Integrating Inland Waterways with Other Modes to Create an Intermodal Transportation System in India

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DECLARATION

I declare that the thesis entitled "Integrating Inland Waterways with Other Modes to Create an Intermodal Transportation System in India" has been prepared by me under the guidance of Dr Neeraj Anand, Professor and Head -Department of Logistics and Supply Chain, School of Business, University of Petroleum and Energy Studies, Dehradun; Dr Saurabh Tiwari, Professor of Logistics and Supply Chain, School of Business, University of Petroleum and Energy Studies, Dehradun and Dr Ganesh Das, Head- Strategy & Business Relations, Tata Power Delhi Distribution Ltd, Kingsway Camp, Delhi. No part of this thesis has formed the basis for the award of any degree or fellowship previously.

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October 2018

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THESIS COMPLETION CERTIFICATE

This is to certify that the thesis on **"Integrating Inland Waterways with Other Modes to Create an Intermodal Transportation System in India"** by Aditya Gupta in Partial completion of the requirements for the award of the Degree of Doctor of Philosophy (Management) is an original work carried out by him under our joint supervision and guidance.

It is certified that the work has not been submitted anywhere else for the award of any other diploma or degree of this or any other University.

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New Delhi, September 15, 2018 Aditya Gupta

DECLARATION BY THE AUTHOR

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

Aditya Gupta

October 2018

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It is certified that the work has not been submitted anywhere else for the award of any other diploma or degree of this or any other University.

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Abstract

Inland Waterways Transportation (IWT), transportation over rivers and canals, is a magnificent mode of transportation. It does not require laying of tracks and highways to move, requires least fuel to more per ton of cargo, emits least carbon gases, does not require precious land parcels for traffic, accounts for least accidents and carries least cost of transportation. In spite of carrying numerous advantages, the share of IWT in total transportation in India is close to negligible. As compared to this the share of IWT in several other countries like USA, China, Germany, Netherlands, Belgium, Bangladesh etc is substantial. Underutilisation of IWT mode in India is leading to loss of opportunity to save the freight bill for the country. IWT is not an independent mode, it requires other modes to do first mile and last mile transportation unless consignors and consignees are located on a river bank. Intermodal transportation is a transportation where cargo successively moves through at least two modes of transport. Intermodal transportation allows the shippers to gain advantage of each mode of transportation and integrating them in a manner to get benefits in terms of cost effectiveness, scheduled departures, larger geographical access and environmental advantages. Containerization is a key enabler for Intermodal transportation which allows unitization of the load and seamless movement from one mode to another. This study attempts to discover how to integrate IWT mode in India with other modes to create an Intermodal Transportation System.

With limited dissemination of IWT in India, limited research has been conducted on this subject. This called for inductive approach to this study. The research required gathering large rich information through close and detailed interactions with subject matter experts. Hence a qualitative technique was found to be most pertinent for this research. Grounded Theory allows a very methodical and disciplined development of theory which is grounded in data and hence was chosen as research strategy. Good research is always founded in Theory. Theoretical framework provides the structure the researcher to connect to existing knowledge and a frame for observations and interpretations. This study draws its roots from General Systems Theory. General Systems theory is a theory of" wholeness" which allows to draw a phenomenon as a system with its structure, properties and characteristics and how it interacts with environment and within. Intermodal transportation is also a system with shippers, carriers, terminal and Government being its key components and their interplay within and with the environment deciding the performance of the system.

The study gathered data by in-depth interviewing of sixteen subject matter experts. Based on the coding and analysis of the data gathered, a conceptual framework for intermodal transportation system was drawn. Ten suggestions were made for integrating IWT with other modes in India. The key suggestion has been that India should identify and channelize all its energies on one marquee waterway and make it successful. Suggestions were made around the freight corridors which are most suitable for IWT transportation in India. Suggestions have been made around the ownership and management of Terminals and Barges. Suggestions have been made around role of Government and Private sector in IWT development in India and importance of Incentives to kick start the process and skill development to continue the process.

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ABBREVATIONS

BIWTA	Bangladesh Inland Water Transport Authority
BOT	Build-Operate-Transfer
CAS	Country Assistance Strategy
CCNR	Central Commission for Navigation on the Rhine
CFS	Container Freight Station
CIWTC	Central Inland Water Corporation Limited
CONCOR	Container Corporation of India
CPT	Cochin Port Trust
DC	Danube Commission
DSO	Domestic Standard Organisation
DWT	Dead Weight Tonnage
ECMT	European Conference of Ministers of Transport
EDI	Electronic Data Interchange
EU	European Union
FCL	Full Container Load
GOI	Government of India
GPS	Global Positioning System
GST	Goods and Services Tax
GT	Grounded Theory
ICD	Inland Container Depot
ICTT	International Container Transhipment Terminal
IMF	International Monetary Fund
IMT	Intermodal Transportation
IMTP	Integrated Multi-Modal Transport policy
ISO	International Standard Organization
IWAI	Inland Waterways Authority of India
IWT	Inland Waterways Transport
IWUB	Inland Waterways User Board
KM	Kilometer
LAD	Least Available Depth
LCL	Less Than Container Load
MARAD	Maritime Administration of the US Department of
MOS	Ministry of Shipping
MMT	Multimodal Transportation
MOT	Ministry of Transport
MT	Metric Tonne
MTO	Multimodal Transport Operator
NAIADES	Navigation and Inland Waterway Action and Development in
NCR	National Capital Region
NDRC	National Development and Reform Commission
NINI	The National Inland Navigation Institute
NIWPP	National Inland Waterways and Ports Plan
NSAPR	National Strategy for Accelerated PovertyReduction
NTPC	National Transport Policy Committee
NVOCC	Non-Vessel Operating Common Carrier
NW	National Waterways

NW1	National Waterways 1
NW2	National Waterways 2
NW3	National Waterways 3
NW4	National Waterways 4
NW5	National Waterways 5
ODC	Over Dimensional Cargo
ORB	Ohio River Basin
PFT	Private freight terminal
RIS	River Information Systems
RITES	Rail India Technical and Economic Services
RSV	River Sea Vessels
SIMSC	Scheme for Incentivizing Modal Shift of Cargo
SCM	Supply Chain Management
TENs	Trans-European Networks
TEU	Twenty foot Equivalent Unit
UN	United Nations
UNECE	United Nations Economic Commission for Europe
USACE	US Army Corps of Engineers
USDOT	United States Department of Transportation

CHAPTER 1

Introduction

'I am the river… sit and listen to my wisdom.'

Ian Menard, 1994

Imagine a world without Transportation. Other towns and countries will only be part of fairy tales or imagination with no possibility of visiting them. We will be confined to small geographical areas with no exchange of goods between locations. We will eat only what we grow. The Apples from Himalaya or Fish from Sea will never reach us. Trade, Sports and Art will all be limited to an area. All knowledge will be confined to a region and cannot be shared. The progress of entire civilization will come to a halt.

Transportation has been a critical aspect in the development of mankind. Transportation allowed trade of goods between various cities and countries from time immortal. Transportation has been the harbinger of growth of civilization. The transportation can happen over various modes of Transport. Water, Surface and Air are the important ones. Water Transportation can occur over coastal through sea and oceans and inland through Rivers, Creeks and Canals.

Inland water transport commonly referred as IWT is a fuel saving, environment-friendly, economic, cost-efficient mode of transportation. This mode of transportation includes natural waterways such as artificially built canals and the navigable rivers. Inland waterways are classically termed as pivotal channel for the purpose of transportation and communication in specific for the rural population. The key advantage of this mode of transportation is that it offers the reduced amount of resistance to the traction at a nominal speed allusive to the other modes of transportation. The maintenance cost is comparatively low as there are natural channels. Moreover, these channels are of multi-use, which makes it a cheaper option to supply goods from one place to another.

However, IWT is relatively low speed mode of transportation and is dependent on the geographical constraints. It is impossible to build a water route for the transportation purpose if nature has not provided the elementary pre-requisites. The

depth is the basic facet that decides the nature and capacity of vessels that can employ in the given channel. The gradients of the channel along with the breadth of the waterway are the another vital dimensions (Sriraman,2002, Brahma,2006).

1.1 IWT: The Magnificent Mode of Transportation

Inland Waterway Transport is the movement of cargo over rivers, backwaters, creeks and canals. Among various modes of transportation, it's the best method of transportation for the following reasons:

- IWT is **fuel efficient**: Estimates indicate that a litre of fuel can transport twenty-four Ton/KM cargo by road, eight-four Ton/KM by rail and hundred and five tonne/km by waterways (www.iwai.nic.in; 2016).
- IWT is **environment friendly**: It uses the least fuel to move the cargo. The order of the ratios between water, railway and road transportation is within the ranges of 1:2:5 in cost and 1:1.5:4 in energy consumption respectively (UNESCAP Report).
- IWT is **least Capital Intensive**: It is estimated that setting up an inland waterway channel costs about five to ten percent to that of four lane highway or railway tracks. No Land acquisition and related infrastructure required (Nagabhatla, 2013).
- IWT is **sustainable**: Infrastructural development of the waterways helps to prevent floods, and provides water reserves and the accompanying fauna and flora. Hydroelectric stations can be installed along rivers and canals (www.32cup.com, 2017).
- IWT carries **least External Costs**: IWT carries least impact on communities, low noise, least pollution, accidents and congestion (An Caris et al., 2013).
- IWT is **safe**: There are rare accidents on the waterways. IWT Barge drivers are well trained and follow very strict safety requirements (www.32cup.com, 2017).
- IWT is **much more**: The conduits can be utilized for tourism and social purposes too.

Parameters	IWT	RAIL	ROAD
Energy Efficiency: 1 horsepower(HP) can move how many kgs of cargo	4000	500	150
Fuel Efficieny: 1 litre of fuel can move how much freight (Ton - KM)	105	85	24
Equivalent single unit carrying capacity	1 Barge	15 Rail Wagons	60 Trucks
Air Pollution	Low	Medium	High
Land Acquisition	Low	High	High
Capital Required	Low	High	High

Table 1.1 IWT Comparison with Other Modes of Transport *(*http://iwai.gov.in/// misc/PPTtoMinofFertilizers28110.pdf)

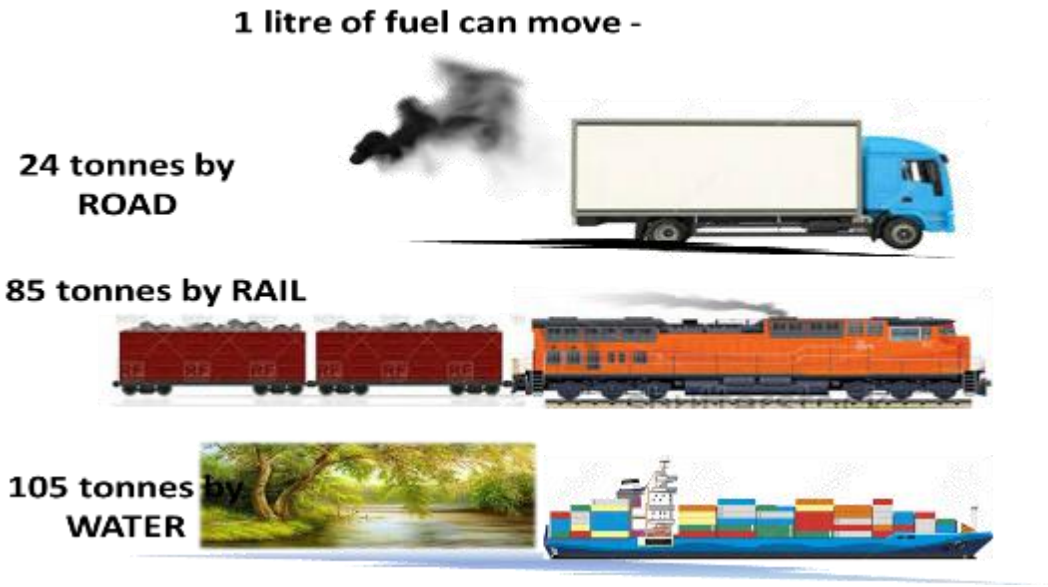


Figure 1.1 Fuel efficiency of Water mode as compared to Rail and Road (Author)

1.2 IWT Progress in India

India carries a rich heritage of River based Transportation. Archaeologists discovered a burnt brick basin at Lothal, Gujarat India which was perhaps the earliest river dock in the history of mankind. This dock connected Harrapan towns with Arabian sea though the network of Sabarmati river during Indus Valley Civilization in approximately 2400BC. Ganga and its tributaries has been major routes of trade throughout the history of India. Megasthenes in his travelogues quotes that inland transportation was flourishing from 4th BC where Ganges and its primary tributaries

were widely navigated. Various aspects of navigation like boat size, ferry regulation laws, port charges, tasks of the workforce and state taxation are widely mentioned by Kautilya in 4th Century BC in his Arthashastra for the days of the Mauryan Empire (Mishra et al, 2012). Even during Mughal era, river based transportation and trade was very common and Agra, Mirzapur, Varanasi, Munger and Patna were major ports connecting all the way upto Bengal. (Mishra et al, 2012). During the British rule, the Barak-Surma and Brahmaputra waterways had been used commonly for exchange and transportation between top east India as well as the port of Kolkata.

Contemporary India has navigable inland waterways of an estimated length of 14500 km, of which includes rivers, canals, backwaters, creeks as well as tidal inlets that can support mechanized crafts. As per Directorate General of Shipping (2009) approximately 5000 KM of large rivers and about 480 KM of canals can be designated as appropriate for inland transport in India. Inland Waterways Authority of India (IWAI) which was started in 1986 has the job to control and manage inland waterway transport of India. 111 Waterways has been declared as National Waterways by Government of India. Nevertheless, the 3 leading ones have been the initial three declared waterways which fall within the governance of the IWAI. The river system from Kolkata/Haldia to Allahabad through the Ganga-Bhagirathi-Hoogly river, River Brahmaputra from Dhubri to Sadiya as well as the West Coast Canal system in Kerala from Kottapuram to Kollam coupled with Udyogmandal and Champakara Canals. Out these waterways, the very first one is termed as National Waterway No.1, the next one is termed as National Waterway No.2 and last one is known as the National Waterway No.3.

Figure 1.2 Inland Waterways Map in India (IWAI)

However, despite of having such a vast network of navigable inland waterways, India has not been able to fully utilize its water resource to their fullest extent due to which only 0.35% of the total inland traffic is moved through them.

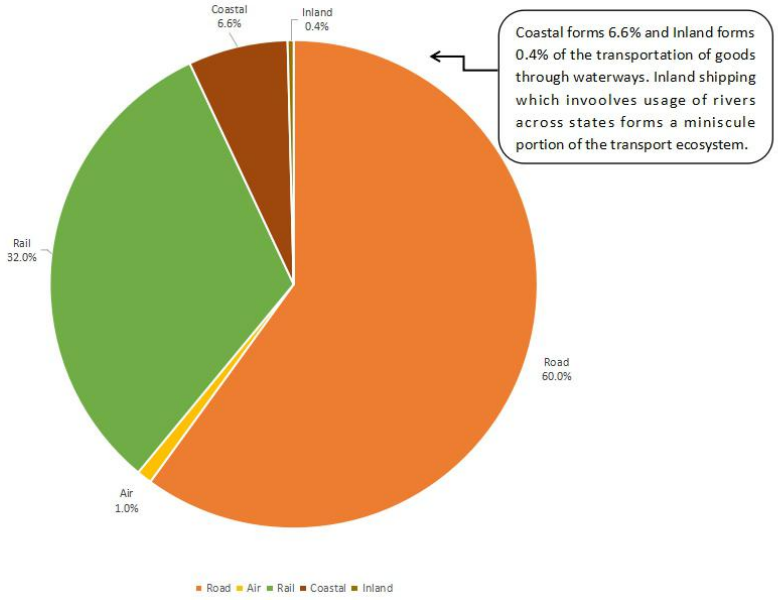


Figure 1.3 Modal Share of Transportation modes (IWAI)

In spite of all the above advantages of Inland Waterways Transportation, Indian Transport Sector has failed to promote this mode. Central Government manages all the National Waterways and few initial requirements needs to be fulfilled by the Govt to promote this transportation mode. They should ensure that minimum required least available depth of the rivers should be provided for smooth navigation all year round. The rivers should be well equipped with navigational aids, so that movement can be done 24 hrs in a day. This will save time and standing cost of the barges. Another challenge is the intermodal terminals requirement which is also one of the essential element to attract the shippers for using this mode of transportation. Once these few basic requirements are fulfilled then inland waterways can be exploited to its full. But the funds allocation by the Govt towards this sector is very minimal vis-à-vis other transportation modes because as per Govt they don't have shippers / users for this mode of transport. Shippers still find it comfortable to use rail or road services in spite of their high fuel cost, environmental hazard etc.

(Sriraman,2010) identified the following reasons for lower adoption of IWT in India:

1. Navigation comes last in Government. priority for river water usage after drinking water, irrigation as well as hydel power.
2. Lack of coordination among central Govt, State Govt and other agencies involved.
3. Inadequate participation of private sector in this particular mode.
4. Insufficient depths through the stretch. Excessive siltation due to alluvial nature of rivers.
5. Non availability of enough navigational aids restricting hours of operation.
6. Non accessibility of lower draft high technology vessels.
7. Non availability of intermodal terminals. Inadequate infrastructure at terminals.
8. Non availability of cargo/industry on the river front.
9. Lack of availability of cargo for return leg.

10. Lack of connectivity along with other modes to produce first mile as well as last mile transportation as well as an intermodal transport system (Sriraman 2010).

A comprehensive review of the improvement of IWT in India is actually being undertaken in chapter two.

1.3 IWT Progress Globally

Inland waterway transport has been one of the major interests for the governments of various countries. There have been many developments in this field. Nations who possess numerable water resources are working towards establishing a properly developed inland waterway transport system. Countries like the United States and China have already created an advanced inland waterway transport system. In Europe, IWT is competing mode to Road and Rail. Inland waterway transport encourages economic growth and also supports environmental sustainability as has been effectively demonstrated by the navigation on the Rhine.

Figure 1.4 Major Navigable Rivers of the world (UNESCO Website)

Over many generations, Inland waterway transport has made large contributions to the development of developed economies. The potential in IWT is now recognised by every nation nowadays.

1.3.1 IWT in USA

In the United States, the water transport infrastructure is dominated by the Missouri-Mississippi river system along with the inter coastal traffic, together they account for bulk of the cargo every annum. The United States of America has developed their water resources to their fullest extents. Despite having one of the best inland waterway transport system, they are continuously developing it further. One can say that IWT as a mode is highly developed in this country (Paul Amos et al, 2009). Planning, building, operating water resources and designing are governed mainly under US Army Corps of Engineers (USACE). All the Federal transport policies are managed by the United States Department of Transportation (USDOT).

1.3.2 IWT in EU

Inland waterways play an important role in the European transportation system. Europe has about 35000Km length of navigable waterways, most of which is of historical, environmental and of recreational value without any significant role in commercial freight. Roughly 4500 Km of waterways, dominated by Rhine -Main-Danube corridor is actually of business value. Like the lower ranges of the Rivers Scheldt, Mosel, Seine, Rhone Saone, Oder and Weser, in addition to the busier channels, offers a sum of about eight thousand KM of channel which may be regarded as noteworthy for freight transportation. IWT plays a important role in connecting the hinterland of EU's seaport and in the import as well as export out of Northwestern Europe. The other facet of the situation may be looked as that only 6 nations Germany, Belgium, Austria, France, Netherlands, and the Luxembourg in the Europe has river interconnected method. Three levels of administration are actually in charge of creating policies as well as the implementation in EU for IWT. Ninety five percent of IWT traffic in the EU is actually contributed by four nations Germany (approximately fifty percent), the Netherlands (thirty four percent), Belgium (seven percent) and France(six percent) (UNECE, 2011). The following chart shows Growth rate of transportation modes 1995 2012 in EU.

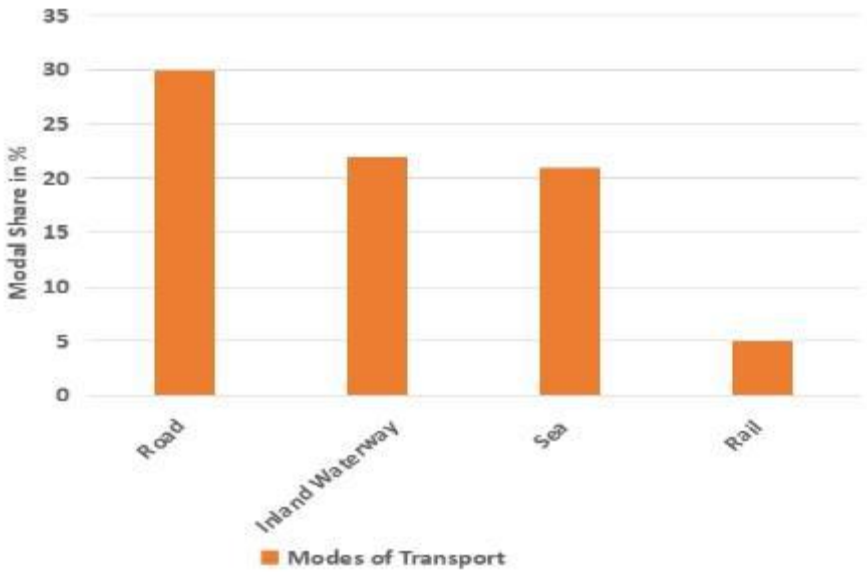


Figure 1.5 Growth rate of transport modes 1995-2012 in EU (Eurostat 2012)

1.3.3 IWT in CHINA

China has largest inland waterway transportation system in the world in terms of length and freight size. China has about one lac twenty three thousand KM of navigable waterway, out of which sixty one thousand KM is actually organized and approximately twenty four thousand KM is considered 'commercially significant'. Since the year 2000, China's IWT encountered quick acceleration in tones kms. IWT of China has been overseen by tripartite Governmental framework. The policies and regulations of IWT sector and the planning of national waterway system are decided by the Ministry of transport (MOT). The special River Administration under MOT is responsible for the implementation of regulations and policies at two most important river of China namely: Yangtze and Pearl Rivers. While in china the waterways of local importance are administrated by local governments, through provincial navigation administration. Thus China has delegated and decentralized structure of IWT management.

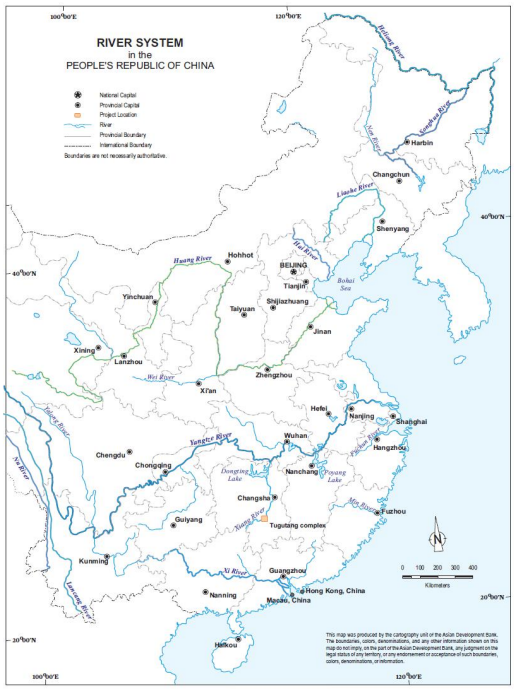


Figure 1.6 IWT map of China (Asian Development Bank)

1.4 Intermodal Transportation

Intermodal transportation may be defined as the movement of cargo or people from the origin to destination by using at least two modes of transportation, the change from the first mode to another mode conducting at an intermodal terminal. (Teodor Gabriel Crainic et al, 2005). European Conference of Ministers of Transport (1993, p.83) gives definition for intermodal transportation: “movement of goods in one and the same loading unit or vehicle, which uses successive, various modes of transportation (road, rail, water) without any handling of the goods themselves during transfers between modes”.

There are several key players in intermodal transportation networks. First are shippers, who create the need for movement of freight, second are *carriers*, who provide the services for transporting the freight, as well as the *intermodal network* composed of multimodal services as well as terminals.

Interchange from one mode to the subsequent are carried out at intermodl terminals, which may be an ocean port or maybe an in land terminal, airplane

terminals, river ports, rail yards etc. The essential notion of intermodal transportation is leveraging the benefits of low cost transportation modes like rail and water for the trunk route and using mode of road for first and last mile transportation.

Intermodal Transportation has been key enabler for intercontinental trades. It allows countries spread across various continents to trade goods. Intermodal Transportation is also more environment friendly as compared to unimodal transportation as bulk of the journey happens over more fuel efficient modes of transport.

Following are some of the advantages of Intermodal transport:

- it reduces the loss of transit time & risk of loss happening due to pilferage & damage, as the entire journey from origin to destination is coordinated and planned as a one operation,
- The markets are getting expanded due to quick movement of goods. With regards to Global trade, the scale between origin and procurement place of materials and the buyers is getting shrunk with all due regards to the development in IMT.
- The effort of issuing more than one documentation for every leg of the movement of considerably reduced in case of Intermodal transportation.

The following picture indicates an example of Intermodal Transportation. The picture tracks the movement of container from a factory in Dehradun, India to a factory in Kerala, India using modes of Road, Sea as well as Rail.

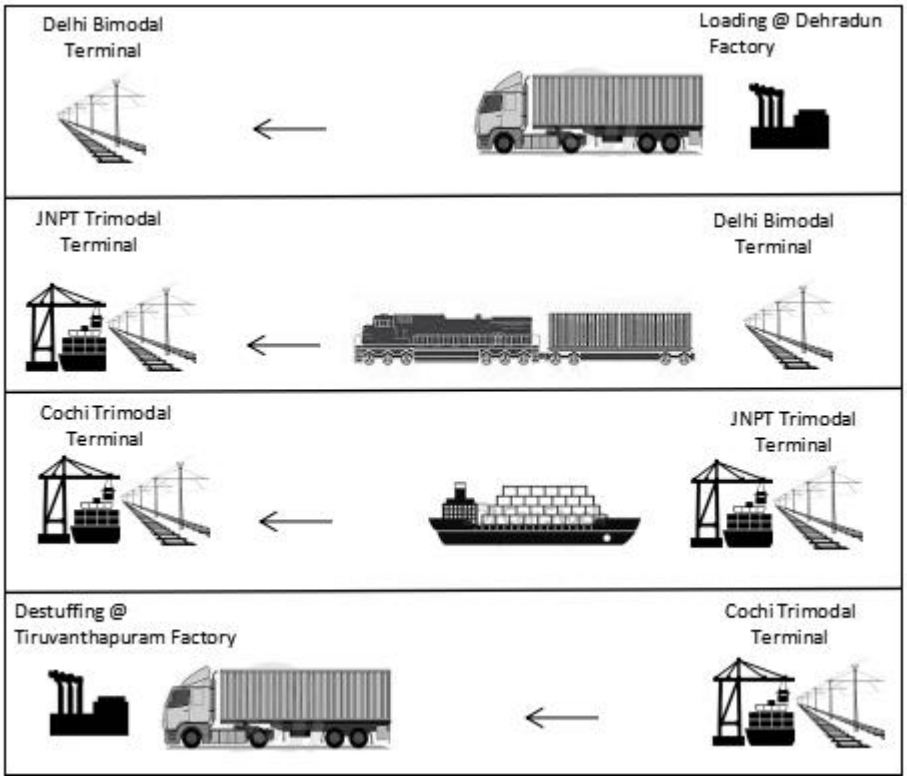


Figure 1.7 An intermodal transportation example from a factory at Dehradun to factory in Tiruvanthapuram in Kerala India (Author)

Intermodal Transportation is discussed in greater detail in chapter 2.

1.5 Business Problem

Inland waterways have unique distinctiveness worldwide. The water in the inland waterways physically differentiates the regions and also connects the cities. For centuries the inland waterways are the main mode of freight transport between long distances on the landsides. For example, the Hansa Network of the Europe was a commercial confederation, which is dominated by the Baltic-intercity trade performed with the vessels in the 17th century. Freight transport through rail and road started gaining interest in the 19^{h} and 20th century. Inland waterways transportation is mostly used to transport large volume of bulk cargoes. The bulk cargoes are required to be transported over long distance, and IWT is most reliable and secure mode of transport for them. The globalization and standardization of containers also supports the development of IWT. Dedicated vessels were built to transport containers also in number of countries. Bridges and inland waterways

adapted new standard with the development of multiple intermodal container terminals (Konings, 2009).

The use of ISO containers at ports makes inland waterways integrated intermodal transport more competitive and profitable over a long distance and for overcoming geographical difficulties. Moreover, owing to the cost effectiveness of IWT, it can play crucial role in reducing the logistics cost of transporting goods. The cost reduction and market benefiting leads to the increase in total trade at domestic and international level. It also supports the ecological protection movements in the logistics sector. It's eco-friendly method of transport as it emits quite much less pollution. The usage of IWT is more sustainable than other mode of transport. Considering the benefit of IWT mode, Policy makers in various countries have been pushing the usage of IWT mode.

Following graph shows the share of IWT in the transportation pie of various countries.

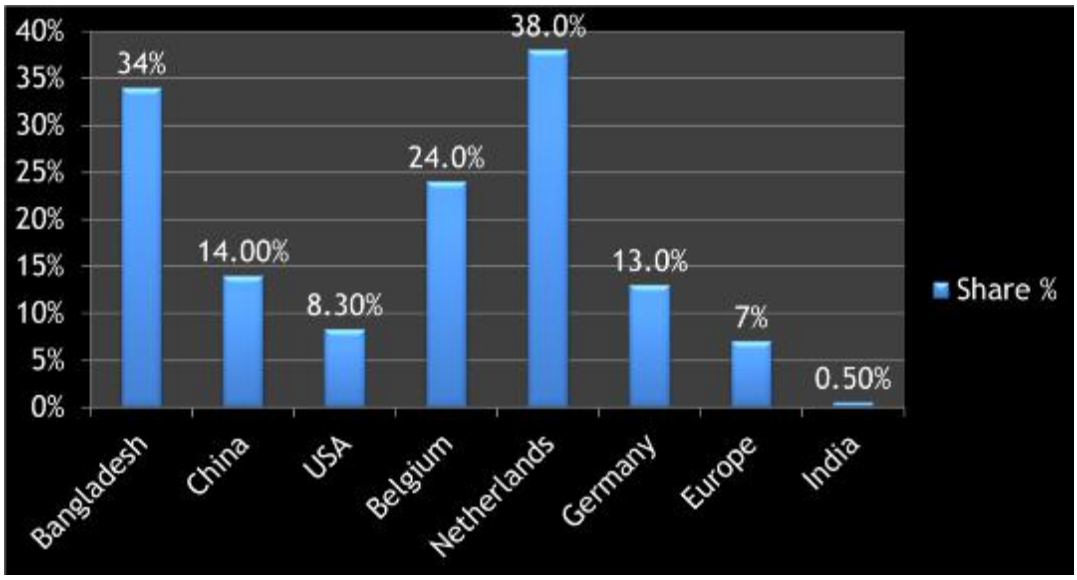


Figure 1.8 Share of IWT in total transportation in various countries (KPMG, Water Transport in India, 2014 and Eurostat 2012)

As you can see in the chart, share of IWT in India is almost negligible as compared to countries like USA, China and EU. Even neighboring countries like Bangladesh enjoy large share of IWT.

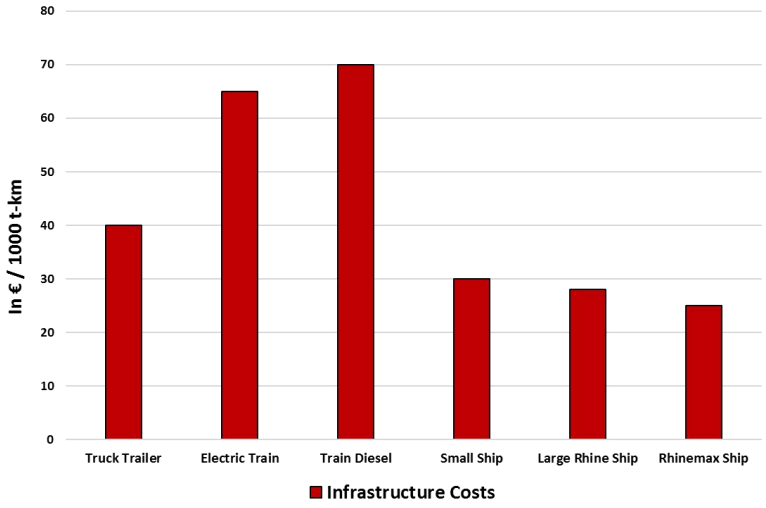


Figure 1.9 External and Infrastructure cost of Container Transport (CE Delft, 2011)

The above graph shows a comparison of Infrastructure and external costs of IWT vis-à-vis Road and Rail. As shown in the last three bars, the external and infra costs for IWT are fraction of that of Road and Rail.

As indicated earlier IWT is an energy efficient source of transportation. One horse power can carry 40000 kilogram of load in water while the same can carry only 150 kilograms and 500 kilograms respectively through road and rail. For heavy and large volume of load IWT is quite useful. **Dr S Sriraman (2010, p18.4) estimated that "diversion of one billion tonne-km of cargo to the IWT mode will reduce transport fuel costs by 5 million USD and the overall transport costs by 9 million USD".**

The current size of Indian transportation market is estimated to be around 2000 BTKM (Billion Ton Kilometre). Refer to following table. If the share of IWT were to go up from 0.5% to 2%, the total saving in transportation cost to India would be Rs 17.6 Billion (1 USD = Rs 65). This saving will go up Rs 93.6 Billion in case the share of IWT

reaches the US number. The saving would jump to Rs 158 Billion in case we reach the share of 14% equal to that of China.

Current Size of Indian Cargo in BTKM *	Share of IWT	Additional BTKM diverted to IWT	Saving Potential in Million USD	Saving Potential in Rs Billion
2,000	0.50%			
2,000	2%	30.00	270	17.6
2,000	8.5%	160.00	1,440	93.6
2,000	10%	190.00	1,710	111.2
2,000	14.0%	270.00	2,430	158.0

*: Current size of Indian Cargo Industry in Billion Ton KM as per IBEF report

Table 1.2 Potential saving in Transportation bill for India for shift of cargo from other modes to IWT (IBEF Report)

The following table compares the cost of transporting cargo across many modes of transport in India.

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

* Service Tax on rail transport is 12.36% abatement is 70%
** Service Tax on Road transport is 12.36% abatement is 75%

Table 1.3 Cost of transporting freight across different modes of transport in India. (Source Railways- Ministry of Railways, Road-TTSS, IWT-IWAI)

A study was done by TCS to compare the cost of moving the bulk cargo of Sodaash from Okha in Gujarat (West corner of India) to Guwahati in Assam (East corner of India). The following table shows that the cost of moving through combination of

Coastal shipping and IWT is almost half of moving through Rail mode of transportation.

Comparison of Cost of Rail Movement with Coastal Shipping & IWT movement

(15000 Tonne of Soda ash from Okhla - Gujarat to Guwahati - Pandu)

Mode	Transport Cost in Rupees Per	
	Tonne	T-Km
Coastal Shipping and IWT	1793	0.30
Rail	1828	0.65

Source: TCS

Table 1.4 Cost of moving soda ash from Gujarat to Guwahati by alternate modes (TCS)

The above analysis makes us conclude that:

1. The modal share of IWT in several countries is much higher as compared to India.
2. The cost of moving through IWT mode is fraction of moving through competing modes of Road and Rail.
3. IWT enjoys lowest infrastructure and external cost.
4. India as a country can save a lot of transportation costs if the share of IWT were to go up.

This brings us to the business problem for this research as:

Underutilization of Inland waterways in India is leading to opportunity cost loss in the form of saving of total transportation cost.

1.6 Motivation for Research

Following the requirement of IWT practice, researchers and practitioners shows more interest in the study of inland waterways thereby creating an Intermodal transportation system for India. They also study about its significance to the society

and transport industry. The research on the inland waterway integrated intermodal transportation is motivated by the total share of it in today's market. The research on the topic relevant to transportation can undertake a range of scholarly and academic issues. The study does not aim at the general development of the theories and conceptual models related to the intermodal transport in analyzing transport arrangement. Intermodal transport is a series of multiple activities, resources and relationship which are to be coordinated in orderly manner. The objective of this research is to identify factors which will enable Inland Waterways based Intermodal Transportation system and to develop a conceptual framework for Inland Waterways based Intermodal Transportation system in India.

The organizational and technical complexity of intermodal transportation system justifies the technique of the study from a wider view point. From the perspective of modern society too, the study on IWT incorporated intermodal transportation has great significance. It takes the accurate integration of many modes of transport to use eco-friendly modes to a much better degree. The European Commission also identifies:

> "… *the need for new and innovative solutions to improve the performance and limit the harmful economic, social and environmental impact of the Union's present transport system. It is no longer possible nor acceptable that the problems of tomorrow are tackled today by the solutions we used yesterday. Fragmented, unimodal solutions no longer offer scope to solve existing bottlenecks. A holistic and system approach is needed*."
>
> (European Commission (1997),

The fact that EU plays a critical role in the development of policies and research funding for Intermodal transportation underlines the importance of the above statement. The other reason behind the study is that the most of the existing research done in the intermodal transport is only by the non-academic research institutes and consultancies which may be biased towards the requirement of their

clients. To get the unbiased theory the orderly and coordinated study of various attributes of IWT is required.

1.7 Aims and Choice of Methodology

The research was conducted with an aim to identify various factors which will enable Inland Waterways based Intermodal Transportation system, and secondly to develop a conceptual framework for Inland Waterways based Intermodal Transportation system in India.

Provided that the intent behind the analysis was developing an understanding as well as reason of the dynamics of connection forming between Intermodal Transportation and IWT, and analyzing the information as extracted by the subject matter instead of pre conceived hypothesis, the inductive technique was regarded as to be by far the most appropriate.

Considering the fact that this study involved a subject where not much research has been done in India; where the numbers of experts available in this field are limited; the study required a deeper interaction with participants; the study needs to answer "why" and "how" type of questions; required gathering large amount of rich information and required detailed investigation, qualitative methods were found out tobe more suitable for this study.

Among all the qualitative methods, Grounded Theory was found to be most appropriate considering the fact that it a very analytic and systematic process of arriving at theory from body of text.

The following figure shows the research methodology in brief. A comprehensive discussion of the methodology is actually provided to the chapter four of this particular thesis.

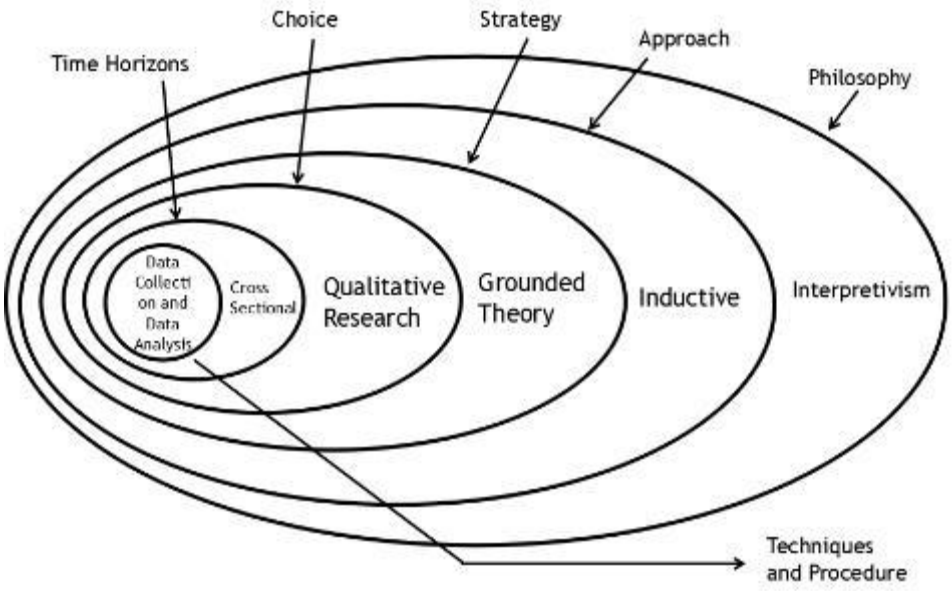


Figure 1.10 Research Methodology used for this study (Author)

With a set of components with their strong interrelationships influenced by external environment, intermodal transportation phenomenon can be treated as a system. General System Theory (GST) provides a strong theoretical backbone to intermodal transportation as a subject of study. GST acts an underpinning theory for this research, acts as the cradle for the research problem and guides the netire research process.

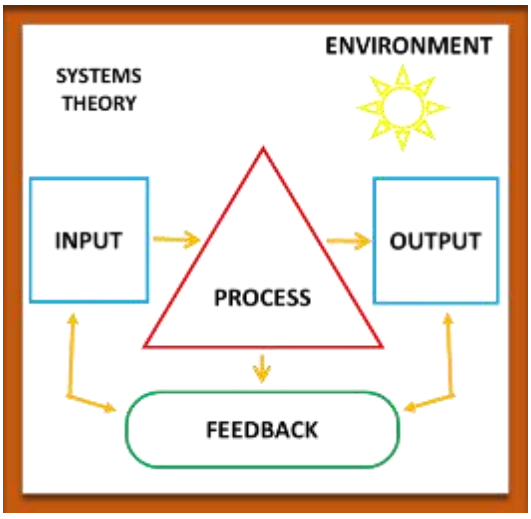


Figure 1.11 General Systems Theory

1.8 Scope of the Research

The research is limited to Inland Waterways based Intermodal Transportation. This research will not study Intermodal systems based on other modes. The study answers ‘‘what’’ and ‘‘how’’ part of the Intermodal system. However, study regarding costing and technical feasibility of the recommendations have not been made in this research. This study has been based on opinions from subject matter experts. The interview with the subject matter experts were analyzed to build a theory grounded in data. As this particular method doesn't exist in India, there was limited number of subject experts in India.

There are two types of cargo which majorly flow on IWT mode, Bulk cargo and containerized cargo. In USA, it is dominantly bulk cargo which flows over IWT in the form of grains, coal and Petroleum products. However, in case of China and EU it is both bulk as well as container cargo which flows through IWT. In case of India it has been majorly bulk cargo till now with some bits of ODC cargo. The share of containerized transportation over IWT has been close to negligible. **This study mainly focuses on promoting containerized transportation over IWT in India.**

1.9 Contribution of Research

The study highlights the problems experienced in building IWT in India as compared to other developed transportation modes.

After successful completion of research on the chosen topic the author is able to derive on few recommendations which will be helpful for the development of Inland Waterways Transportation in India. The conceptual framework of Inland Waterways based Intermodal System will help IWAI and other regulators to implement IWT based Intermodal solution and thus significantly lower the transportation costs in India.

The results of this particular research will augment the theory of General Systems. Grounded Theory methodology is not a common research Methodogy in the domain

of SCM and logistics. This research may be considered as a methodological contribution in this field of study.

1.10 Structure of the Thesis

This thesis has been divided into seven chapters. Starting from Introduction about the topic to reviewing the writeup on the topic of the study, introducing Research Methodogy, data collection and analysing therafter finally concluding with results and recommendations. The study has been put together to the following chapters-

Chapter 1: INTRODUCTION - This first chapter introduces the background of what Inland Water Transportation actually is and the progress of its in India right from evolution. Subsequently the primary business problem which is guiding the study is presented and discussed. The research Methodogy used in this research has been briefly described with the reasoning explained for choosing this particular Methodogy. The scope and motivation of conducting this research have been explained. Lastly the expected contribution from this research has been briefly addressed.

Chapter 2: REVIEW OF LITERATURE – There are five broad themes under which rigorous literature review has been carried out. These themes include: Intermodal Transportation in India, Integrating IWT with other modes of transportation, Infrastructure required for integrating IWT with other modes, Use of technology in connecting IWT with other modes, Choice of transportation modes by shippers. The chapter summarizes the outcomes in the form of the research gaps that have risen from the literature viewed.

Chapter 3: THEORTICAL FRAMEWORK: GENERAL SYSTEMS THEORY – This particular chapter justifies the usage of General Systems Theory as the theory unpinning this particular study. The chapter starts with the significance of Theoretical framework for any research. Structure, properties, and characteristics of systems are studied in great detail. How Systems interact within and with the external environment is focused upon.

Chapter 4: RESEARCH METHODOLOGY - This portion of the dissertation starts with the research problem guiding this research. The research questions and objectives

are identified and rationale explained. A detailed layer by layer explanation is given for the final research Methodogy identified for this research. The data collection and analysis process are explained. The validity protocol for this research are discussed. At the end, the ethical considerations and role of researcher in this research are discussed.

Chapter 5: DATA COLLECTION AND ANALYSIS - This portion focuses on examination as well as compilation of empirical data. The collection of data mainly happened through the process of interview with subject matter experts. Sampling process, the respondents profile and data collection procedure in discussed in greater detail. The collected data was constantly compared and coded based on the procedures as suggested by Grounded Theory. This chapter provides a detailed coding process as done in this study. The chapter concludes with generation of the theory from the grounding procedures.

Chapter 6: RESEARCH OUTCOME, FINDINGS & SUGGESTIONS - This disseration portion highlights the results obtained from study of empirical data. This chapter presents a set of suggestions for implementing an IWT based Intermodal Transportation System in India. The suggestions cover whole gamut of IWT transportation from key requirements to run IWT to role of Government to the skill development requirements in India.

Chapter 7: RESULTS, CONCLUSIONS AND RECOMMENDATIONS - This particular chapters sums up the findings of the study. Outcomes of the analysis are summarized to revisit solutions to the study questions as well as investigation goal. The study even attempted to deal with the analysis issue originating out of the principle underpinning this particular exploration. The analysis identifies the major elements and recommend a conceptual framework for an IWT based Intermodal Transportation System. This particular chapter further provides the practical and theoretical contribution of the research and argues for the validity of the findings. This particular chapter concludes with limits of the study as well as instructions for further exploration on the topic.

Conclusion

The foundation for thesis has been laid in this chapter. The business problem driving and guiding this research has been introduced. The motivation and rationale for this

research has been set out. A small introduction was made to the theory underpinning this research and the research methodology used to arrive at the research findings.

With the reasonable advantages of IWT mode and Intermodal Transportation, both as a training and an exploration point, this examination attempts to make a legitimate commitment to the creating assortment of learning in the field.

Chapter 2

A review of Literature

"Knowledge has a beginning but no end"

Geeta Iyenger

2.1 Introduction

The fundamental motive of literature review is to not to reinvent the wheel and build upon the ideas of other researchers who have studied the field before (Jankowicz, 2005). The key objective of literature review is identifying the key themes for study, critically review earlier studies and theories around these themes and makes comparisons. Literature review is not just reproducing the opinions of previous scholars, it demonstrates the ability of researcher to interpret the facts and present them. A Literature Review overviews researcher's chosen topic or field, it demonstrates his depth of knowledge and supports / guides future research.

2.2 Literature Search Strategy

Literature review is a search engine which looks for the published research papers and articles relevant to the topic. The literature search is quite important and need an organized and systemic approach. It requires keeping the record of all researches and findings to make an effective literature search. This requires developing a search strategy.

There are various sorts of literature reviews, each with its own approach, examination, and reason. To confound matters, these sorts aren't named reliably. The accompanying are sorts of literature reviews as demonstrated by (Grant, M. J., and Booth, A., 2009):

Method	Small description
Critical review	Generally used to build model or hypothesis. The researcher researches extensively and critically evaluates the existing literature.
Literature review	Covers a range of topics at various levels of comprehensiveness. Used to identify gaps in literature.
Mapping review / systematic map	Identifying the gap in literature which will guide primary research by mapping out and categorizing existing literature.
Meta-analysis	More precise effect of results are provided through statistically combining results of quantitative studies
Mixed Methods review	This method used combination of review methods like process with outcome studies or qualitative with quantitative research.
Overview	Generally used in medicine, this technique attempts to describe the characteristics by surveying the literature.
Qualitative systematic review	This method searches for constructs or themes across various qualitative studies by comparing the findings from different qualitative studies.
Rapid review	This method includes systematically reviewing and critically appraising the existing research about a policy of practice issue.
Scoping review	The aim here is identify the extent of the current research done to assess the potential and scope of further research.
State-of-the-art review	The method focuses more on the current research rather than retrospective researches to bring out new perspectives on a issue.
Systematic review	Uses a set of systematic guidelines to appraise the literature and synthesize the research evidence.
Systematic search and review	This method addresses broader questions and uses a combination of critical review and comprehensive study to synthesize the best evidence.

Systematized review	Typically used by post graduate students, this method includes elements of systematic review and stops short of it.
Umbrella review	This method uses evidences from multiple literature reviews to arrive at one usable document, used when there are competing interventions on a wide problem or concern.

Table 2.1 Strategies of literature (Grant, M. J., & Booth, A. 2009)

The methodological method - inductive or deductive which the researcher is intending to use guides the method of the literature review (Johnson, 2010). In case of **deductive** methodology, the role literature review is to deeply analyze the prevailing knowledge and discover different theories or concepts of interest. The primary aim of literature review in this case is to identify theories which can be used to identify hypothesis which can then be tested through compilation of relevant information. However, the objective of the literature review is completely different in case of **inductive research** methodology. As inductive approach is about developing a theory from the actual data, where there are do not exist any conceptual frameworks or theories.

Based on the above mentioned arguments, Traditional or narrative literature review method was utilized to critique and summarize an entire body of literature regarding the thesis matter. Narrative or traditional Literature Review helps to:

- Critiques and summarizes an entire body of literature
- Draws conclusions about the topic
- Identifies spaces or perhaps inconsistencies of the body of knowledge

With regards to sources of literature following sources were dominantly used to gather information -

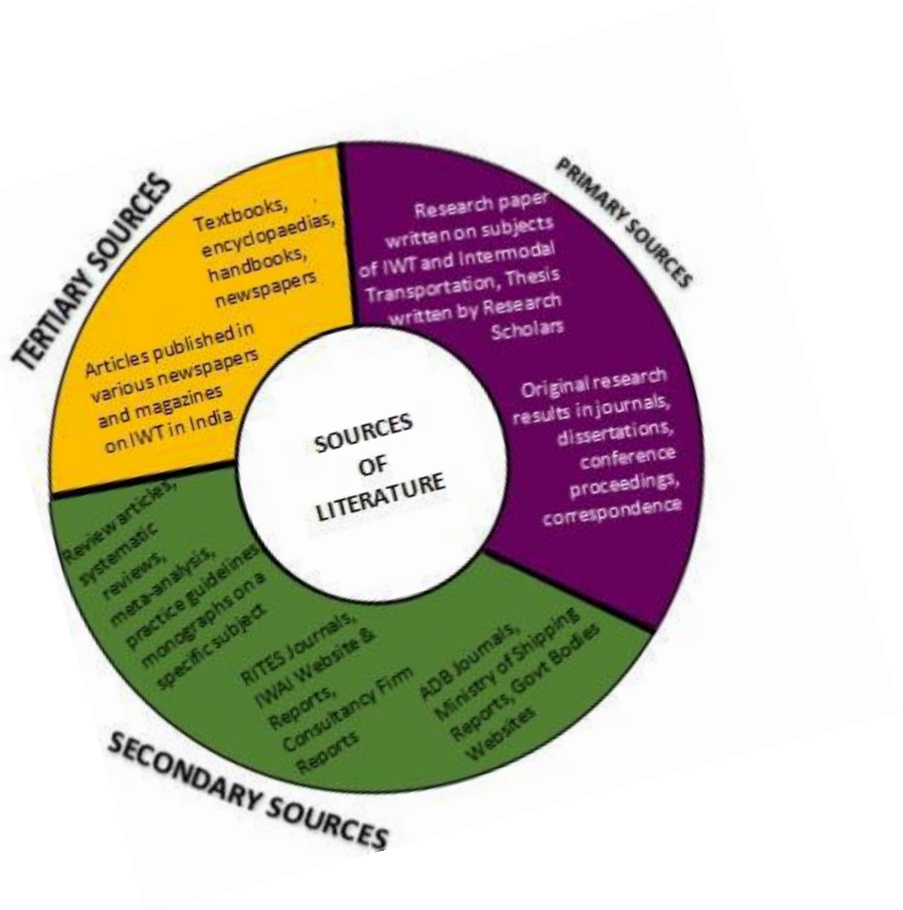


Figure 2.1 Sources of Literature (Author)

2.3. Structure of Literature Review

Review of literature is akin to an article which consists of introduction, middle or main body and a conclusion.

Figure 2.2 Structure of Literature Review (Author)

The three sections of a Literature Review have been described as follows:

Introduction –

- In the beginning of the section, topic is defined appropriately and a context favouring the corresponding literature review has been inserted.
- The introductory section of the literature review also establishes a convincing strategy for reviewing the literature.
- Introduction explains the sequence of the content in the literature review.

Main body –

- The middle body of the literature review follows the motives of the study and centred towards explaining them in greater detail. This part forms the core of the chapter and provides detailed explanation to the topics chosen.
- It also shed light into the relationship between the core topic of the study and the wider subject area.
- As we progress towards the middle of the review it shifts from a general or broader view of the literature to the specified topic of the study

Conclusion –

- It brings out the imperative points of the literature review.
- It also assesses the current state of the literature reviewed.
- Helps in drawing a conceptual framework based on the studied literature.
- Identifies the gaps in existing knowledge.

The advantages of a good literature search are -

- It prevents the researcher from duplicating work that's been already done.
- By blending information from previous examinations, researcher will hold the capability to make a far more grounded foundation of the own investigation of his.
- Pertinent investigations are able to provide lucrative bits of ideas as well as expertise to enhance the very own specific examination of his, for instance, the greatest tactic or maybe info exploration tactics to use.

- Researcher is going to be in a position to meet weaknesses and gaps in the current research and thereby come up with meaningful and useful research questions.
- Researcher is going to become acquainted with terminologies of the area of his by utilizing as well as finding ideal keywords.

This particular literature review attempts to creates a rational flow to guide the reader from general comprehensive knowledge to research gaps and goal. The structure of the review is depicted in Fig 2.3.

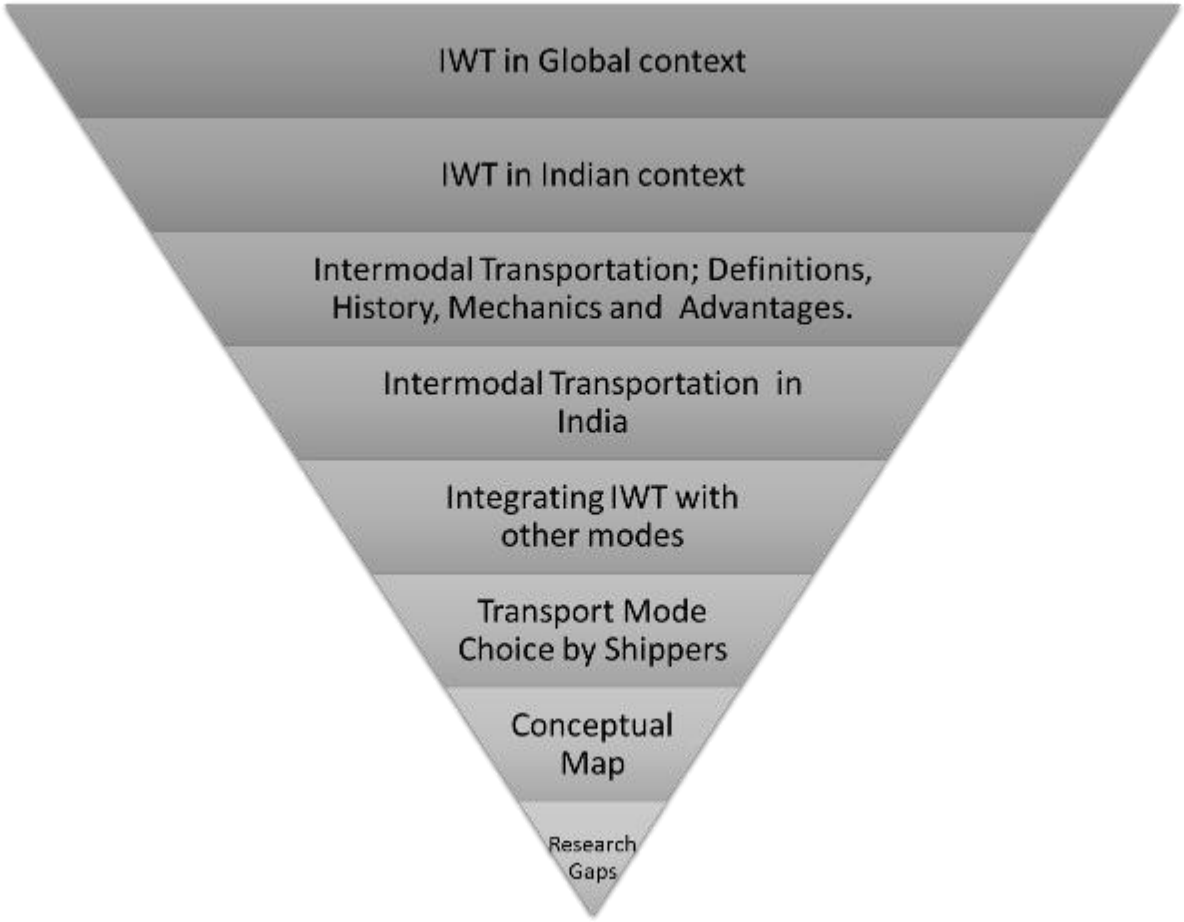


Figure 2.3 Structure of Literature review (Author)

2.4 IWT in Global context

The development in the inland waterway transport in recent is supported by its potential in cost saving, reliability and environmental friendliness. It could be a best feasible alternative to the road and rail transport in most part of the world as one

third of the earth is covered by water (Sjogren and Woxenius, 1994). Thus inland waterways can play a significant role in the future of the world trade. After all it is remain an area which is not exploited much by the practitioners and researches, though in recent it gains a lot of attention of policy makers at national and international front of the logistics world due to its potential in bringing the sustainable solutions in the transportation world (Rangaraj and Raghuram, 2007).

IWT is a low cost and more environmentally friendly mode of transport for people and goods, but it is not realized to its full potential in number of countries worldwide. Many of Asian and Pacific region have very good network of rivers and canals to support the IWT. However, the share of IWT still remains low in several countries due to lag in implementing the policies and regulations regarding the development of IWT. Below is the list of countries along with their total waterways length.

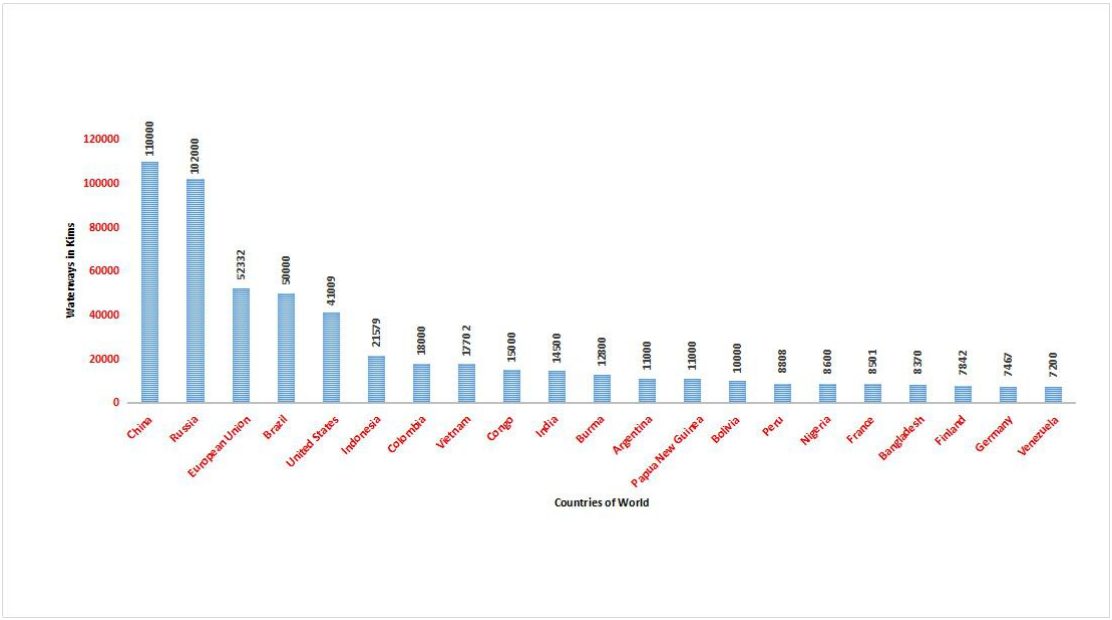


Figure 2.4 Length of Waterways in major World Nations (The World Fact book accessed in July 2016)

As discussed in chapter 1, the usage of IWT as mode of the transportation is highest among nations like USA, China, EU and Bangladesh. Considering the fact these countries have long length of Waterways and higher pie of IWT, researcher decided to dug deeper into these counties in terms of the infrastructure, Governance structure and policies.

2.4.1 IWT in USA

Overview

Figure 2.5 River System in USA (Wikipedia)

Transportation by Inland Waterways is a vital component of Transportation network in USA. For a set of commodities and geographies, water transportation is far more economical and effective as compared to Road and Rail. The U.S. waterway system is actually composed of 25000 miles (40000 KM) of waterway which are navigable, consisting 275 lock stations. (IWR Report 05-NETS-R-12, 2005). The main waterways process of USA integrates the Mississippi river system, the Gulf Inter coastal Waterways, the Ohio River Basin river system and the Pacific Coast frameworks. The Great Lakes and Mississippi River frameworks of US water transportation leading up to coastal location of the US also carry large quantities of merchandise. For instance: coal as well as petrochemical products as petroleum, iron and homestead products as grains. This system adds further value by connection with the railroads in the north south arrangement.

Mississippi River System: A major element of the commercially significant waterways of the United States comprise of the Mississippi River System - the Mississippi River and associating waterways. It's the important inland waterways system, extending from Louisiana to Minnesota, carrying freight traffic from the Missouri, Illinois, as well as Ohio River frameworks. This's the most crucial river system in USA contributing to nearly 3 fourths of complete volumes. This river system includes about eighteen hundred miles of Mississippi river and other rivers which flow into it like Ohio, Illinois and Missouri to create a large system of navigable waterways

Figure 2.6 Mississippi River System (Wikipedia)

measuring about nine thousand miles. It's twenty-nine locks. Main shipments: coal, farm and food products, petroleum, crude substances & chemicals. (MARAD, 2007).

Ohio River Basin System: Spread over nearly 2800 miles, The Ohio River Basin is the second largest navigable waterway system in USA. The key commodity shipped through this network is Coal, as this region carries large reserves of this commodity. The Ohio river system uses sixty lock and dam facilities maintained by the USACE. Beside Coal, large quantities of chemicals, grains, petroleum, and aggregates are also shipped on the Ohio River Basin System. (USACE)

Figure 2.7 Ohio River Basin (Wikipedia)

Governance Structure

The institutions responsible for the laws, policies, development and maintenance of USA's IWT structure are: Maritime Administration of the United States Department of Transportation (MARAD) and US Army Corps of Engineers (USACE).

Maritime Administration of US Department of Transportation: (MARAD) The federal transportation policies of the USA are created by the United States Department of Transportation (USDOT). While USDOT is responsible for creating overall policies and directions, MARAD, is one of ten functioning organizations of the USDOT, is responsible for executing its policies towards IWT and maritime transportation. Marad is also responsible for safety of navigation as well as vessel.

US Army Corps of Engineers (USACE). This organization is responsible for development and maintenance of Waterways in USA. They are responsible for safe, reliable and efficient movement of barge on Waterways. They are responsible planning, designing, constructing, operating and maintaining all Waterways in USA. They are responsible for building all channels, operating locks and regulating water levels for safe navigation.

Inland Waterways User Board (IWUB) is a Federal advisory committee also involved in Inland Waterways. This committee carries members from USACE, freight customers and Barge companies. This committee makes recommendations to US Congress on the priorities for projects on IWT and best possible ways of spending money from Inland Waterways Trust Fund.

Policies for promotion of IWT sector

The guiding principle of USDOT policy on IWT is to utilise the waterway system to reduce the congestion in the land transportation system. MARAD comes up with five-year strategy documents with an objective to progress and bolster the marine transportation system of USA, including infrastructure to cater the commercial and safety needs of the USA.

The investment in the US's IWT device is achieved by the federal money along with a separate Inland Waterway Trust Fund (Fund). In 1986 the Inland Waterway trust fund has been established to spend fifty % of main rehabilitation and building of IWT infrastructure. A bit of fund is collected by levying energy tax on the towboats. Maintenance and operations (O&M) is actually paid from the Federal Government. (Inland Waterways Trust Fund Facts Sheet, 2012-01-17).

The IWT's share of inland website traffic is actually approximately 8.3 % in the USA. Though, the percentage of the container traffic on main inland waterways is quite less as opposed to the full IWT traffic in the United States. This's because of the orientation of river network, and that is in the most and north-south of the container movement is actually on the east west of the State. Hence the container shipment on the Mississippi River has no stable trend. Only little selection of pots are actually carried on the USA process, which have been utilized for regular barges for the shipment of bulky products. The larger capacity tows ply on the agreement platform from one point to the other.

2.4.2 IWT in EU

Overview

Waterway system plays a very significant role in cargo transportation in Europe. Hundreds of industrial hubs and towns are connected through a network of waterways extending by over thirty five thousand KM. Twenty-one out of twenty-eight EU member states possess formal Waterways system and thirteen out of these have an interconnected Waterways system. Rhine-Meuse-Main-Danube river system measuring around 4,500 km of waterway, is the most significant commercial waterway system in Europe. To this one may add the lower reaches of the Rivers Scheldt, Seine, Mosel, Weser, Rhone-Saone and some busier channels to give a sum of around eight thousand KM of conduit that used for cargo transport (Paul Amos, 2009).

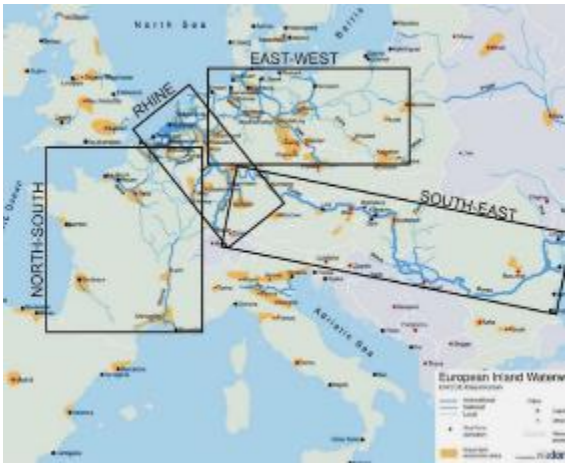


Figure 2.8 European Inland Waterways (wikipedia)

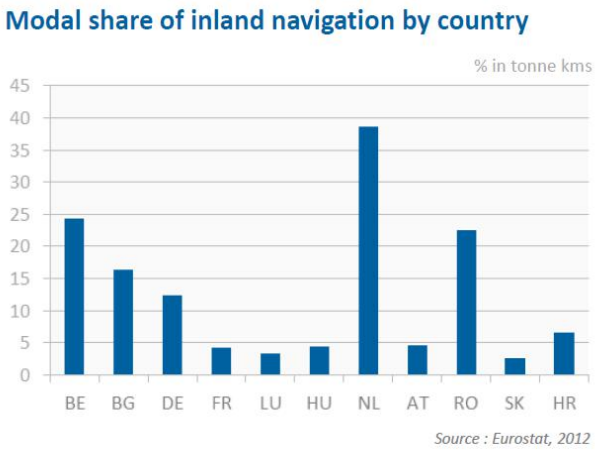


Figure 2.9 Modal share of Inland navigation by Country (Eurostat, 2012)

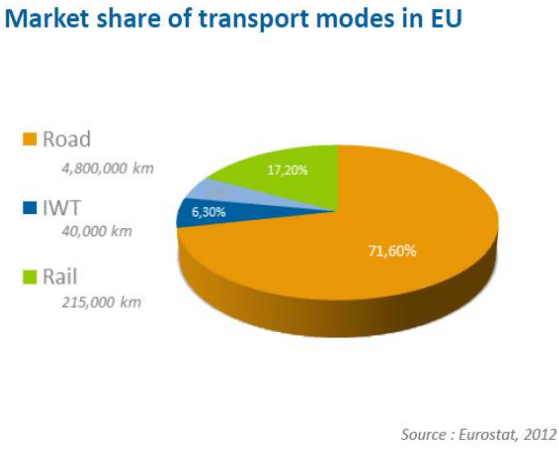


Figure 2.10 Market share of transport modes in EU (Eurostat, 2012)

Container transportation on waterways is very evolved in Europe, particularly on river Rhine using the gateway ports of Antwerp and Rotterdam. From the Rotterdam port barges carry more than thirty percent of the containers into hinterland. More than thirty percent of the movement originates or terminates into countries of Belgium, Netherlands and Germany while other EU countries account for the rest.

The major German inland container port of Duisberg, about 220 KM from Rotterdam port, is capable of handling river-sea vessels and feeds into major cities in Germany. IWT is popular for containerized transportation in EU not just for lower freight cost but also due to subsidies provided by Government in the countries of Netherlands, Germany and Belgium for development of intermodal terminals (Paul Amos, 2009).

Increase in transport in Europe in last decade led to the consideration of societal and ecological ramifications into the transport. This led to the consideration of energy efficient, environmental friendly and sustainable mode of transport. Hence IWT attracts the EU's policy maker and become a partner with significant share of total transport in the Europe. (European Commission, 2009).

Governance Structure

EU governs the Waterways systems at four levels:

- **Ministry of Transport and its national IWT agency managing Waterways in each individual country:** Within its territories, individual EU country is responsible for the managing and operating the waterway network. Each country plans its own waterway system, builds required infrastructure, manages its waterways system, licences vessels and ensure safety and security (European Commission, 2009).
- **International Conventions creating Multi-national River Commissions:** The most important ones have been the 1868 Mannheim Convention on the Rhine River and its tributaries, and the 1948 Belgrade Convention on the Danube River and its tributaries. (European Commission, 2009).
- **Central Commission for Navigation of the Rhine (CCNR):** CCNR is one of the most important commissions. CCNR's main tasks are to supervise the technical regulations on the Rhine and its tributaries and to safeguard free flow of navigation. (European Commission, 2009).
- **Danube River Commission:** After CCNR, the Danube Commission is the second most significant Commission. This consists of Austria, Romania, Bulgaria, Moldova, Croatia, Slovakia Germany, Russia, Hungary, Ukraine and Serbia and was established in 1948 by the Belgrade Convention. Under this

Convention, each member country is responsible for maintenance and upgradation of the part of Danube river flowing through it. The member country has to ensure that there are no hindrances to the navigation. However, in case of the Danube Commission, each country makes its own decision and the commission powers are advisory only (European Commission, 2009).

- The European Union (EU) itself.
- United Nations Economic Commission for Europe (UNECE). The objective of this body is to seek synchronization between IWT navigation and EU environmental standards. This is not an administrative body, but more of an advisory body (European Commission, 2009).

Policies and Programs to promote IWT

EU has been trying to put environment sustainability at the core of its transportation strategy. EU policy is thus trying to encourage Intermodal transport, railways, short-sea shipping, and IWT and make all of them far more competitive with road transport. With regards to IWT, EU felt that IWT mode can be enhanced by combining it with other modes and building multimodal chains. The EU introduced several programs like Marco Polo Program, NAIADES and sponsoring trans-European transport networks.

Marco Polo Program – EU felt that to shift balance between various modes it has to follow an active policy to promote intermodality with transport through IWT, Railways and Short-sea Shipping. EU introduced Marco Polo program where funds would be allocated to any proposal which will cargo from road to more environment friendly mode. Under the program EU was funding upto 35 percent of the costs depending upon the total ton-KM transferred from road to alternate mode of IWT, sea or rail transport.

Navigation & Inland Waterway Action & Development in Europe (NAIADES Program) – EU began an action program called NAIADES following a policy assessment in 2005. NAIADES concentrated over five major strategic areas:

1. **Markets**: The objective was to spread IWT past bulk and containers cargo to transport of vehicles, dangerous cargo, invisible loads and others. The commission created policies to encourage close cooperation among various stake holders, encourage intermodal transportation, provide easier access to capital and efforts to simplify administrative and regulatory framework.
2. **Fleet**: NAIADES program recognised and promoted use of newer and modern technology in fleet management and use of viable alternate fuels.
3. **Jobs and Skills**: NAIADES program aims to attract manpower by offering better work and social conditions in the IWT sector.
4. **Image**: The program calls for improving the shippers awareness about IWT in terms of its benefits and quality and reliability.
5. **Infrastructure**: NAIADES asserts that IWT can become more competitive by removing the infrastructure bottlenecks in IWT sector. As an example a modern River Information system can enhance competiveness and safety of IWT

Trans-European Transport Network (TEN-T) policies and projects – With the aim of single Market, in end 1980s EU came up with an idea of Trans-European Networks (TENs) in the areas of Energy, Transport and Telecommunication networks. Thirty priority projects were identified in these three areas, out of which two projects fell under IWT category:

1. **The Rhine/Meuse-Main-Danube Inland Waterway Axis**: With an objective of providing minimum 2.5m draft and allowing vessel of 3000 DWT, this initiative focused on Europe's two largest waterway routes, the Rhine and the Danube as well as the connection between them (the Main) and the junction into Belgium (the Meuse).
2. **Seine-Scheldt Inland Waterway:** This initiative aimed at improving IWT between Belgium, Netherlands and Luxembourg region and the Paris region.

2.4.3. IWT in China

Overview

China's Inland Waterways network is the biggest in the world in terms of length and the cargo carried (Paul Amos, World bank, 2009). China also an extremely rich heritage of transportation over rivers. China builds Grand Canal some 2500 years back. It's the very first such structure develop by mankind It connected the 5 major rivers of China and also played an important role of development of China as a nation.

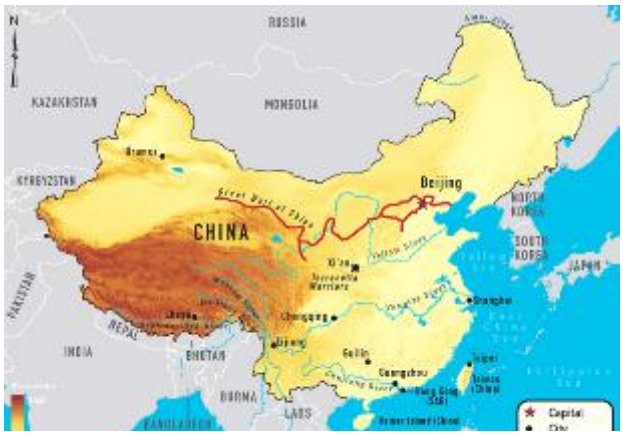


Figure 2.11 Inland Waterways of China (Wikipedia)

Modern China has almost 126,000 KM of navigable rivers, streams, lakes, and canals, more than any country in the world. The primary traversable rivers are the Yangtze River; Heilong Jiang; Pearl River; Xiang River, Lijiang River; Huangpu River; and Xi Jiang. (Paul Amos, World bank, 2009)

Major navigable rivers

Yangtze: Yangtze River, flows out of the inner Western part of the nation to the Eastern coast, where it meets the ocean. The Yangtze River along with the tributaries accounts for over half of China's total waterway system and features a navigable length of approximately 60,000 km (UNESCAP Report). Yangtze on its own accounts for over two thirds of the cargo carried over IWT system in China. Provinces of Hubei, Hunan and Jiangsu account for bulk of the freight carried over Yangtze river.

Pearl River: The Pearl River with its total trunk length of 2167 kms stands one amongst the four biggest rivers in China. It is next to Yangtze River and there are almost 988 rivers with total length of 36000 kms in Pearl River basin. Out of this 13000 KMs is navigable, the 5000 kms stretch links inward to southwest side via barges leading its outward to South China Sea (UNESCAP Report). Since it is connected all over the world through eight ports it forms an important coastal port system in the world which consists of Hongkong, Gunagzhou and Shenzhen (James Wang, 2013).

Governance Structure

A three level administration is governing IWT in China (Paul Amos, World bank, 2009). Ministry of Transport (MOT), at the apex level, develops the policies for IWT sector and conducts infrastructure planning (Paul Amos, World bank, 2009). On a next level are the Yangtze and Pearl River Administration who are responsible for the implementation of IWT projects on these two key rivers (Paul Amos, World bank, 2009). On the third level, are the provinces, who too implement IWT projects. The provincial Governments carry ownership for development, operation, upkeep, administration and governance of inland waterways in their province. In China, the MOT at centre, River Administration and Provincial governments are all aligned for various IWT projects.

Policies and Programs

China government has been running various programs to promote IWT. The key ones are as under:

Standardization of Waterways: State promulgated "Inland Navigation Standard of People's Republic of China" after an extensive investigation and study (Paul Amos, World Bank, 2009). The waterways have been classified as under:

Class of Waterways	Tonnage Capacity	Depth of Waterway in meters
I	3000	3.5 - 4.0
II	2000	2.6 - 3.8
III	1000	2.0 - 2.4
IV	500	1.6 - 1.9
V	300	1.3 - 1.6
VI	100	1.0 - 1.2
VII	50	0.7 - 1.0

Table 2.2 Classification of Waterways based on Tonnage and Depth (Paul Amos, 2009)

The intent of creating classification in China was to continuously monitor and improve the waterway system. To move lower class Waterways to higher class Waterways, targets were taken to increase Class III+ from about nine thousand KM to fourteen thousand KM and increase Class V+ from twenty-four thousand KM to thirty-six thousand KM. (Paul Amos, 2009)

National Inland Waterways and Ports Plan to 2020 (**NIWPP2020):** In 2007, NIWPP2020 was jointly agreed by MOT and the National Development and Reform Commission (NDRC) to significantly increase the length of waterways in China and bring the navigation standards at par with Europe and US. Based on economic and engineering feasibility studies conducted time bound plans were set for the Government to improve the class of waterways (Paul Amos, World Bank, 2009).

Barge standardization program: In 2006 MOT issued Inland Waterway Vessel Standardization guidelines to pursue vessel standardization (Paul Amos, World Bank, 2009). To replace old vessels with new vessels, scrapping subsidy scheme was offered. The old vessels were causing congestion, had low average tonnage and carried environmental and safety concerns thereby rendering IWT less competitive (Paul Amos, World Bank, 2009). The old vessel owners were urged to scrap their old vessels and replace them with more modern vessels through financial assistance (Paul Amos, World Bank, 2009).

2.4.4. IWT in Bangladesh

Overview

Bangladesh is endowed with large river network with river length of approximate length of 24000 KM, out of which a navigable waterway of 5800 Km is navigable during monsoon and 3800 Km during dry season. IWT is a critical mode of transportation for this country not only for imports and domestic freight but passengers as well. IWT provides

Figure 2.12 Bangladesh River System (Wikipedia)

access to almost twenty-five percent of the countryside home of Bangladesh. (Bangladesh Transport Policy Note, 2009). In Bangladesh, country boats play a significant part in the rural transportation of cargo and people. Bangladesh IWT infrastructure network includes eleven major inland ports, twenty-three coastal island ports, one hundred and thirty-three launch stations and more than one thousand minor landing points located in rural areas. Chittagong and Dhaka terminals along the Burigang River are connected through a barge service. A multimodal IWT terminal has been created at seaport called Mongla, to connect to railhead at Khulna. Bangladesh can be a called as riverine country as several rivers crisscross the country and major part of its border is coastal line.

Governance Structure

Bangladesh Inland Water Transport Authority (BIWTA) controls the IWT network in the country. It is responsible for development and upkeep of Inland Water Transport framework.

In last three decades the Bangladesh Government has shown a lot of interest in development of IWT. In October 2005, the National Strategy for Accelerated poverty reduction (NSAPR) recommends the long term planning for the development of IWT in the country by setting up the standards for bridges and berths. The NSAPR also ensures the preservation of country boats. In November 2005, Government of Bangladesh also drafted an Integrated Multi-Modal Transport policy (IMTP) to encourage an efficient, safe and cheap IWT system.

2.5 IWT in Indian context

2.5.1 IWT progress in India

As discussed in chapter one, India carries a rich tradition of transportation on rivers. The historical manuscripts extensively mention use of Ganga and other rivers for transportation of cargo in India. Even during early period of British rule, IWT was commonly used for cargo transportation. The development of tea business lead to the growth of river transportation. Way back in 1844, water route was developed over river Brahmaputra from Kolkata to Dibrugarh (Mishra et al, 2012). By year 1863,

regular fortnightly services were operating between Agra and Kolkata on river Yamuna-Ganga and a similar service from Kolkata to Assam. The river transportation was extended all the way up to Gurmukteshwar on river Ganga and Ayodhaya on river Ghaghara. At its peak in 1877, almost 1.8 lac country boats were registered at Kolkata port, almost 1.24 lac boats at Hooghly and almost 62 thousand at Patna port. However, in later part of nineteenth century and early part of twentieth century, the British Government began overlooking IWT and diverted their energies and resources in development of Road and Rail. Several irrigation projects also came into being which consumed lot of river water reducing the flow and leading to siltation on river beds. The earthquakes in Bihar in 1934 and in Assam in 1897 and 1950 caused disturbances in river beds of river Brahmaputra and several tributaries of river Ganga affecting drainage of water and putting further stress on river network system (Mishra et al, 2012).

River transpiration continued to lack attention during early part of Independent India. It was in the year 1980 when National Transport Policy Committee (NTPC), headed by B.D.Pandey, discovered that attention and financing to this particular segment was awfully deficient. The NTPC (1980) recommended the following standards to declare any waterway as national waterway:

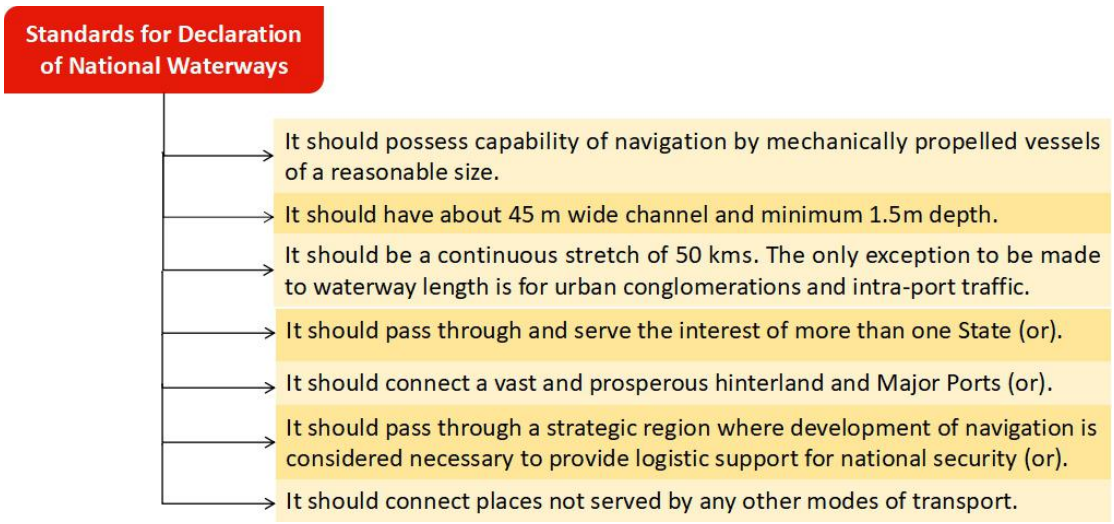


Figure 2.13 Standards for Declaration of National Waterways (B D Pandey)

As per above recommendations an apex authority called Inland Waterway Authority of India(IWAI) was constituted under Ministry of Shipping for developing and promoting IWT in India.

Between 1986 and 2015, Indian Government declared five waterways as National Waterways. In year 2016, Indian government through a bill declared another set of 106 waterways as National Waterways making it a total of 111. Figure 2.14 & Figure 2.15 indicates all 5 NWs on Indian map in greater detail.

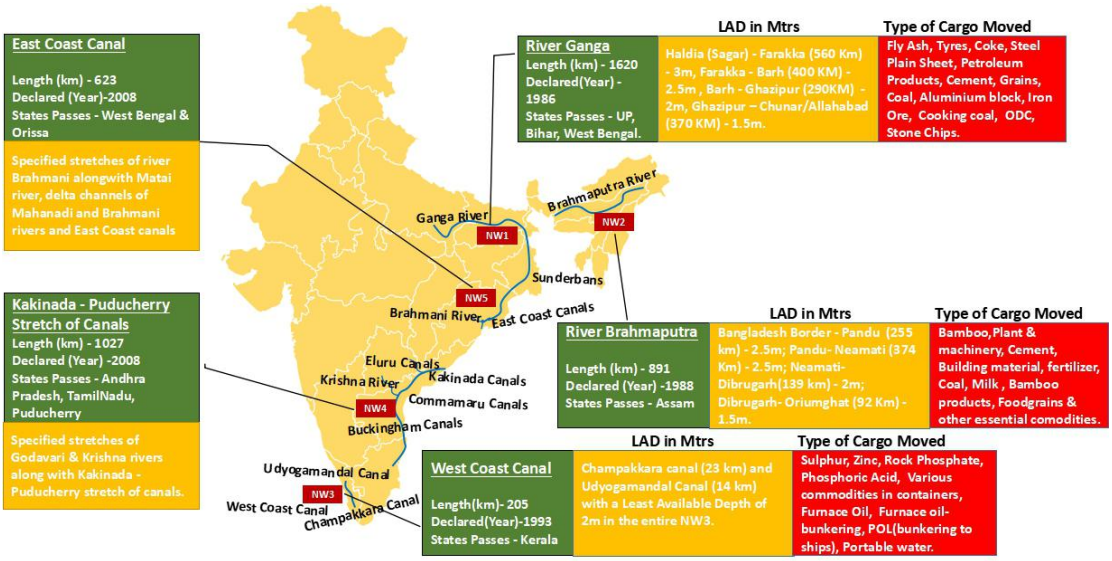


Figure 2.14 National Waterways of India and their specifications (Author)

Figure 2.15 Five National Waterways of India (IWAI Website)

Volumes carried on Indian waterways

The following chart indicates the cargo carried on Indian Waterways.

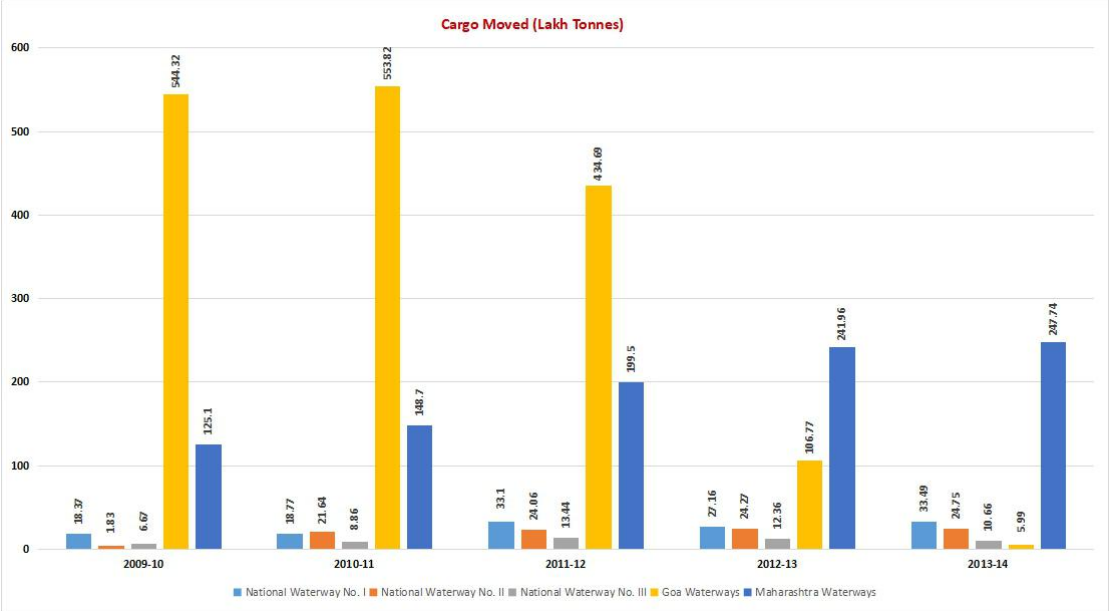


Figure 2.16 Cargo moved on various Indian Waterways (Ministry of Shipping website)

Commodity Types

Following chart indicates the key commodities and their volumes carried over IWT in India.

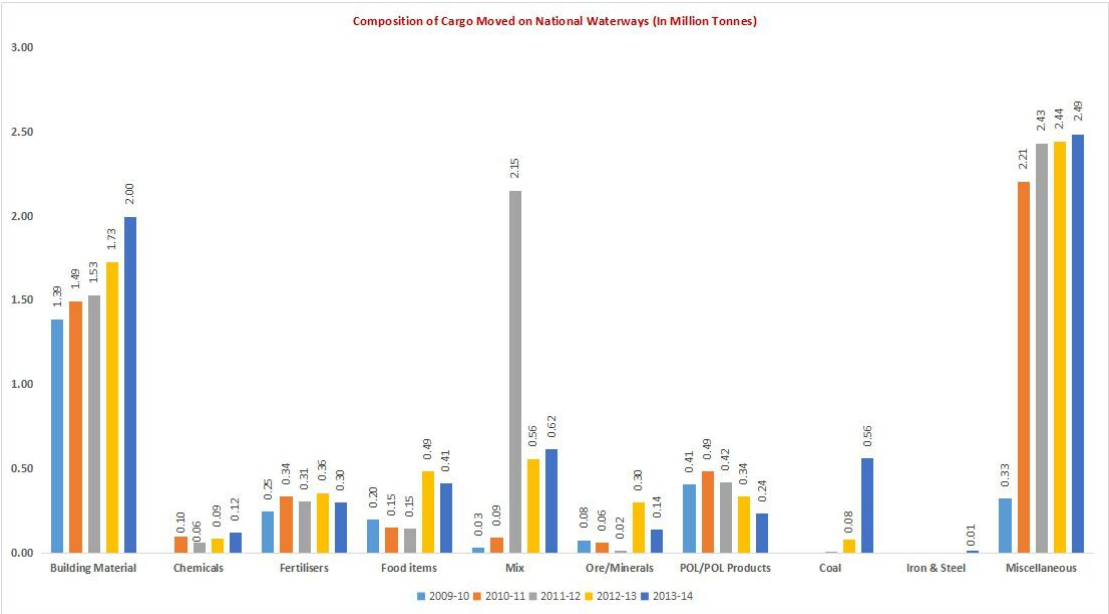


Figure 2.17 Composition of Cargo moved in Million Tons on National Waterways (Ministry of Shipping website)

2.5.2 IWT Governance Structure

The key organisations involved in policy making and administering WT in India are as under:

Ministry of Shipping

Under the aegis of Government of India, The Ministry of Shipping has been entrusted with job of formulating and administering the Laws, Rules and procedures pertaining to Sea Transportation and Inland Water Transportation. Ministry of Shipping administers IWT through its agency called IWAI.

The Inland Waterways Authority of India (IWAI)

Under the fold of Ministry of Shipping, IWAI came into existence in October 1986 responsible for development and regulation of inland waterways transportation for India. IWAI utilizes the grants received from the Ministry to undertake various projects for development of fairways on the declared National Waterways. The authority of Headquartered at Noida and has offices and sub offices in various parts of the country. The key responsibilities for IWAI are:

a) Proposals for declaration of new NWs
b) Classification of waterways
c) Development of Infrastructure on National Waterways
d) Conducting technical and commercial feasibility checks for various suggested projects
e) Counsel and inform on IWT related matters to Ministry of Shipping
f) Provide support to State Governments for development of IWT in their states

Central Inland Water Transport Corporation Limited (CIWTC)

CIWTC was incorporated in 1967 mainly responsible for providing Barge services for transportation of cargo through IWT mode in the Eastern and North Eastern India. However, it was closed in August of 2016 due to continued losses.

The National Inland Navigation Institute (NINI)

NINI was established in Feb 2004 at Patna, Bihar by IWAI to develop human capital for managing Inland Waterways in India. The institute imparts training on several aspects of IWT namely, designing, building, operating and managing Waterways, Terminals and Barges. Surveying & dredging of waterways, traffic management and commercial aspects of IWT (www.nini.bih.nic.in).

State Governments

As like National Highways, National Waterways are build and managed by central Government through IWAI. The state waterways are being handled by various State Governments. To promote State Waterways, Ministry of Shipping provides subsidy to state Governments for various IWT projects through a scheme called as Central Sector Scheme.

2.5.3 Policies and programs to promote IWT industry

Indian Government has taken several initiatives to encourage IWT in India:

Indo - Bangladesh Protocol

An understanding exists between India and Bangladesh in the form of a Protocol which allows the inland vessel of one country to transit certain approved and specified routes in other country. The key objective of this protocol was to allow access to North eastern India with rest of India through Kolkata and Haldia ports. After being first signed in 1972, the protocol has been extended repeatedly, the currently being valid till March 2020.

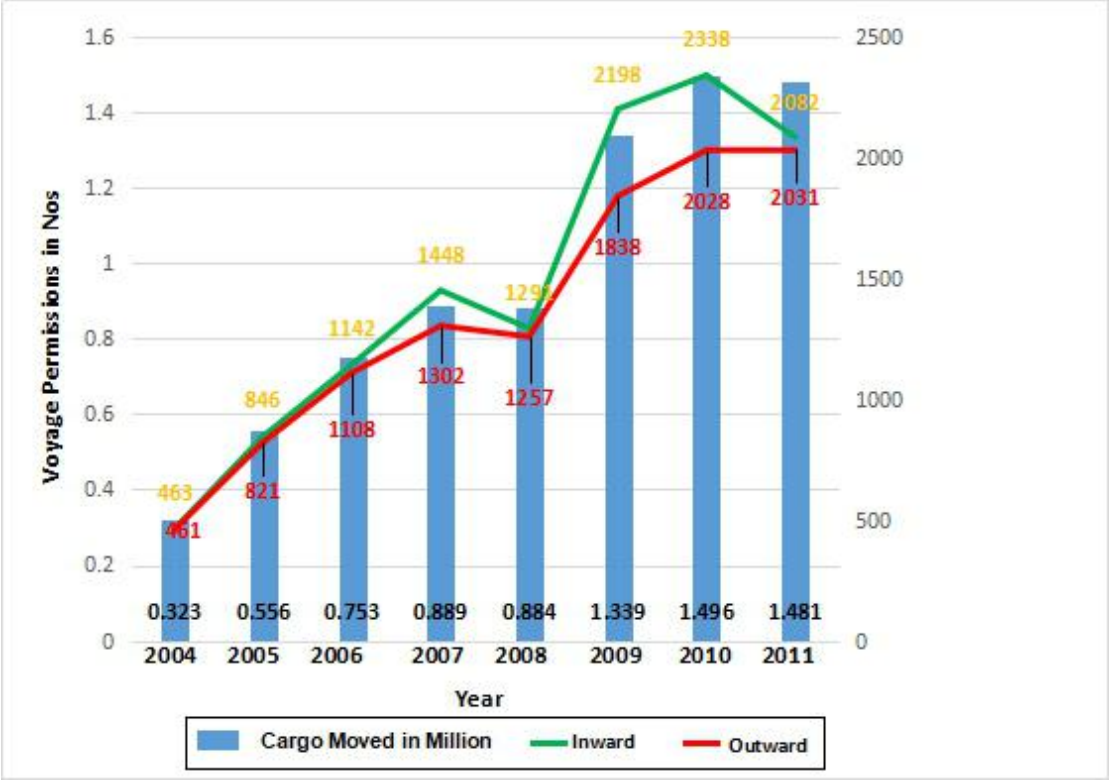


Figure 2.18 : Details of cargo movement and voyage permissions under the Protocol (IWAI Website)

IWT Policy

In year 2001, the Government came up with IWT Policy. The policy recognizes the strong need to promote IWT due to its environment, economic and fuel-efficient credentials. The policy clearly envisages an increase in share of IWT in the total modal mix in the country. The policy provided encouragement for private participation in this sector through several fiscal concessions and policy guidelines.

Key thrust areas in the policy:

1. Building waterways infrastructure like adequate channel, depth, navigational aids and terminals to allow competitive navigation.
2. Provide adequate fleet of right sized barges.
3. Encourage private participation. IWT cannot be developed only based on budgetary allocations. It required a strong private participation as well.

4. Pooling PSU resources: Efforts will be made to encourage PSU involved in bulk commodities like Coal, Oil and Fertilizers to utilize this mode and encourage this mode through capital investments or soft loans.
5. Funding from external sources. External assistance to turn-key projects may be explored as part of privatization efforts.
6. North Eastern region would be the special focus area for development of IWT
7. Developing human capital. Strong human capital has to be built for success of this sector through training at NINI and various regional Institutes.
8. Linking Waterways with coastal shipping can provide synergies.
9. A crucial role in the development of IWT will be played by R&D efforts. Designing India specific solutions like shallow-draft and low-cost vessel and identifying low cost navigational aids.

Encouraging Private Participation in IWT Sector

The policy provides possible areas and recommendations for private participation in IWT sector as listed below (IWT Policy, 2001):

a. Ownership and operation of Barges
b. Waterway development, operations and maintenance. Putting up and maintenance of navigational aids
c. Construction, operations and operation of Waterways terminals. Deployment and operating of mechanized cargo-handling systems
d. Setting and managing of IWT training institutions.

Jal Vikas Marg Project

The 'Jal Marg Vikas' project being implemented with funding and technical assistance from World Bank, targets consistent 3 meters' of draft between Haldia and Allahabad covering a distance of 1620 KM on National Waterway 1. This will allow commercial navigation of barges with carrying capacity in excess of 1500 DWT. With an estimated cost of Rs 42 billion this project is targeted to be completed between 2014 to 2020. The project involves channel marking, river training, river

information systems, navigational locks, construction of jetties and multi modal terminals as part of the development (Ministry of Shipping, 2015).

Ro-Ro Barge service

In Year 2011 new International Container Transhipment Terminal (ICTT) was contracted at Vallarpadam Island under Cochin Port Trust (CPT) in the state of Kerala. In order to decongest containers trucks crossing the Kochi city, IWAI together with CPT established 2 IWT terminals at Bolgatty and Willingdon Island. This two terminals allow RORO movement of container loaded trucks to fill containers to ICTT at Vallarpadam and thus reducing the traffic. RORO services are also introduced at many points in NW2.

The following figures shows a comparison between IWT network in the countries of India, US, China and EU.

Comparison between IWT network in the countries of US, European Union , China & India

	US	EUROPEAN UNION	CHINA	INDIA
Waterways Length in KMs	Designated Waterways - 40,000; Commercially Significant - 16,000	Designated Waterways - 35,000; Commercially Significant - 8,000	Designated Waterways - 61,000; Commercially Significant - 24,000	Designated Waterways -4,400; Commercially Significant - 2,900*
Freight Utilization in Mn MT & Bn Ton KM	566,400 (Year 2005)	440,138 (Year 2006)	1,160,303 (Year 2006)	70,477 (Year 2011-12)
IWT share on total Ton KM (2006)	8.30 %	5.60 %	8.70 %	<0.50 %
Main Commodity Types Using IWT	Coal & coke 22%, Oil and oil prods.14%, Food grains, farm 25 % (Year 2005), Crude materials 18%, Chemicals 11%, Manufactures 9%, Others 1%	Coal & coke 11.6%, Oil & oil products 16.2%, Agriculture & food 14.6% (Year 2005), Building materials 20%, Chemical and fertilizers 11.1%, Manufact. & Iron/steel 16.6%	Coal & coke 17%, Oil & oil products 8%, Metallic & non-met. ores 19% (Year 2006), Building materials 34%, Steel 7%, Containers 6%, Others 9%	Coal, cement, bauxite, iron ore pellets, stone, HR steel, project cargo and related raw material, Sulphur, rock phosphate, cement, lime stone & clinker (Year 2011-12)
Containers handled at inland ports	Negligible	About 2 million TEU trips/year (2005)	7.82 million TEU handled/year (2006)	Negligible
Main Policy and Administrative Institutions in IWT Sector	1. Maritime Administration of the US Department of Transportation (MARAD). 2. US Army Corps of Engineers (USACE)	1 River Comm issions set up by international treaty .2 National Governments. 3 United Nations Economic Commission for Europe (UNECE) (harmonization of pan-European navigation rules)	1 Ministry of Water Resources. 2 Ministry of Transport (MOT). 3 Yangtze and Pearl River Navigation administrations (report to MOT). 4 Provincial Governments and their navigation authorities.	1. Ministry of Shipping 2. Inland Waterways Authority of India
Strategic objectives	1. USDOT transport objective to alleviate transport congestion by increasing use of IWT and intermodal transport using IWT. 2. Main sector objective stated by MARAD is to protect the industry and preserve it for US operators/ships/crews	1. To promote and strengthen the competitive position of IWT to help create a more sustainable transport system overall. 2. To overcome bottlenecks and increase connectivity of waterways of EU-wide significance	1. To increase the utilization of IWT by substantially upgrading the waterway system by 2020: -increase Class III+ from 8,687km to 14,300km -increase Class V+ from 24,000 to 36,000 km; 2. To promote a more efficient and effective fleet of vessels	The vision of development of IWT of the country is their utilization for transportation of cargo to about 20 bn tonne km by 2020. To develop all potential inland waterways with adequate IWT infrastructure both through public and pvt funding to make them a commercially viable.
Programs being run	1. USDOT Strategic Plan 2005-2011 and MARAD Strategy 2003-2008 2. Coastal and River Information Services development and implementation (CRIS)	1. National programs, plus. 2. Navigation and Inland Waterway Action and Development Plan in Europe (NAIADES). 3. Marco Polo Program Trans European Network program (TEN-T): 2 IWT projects. 4. Harmonized River Information Services (RIS)	Long-term Waterway 1. Development Plan to 2020 2. 11th 5-year plan to 2010 3. Vessel standardization program 4. Early framework design for an integrated river information service	1. IWT Policy. 2. Indo Bangladesh Protocol 3. Kaladan Multi-modal Transit Transport Project. 4. Integrated National Inland Waterways Transport Grid (INWTG). 5. Jal Vikas Marg Project

Figure 2.19 A comparison between IWT network in the countries of India, US, China and EU (Author)

2.6. Intermodal Transportation

Traditionally logistics of a supply chain had not been emphasized too much and the carrier of goods from source to destination was operated by a single mode of transportation. Single mode of transportation will deliver the advantages of cost, safety, transit time and reliability. However, the revolution in global supply chain and technical evolution of each mode of transportation propel towards the effective and efficient utilization of transportation (Rondinelli and Berry, 2000). The prominence of logistics in the supply chain and the containerization in the amid 1900's set the stage for intermodal transportation. Intermodal transportation seeks towards the integration of more than one mode of transportation and their services to improve the efficiency of freight distribution. Thus, the growth in the intermodal transportation should imitate the growth in the amount of the freight to be transported.

2.6.1. Definition

To characterize the Intermodal transportation, allows first characterize the flexibility. (Mahoney, 1986), characterizes Intermodality as the development of cargo by means of at least two divergent methods for methods of transportation. Flexibility is portrayed as the development of payload from shipper to representative by no less than two unique methods of transport under a solitary rate, through-charging and through-liability (Hayuth, 1987). Henceforth, Intermodal transportation might be depicted as the transportation of travellers or cargo through at least two than two methods of transport without stacking and emptying and the difference in method of transport is occurring at a terminal specially designed for the purpose.

Definition of Intermodal Transportation is provided by number of practitioners and researchers as follows. (D'Este, 1996) outlined the intermodal transportation as a service, that has many characteristics as well as business, operational and managerial perspectives for shifting items from place-to-place using greater than one method of transport. (Daley and Murphy, 1998) defined it as a process as opposed to a framework or a concept. Probably the most comprehensible characterization of intermodal transportation is actually provided by European Conference of Ministers of Transport (ECMT). ECMT defines the intermodal transportation in (2001) "as *the movement of goods in one and the same loading unit*

or vehicle which uses successively several modes of transport without handling of the goods themselves in changing mode".

IMT can be looked as transport of goods in specially designed containers and exchangeable bodies through sea, road and rail. The EC definition goes beyond the ECMT/CEN definition, and corresponds with the ECMT/CEN definition of multimodal transport: "*the movement of goods whereby at least two different modes are used in a door-to-door transport chain"*. United Nations in 2001 modified the ECMT and CEN definition of intermodal transport as *"a system of transport whereby two or more modes of transport are used to transport the same loading unit or truck in an integrated manner, without loading or unloading, in a door to door transport chain.* "(Lowe, 2006) define it as "*the utilization of two or more 'suitable' modes in forming an integrated transport chain, which is aimed to achieve operational efficiency and cost-effectiveness in delivery of goods in an environmentally sustainable manner from their point of origin to their final destination*".

More elaborately, Intermodal transportation can be described by a small example. A pictorial depiction of Intermodal Freight Transportation is given below. Consider the movement of goods in intercontinental intermodal chain. Goods in containers depart the shipper's facility in truck to reach a rail terminal. The container then moves from rail terminal to reach the origin port. A ship at the origin port transports the containers to the destination port at other continent, from where these containers leaves in a train and then moved in a truck to reach the receiver. A pictorial depiction of the example is given below in Fig. 2.20

Fig. 2.20 Depiction of Intermodal Freight transportation (Author)

2.6.2 Evolution of Intermodal Transportation

Intermodal transportation entails the transportation of freight in an intermodal container using more than one modes of transportation, therefore containerization is actually the major driver of intermodalism (Woxenius, 1992). The preliminary improvement of containerization may be traced back in the 18th century when coal is actually being delivered in a container on the Canal of England. Throughout 1830 railways began using especially created wooden container of Manchester and Liverpool for the same, while in 1841 iron containers have been used between Swansea and Neath Docks. After that in the start of 19th century covered containers had been utilized for the movement of freight among rail as well as road. During 1920's United Kingdom's Railways standardized curved roof containers to be carried on regular container flats and began door-to-door intermodal road rail with these container service by 1928. Truck trailers had been initially worn by Chicago Great Western railways in 1936, later on in 1952 it's been created in North America. In exactly the same United Kingdom railways provided the craned service to load on as well as load off the containers at back of the truck. America additionally encountered the real wood baggage crates on flatcars form the 1830s to the 1940s on railroads.

Importance of Containerization in Intermodal transportation

Mr. M McLean can be attributed the credit of introducing containers. He was working with a trucking company which took over a shipping company. He applied the concept with Rail-Land transportation to Sea – Land transportation with the help of standard dimensions for containers which will allow seamless movement between Sea and Land. He decided that containers should be fitted with special devices which will allow ease of pick up and movement from one mode to another. He also suggested ships to be fitted with special cell guides or rail structures which will allow vertical stowing of containers on top of each other.

The development of intermodal transportation and containerization almost happened simultaneously. There was lot of confusion at shipping line due to the different sizes and dimension of the containers. Hauliers of containers engage

different volumes and boxes of different sizes. Hence, a standard TEU (20-foot Equivalent Unit) was first coined by Richard F. Gibney in 1969. Containerization also contributes in the adoption and diffusion of intermodal transportation system. Thus, the significance of containers is not what they are - simple boxes - but what they enable; intermodalism.

There are many factors which influenced the development of intermodal transportation, slowing it down in certain periods as well as progressing it in others.

- **Adoption (1970-1990) Stage.** The world started acknowledging container as a transportation product and started building intermodal facilities. This stage also saw introduction of ships dedicated to only carrying containers and port being converted into containers ports reserved to handling containers only. The investments in intermodal transportation and containerization grew as the risk factor reduced and the business became more commercially viable.
- **Growth (1990-2008) Stage.** The journey of Containerization started earnestly impacting the manufacturing strategies and global trade patterns. Chains emerged as major manufacturing hub and allowed long distance trans-atlantic and trans-pacific container pendulum travels. During this period, the shp building industry also came up with large post-Panamax vessels with large capacities. On land side the containerization started moving more hinterland with movement of containers through rail and barges from port to inland locations.
- **Maturity (2008-) Stage.** The maturation of container traffic will be led by the maturation of the global economy. Several factors affect global trade. Manufacturing advantages with several countries, high energy cost and trade imbalances will affect global trade in coming days. Maturity of containerization stage will also see more introduction of technology in container transportation.

With the advent of information technology services, high global trade, improved technical specifications, the most favourable conditions for intermodal

transportation are experienced today. Change in Government regulations can have serious influence of Intermodal Transportation. Hopefully these conditions and other technical developments aid further evolution of intermodal transportation so that it continues to drive and support growth of Global economy.

2.6.3 The Mechanics of Intermodal Transportation

Intermodal transportation transferred the freight (people) from origin to destination using at least two modes of transportation having common handling characteristics. In this type of transportation cargo need not be handled, only load units such as pallet or container is to be shifted from one mode to other and to be supervised by individual mode operator with separate set of documentation. Though, to enhance the economic performance of the freight (people) transportation from source to destination is to be seen as single trip and the modes are to be chosen in productive manner. Rails can be used for long distance haulage with competence of the truck shipping for local pick up and deliveries. The consecutive use of different modes of transportation is also called intermodal transportation chain.

In chapter 1, we studied brief introduction about the mechanics of Intermodal Transportation. The following figure gives an example of Intermodal Transportation.

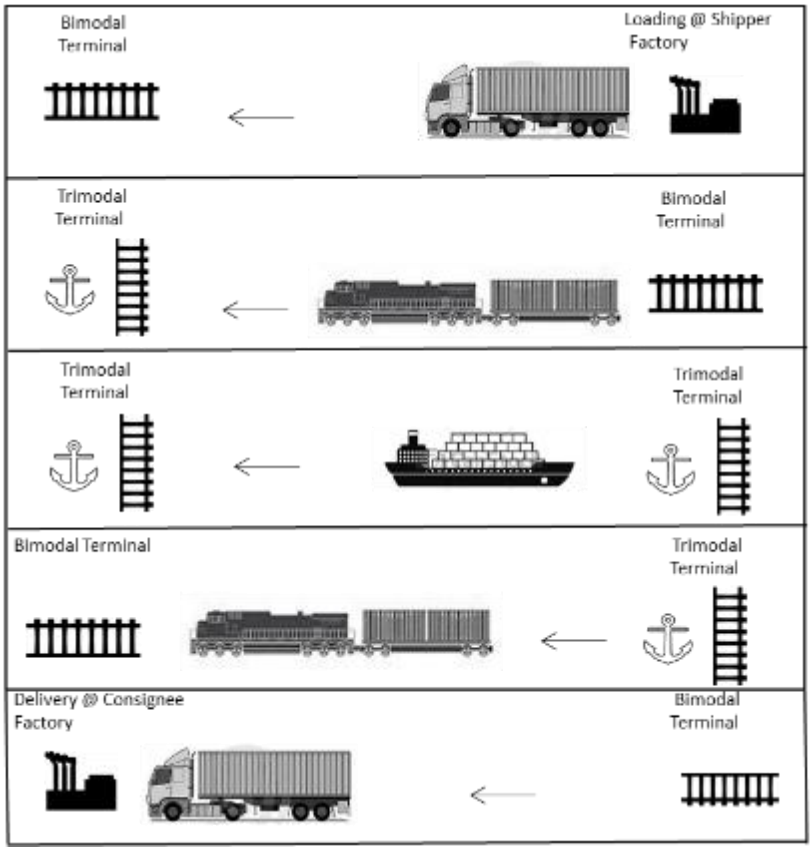


Figure 2.21 Example of Intermodal Transportation(Author)

- The container is loaded in the factory of the shipper and sent by Road mode to a bimodal terminal connecting Rail and Road. The terminal generally is closest Rail Head to the shipper's factory.
- The container then moves by Rail from a bimodal terminal to an trimodal terminal. This trimodal terminal is generally close to port and this movement from hinterland into the main port. The trimodal terminal connects Rail, Road and Sea.
- The containers now move from one trimodal terminal to another trimodal terminal by Vessel. This movement is generally from one country to another country.
- In the fourth movement the containers again move from trimodal terminal to a bimodal terminal. This movement is generally from port to the nearest Rail head on the consignee.
- The container now moves bimodal terminal to consignee factory by Road. This the last mile delivery the consignee.

During the entire journey the unit of movement remains the container. The container travels across three modes of Road, Rail and Sea. The terminals are the places where the exchange of container happen from one mode to another. Four major functions define an intermodal transport chain:

- **Composition** usually involves assembling, packaging, warehousing and consolidation of the freight. Freights coming from different suppliers through trucks are to be assembled at the distribution centre. Than it has been consolidated into a load unit to be progressed to higher capacity modes such as rail and maritime shipping. This process is generally called "**first mile**", which provides an interface between the local distribution system and domestic / abroad distribution system.
- **Transfer** involves the consolidated flow (in train or maritime shipment) of cargos between two terminals (at least). Transfer takes place in domestic / abroad freight distribution system, while taking advantage of **economies of scale**.
- **Interchange** of load unit from one mode to another at terminals is the major intermodal function and provides continuous flow of cargo. Ports are the good example of terminals, which comes under the dominion of national or international freight distribution systems.
- **Decomposition** also referred as "**last mile**". As the freight reaches to last terminal near to the destination it has been fragmented and shipped to the local/ regional distribution.

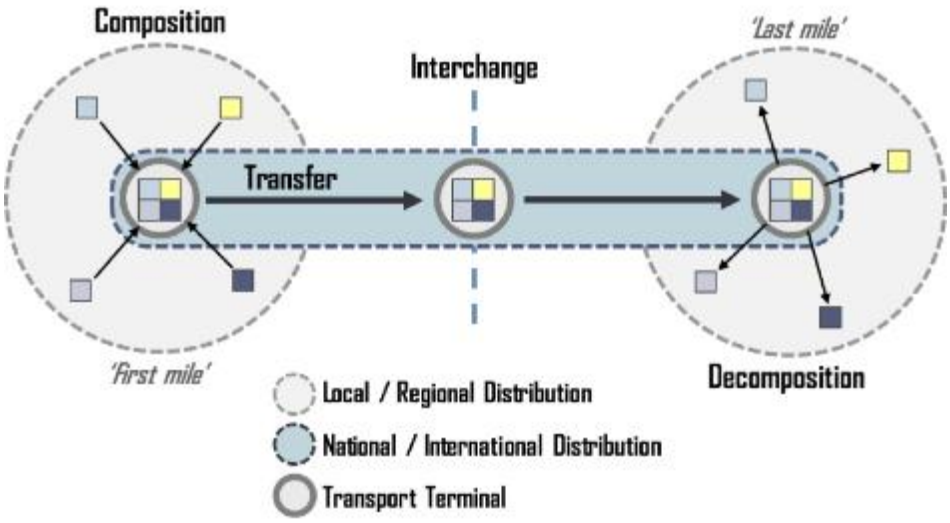


Figure 2.22 Intermodal transportation chain (https://people.hofstra.edu/geotrans /eng/ch3en / conc3en/intertranspchain.html)

Decisive Characteristics of intermodal transportation:

- **Nature and quantity of transported cargo** - This type of transportation fits for the freight having less than 25 tons of cargo in the load unit.
- **Origin and destination** – longer the distance, more likely the use of an intermodal transportation. As a rule, a distance of more than 500 km is preferably to be covered through intermodal transportation.
- **Transportation cost and time** – truck, rail and maritime are the governing modes of transportation in the intermodal transportation due to their reach and cost effectiveness. Air transportation is costly and load units are not easily transferable to other modes.
- **Value of shipment** – the high value shipment through air cargo is a direct option (joined by trucks) and the low value shipment trough rail and maritime have limited reach. Thus intermodal transportation provides an intermediate cargo value option.
- **Frequency** – for the efficiency and cost effectiveness cargo flow need to be continuous and constant in weight and quantity.

2.6.4 The Advantages of Intermodal Transportation System

Traditionally a transportation system had been evaluated on the basis of the Vehicle maintenance cost, operation cost and travel time. However, a transportation system does have impact on the production, consumption, leisure and dissemination of knowledge as it consists of multiple services to multiple users. Thus it becomes imperative to measure the effect of any transportation system on whole network. Intermodal transportation as it was defined is more than mere improvements in the transportation infrastructure as it utilizes the relative advantages of different transportation modes (Churchman, 1979). The advantages of adopting intermodal transportation can be categorized as economic, environmental and operational benefits:

Economic advantages

(Yuri Yevdokimov, 2000) suggested economic advantages of intermodal transportation. The impact of intermodal transportation can be divided into four elements as per him:

- **Increase in volume of transportation**: Increased use of intermodal transportation leads to increase in the volume of cargo being transported. This increase in volume does not require the proportionate increase in the efforts of the system, hence leads to the **"economies of density".** The containerization and consolidation of cargo in the intermodal transportation increases the vehicles load factor thus enhances economies of density.
- **Reduction in logistics cost:** it enables the shippers to take the advantages of lower freight rates, more standardized pricing, frequency of services and flexibility of loading and unloading services. Thus it leads to just in time delivery and reduction of inventory holding cost (a major part of logistics cost). Reduction in inventory holding cost goes ahead with the improvement in productivity.
- **Expansion of Transportation network:** Intermodal Transportation increases the total distance covered between all the service points in the network characterizes the **economies of size** (transportation analog of economies of scale). Addition in the number of service points proportionally adds to the economies of size. Since, intermodal transportation has preliminary big network

of interconnected terminals (service points). Hence, intermodal transportation expands the transportation network and overall mileage. The increase in overall mileage decreases the increasing rate of transportation cost per tonnage of freight and improves the economies of size.

- **Improved access to input and output market:** the expanded transportation network increases the network's accessibility to specialized manpower skills and better input products. It also enhances the networks accessibility to serve broader market at an economical rate.

Operational advantages

Surface transportation by Road offers several challenges. Continuous driver shortage, increasing fuel prices, limited capacity of the truck and new policies of various cities and states that restrict the motorable hours of service on the road are multiple challenges. Intermodal Transportation offers several operational advantages like:

- Intermodal transportation has high capacity of transportation and due to consolidation of cargo in a load unit it is much reliable and safe than other modes of transportation.
- The use of many modes of transportation minimizes the idle sitting time of transportation due to weather conditions, documentation at borders, holidays and accident.
- Shippers gain access to standard equipment and scheduled transit times.
- With intermodal transportation the pricing is more predictable, lower rates and less efforts in unloading and loading, which reduces handling costs.
- An intermodal movement is planned and coordinated as a single journey, thus reducing the risk of loss, damage or pilferage during the transit.
- Documentation process becomes easier, with lesser efforts for need of issuing documents at each stage of the journey.

Environmental Advantages

Rail or maritime shipment emits far less carbon emission gases as compared to road transportation. Hence, the carbon footprint of the shipper is far reduced in case of

use of multiple modes as the transport as bulk of the journey in case of intermodal transportation happens on environment friendly mode.

Figure 2.23 Diagrammatical representation of advantages of intermodal transportation (http://www.ekol.com/en/services/freight/intermodal/advantages)

2.6.5 Intermodal v/s Unimodal Transportation Costs

There is transportation cost which is incurred in transporting goods from manufacturing location to consumption location which is passed on to the consumers. Due to its comparatively low infrastructural requirement and external costs, traditionally road has been a market leader in logistics (Mortimer and Robinson, 2004). However, it lacks quality in terms of being less reliable, longer lead times and lesser frequency. Other road, other unimodal transportation also carry some or other limitations. Hence it is recommended by practitioners and researchers to use more than one mode for national, international and intercontinental routes.

(Fowkes et al., 1989) discussed the cost distance model of rail versus road for the national movement while (Hayuth, 1986) discussed for the sea versus air for intercontinental movements of goods. (Beresford, 1999) discussed the MMT for international trade to pick the most cost efficient mode or integrated modes. These

models had been discussed to minimize the cost and risk and for on time delivery of goods. The cost includes unit cost of transportation and the intermodal transfer cost. The curve represents that for a certain volume movement, sea transport is cheapest per ton per Km, Road transport is most expensive (for certain distance) while waterways and rail costs are intermediate. The height of straight step in the cost curve is proportional to the freight handling charges at terminal point. Aim of the cost distance model is to choose the most cost effective combination of transport mode for a specified route.

The fig. 2.24(d) depicts that there seems to be not much difference in the unimodal and intermodal cost. Though, each type of transportation mode on its own has limited reach and some other shortcomings. Road is seeming to be most expensive but exposed to most of the destination, while the movement through rail, waterways and sea can reach to only specifically designed terminals and further movement to destination requires road transportation.

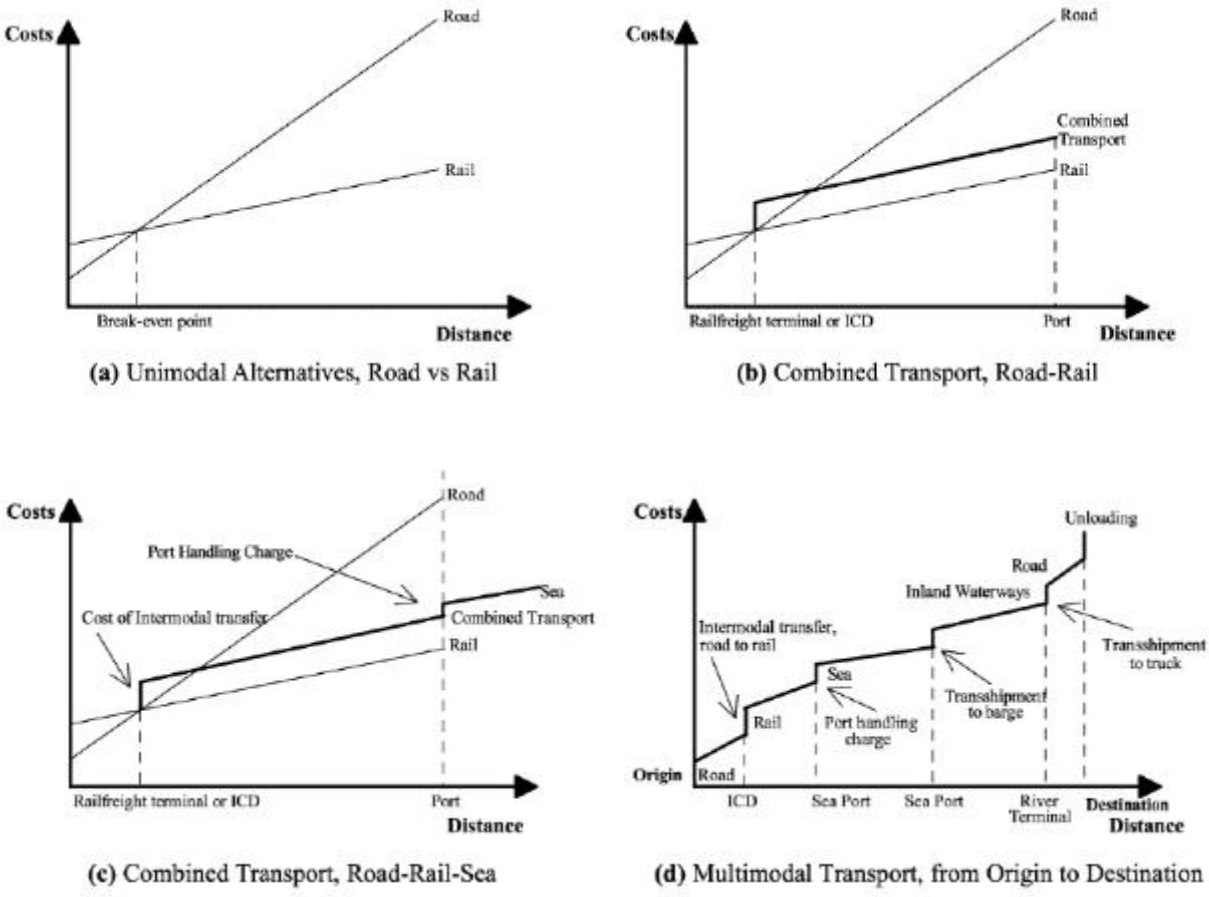


Figure 2.24 Cost Distance model for multimodal transportation (Beresford ,1999)

2.6.6 How is Intermodal Transportation (IMT) different from Multimodal Transportation (MMT) ?

The terms of multimodal and intermodal have been used synonymously on several occasions. IMT can be understood as a service of freight distribution between the points where the cargos have been consolidated (in container) and deconsolidated (Ockwell, 2002). While multimodal transportation is a concept, it ensures the efficient and cost effective nonstop shipment of the goods from the shipper's factory to the consignee's factory along the best path under the responsibility of one operator. Multimodal is more used in European and developing countries while intermodal transportation system is renowned in U.S. (Intersecretariat Working Group on Transport Statistics, 1997). UNCTAD defined the Multimodal Transport as "the combination of various types of transport modes used in a national or international transport operation, in which provides door-to-door services, under the responsibility of one single transport operator". While, intermodalism refers to a transport service which is more coordinated, flawless, flexible and uninterrupted. Intermodal transport concentrates on the operational aspects and logistics infrastructure under the legal environment. Intermodalism also requires possessing the information of interchange (D'Este, 1996). Multimodal transport need to control and regulate the involving parties in providing clarification and legal liabilities.

Moreover, the Multimodal Transport differs by the intermodal Transport in the sense of use of single Multimodal Transport Operator (MTO), in which shipper can avail the facility of multiple modes of transport under single contract. It provides the one step service to shippers with the benefits of cost control, economies of scale, competitive advantage and reliability over the shipment (Banomyong and Beresford, 2001). The operator is responsible for the entire journey and issue a multimodal transport document. While in Intermodal transport requires various types of transport documentation, which further depends on the responsibility sharing of the entire transport journey (SLA, 2008).

An additional distinction between the two can be seen in the term of usage of cargo types. Intermodal transportation is more or less the shipment of cargoes having

containerized goods, While in Multimodal Transportation no specific forms of cargo have been defined (UNCTAD, 2001; Banomyong, 2000). However, this feature solely cannot be used to distinguish the two form of transportation, as multimodal can use any kind of cargo. Researchers and practitioners also did not use them interchangeably due to the differences in key features and the chronological order of introduction of the two. Intermodal transport is assumed to be more mature in the sense its earlier evolution than the multimodal transport.

2.7 Players involved in IWT based Intermodal Transportation

(An Caris et al, 2015) identified intermodal transport as a series of players who provide a transport service. They identified the key players in IWT based intermodal transportation as shippers, terminal operators, road operators, barge operators, waterway operators and consignees. In an IWT based Intermodal Transportation the first and last mile would typically happen though Road and the main haul through IWT mode. Exact coordination of equipment's, information, and processes is required over all modes to deliver the advantages guaranteed by intermodal transport. The key players involved in the complete intermodal transportation are –

1. Shippers
2. Road Hauliers
3. Terminal Operators
4. Barge Operator
5. Consignees

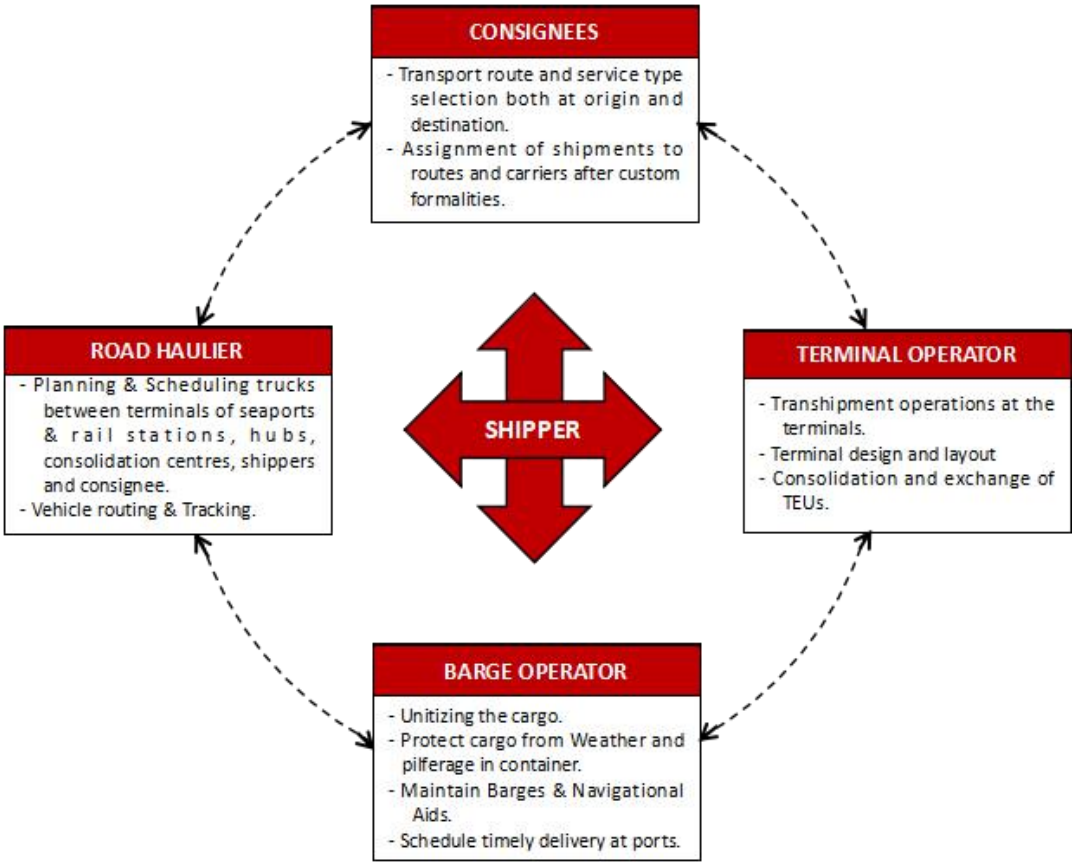


Figure 2.25 Players in IWT based Intermodal Transportation (Author)

1. **Shippers:** Shipper is the individual or organization that places a shipment with the carrier /transporter to be transported from origin to destination. They are those on whose request intermodal administrations are being made accessible. The decision of transportation mode is a piece of logistics framework of the shippers. In such decisions shipper consider the availability and the characteristics of the services offered in the market by logistics providers, as Shipper is the main decision maker in the complete Intermodal Transportation chain. It is his decision as to which operator from the market he will select based on his cost and services rendered.

2. **Road Haulier:** In multiple modes of usage for freight movement, road hauliers play a crucial role. They are responsible for initiation of intermodal transportation from the shipper's door and end the chain by delivering to consignee's door. The intermodal industry is highly dependent on effective

and efficient road freight transports. They fulfill demand and replenishment requirement of intermodal chain. Their major functions are transportation planning and co-ordination between shipper and drivers, ensure safe handling of freight in transit by adopting all road safety guidelines, transit cost calculation, carriage and handling of cargoes, shipment tracking.

3. **Terminal Operator:** They are the one who is responsible for loading/unloading of containerized goods from one mode to another at terminals. Terminals are basic obstruct in the whole Intermodal Transportation System. If they are not functioning effectively the complete objective of Intermodal Transportation in terms of cost and time saving is failed. Terminals can be Bimodal, Trimodal or Quadmodal based on the modes of transportation connected to it. A terminal operator provides all types of services required at the port. Services such as consolidation & De-consolidation, bundling, bonding, warehousing, bulk material handling and transportation, container handling equipment, customs and dedicated berth facilities. He should be able to design the structure and infrastructure at the terminal in such a way that all the services are provided in a smooth and effective manner.

4. **Barge Operator:** Barge operators are the ones who run the main haul of IWT transportation. They provide the services from dockside to ship to dockside. Initially the dominant modes supporting intermodalism were trucking, rail, and maritime, in recent times waterways transport through rivers, canals etc has received significance due to problems with roadways like congestion, accidents and security. Though Barge operators can provide services to transport both Bulk as well containerized cargo, in case of chain of intermodal transportation their role of transporting containerized cargo is considered paramount.

5. **Waterways Operator:** One of the key player in IWT based Intermodal transportation is the agency or the organisation responsible for creating, maintaining and operating the waterways. Unless a channel with adequate depth round the year is not available, commercial navigation on waterways won't be possible. The operator also need to ensure navigational aids to ensure round the clock movement. He needs to do river training and dredging to ensure round the year movement. An operating RIS system should be available to guide barges throughout the journey.

6. **Consignees:** Intermodal transportation is the movement of goods in an intermodal container or vehicle, using two or more modes or carriers, during its journey from shipper to consignee. Though the consignees are not the decision makers or executors in the whole chain of intermodal transportation, they do help in terms of agreeing to receive the material in containers through IWT mode with a transit time as made possible through the chain. A movement through environment friendly mode of IWT also lowers the overall carbon footprint of the consignee organization.

2.8. Integrating IWT with other modes

The transport infrastructure in most of the developing nations is in the stage of modernization, transformation and extension. The unsuitable infrastructure of various modes of transportation is unfavourable to the nation's domestic and international trade. Moreover, in developing countries governments prefer to invest in the artificial modes of transport such as road, railways etc rather than investing in the natural waterways. Hence inland waterway development in the Asian countries is hampered largely due to the lack of funds. Thus World Bank has taken initiative to reverse this trend and implement number of projects related to IWT in Bangladesh, China, Thailand and Viet Nam. Seeing the growing percentage of multimodal and intermodal transport in the domestic and international business front, stimulating the IWT as a part of them can reap up with many economic, environmental and social benefits. Use of natural waterways has great potential, less congestion and better accessibility. Thus to achieve the sustainability in the transport system,

promotion of integrated IWT should be a long term priority, as it can play a vital role in the hinterland connectivity of major sea ports.

United Nations Publication (ISBN: 92-1-120355-4, 2004) suggested that a good integration of IWT in the intermodal transportation system requires that:

- the sufficient infrastructure is in place;
- the latest technology is utilized and continually updated;
- regulations facilitate the interchange.

2.8.1 Infrastructure requirements

IWT movement requires two basic components of infrastructure to operate: terminals and waterway. Third element could be Barges which could be treated equivalent to Infrastructure.

Creating a navigable waterway provides numerous advantages like recreation, water supply, flood control, irrigation & power development in addition to enhancement of communities residing close to the water sources. Developing a well-structured, economically and ecologically sound inland waterway transportation system should be the crucial priority of the water way industry. Following can be the infrastructural requirement of inland waterway transportation to accomplish with the above said goals:

2.8.1.1. Waterways

The standard requirements for navigation on waterways are locks width, fairway depths and vertical clearance under bridges, while on the basis of route vessels can be modified easily. For the Hassel free navigation of the vessel dams or barrages must have locks and the developed waterways must be linked to create a network.

Depth: The draft of a conduit is the vertical separation between the waterline and the base of the structure. Draft decides the base profundity of water a ship can securely explore. Utilizing the Archimedes' rule, draft additionally decides the heaviness of the payload which can be carried on a ship figuring the displacement of the water. Availability of adequate draft is a fundamental requirement for IWT. In

countries like India, where rivers are alluvial in nature, the available draft varies during the months.

Width: to make the inland waterway transport more flexible for the positioning of various weight barges, the waterway width should be adequate to allow convenient movement of Barges. The fairway should be wide enough to allow the 2-way movement of upstream and downstream cargos. The edges of the fairway should be marked with navigational aids to indicate the boundaries and allow navigation during night. In case of dams and barrages, width of locks should be sufficient. The inter European Gauge has lock of 12 m wide, which can be easily used by a vessel having four lines of containers. While in Asia some locks are 40-foot-wide having 18 cm of extra width as compared to European locks can be ply by the wider barges used to their full capacity.

Vertical clearance: the other important aspect for the use of waterways in transportation is the available height under the bridge, which is also called vertical clearance. This is an important factor: as the number of layers on the vessel increases, there is simultaneous increase in its capacity and reduce in the charges for each container. The lower valley rivers such as Yangtze, Pearl, Ayeyarwady and Mekong have benefits of long bridges and have ample space below to ply a vessel stacked with number of layers of containers. However, the problem in India have been reverse. We built bridges before deciding on IWT. Several of the bridges in NWI and NW3 do not provide adequate vertical clearance.

2.8.1.2 Terminals

Establishing a container terminal with quay of aprons, space to stack containers, a gantry, a crane is is not much difficult. Though some are operating without a crane, what is really needed is the hinterland a connecting network.

Bimodal Terminal: this type of terminal links the river operations to a hinterland exclusively by road. This type of terminal has low investment requirements and has potential of popularizing the intermodal presence. These types of terminals also help in achieving the goal of minimizing the road transport.

Trimodal Terminal: terminals having the access to rail, road and water are called trimodal terminals. It also implies that cooperation between rail and waterway is such that at least 80 percent part of the route is covered by either rail or water, that is rail or water mode has its own connection with road transport via common location. The usage of trimodal terminal is infrequent; few have been recorded in German public river ports. Beside it a proposal of rail shuttle trains from Rhine River to Italy through the Alps are under the way (O'MAHONY, 1996). A very good example of use of trimodal terminals is Basel, where due to strict trucking regulations, more than half of the containers are carried through rail. Trimodal terminals are also called freight villages as they provide a number of transported related services such as freight forward, customs and warehousing. A good example of such kind of freight village is Lille in Northern France.

2.8.1.3 Barges

Transport of heavy goods through river and canal uses a flat bottomed boat, which is called barges. Many of the barges do not move by the process of self propelling, instead they must be towed or pushed by towboats on the adjustment towpath. Those barges which have been propelled by self-operating system are suitable for water having easy going downstream and upstream ways. They require tugboats to move in upstream water. Canal barges are specifically made for the canals in which they require to operate. Transporting cargo through barges competed with railways during the industrial revolution but lacks behind the railways due to the efficiency of later in the shipment of high value items, faster speed, and rote flexibility. Though, shipping by barge is more energy efficient.

Today most of the transportation of goods through barges is of heavy and bulky items. Barges uses in US are 59.4 m × 10.7 m in dimension and can carry up to 1500 tons of cargo. Barges used in Europe are of dimension 251ft x 37 ft and can carry a weight up to 2400 tons.

2.8.2 Use of Technology in connecting IWT with Other modes: Resource Information System

United Nations Publication (ISBN: 92-1-120355-4, 2004) suggested use of Technology and modern developments for connecting IWT with other modes: Use of latest technology and information system is a new beginning in the IWT, it easily provides a marketplace to shippers and carriers to meet and exchange information about the time, cost etc. the community associated with waterway transportation is still small and most of the freight shipped is either due to trade contracts or the freight forward. Use of latest technology in the IWT to integrate it with other modes of transport could be an important factor and can increase the share of IWT market in the container shipment.

Communication Revolution: Nowadays vessels are connected with radio and phone for the exchange of information. Vessel Traffic system provides easy access to any information regarding the safety and other issues to the shores and other ships. Moreover, the increasing coverage of cellular phones made it easier to connect with on board ships by phones. Thus waterway owner operators in Europe are seeking for the potential clients, while previously they were outsourcing from third party to do so.

Positioning and Tracing: Nowadays each and every vessel on the board is equipped with a Global Positioning System (GPS). This system helps in organizing the water traffic by providing the information regarding the speed, location etc. it also enables tracking and tracing, which are the main requirement of the operator and clients. IWT in its forefront having GPS monitoring become a responsive system to the needs of its clients.

Reliability and Just-In-Time Delivery: With the introduction of different GPS, vessel traffic system and access to traffic system, weather forecast the delay of waterway transport vehicle due to fog, rail and night is no longer a problem. Moreover, the strength of current is not a problem due to the use of highly powerful engines in the vessels. The resource information system (RIS) in IWT makes it able to integrate the just-in-time delivery concept.

Electronic Data Interchange (EDI): to integrate the IWT with other modes of transport, IWT container lines need to be designed with the present EDI system. In

Europe most of the IWT vessels has been integrated with this facility due to onboard computerization. Trucks have been linked with them by EDI. Vessels having port software manage their load during loading and unloading operation and instruct crane operator on where to place the particular container.

Gantries and other handling equipment: The container crane at sea port can easily handle IWT container vessel, other than these reach stackers and big cranes can also be used for the same purpose. That is the inland container terminals also use the same state of art handling machinery. The barge gantries and trimodal gantries other than bimodal gantries are some special cranes with a cantilever on the water side and quite large with a record spanning over rail track, road and water.

2.8.3 Facilitation measures between IWT and other transport modes

United Nations Publication (ISBN: 92-1-120355-4, 2004) indicated the following measures as facilitation measures between Inland Waterways Transport and various other modes of Transportation:

Including IWT in all intermodal legal instrument: In most part of the world the incentives being reserved for railways and road infrastructure development, though IWT also got the modest share but overlooked. Seeing the potential of IWT in providing the services exactly same as of rail it has been coordinated with other modes of transportation through the simplification and normalization of documents. In Europe the number of international containers carried by waterway is greater than of rail.

Infrastructure planning requirement for IWT integrated intermodal: Intermodal IWT requires high bridges up to 7m (three layers with ballast) and 12.4 m of clearance (four layers without ballast) over a long network. To take into account such requirement of IWT is difficult as it need to obtain the go ahead permission from the rail and road authorities. Roads and railways require substantial clearance as compared to IWT. The ITO also need to recommend the waterway authority about the width of lock. Moreover, it is important to implement the modern design guidelines in the building of locks, bridges etc. on the navigable waterways in impending the intermodal transport with the viability of linked network.

Coordination at planning stage on location and layout of Inland Container Depots (ICD): most of the ICDs are owned by private bodies and are not dry ports. Instead most of the ICDs are trimodal or quadmodal terminals on the banks of rivers. The layout of these depots need to be revised carefully so that IWT can be successfully integrated with multimodal transport.

Setting up customs within inland ports: the hosting of custom office within the premises of the port helps in building a base for a service node, freight forwarding, in providing road, rail and sea carriers, in repair of containers and truck. The planning for the setting up of driver hotels, restaurant should be an integrated part of inland terminal planning.

Evolution of water transport companies towards ITOs: The cost of waterway transportation is very less as compared to the other modes of transportation. But to set a market for itself IWT need to propose a door to door service or seaport to door service. Hence it need to be combined with road and rail services. Thus IWT need to be authorized with adequate regulations toward ITO.

Introducing IWT in the EDI system and e- commerce: To make IWT be a part of the national transport trade, it needs the integral access to the government approved EDI.

Incentives given on the legislative side: to fight with the adverse effect of road and rail transport on the earth ecological system, adoption of IWT is essential. Thus it has to be promoted by providing the incentives to its users.

Customs facilitation: The environmental friendliness is the utmost requirement of the international transport of containers. The two fine example of IWT in facilitating the international goods movement are Bangladesh and India.

Night Navigation: the facilitation related to night navigation is very important. It has to be permitted only when the entire navigable path is cleared and do not have the danger of any natural disaster such as eddies and reefs. For this radars and navigation software have been installed on board. It is again a part of facilitation; as

international traffic is the one using this system most. Night navigation should also require a safety measure from the piracy.

2.9 Intermodal Transportation in India

Transportation plays a vital part in economic advancement of any nation. A vast and geographically diversified state as India provides a great opportunity to implement the idea of Intermodal Transport in its real form. India features a coast line of approx. 7,517 kilometres that is dotted with thirteen large ports (twelve Government and one corporate) and 187 transitional and minor ports (Vivek Kele, 2013). By the year 2020, Indian Logistics segment is expected to create incomes of USD 200 Billion. The Indian logistics sector spends roughly fourteen percent of the GDP on various kinds of costs related with logistics operation. Logistics as a function has been frequently outsourced by companies.

In India the manufacturing hubs are located in the hinterlands away from the main gateway port. North Indian states of Punjab, Haryana, Delhi NCR and states like MP are large manufacturing hubs located away from ports (Badvar Dnyandev Vishvas, 2015). Along these lines, the possibility for intermodal transportation (counting long as well as short hauls) is great. India's international trade, both exports as well as imports combined, is growing at a brisk pace of about eight to ten percent per annum.

2.9.1 Evolution of Intermodal Transportation in India.

Container Corporation of India popularly referred to as CONCOR is a subsidiary of Indian Railways. CONCOR have played a pivotal part to promote multimodal transportation in India (Vivek Kele, 2013). Indian Railway's drive started in 1966 to put India on containerize transportation map. Considering India's large size, more than three thousand kilometres from North to South and West to East, rail transportation is surely a more economical option to transport large tonnages over long distances.

In 1966 Indian Railways moved into the Intermodal industry for shifting door-to-door load in DSO containers. Despite the reality that the first ISO container in India were handled in Kochi in 1973, it wasn't until 1981 that the main ISO container was put

inland by Indian Railways to the nation's very first ICD at Bangalore (Vivek Kele, 2013). Extension of the network to 7 ICDs by 1988 created a need for an organization to deal and advance with the improvement of containerization in India. Consequently, CONCOR was Incorporated in March 1988 and began tasks in November 1989 assuming command of a present network of 7 inland holder terminals (ICDs) from Indian Railways (Vivek Kele, 2013). It today has operations sixty-one ICDs/CFSs (Container Freight Stations) through India. India currently has near 300 privates as well as open CFSs and ICDs providing Intermodal Transport framework (Vivek Kele, 2013).

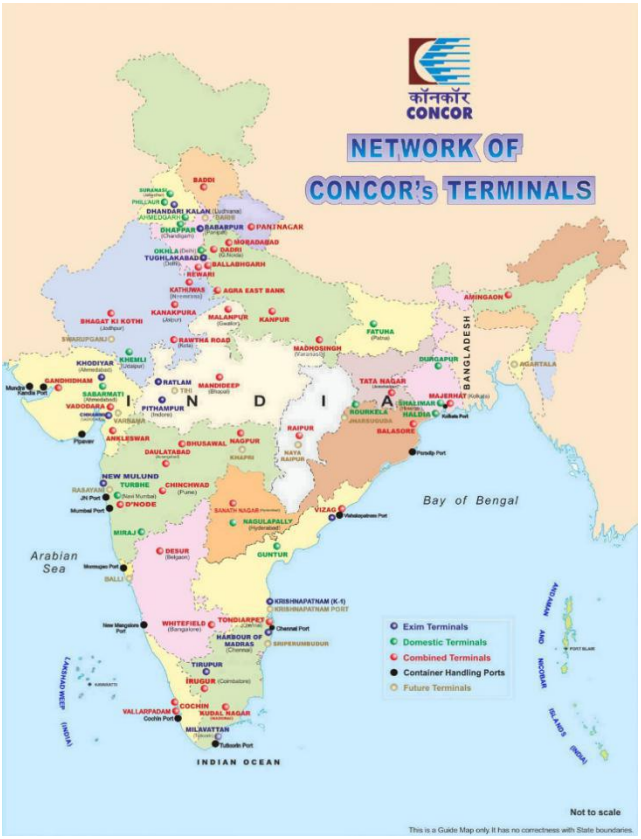


Figure 2.26 The ICD map of India as managed by Concor (IWAI)

The MMT Act (Multimodal Transport Act) was passed by Indian Parliament in the year 1993; the vital focus of the law was developing a dedicated organization for Multimodal Transport Operators (Vivek Kele, 2013). The Director General of Shipping was designated as a competent Authority under the aegis of the law. The Act would allow different Indian Logistic Service providers to register themselves as ITO operators and to issue InterModal Transport Document. This helped the shippers of

India to carry items from any ICD in India to any destination in the world under one Contract of Carriage (Vivek Kele, 2013).

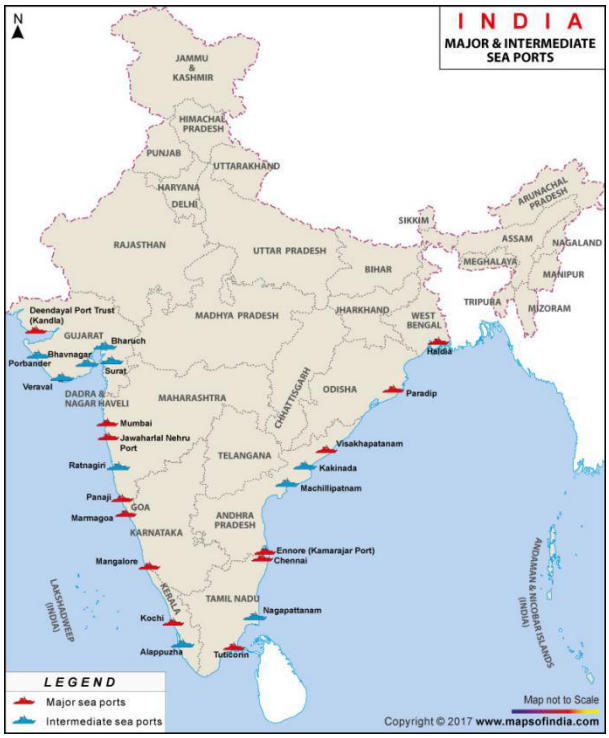


Figure 2.27 The Ports map of India (IWAI)

2.9.2 Challenges faced by Intermodal Transportation in India

The Indian logistics industry still lags behind the worldwide standards of performance. This's apparent from the point that India placed close to 46th among 155 nations on the world Bank International Logistics Performance Index. Multimodal transportation, that is shown elsewhere in the world as a solution for decrease transportation expenses, is promoted as an adept technique for shipping merchandise over longer distances. Adequate road as well as rail foundation is necessary to assist the improvement of intermodal transportation methods of transportation accessible in the country. Badvar Dnyandev Vishvas (2015) recognized the primary difficulties in creating a robust Intermodal Transportation System in India:

Road Freight

- Poor quality of roads and National Highways.

- Poor utilization of vehicles. Commercial vehicles in India run about one third of developed countries.
- Interstate check posts and surprise checks by Sales Tax inspectors further affect the utilization of vehicles. It is estimated that trucks lose about forty percent of their driving times due to these stoppages.
- Entry charges into cities like Octroi for products or services similarly commit procedural bottlenecks.
- National Highways carry about 40% of national load but form only 2% of total Indian Road network.
- No formal regulations in place for starting trucking business. Any person can enter into this business.
- Large number of unorganized and small players, fiercely competing with each other.

Rail Freight

- Due to cross subsidization of passenger freights, freight tariffs on rail in India are among the highest in the world.
- Rail freight lacks reliability or real time tracking.
- Large minimum chargeable distance.
- Difficult process of refunds as well as documentation.
- Limited manufacturing capability for creating wagons and racks.
- The tariff framework as well as revenue sharing is hindering the public private partnership in the business of rail infrastructure development.
- Monopolistic approach of Indian Railways in various aspects of business.
- Indian Railways is lacking in terms of quality of operations, client orientation, and speed.

Port Freight

- Higher turnaround times of vessels due to inefficiencies while berthing and delays in loading and unloading.
- There are delays in coordination between Port Authorities and Customs authorities.
- Some of the ports in India have very poor hinterland connectivity as well as bad port and landside infrastructure with outdated equipment's.

- Inadequate berth at ports not allowing big vessels to berth.
- Navigation channel restrictions don't enable larger vessels to berth

Beside the above changes, there are restrictions caused by lack of coordination among various modes and agencies. In India we have different ministries for Road, Rail and Shipping and no single ministry like China for transportation which can look after coordinated holistic development.

2.9.3 Initiatives taken to promote Intermodal Transportation in India.

The transportation and logistics infrastructure are fundamental to the development of any nation. In India, during last three decades the transportation infrastructure has undergone a significant progress. While during 90's the transportation market was growing at the rate of 10% per annum, in last decade or so, the transportation industry is growing at 2x rate vis-à-vis GDP growth. This growth of transportation needs fueled by GDP growth has increased demand all transport services. Various estimates peg Indian Logistics Market between USD 90 to 200 Billion. The logistics Industry is also estimated to be generating employment for about 4.5 crore people.

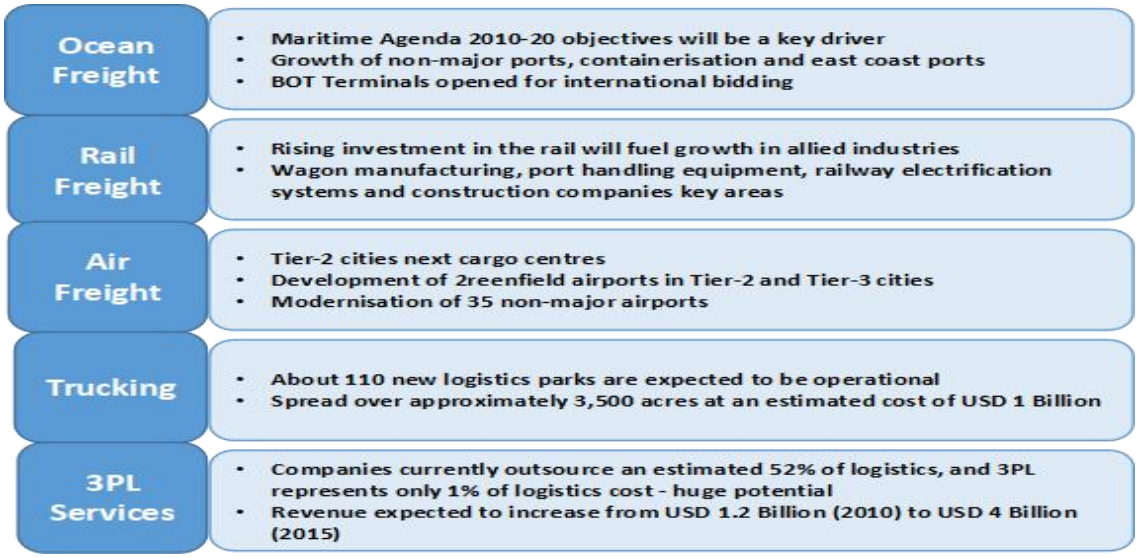


Figure 2.28 Future outlook of Multimodal Logistics (Badvar Dnyandev Vishvas, 2015)

There are several taken by Government of India to promote Intermodal Transportation:

- With the objective of shifting cargo from Road to rail, Indian Railways allowed from year 2006 private participation in the container movement.
- The ambitious Eastern and Western freight corridor project connecting North of India with Western and Eastern India, undertaken by the Ministry of Railways is expected to commence operations by 2020. Only operational this project is also expected to significantly push the share of railways.
- With the advent of GST, the manufacturing companies which were forced in the past to set up one warehouse every state due to taxation reasons, can now set up large warehouses at strategic locations to meet delivery requirements of their channel partners.
- The government is dedicated to attaining a goal of creating thirty kilometres of roads & highways every day.
- Alternate way to promote infrastructure development to is allow Foreign participation. 100% FDI is now permissible in almost all logistics services except courier services where 100% FDI is subject to FIPB approval. FDI up to 49% is permitted in air cargo and transport services.

Badvar Dnyandev Vishvas (2015) made following recommendations to promote intermodal Transportation System in India:

- An integrated and holistic approach to develop logistics sector in India.
- There should be continued focus building good quality roads and push for the creation of good road network to improve first-mile and last-mile connectivity.
- Creation of multimodal logistics hubs incorporating facilities like modern warehousing, cold storage, good internal roads, parking facilities and connectivity my multiple modes to rest of India.
- India needs a Logistics policy carrying vision of logistics needs for the country over next few decades and outlining a roadmap for development of infrastructure to allow comprehensive and substantial intermodal mix.

- Projects for development of CFS (Container Freight Stations) with hinterland connectivity with large emphasis on last-mile connectivity. Indian Railways should continue its drive to privatize the container handling and operations to the extent possible.
- Sustainability is another area which deserves attention and technologies and strategies should be adopted which can lower the carbon footprint of the Indian Logistics Sector.
- Enhanced private participation in logistics infrastructure development sector through PPP route (Badvar Dnyandev Vishvas, 2015).

2.9.4 Multimodal Transportation (MMT) of Goods Act, 1993

India's MMT Goods Act 1993 obliges "the bearing of the MMT of items, from within India to outside India, in view of a MMT contract and for issues related therewith or incidental there to." This Act has come into drive since Feb 2, 1993. The Act characterizes the expression "multimodal transportation" as the "carriage of merchandise by more than one mode of transport from the place of receipt of the products in India to a place of delivery of the products outside India". This Act has the arrangements for the enrolment of an organization as a MTO and MMT can be undertaken by an enlisted MTO.

The authorized person to act on behalf of the MMT Act including the registration of MTO is the Director General of Shipping. MTO registration expires after the period of one year and needs to be renewed every year.

This act facilitates the exporter to participate in the international trade with the secure door to door shipment. The multimodal transportation reduces the logistics cost thereby reduces the overall cost of the product, hence make the product more competitive in the international market. The MMT Act, 1993 has been implemented in the above context to match with the international business, it has been more or less base on the UNCTAD/ICC rules. Moreover, to protect the interest of the shippers MMT ACT, also makes sure that only those companies having sufficiently well enough infrastructures and financial capability got the registration to carry multimodal transport. Any shipping company or freight forwarding company having

the turnover of Rs 50 lakhs or more in the last three years is eligible for the registration as MTO.

MMT Act also follows the guidelines for the issue of Multimodal Transport Documents. The documentation of the all modes of transport from the exporter to the consignee is covered under single transport document. Multimodal Transport Documents rule out any non-uniformity and ambiguity in the shipment of cargo and sketch the responsibilities and liabilities of the MTO. The multimodal transport document issued would be an agreement for the shipment of cargo from the shippers to the consignee through Multimodal Transport; a negotiable document by default and a document of title on the basis of which its holder can take delivery. Following parties who have been entitled responsible in the Multimodal transport document would be: the MTO/ITO responsible for the execution of multimodal transport contract, the consignor who place the goods with MTO/ITO, the consignee who is to take delivery, the banker who provides the documentary credit and the insurers who insure the goods against the lost and damage.

2.10 Transport Mode Choice by Shippers

The option of carrier and transportation mode have become the key choice to move firm's outbound and inbound freight. Generally, there might be number of characteristics impacting this particular decision making including price, transit period etc. Because of the participation of amount of conditions from which some can't be quantified, the transportation mode choice by shippers is a non-trivial choice. Furthermore, the priority of each criterion varies from industry to industry as well as business to business. Hence the decision about the option of mode as well as carrier necessitates determining the appropriate transportation general performance variables, rate negotiation, service levels as well as carrier performance variables (Monczka et al., 2005). The choice about the method along with carrier is really crucial as transportation expense accounts for approximately twenty percent of complete production expense in a manufacturing firm (Taylor and Russell, 2003). Transportation choices in addition have a really crucial part in getting the competitive advantage. Therefore, drawing a suitable choice concerning method as well as carrier is of utmost important.

Earlier it was assumed that carrier selection is to be done after the selection of transportation mode, but nowadays these two decisions has to be taken simultaneously. Moreover, the number of regulations implemented in practice leads to the limited usage of trucking and rail transportation, new innovative Just-In-Time manufacturing strategies, with thrust on quality management makes the mode related decisions more complicated. All these complexities lead to the development of number of approaches to answer the problem consisting of multiple variables and objective to find the optimal solution. The five most considerable issues in transportation choice: capacity shortages, economies of scale and scope, international growth, security concerns, and environmental and energy use concerns (Meixell & Norbis, 2008).

Below figure indicates key points considered by shipper while choosing a mode of transport.

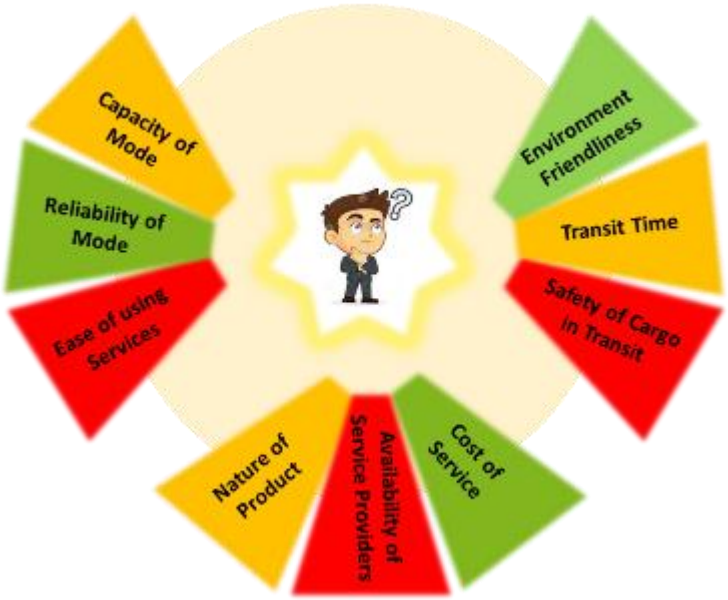


Figure 2.29 Key considerations for a shipper in choosing a mode of transport (Author)

1. Cost of Service

The objective of any business organisation is to make profits. Any decision made has to make a commercial sense. After raw material, transportation could be the largest contributor of cost and have a great impact on the final pricing of the product. Hence the cost of transportation is a key consideration in selecting the mode of movement.

2. Nature of the Product

The physical characteristic of the product is an important determinant is deciding the mode of transport. Solid bulk cargo like cement, plastic, ore etc and liquid bulk like petroleum products are generally carried by modes likes Rail. IWT and Coastal shipping. However, manufactured and packed products are carried more over Road and Air. Products with special traits like temperature controlled or Over dimensioned or hazardous need special handling and demand several considerations before choosing the mode.

3. Transit-Time (Speed of Transport)

A very important consideration in modal choice is transit times. The criticality of transit time depends upon the nature of the industry. Very high value cargo demands a faster transit time and moves by air or express trains. Low value bulk cargo may not carry speed demand and moves by Rail or Coastal shipping.

4. Safety of the Cargo in Transit

All shippers and consignees expect a safe delivery of the shipment. Road mode by its very nature may not score high against other modes due to bumps on the way and high instances of accidents. As compared Road, Rail is far better mode for damage control. During ocean voyage too, cargo is subjected to several stress and may lead to damage if not stowed and lashed properly.

5. Reliability of the Mode (Quality of Mode)

Inventory is a killer. As companies moving towards JIT and Lean Inventory Management, the reliability of the mode is of critical importance. Variations in transit times can affect production schedules or customer deliveries. For bulk low value cargo shipments, the transit time variability within a higher tolerance may be acceptable but for high value cargo, particularly critical spares, the tolerance range will be very narrow with Service Level expectation close to 100% against standard transit times.

6. Capacity of the Mode

Another key consideration is the volumes which a mode can handle. Modes like Air can never be suitable for high volume cargos. Bulk cargo tend to rely more on modes like Rail and Water for the transportation due to capacities. Road tends to be more suitable for low volume high frequency cargo.

7. Environment Friendliness

Sustainability and carbon footprint is becoming large considerations for several organisations. After manufacturing, transportation could perhaps the second largest contributor to the carbon footprint of an organisation. Some of the evolved organisation have initiated triple bottom line reporting. For all the carbon conscious organisations carbon footprint of the mode is important. Road is the worst of the lot and other modes through an intermodal solutions provide a more environment friendly solution.

8. Ease of using the service

Ease of using the service is another key consideration in choosing the mode. Road is the simplest of all. The indent can be placed to the transporter over a phone or a mail. The entire process from indenting to loading to tracking to delivering to freight settlement is extremely convenient. As compared to this the use of Rail, IWT or Coastal shipping is far more complex. Road also provides door-to-door service which may not be possible with other modes.

9. Availability of Service Providers

Quality as well as availability of right set of carriers or Logistics service providers (SP) is also a crucial consideration for picking the mode. Good monetary standing of the SP, the years of its in business, carrying capacity, wider presence are taken into consideration in choosing the service provider.

Shippers want to find a good door-to-door service from 3PL partners. Transport-related options are needy upon an arrangement of transport advantage necessities, lead-time, for example, unwavering quality as discussed in before passages. The

shippers are not looking for a particular transportation mode but best execution of their freight movement (Woxenius, 1999).

Within the overall supply chain network, the shipper's perception of multimodal transportation is described in Figure 2.30.

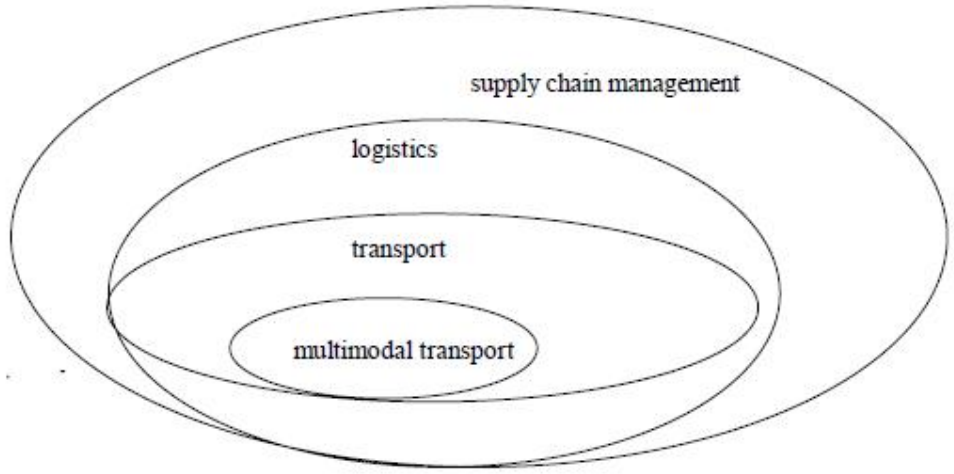


Figure 2.30 Multimodal Transportation from Shipper's perspective (Henstra & Woxenius, 1999)

2.11 Criticism against IWT and Intermodal Transportation

Although IWT is scoring very high as compared to all other modes of transport but still lacking some areas of performance:

Slow: Speed of Inland water transportation is reasonable and consequently this particular technique of transportation is inadmissible where time is an important component.

Limited Area of Operation: It may be used specifically in a constrained zone that is served by deep waterways & streams. In the nations or even geogrphies just where there're no traversable waterways, IWT mode cannot be practiced.

Occasional Character: Trenches as well as rivers cannot be worked for transportation throughout time as water might solidify amid wintertime or water level may go especially down amid summer.

Unreliable: The inland water transport by rivers is temperamental. At times the waterway switches the course of its that causes disengagement in the standard course of the exchange.

Unsuitable for Smaller Distances: Inland water transport by rivers as well as canals isn't ideal for modest distances. As Inland Waterways Transportation is a reliant mode and first & last mile must occur via various other modes, a tiny distance above IWT gets economically unfeasible. Intermodal transportation does take a number of financial, functional, social and environmental benefits. Nevertheless, you will find specific disadvantages also with intermodal conveyance.

Infrastructure costs: Container handling equipment's, for rail, road, yard hardware, gantry cranes, are required for executing multi modal transportation.

Empty Travels: An inventory of empty containers has to be maintained at ports to ensure intermodal transportation. Almost 56% of the time of their life of about 10 to 15 years, the containers are sitting idle at the ports waiting for their turn to be filled. Further there is a movement of empty containers from an excess location to an shortfall location.

Speed: Although intermodal transportation conveyance provides the benefit of typically small expenses contrasted with strategies that are different, it acquires the by yielding pace; anytime load is replaced to an almost reduced technique for movement, for example prepares, which focus on settled rails that could not provide as instant program as the roadways a pickup truck uses, it backs off. To function at best strength, multi modal transportation must similarly minimize the degree of your time spent sitting scarce in facilities for an additional transporter to show up or even for load to be emptied.

Absence of Reliability: Because of its dependence on more than one method of travel, multi-purpose transportation is additionally subject to bring down general unwavering quality; as the chain of various modes develops, the likelihood of any connection in the tie breaking likewise increments. This is especially dangerous when one of the methods of transport is rail; railways are more vulnerable to delays presented by awful climate or hardware disappointment. Therefore, and in addition

worries over speed, shippers that require dependable, fast transportation are less inclined to consider multi-modal frameworks.

Damage: Whenever load must be rearranged around, shippers hazard the likelihood of harm as the cargo is exchanged starting with one technique for transportation then onto the next. Luckily, this risk can be relieved, however doing as such for the most part includes over packing by including more supporting and defensive material than would ordinarily be regarded adequate. This additional weight and cost halfway neutralizes the points of interest multi-purpose transportation has as far as vitality proficiency and cost.

2.12 Conceptual Framework

A conceptual framework speaks to the analyst's union of writing on the most proficient method to clarify a wonder. It maps out the exercises required over the traverse of the examination given his past data of other scientists' point of view and his observations with respect to the matter of research. Toward the day's end, the applied structure is the analysts' appreciation of how the particular factors in his examination connect with each other. It is the analyst's "guide" in seeking after the exploration. As McGaghie et al. (2001) put it: The applied system "sets the stage" for the presentation of the particular research question that drives the examination being represented in perspective of the issue clarification. Applied systems should act like maps that offer clarity to the Inquiry. Close by demonstrating the course of the examination, through the hypothetical structures, the expert can be able to show the relationship of the specific builds up that he needs to explore.

In light of the literature review done, the specialist assembles a theoretical structure for IWT based Intermodal Transportation System and endeavored to orchestrated components which permit coordination of IWT with different modes.

The following table 2.4 shows the factors identified from literature review enabling integration of IWT with other modes .

Factors from Literature Review			
Shipper	Awareness about IWT	Waterway Operations	Availability of Least Available Depth
	IWT as part of SCM Strategy		Availability of Navigational Aids
	Cost of Transport		Availability of RIS System
	Environment Impact		Commercially Significant Waterways
	Availability of Subsidies		Operational Management
Government	Governance Structure	Terminal Operations	Availability of Terminals
	Legal Framework		Terminal Ownership
	Funding Availability		Terminal Operations
	Modal Shift Targets		Terminal Management
	Policies and Programs		Facilities at Terminals
MTO Operators	Linking IWT with Coastal Shipping		Terminal Locations
	Linking IWT with Road	Barge Operations	Availability of Barges
	Linking IWT with Rail		Barge Ownership
	MMT Act		Barge Operations
	Bundling Services		Barge Maintenance
			Barge Types

Table 2.4 Factors enabling integration of IWT with other modes (Author)

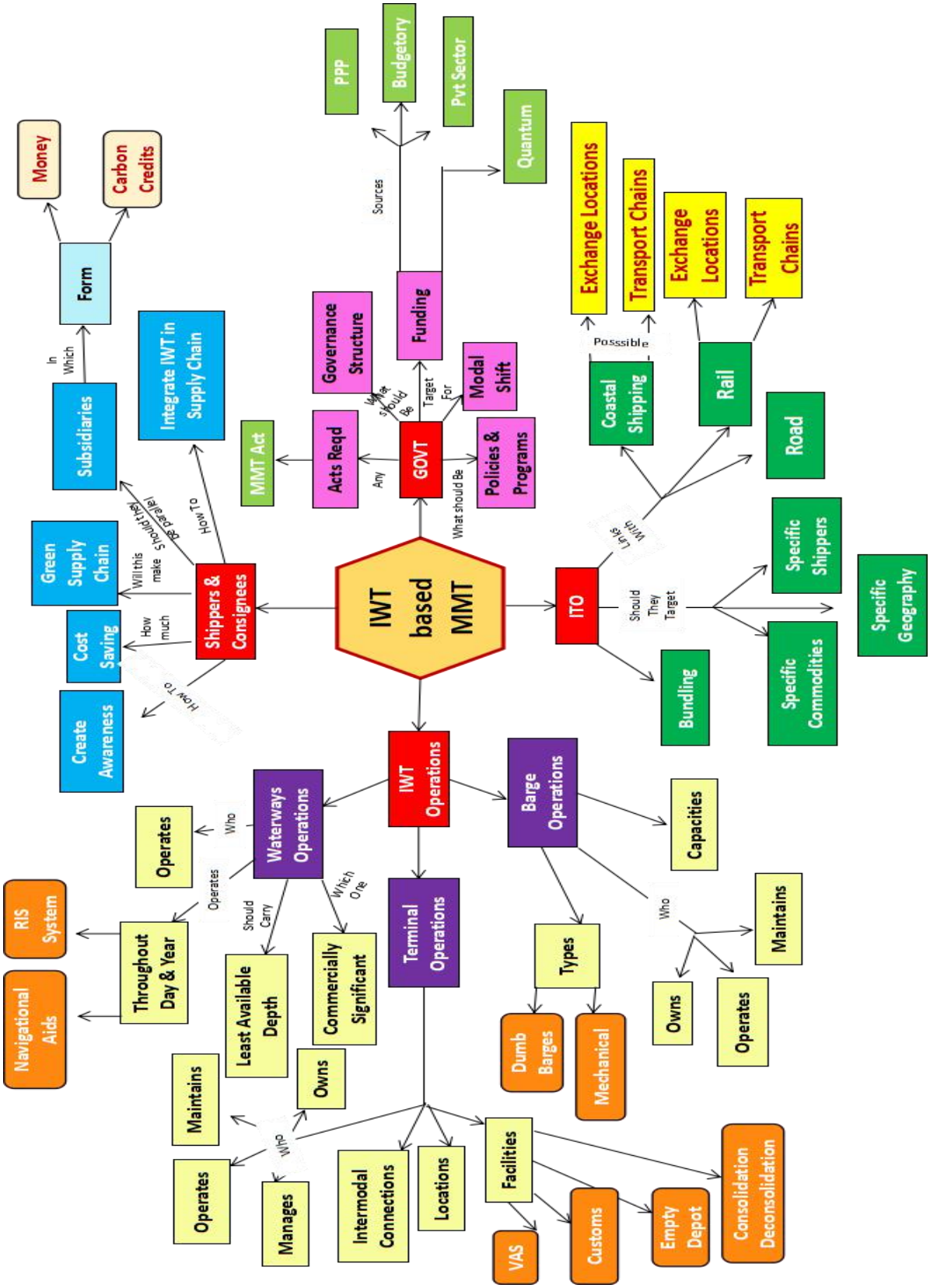


Figure 2.31 Conceptual Framework for IWT based Intermodal Transportation System drawn from Literature review (Author)

2.13 Research Gaps

As a final summary of the entire discussion in this chapter, this section sets out the research gaps identified from the literature review:

Research in the field of Inland Waterways is still in its infancy in India: IWT as being a topic hasn't attracted a lot of interest for investigation in India. A big explanation might be the miniscule share of it in the entire transportation pie. Yet another might be in conditions of the locational geographical constraints of its wherein this feature can be obtained just in parts of India and no main navigable river is flowing by centre of India. Researcher conducted detailed survey of the research papers and articles created on IWT in India; the figures for them obviously shows the deficiency of interest this topic has experienced.

1. **Limited research has been conducted on integration of IWT with other modes.** IWT is a dependent mode and needs Roadways for sure in first - last mile connectivity. Beside Road it can be combined with Rail and Coastal shipping too. Very limited research has been conducted to study the assimilation of IWT with other modes. (An Caris et al., 2014) recognized various research possibilities which will encourage integrating Inland Waterways into an Intermodal network.

2. **No conceptual framework or model is available to enable integration of IWT with other modes of transportation**. Conceptual framework helps to show the relationships of the different constructs for any phenomenon. No formal conceptual framework could be found in existing literature for IWT based Intermodal Transportation System.

Conclusion

Literature review allows researcher to critically examine and uncover unexplored facets of any research topic. This chapter provided the literature review strategy and structure adopted by the researcher. The researcher identified key themes within the main topic to evaluate the previous publications. The structure and policies were explored in key countries with higher share of IWT. The IWT progress in India was

evaluated. Intermodal transportation as a subject was explored and its various facets like its advantages, components, mechanics, evolution, players and cost were deliberated. The key parameters which enable IWT to be integrated with other modes to create an intermodal transportation system were evaluated. Choice of mode is a critical decision for a shipper, various considerations which make shipper chose a mode were discussed. A conceptual lens for an IWT based Intermodal transportation system was developed based on the literature review. Set of factors identified which allow integration of IWT with other modes. Finally, the literature review allowed to establish the broad research gaps on the subject. This research therefore aims to connect the research gaps in developing a framework for integrating IWT with other modes of transportation to create an intermodal transportation system.

Chapter 3

Theoretical Framework: General Systems Theory

"System thinking is a discipline of seeing whole."

Peter M Senge.

The story of blind men and an elephant

In a village lived six blind men. One day the villagers announced that an elephant has arrived in the town. The blind men had no idea as to how an elephant looks like. They decided to make a visit to the elephant and at least feel him. All of them touched the elephant and shared their experience.

Figure 3.1 The story of blind men and the elephant

"Hello, the elephant is actually a column," said the 1st man that felt his leg.

"Goodness, it resembles a rope," claimed another man who felt the tail.

"Gracious, it looks like a thick branch of a tree," claimed the 3rd man who felt the trunk of elephant.

"It is like a huge hand fan" said the 4th man that felt the ear of elephant.

"It looks like a huge wall," said the 5th man that felt the stomach of elephant.

"It seems like a strong pipe," Said the 6th man that felt the tusk of elephant.

They began to quarrel about the elephant and everybody felt that he was right.

Moral of the Story: The whole is very distinct from the individual elements.

3.1 Theoretical Framework

Any perfect research is founded in theory (Mentzer, 2008). Theory acts as framework capable of both predicting and explaining a phenomenon (Hunt, 1991). Any research problem has its start point from a theory. Theory directs and guides a research as it undertakes to solve a problem.

The theoretical framework acts as a structure that supports any research endeavour. The theoretical framework introduces the theory that explains why the research problem under study exists. The theoretical framework is a theory that serves as a foundation for conducting research.

A good way of understanding Theoretical framework would be to comprehend it like a framework of a house. The way foundation supports a house, similarly theoretical framework assists to explain the relationship among the variables in a study.

The theoretical framework improves the research in the following possible manners:

1. A reader of any research work can critically evaluate if the theoretical base is explicitly stated.
2. The theoretical framework links the researcher to prevailing knowledge on the subject and provides him a strong basis for the setting up the hypothesis and the methodology chosen for the research.
3. 'Why' and 'How' are two most important question in any research. Theoretical framework allows researcher to address these questions and explain about various aspects of the phenomenon under study.
4. Theoretical Framework allows researcher to recognize the limitations of the generalizations

5. Researcher see identify the variables of the research using Theoretical Framework.
6. Theoretical Framework tools researcher with a structure for his data analysis stage.
7. Theoretical Framework provides a background to the research problem and helps in setting up the hypothesis for the study.
8. Theoretical Framework provides reference frame for making observations, defining concepts, setting up Research designs, offering explanations and theorizing.
9. Relationships among variables can be identified in most methodical and logical manner with the help of Theoretical Framework

Formulating a Theoretical Framework involves, identifying the variables, defining the technical terms, identifying the relevant and related theories and connecting the relationships of the variables with respect to the theories.

Many authors, including (Mentzer and Kahn, 1995), have written about requirement for wider application of theory in the area of logistics and supply chain management research. (Brent D. Williams and Wesley S. Randall, 2010) researched on the theories being used in the research on the subject of logistics and supply chain management. They conducted a detailed literature review of papers which appeared in the top 5 logistics and SCM literatures to identify most frequently used theories and further categorise and classify them. They found about one hundred eighty different theories being used within the sample articles and explained their type and frequency of usage.

Competitive	Inventory	Other social psych theories	Theories of organizations
RBV	General inventory theory	Communication theory	Organizational learning
Porter's framework	EOQ	Theory of reasoned action	Organizational theory
Contingency theory	Periodic review	Theory of planned be havior	Coordination theory
Core competency	Portfolio effect	Actors approach	Interdependence theory
Knowledge-based view	Continuous review	Behavioral decision theory	Integration
Relational view	Square root law	Conflict theory	Lewin's three phase force field
Dynamic capabilities		Consumer culture theory	Manager behavior
Resource advantage theory	**Marketing**	Cultural differences	Organizational citizenship behavior
Supply chain orientation	Relationship marketing	Employee turnover	Stakeholder influence
Structure-conduct-performance	Market orientation	Human communication theory	Attraction theory
Natural resource-based view	Alliance	Media richness theory	Collaborative supply chain framework
Strategy-structure-performance	Disconfirmation theory	Relational theory	Competing values theory
B-to-B relationship theory	Collaboration	Social penetration theory	Configuration
Cluster theory	Customer orientation	Social resource theory	Constituency-based theory
Competitive advantage	Collaborative advantage paradigm	Theory of choice	Interorganizational relationship theory
Information-based logistics orientation	Dependence theory	Theory of prejudices	Mangerial control
Market-based logistics orientation	Asset specificity	Training	Organizatonal change framework
Modularity theory	Buyer-supplier relationships		Organization response to disaster
Process orientation	Comparative advantage	**Psych theories of individuals**	Social identity
Process-based logistics orientation	Competitor orientation	Power dependence	Strategic orientation
Strategic behavior theory	Consumer-based brand equity	Attribution theory	Theory of organizational design
Supply-demand strategy matrix	Cost orientation	Cognitive dissonance	Value congruence
Theory of production competence	Customer focus	Developmental theory	
Time-based competition theory	Exchange theory	Rational choice theory	**Other**
Work design	Information search	Response to disaster	Corporate social responsibility
	Internal marketing		Information processing
Decision	Means-end theory	**Social exchange**	Measurement theory
Auction theory	Reciprocity theory	Social exchange theory	Activity-based costing
Decision theory	Relationship management	Social network theory	Chaos theory
Vehicle routing problem optimization	Relationship orientation	Social capital	Adaptive cycle theory
Negotiation theory	Strategic choice	Balance theory	Bonding theory
Supplier selection decision theory	Substitute, delay, leave	Firm-specific factors	Causal chain approach
Centralized decision theory	Theory of channel behavior		Crime displacement theory
Cost minimization	Trust theory	**Systems**	Free cash flow model
Decentralized decision theory		Bullwhip effect	Individual effects model
Decision support	**Microeconomic**	General systems theory	Information quality theory
	TCE	Risk management	Integrated strategic positioning process
Innovation	Resource dependence theory	Supply chain risk	Logistics social responsibility
Diffusion of innovation	Agency theory	Total cost	Path-goal theory
Innovation adoption	Came theory	Network theory	Population ecology
Innovation theory	Principal-agent theory	Total cost of ownership	Probabilistic choice framework
Creative distraction	Fuzzy set theory	Network optimization	Product-process matrix
Innovation adoption	Utility theory	Theory of constraints	Purchasing social responsibility
Theory of logistics innovation	Williamson's failure framework	Business process systems engineering	Risk asessement framework
	Coordination cost theory	Input output choice	Situational crime prevention theory
Institutional	Diversification	Inter-organizational conditions	Target costing theory
Institutional theory	Transfer pricing theory	Multiple attribute utility theory	Technology-market positioning portfolio
Political economy		Normal accident theory	Theory of insurance
Labor theory		Pricing	Unified integration model
Ecocentric view		System dynamics	
Social costs		3D concurrent enginerring theory	
Social welfare			

Table 3.1 Inventory of theories used in Logistics and Supply Chain (Brent D. Williams and Wesley S. Randall 2010)

All these theories were studied to find the most appropriate theory applicable for this research. Based on the analysis General Systems Theory was found to be most relevant for following reasons:

- The intent of the study is to create an Intermodal Transportation System in India. The topic of the research also alluded towards system approach.
- Intermodal transportation is a combination of several actors like shippers, carriers and intermodal network players. These actors relate with each other in sub system like manner.
- The topic of the research required a study of integrating IWT with other modes this demanding study of interaction of various components.
- The business problem indicated that the IWT mode is not a successful mode in India so far. This required a system like thinking for problem solving.
- The IWT and Intermodal Transportation are greatly influenced by the environment surrounding them.

3.2 General Systems Theory

Systems Theory finds its roots in the research carried out during late 1940's by the Austrian Biologist Ludwig VON BARTALANFFY. He wrote that the basic character of any living being lies in its organisation and investigation of the single parts or process cannot provide explanation to the whole phenomenon. Study of individual parts provides no information about the coordination of parts and processes. Hence he proposed that systems are open systems which led to the **General Systems Theory** which factored in effects of the environment on the system.

General System Theory (GST) -

- Is a general science of "wholeness".
- It defines how to break the whole into parts and then learn how parts interact and work together to form a system

- It may be applied to any kind of systems.

(Jackson, 1985) wrote that the systems model depicts organisations as complex system of interrelationships and insists that it can only be studied only as a whole.

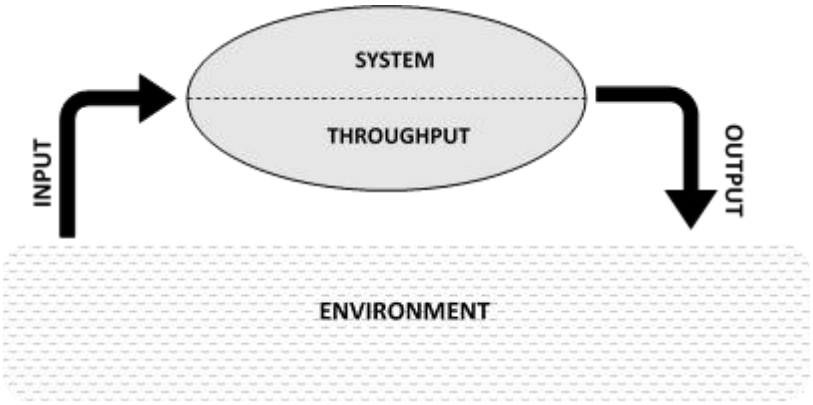


Figure 3.2 : General System Theory (Author)

General systems theory is a philosophy of organization. It is a system of categorizing systems throughout nature i.e. alive and lifeless. As per the general systems theory, the family is a living system with a ability to acclimatize (a) the boundary around the family and family sub systems (b) the distinction of such sub systems and the point to which the boundaries within them is clear. For instance, married relationship is distinct to the parent sub-system.

There are seven key tenets of systems theory. The same are detailed below:

1. The total is equal to more than the sum of its portions.
2. Systems are highly ordered and relationships are stable.
3. Systems are well-defined by restrictions nevertheless, if the boundary is too rock-solid or too penetrable, the system will become dysfunctional.
4. The behavior of characters cannot be assumed without reference to the systems to which they have its place.
5. Rounded connectedness.
6. Homeostasis i.e. systems seek constancy but so as to stay hale and hearty they must be able to change.
7. Systems are goal focused.

Woxenius (1998) defined two mains applications of general systems theory. In the first application, which is a normative approach based on logical conclusions, the systems theory is used to break down the complex systems into understandable sub-systems or components and their functions and interactions are studied. The second application used generally by biologists, Systems theory is used with a inductive touch as analytical and descriptive tool (Woxenius, 1998).

The characteristics of a system can be summarized as under -

- Each part can only be appreciated in terms of its relation to the other parts of the system.
- The parts of the system, including their interrelatedness, are important and contribute to the overall functioning of the system.
- Organizations may be considered as biological organisms, with aims and requirements of individual parts or members are very different from needs or goals of the whole.

Every organization need to be understood in terms of its relationship with its environment which provides resources and conditions for the survival of the organization.

An important concept of general systems theory is significance of communications. Sub systems cooperate and support with other sub systems. Another key principle of systems theory is difference among Open, Closed and Isolated Systems. In case of open systems there is an exchange of energy, information and matter between environment and the system. In case of closed system there is no exchange except for energy. In case of isolated system there is no communication among components.

3.3 Classical v/s System view of the world

System thinking is more than another new field of logical and philosophical research. It prompts another world view, incorporating the sciences of nature and man. It is a world view for recent times, clarifying some of our most treasured successes and some of our failures, issues and indicating systems to continue advancement towards new attainments. Understanding of systems thinking is a fundamental to

comprehend recent progresses in the domain of science, business management, environmental science, politics, and natural resources etc.

Ervin Laszlo is one of the most important essential supporters of the advancement of system science and philosophy. Laszlo follows with the elucidation of the systems view of nature, summarized in four propositions, which are established and demonstrated. (Ervin Laszlo, 1972)

- Natural systems are wholes with complicated characteristics;
- Natural systems keep up themselves in an evolving domain;
- Natural systems make themselves because of self-innovativeness in different frameworks;
- Natural frameworks are organizing interfaces in nature's holarchy.

Laszlo observed following differences between classical systems view and systems view of the world (Ervin Laszlo, 1972):

	Systems of View of world	Classical sciences
1	The new systems sciences sees at nature as a being with imitable components and an innate but non deterministic intention for choice, for flow, for impulsiveness.	The world view of the classical sciences theorized nature as a giant machine made up of complex but disposable machine like parts.
2	The systems view considers acquaintances and communications between publics and between society and nature, and focuses on civic and integrity in both the natural and the human ecosphere.	The classical view was atomistic and distinctive. It perceives the objects as detached from environ and publics as isolated from each other and from their settings.
3	The systems views provides a new significance to the idea of matter, as a configuration of dynamism, energy that flow and cooperate and permits for probabilistic progression, for self-creativity as well as for randomness	The classical view was materialistic, perceiving all things as dissimilar and quantifiable material entities.
4	The system view made emphasis on the significance of information and therefore of education, interaction, and human services over the consolidation of material merchandises and acquisition of raw power.	In its application to daily dealings, the classical world view commended the association of material goods and endorsed a power starving, compete to win attitude.
5	The systems view of the world is whole formed by societal and economic parts. It emphasis on sustainable development through flexibility and space among cooperative and shared parts.	The classical sciences visualizes the development in the material sphere as the peak of socio economic advancement and promoted higher and higher usages (and indirectly of waste) of dynamisms, raw supplies and other assets.
6	The holistic idea takes in the diversity of human cultures and civilizations and perceives all of them as likewise valid, ranking them only in regard to sustainability and the contentment they provide for their members.	The classical world view was Eurocentric, taking western developed societies as the role models of growth and progress
7	The system views visualizes the human as an living parts within a self-maintaining and self-progressing whole that is context and the prerequisite of life on this earth	The classical world view was also anthropocentric, observing human beings as grasping and monitoring nature for their own ends.
8	When the systemic vision stimulates the philosophy of social science, the principles of competition are lessened by those of interaction, collaboration and the emphasis on individualistic work philosophy is moderated with a acceptance of diversity and of research with institutes and practices that nurture man to man and man to nature adjustment and accord.	When the classical world view was applied to social science, the dominant ideas resulted in tussle for existence, the yield of the individual, with at best an assumed automatic chance of individual and societal good.
9	When the systems view is the foundation of a diagnosis the body, it is perceived as a system of cooperating parts, and the body and mind are not divisible. It is the wellbeing of the whole system that is to be preserved by focus to physic and interpersonal as much as to bodily and physiological considerations.	When the classical world view was applied to medical science, the human body seemed to be a machine often in requirement of healing by factual and impersonal interventions and treatments. The issues of the mind were perceived to be divisible from those of the body and hence to be discretely cured.

Table 3.2 Differences between classical systems and the classical sciences view of the world (Ervin Laszlo, 1972)

Laszlo has highlighted the significance of values, principles and elucidates why even customary beliefs, in spite of their lasting role, must be re-formulated to meet the requirements of the recent times. Laszlo has revealed how the system view of the world has a place for autonomy and diversity in an integrated world.

3.4 Concept of the System and its characteristics

A system could be defined as an accumulation of components unified by some type of communication or interdependence. It's a theoretical framework which elucidates some facets of the world as well as guidelines for its operations and setup. Systems might by abstract and physical (Peter Khaiter, 2008).

• An **abstract system** is conceptual in nature and build through human imagination and thoughts. It can't be seen or felt. They can't be pictured or drawn. Theological, cultural, governance and social systems are examples of abstract systems. However, these systems can be broken down into components and can be discussed and studied like any other system.

• A **physical system**, on the other hand, features a material nature. It depends on material premise instead of on thoughts or theoretical concepts. (Peter Khaiter, 2008)

There are many important system's principles which help studying a program and understand its functioning:

Decomposition is actually the way toward separating a system in the smaller segments. These components might themselves be structures (subsystems) and also may be isolated into the sections of theirs as well. Just how does decomposition assist perception of a product? It realizes tinier as well as less eccentric parts that are much less complex to comprehend than greater, complex parts.

Modularity is an immediate outcome of decomposition. It alludes to partitioning a system into modules or pieces of a typically consistent size.

Modules are able to represent system, which makes it less demanding to upgrade as well as reconstruct.

Coupling implies that subsystems are dependent on each other. Be that as it may, they ought to be as autonomous as could be expected under the circumstances. In the event that one subsystem comes up short and different subsystems are exceptionally reliant on it, the others will either come up short themselves or have issues working.

Cohesion is the reach out to which a subsystem plays out a solitary capacity.

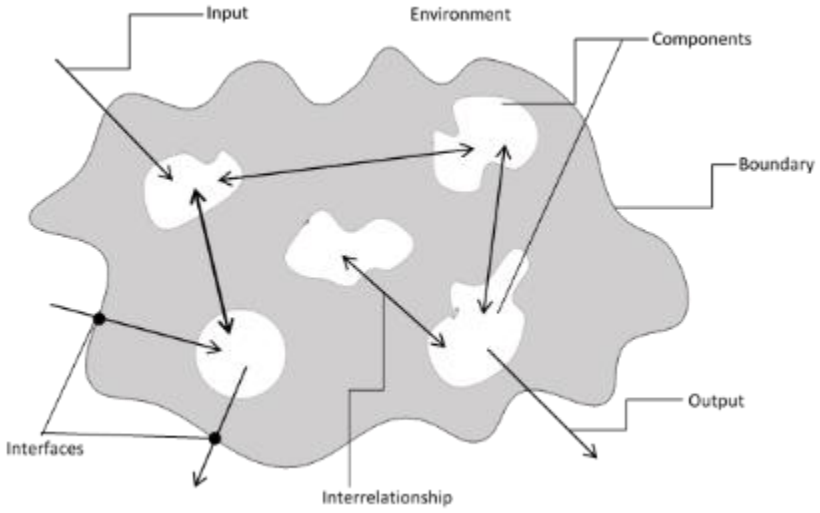


Figure 3.3 Characteristics of System

System has 9 primary characteristics. They're -

Components, Boundary, Inter-relationships, Input, Purpose, Interface,Environment, Output, Constraints.

1. A ***component*** also called as sub-system is the irreducible part of the system**.** The idea of a component is fundamental to systems theory and extremely effective. As an example, in case of any machine or consumer durable we can improve performance by changing specific parts without changing the whole system. (Peter Khaiter, 2008).

2. The component is **interrelated**; that's, the performance of one is linked with the function of the others. For instance, in the human body improper functioning of one system may affect other systems as well (Peter Khaiter, 2008).

3. Every system is delineated by a **boundary**, within which are all the components are found and which establishes the border of the system separating it from other systems (Peter Khaiter, 2008).

4. All of the components cooperate to complete a common **purpose**: the system's reason behind existing (Peter Khaiter, 2008).

5. Anything outside the system boundary is the **environment**. The system is encompassed by the environment, both influencing it and getting influenced by it. For example, a university operates in an environment of education system. Any changes in policies or demographics or industry priorities affects the university (Peter Khaiter, 2008).

6. The state when the system meets its environment are labelled as **interface** (Peter Khaiter, 2008)

7. A system faces **constraints** in its working as there are limitations to what it can achieve considering its external environment. The constraints could be within the system (e.g., a limited number of staff in a university) or external (e.g., due to regulations) (Peter Khaiter, 2008).

8. Through input and output, a system interacts with the environment. Anything from the environment entering the system is the **Input**; anything crossing the boundary the system and leaving the environment is the **Output** (Peter Khaiter, 2008). Input and Output could be in the form of Information, energy, and material exchanged with the environment. As an example, human beings consume inputs such as water, oxygen and food from the environment and its action, breathe and speech are the outputs. A manufacturing company uses raw

materials, machinery, components, utilities as inputs and produces manufactured goods and sub products as outputs (Peter Khaiter, 2008).

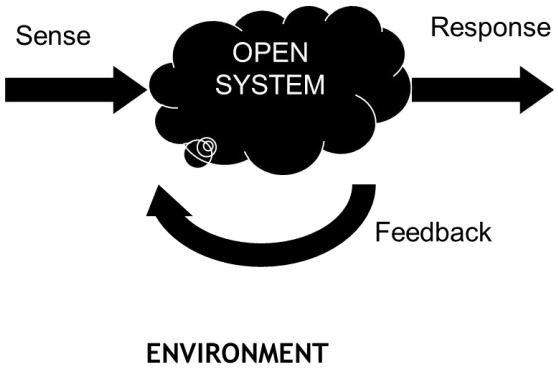


Figure 3.4 A typical system (Author)

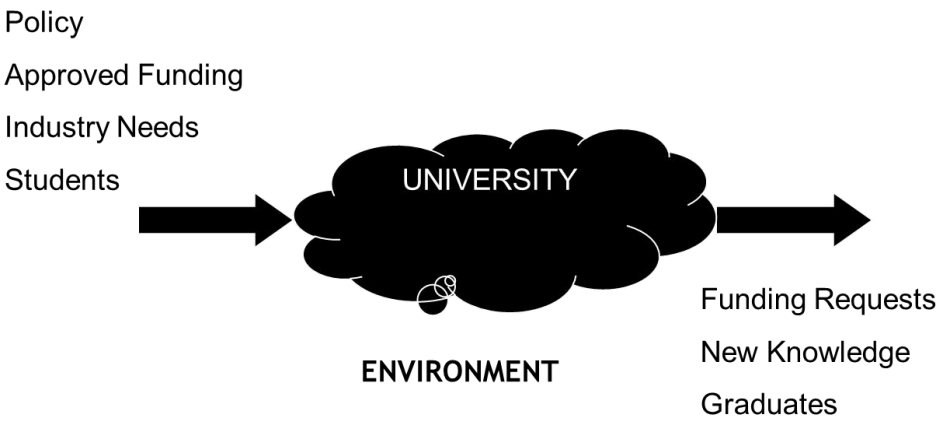


Figure 3.5 University as an example of System (Author)

3.5 Principles of Systems Theory

System Theory is a philosophy that visualizes an organization as a set of interconnected and mutually dependent fragments. The basic principles of systems approach as detailed below:

1. The analysis of individual components in isolation cannot explain the **properties** of the whole.

2. System means an arrangement of components linked together by a **network of connections.**
3. **Interactions** of the elements are not **static** but **dynamic** in nature.
4. All systems whether social or biological in nature exhibhit similar patterns, properties and behaviours which can be analysed to develop greater understanding of a complex phenomenon.
    A. we need to study the 'transactional processes' occurring between the components of the system if we are to understand it.
    B. we need to 'notice' emerging patterns and the organised relationships between these components
5. Every system is an **information** system whether mechanical or living.
6. A system interacts with its environment are highly **interconnected**.
7. The greater the degree of **wholeness** in the system, the more **efficient** the system
8. The greater the degree of **systemization**, the more **efficient** the operation of the system
9. The **effectiveness** of the system depends on the **optimization** of the system
10. A **complex** system can be broken into various **components** and each part can be analyzed to understand the phenomenon and reassembled as a whole.
11. **Application** of systems theory can guide decision makers in understanding, modifying and controlling the **organization**, actions.

3.6 "Systems" Thinking and its Advantages

System's Thinking is actually learning characteristics, properties, and the structure of systems, focusing on exactly how systems interact as well as influence one another and/or the environment, and/or just how systems, in turn, are actually impacted by way of the environment. It's a way for understanding that emphasizes the connections with systems components, instead of the components themselves.

Inside system thinking, it's incredibly essential to take note of the observer/watched affiliations, underlining just how big the particular point of view is actually in realizing authoritative immediate. Behavioural capabilities emphasize on the significance of people of the overall performance of companies, signifying the

requirement to take a look at social associations dynamics, specific actions, individual circumstances in addition to individual inspirations. In a nutshell, the concept of a system isn't linked with the concept of objectivity but rather denotes to a specific stand perspective and will fluctuate from performer to performer; it's securely contingent on the contextualized programs perception for place and period.

There are various advantages of systems thinking. Few of them are listed below:

Effective problem solving:

To effectively solve problems within the organization, the leader has to understand the root of the cause rather than treating the symptoms. He need to see the big picture and understand the organizational system to address the problem forever.

Effective leadership:

The most important job of a leder is to set a vision and motivate other towards that vision. For a leader to effectively lead an organization it is imperative that he understands how the organizations operates in the first place. He need to understand the various sub systems or functions within the organization and understand how they interact with other and the environment around it. A systems thinking cap helps the leader to identify the various constraints and thus plan to get over them.

Effective communications:

Certainly one of most essential part for the good results of any system, such as workplace, is actually recurring communications amid all the sections as well as parts of the business. One of the first indications of a company in distress are inadequate and irregular communications. The team members are not able to see outside their own roles. As a result, the company is significantly less effective than it might be. Without a strong understanding of the sections of an organization and how they relate to each other, it is possible to understand what to communicate and to whom.

Effective planning:

An effective planning process would mean identifying the tangible goals of the organization and creating systems and procedures to attain these goals. A systems approach will help to align the various functions towards a common goal.

Effective organizational development:

Probably the most active form of organizational growth results from the use of several approaches, combined with strategic preparation, administration as well as leadership growth, team building, supervisory advancement, organizational and team as well as employee overall performance management as well as concepts of organizational change. Any leader will find it difficult to make use of these approaches without a great comprehension of the entire systems in the organizations of theirs, such as the primary roles of its, sections, individual employees and processes teams. As a result, having a systems perspective is powerful tool in accomplishing powerful organizational development.

3.7 Transportation Systems

The term transportation comprises of two portions. The movement itself – transport, and the means by which this movement is undertaken – traffic. Transportation is thus the blend of transport and traffic.

The logistics sector is of major significance for the development of any nation. From the time of the 1990s, the transport industry of India has encountered a sizable transformation. For that reason, to sustain as well as drive fiscal growth, the movement of goods connected with an evolved economy will need a significantly bigger service sector coupled with physical logistics infrastructure.

Researcher, Sjostedt et al, have modelled transportation systems using the principles of transport, traffic and mobility. The model comprises of 4 structural pieces as well as 4 interactions that is likewise recognized as sub systems i.e. between these parts as depicted in the given below figure (Sjostedt ,1996).

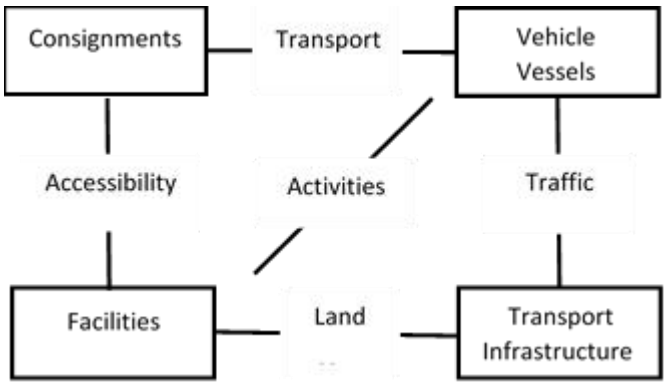


Figure 3.6 Transportation System (Sjostedt ,1996).

Though this model can be applied to any type of flow, however, here the discussion is restricted to flow of cargo.

Activities are not part of the model but drive the system and hence indicated as perpendicular to the plane encompassing the other parts of the model.

Transport infrastructure indicates man made and permanent facilities that allow movement of cargo possible, like roads, rail-tracks, navigable fairways and air ways .

Facilities are created for facilitating as the site of activities.

Consignments and the goods that move from one facility to another as part of the activity.

Vehicles and vessels are the devices utilised for conducting movement of shipments.

Land use is creation of infrastructure for certain transportation activities.

Accessibility is the measure of ability to reach a location to deliver a shipment of pick up a consignment.

The set of activities which change the location of the shipment is *Transport*.

Traffic is the movement of vehicles from transporting the goods from origin to desired destination location (Woxenius, 1998).

Manheim is actually among the famous researchers/ authors have worked on the product of transportation systems that are much more precisely based upon links as well as nodes. The study recognizes the need for various different viewpoints when evaluating the transportation systems though the objective for changing small nomenclature numerous times in the broadly recognized manuals is actually pedagogic. (M L Manheim ,1978).

Manheim observed that the primary ingredients of transportation system are actually load carrying system, management system, maintenance system, guide way, and transfer facilities. The primary elements were more split into a number of sub systems.

3.8 Intermodal Transportation Systems

In the existing world, intermodal transportation forms the pillar of world trade. In contrast to standard transportation systems in which some of the techniques of transportation function in an autonomous manner, intermodal transportation goes for incorporating different modes and combines them to create a whole. Intermodal Transpiration showcases a great solution to meet the growing needs to modern supply chains.

(Woxenius, 1998) used Churchman's Systems design model to Intermodal Transportation System. (Churchman, 1979) defines fundamental descriptive facets of a system: the objective, the environment, the components, the resources, the customers & lastly the management of the system.

The *objective* is the aim which guides the system direction. It's known as a genuine goal and the system moves towards it (Woxenius, 1998).

The *environment* refers to external factors which impact the system but cannot be affected by the interior of the system (Woxenius, 1998).

The *resources* like environment are factors which impact the system however, in contrast to environment they do get affected from inside the system. The meaning of the resources and difference between environment and resources is crucial in all systems analyses (Woxenius, 1998).

The *components* of the system have resources tied to it. Each resource belongs to a component while each component carries at least one resource. Each component carries Sub-objectives (Woxenius, 1998).

All systems have to be supervised for achievement of overall objective of the system. The process of the *management* is actually allocating resources and defining the sub-objectives for every component (Woxenius, 1998).

CHURCHMAN further evolves the model by appending
(6) - the *customers*,
(7) - the *decision-makers* and
(8) - the *planners* of the system (Woxenius, 1998).

To conclude, (Woxenius, 1998) defines the analytic and descriptive areas of system are:

1. Measurable goals
2. Setting factors which influence the system however, cannot be affected by the system
3. Resources are factors which may be affected by the system
4. Components are sections of the system which manage the resources
5. Management is the management of mechanism of the system
6. Clients are the users or perhaps customers of the system's output
7. Decision makers are people accountable for management
8. Planners are team responsible for the plans (Woxenius,1998).

Using above mentioned strategy of Churhman, Woxenius (1998) analyzed the Intermodal Transportation System as under:

Objective	To transport ITUs from consignor to consignee at a high service level, yet with the least possible consumption of resources.
Environment	The demand for transport services. Effects of political decisions such as laws, regulations, taxes and subventions. Competing transportation modes. Infrastructure.
Resources	Lorries. Handling equipment at terminals. Railway wagons. Rail engines. Ferries. Personnel.
Components	Hauliers. Terminal companies. Railway administrations. Ferry lines. Forwarders. Intermodal transport companies.
Management	Forwarders and intermodal transport companies, although lacking formal power.
Customers	Shippers directly or via forwarders with groupage terminals for general cargo.
Decision-makers	No formal, but nearest are some personnel of forwarders and intermodal transport companies.
Planners	As above, but closer co-operation between personnel at terminal companies and railway administrations.

Table 3.3 Applying Churchman's systems approach to intermodal transportation System (Woxenius, 1998)

3.9 CONCLUSION

The goal of this particular chapter was laying the need for theoretical framework and analysing various theories to identify the most appropriate theory for this research. General Systems Theory was identified as the most applicable theory. Primary principles of General Systems Theory had been identified and a study was produced on application of this particular concept in Transportation along with Intermodal Transportation.

Chapter 4

Research Methodology

"It is important to get results from the experiment, but the most important is the process of getting the results."

Dr Nik Ahmad Nizam

4.1. Introduction

Research is an accurate, intensive and exact process of the query to ascertain, understand or revise facts, events, concepts, and behaviours. Research is also universal. In the words of two scientists, Mory and Redman's investigative study is a "systematised attempt to get novel information".

The study methodology is a well organised and practical approach to address a problem. It's a science to consider the process which is expected to execute the research. The methods which investigators use to explain and forecast the answers to some problem are known as the research methodology. It may similarly be construed as the analysis of approaches by which knowledge can be obtained. The essential purpose of research methodology would be to create the working strategy of study. It's crucial and critical for any researcher to look for a method for the issue selected.

After a subject is identified and a study query is refined, the next step is to sort the information necessary to resolve the query and determine the way by which information may be congregated. Picking the right approach is dependent upon a clear comprehension of precisely what each method offers, what it's capable of and the more especially what type of research discoveries will soon be delivered. The method of finding answers to our investigation queries comprises research methodology.

At every operational step in the study procedure, it's required to pick from several methods processes and versions that will enable us to achieve our aims correctly. The study methodologies must include along with other matters the theme of study,

basic logical slants about how philosophy ought to be created, what standards must be fulfilled and what resources are available. In 2009, Saunders said that the investigation methodology adopted should comprise critical presumptions concerning the writer's ontological and epistemological interpretations on the world.

This part comprises the research approach of this dissertation. This section outlines the study process, the study design, the means of information collection, the range of the sample and the study method, the frame of study design, the kind of information analysis, the ethical issues applied for the study and the study constraints of this undertaking. To describe and justify that the process of contemplation and thinking concerned in reaching at the final methodology. The layers of research onion are methodically shed together with the examination of every uncovered coating being provided to describe the rationale behind the choice of selected strategy.

4.2. Research Problem Statement

Researchers outline their study by analysing inventing and distinguishing a study dilemma. Identification of research issues encourages them in concentrating and focusing on the study process with the purpose that they can resolve the issue in the most significant way possible. The primary and first phase of the study procedure is to select and officially characterise the study issue. An examination problem is reportedly the one that demands an expert to find the very best available answer to the question. The expert must decide the ideal arrangement of action whereby the mining reason may be proficient concerning a specified circumstance.

Different factors can contribute to creating the problem difficult. A problem statement is the explanation of a query which now exists and must be dealt. It generates the circumstance for the research and creates the questions that the study suggests answering. The task of inventing or defining a research problem is the most important and valuable step in the full research procedure. The problem statement must be exact to differentiate relevant info from insignificant ones. It's also crucial to establish that the objectivity and efficacy of all the facts regarding the study issue.

As mentioned in chapter 3 concept in research would be to differentiate the onset phase of the research problem and to develop the vision of the problem is coordinated. It determines and characterises the focus and objective of this study issue. The theoretical frame presents and defines the concept that explains why the research problem under investigation is different. The research problem is a theory underpinned by the conceptual structure that's examined during the analysis. As mentioned in the prior chapter the concept that is directing this research is General Systems Theory. The researcher has selected the following statement as a research problem in the General Systems Theory that would be analysed in this study.

Research Problem

The orderly and coordinated development of various elements of system elements will lead to total function of the system.

4.3. The emergence of Research Questions

Researchers usually commence the research by choosing a research subject, then defining the study questions within the topic to explore further. The issue will permit the researcher to select, assess and decipher the resources analytically. A valid question demands comprehensive research (not merely a reflection or comment) and is easy enough to allow to get a response. Assessing and participating with the information associated with the main objective of the study must be a familiar idea to the whole exploration procedure. To correctly determine what work was earlier available within the topic section, it's vital to thoroughly organise the literature research to make sure the latest and relevant materials are found.

Within the framework of this investigation, two questions are formulated.

1. "Which are the factors which enable incorporating Inland Waterways along with different modes of transport?"

This query is exploratory in nature, and its range is to learn the present things responsible for its integration of inland waterways along with different modes of transport.

2. "The best way to make Inland Waterways established Intermodal Transportation program in India?"

This query attempts to learn the probable approaches to create inland waterways based intermodal transportation system in India.

Research Questions

RQ1: "What are the factors which enable integrating Inland Waterways with other modes of transportation?"

RQ2: "How to create Inland Waterways based Intermodal Transportation system in India?"

4.4. Research Objectives of the Study

Objectives are the targets which are set to achieve in any research. They update a reader what the researcher desires to reach through the study. Problem statement formulation describes the aim of any hypothesis, but the objectives deliver a precise and thorough description of the detailed actions required to reach that aim. It is essential to write the goals clearly and explicitly. Each objective should comprise only one characteristic of the investigation. The goal of the analysis is one of the necessary components for investigating any idea because it aids in shaping the probability of conducting the study.

The general goal of all researchers is to approve the authenticity of current knowledge and to discover the variation of current knowledge, i.e. to contribute new insights into the existing knowledge. Before starting the research, it is crucial to identify the objectives because it evades wastage of time and efforts in later stages. Research objectives can be categorised into qualitative and quantitative.

The qualitative objective aims to assess the theories and the relevance of the investigation while the quantitative objective seeks to optimise specific performance

measures of the research system. It is essential for the researcher to decide the best strategy through which the exploration target can be accomplished ideally with regards to a given circumstance.

The specific objectives of the research work in this dissertation are:

Research Objectives

RO1: To identify various factors which will enable Inland Waterways based Intermodal Transportation system.

RO2: To develop a conceptual framework for Inland Waterways based Intermodal Transportation system in India

4.5. Arriving at the Methodology

This part is a very complicated procedure. Wide-Ranging practical tasks are present to explain the different methods of research. It signifies that how vast the choices are, and how dubious decisions could be and in what way they are linked to distinct logical and hypothetical viewpoints. There are various academic models present which wants to aid investigators in navigating several choices, the inherent complexities and conflicts involved in choosing a suitable methodology. It might be unwise to think about just one model individually as always right, but at precisely the same merit, it would be foolish to think about any version as erroneous, at least since all of them offer suggestions and alternatives down to a viable and sensible degree. In simple words, as a manual for how to solve a problem, they're beneficial and essential.

In 2000, Partington indicated that the level of thought must lie somewhere between only employing a conventional, normative strategy and restructuring the whole scientific philosophy to reach an exclusive operational plan. He advised to locate and clarify a method which is suitable for the demands of the study and its framework. It embraces a design that's primarily a subject of expediency, using a tactic which is

significant and beneficial to this purpose and the procedure of enquiry, rather than specified as a complete. Many models try to reflect the area.

One such design was given by Saunders in 2009 which is known "The Research Onion Model". It encapsulated hierarchy efforts in preventing the rigorous polarity apparent in a few versions while keeping the theoretical individuality of the various strata and suggesting probable relationships amongst these layers.

Saunders presented a design which permits the scholar to recognise the essential problems which need responsiveness in the last analysis method implemented is to be equally admissible and plausible. It is a procedure which leads to early investigations of philosophical aspects through a string of sheets before reaching suitable approaches to information gathering and analysis.

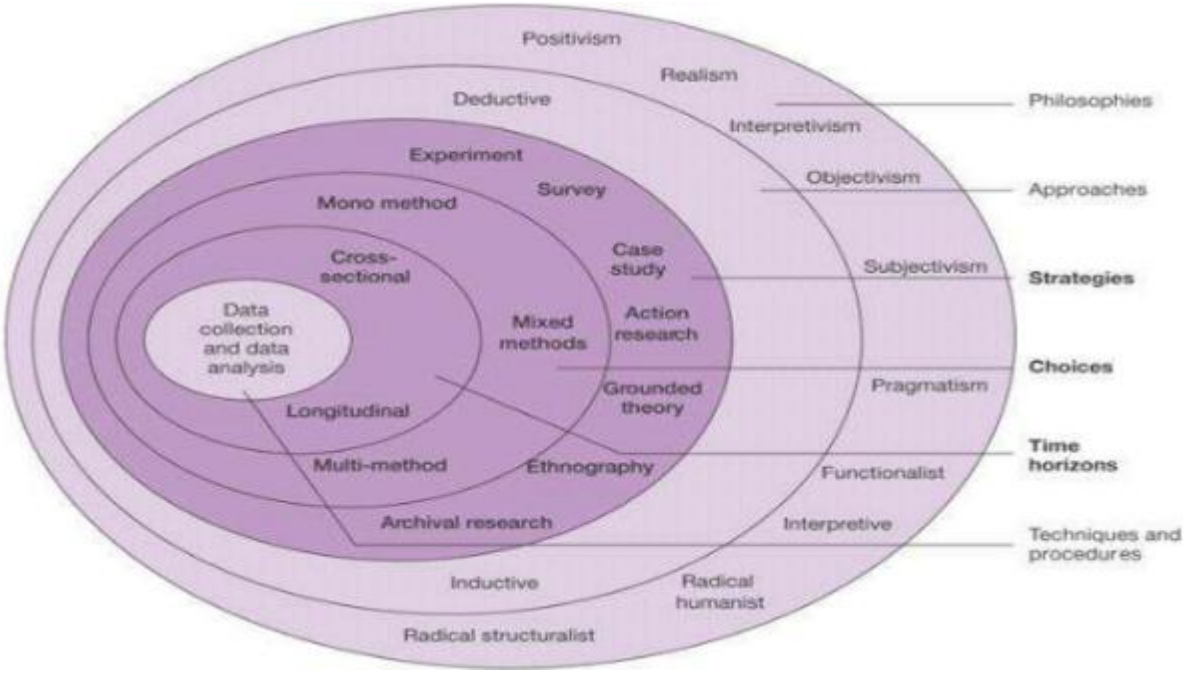


Fig 4.1 Research Onion (Saunders *et al.*, 2009)

Initial two layers in this model deal with research philosophy adopted and preferred research approach. Subsequent segments deal with the research strategies, choices and time horizons. The sixth layer of this model deals with data collection methods and process of analysis.

Therefore, keeping this in mind to clarify and legitimise the perspectives associated with touching base at the last technique the onion will be analytically peeled, with the analysis of each uncovered layer offered to clarify the reasoning as to why the final approach is being picked.

4.5.1 Philosophical Positioning

This point is concerned chiefly with the first layer of the Saunders onion model to demonstrate investigation reasoning.

The investigation logic any specialist receives contains critical presumptions about how they see the world. These suppositions will help in building up the strategy for the research. Business and administration analysts should know about the philosophical responsibilities they settle on through the decision of research procedure since this has a remarkable effect on what they do as well as to comprehend what is being examined. The principal motivation is the view of the association amongst awareness and the procedure to develop it.

The philosophy selected will be impacted by technical considerations (accessibility to participants and data, time limitations) but it is these postulations about primary investigator positioning which will reinforce general examination plan alongwith the related investigation procedures.

Research philosophy can also be characterised by the progression of the investigation context, information about the study, alongwith its characteristics. It can also be designated with the aid of the research prototype. In 2000, Cohen, Manion, and Morrison explained the research paradigm/prototype as outer skeleton, which encompasses insight, opinions, and comprehension of numerous philosophies and methods which are utilized in conducting research. It is a correct procedure, which includes several phases using which an investigator produces a correlation linking the analysis goals and queries. This idea influences beliefs and value of the researcher to provide valid arguments and terminology for a reliable result.

The research study, keeping the outer layer of the research onion in mind, depends upon appropriateness of examination approaches employed, validity of the research alongwith existing assumptions about nature of reality (Myers, 2013). The research philosophy implemented should contain relevant postulations about the scientist's epistemological and ontological views of the world. In this evaluation, two remarkable ways of assessment about research philosophy are epistemology and ontology. These both include quintessential variations which affect the research process.

Epistemology is stemmed from the term 'episteme' meaning information and 'logos' meaning study. This division of philosophy deals with the discovery of the correct and accurate meaning of knowledge. Ontology deals with the fundamental norms which are formed to comprehend the actual nature of the surrounding. It tries to pinpoint things around us that exist.

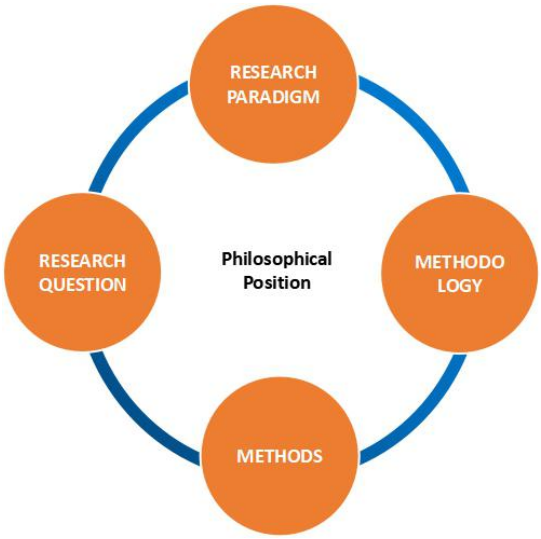


Figure 4.2 The importance of the Philosophical position (Author)

It is imperative for any scholar to recognise the philosophical view of the research issues and a unique blend of research methods. The investigation could be influenced and directed by a paradigm, and it is specified as the patterns of belief and systems which regulate the investigation. Four types of standards are Positivism, Interpretivism, Realism, and Pragmatism. These are important to understanding the research philosophy.

The explanation of the assumptions and their implications related to the goal are given in this table:

	Positivism	Realism	Interpretivism	Pragmatism
Ontology - the nature of reality	External, objective, independent of social actors	Objective. Exists independent of human thoughts and beliefs or knowledge	Socially constructed, subjective, may change	External multiple, view chosen to best enable answering of research question
Epistemology -what constitutes knowledge	Only observable phenomena can provide credible data	Observable phenomena provide credible facts. Insufficient data means inaccuracies	Subjective meanings and social phenomena. Focus upon the details of a situation and reality behind the details	Depends on the research question. Either or both observable phenomena and subjective meanings can provide acceptable knowledge

Table 4.1 Contrast of four Research Philosophies (Saunders *et al*., 2009)

PHILOSOPHICAL POSITIONING ALONG WITH IMPLICATIONS FOR THIS RESEARCH STUDY

Positivism: The concept of Positivism deals with objectivism. In this approach, specialists provide their perspective to assess society with the aid of objectivity as opposed to subjectivity. As showed by this paradigm, authorities are involved with gathering broad information and data from an extensive social illustration.

Interpretivism: In this approach, researchers give importance to their principles, opinions and values to deliver a reasonable clarification of the research problem. This method helps the investigators in emphasizing the actual evidences and statistics in accordance with the research problem. This logical approach appreciates the certain business condition.

Realism: Here the research philosophy mostly focusses on the authenticity and principles which are already present in the environment. In 2004, McMurray, Pace and Scott postulated the two methods of realism which are critical and direct. The later represents, what a person sense, hear, or view whereas, in first, persons reason about their proficiencies for a condition.

Pragmatism: It claims that one of the most critical determining factors of the investigation idea is the research question. It states that one tactic may be superior to the other for resolving issues.

Therefore, to seek clarity of the researcher ‘s developed structure of the study and the choice of methodology, there is a need to discuss the paradigm adopted for this research.

This investigation aims to demonstrate an approach that would reveal the researcher's understanding and justification of the research problem. This research aspires to develop a strategy that would explain participants’ perceptions of behaviours which were real and authentic for them. Therefore, the philosophy of this thesis is an interpretivist one. This study employs an interpretive paradigm.

Final Philosophical Position

Interpretivism

4.5.2 Research Approach – Deductive or Inductive

The Appropriate Research Approach

There are mainly 2 research methods induction and deduction. In the deduction, a theory and speculations are produced, and an exploration methodology intended to test the thesis. With induction, information is gathered, and opinion is created because of the data analysis.

Deductive Approach

Deductive approach is originated in the investigation in the field of natural sciences. The deductive approach begins with the theories already existing in a specific research area. The testing of these theories is done by employing hypothesis and formulating research query enabling the study. These hypothesis alongwith research questions form the basis for empirical data collection so that the researcher can arrive at a comparison between observed data and existing theories. An analytical

process is used to conclude (Bell, E; Bryman, A; 2007). The deductive approach follows a top-down approach.

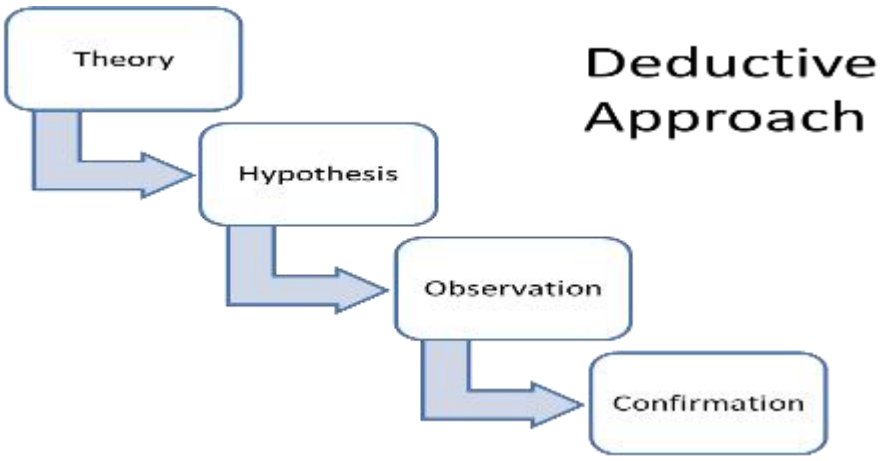


Figure 4.3 Deductive Approach (Author)

Inductive Approach

Inductive research does quite the contradictory of the deductive method as its foundation is centred on observations and it draws theory from those observations. The inductive method lies in the foundation of empirical facts. The first for this approach is to collect empirical data by which the researcher further develops a concept which is used to give structure to the theories. The difference between the previous plan and Inductive is that last method tests the existing theory and later helps in generation of a new one. The deductive method follows a bottoms-up approach.

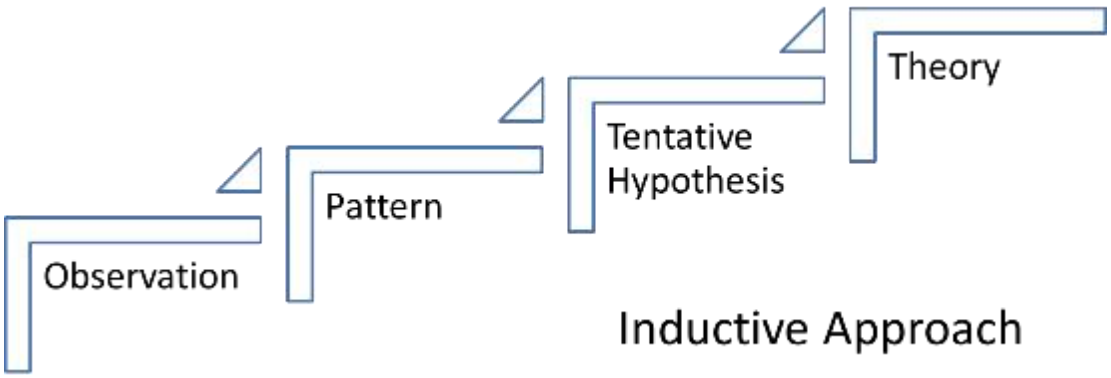


Figure 4.4 Inductive Approach (Author)

The following table indicates a comparison between the two approaches

	INDUCTIVE APPROACH	DEDUCTIVE APPROACH
Application	The need to describe fundamental relationships between variables	To gain an understanding of the meanings, humans attribute to events
Theory	Moves from theory to data. Is concerned with testing an existing one.	Builds a new theory from the data
Data Type	The collection of quantitative data	The accumulation of qualitative data
Role of Researcher	Researcher independence of what is being researched	The researcher is part of the research process
Sample Size	The necessity to choose samples of adequate size to simplify conclusions.	Less concerned with generalising. Small numbers of the sample are analysed with greater gravity
Structure	A highly organised approach based on scientific principles	A more flexible structure to permit changes of research emphasis as the research progresses

Table 4.2 A comparison between the Inductive and Deductive approach (Author)

In 2007, Bell and Bryman provided the notion that the deductive method reflects the most common outlook of the essence in connection with research and theory as the investigator progresses suppositions according to what is identified about the scope under investigation and of those related empirical notions. While noting that deductive approach is considered more scientific, they had the view that inductive method has to come prior as induction is the "chicken which lays the eggs of theory". As the procedures connected with a deductive strategy will encompass a component of induction, the inductive method is also likely to incorporate some deduction.

The researchers were cautioned with the developments in social sciences studies in the 20th century. The investigators opinion differentiated in this concept that a hyperlinks connection may be drawn up between specific factors without allowance being made to get a comprehension of how people interact and socialise with their social sphere. Those who agreed on induction approach also differed the rigid practices involved with the deduction methodology allowing no room for different explanations about what's occurring.

Here the researcher wants to identify the relationships between IWT mode and other modes of transport. Hence the interpretive view working inside the field was implemented. Additionally, as shown in Chapter 2 although the discipline of IWT in India is still evolving, further research is needed to develop this as a viable alternative mode. Developed Intermodal Transport Systems as observed between Rail and Road is not considered in the IWT, which require additional inquiry to create innovative and inventive means to define build relationships of IWT with other modes. Hence, the situation for inductive strategy is within the need to induce research in the area only. The main aim of research was to create an understanding of the integration of IWT mode with other modes and explain the nature of the relationship between various subsystems of the Intermodal Transportation System. Thus, analysing data according to the topic matter instead of earlier determined thesis was developed earlier to framework, the inductive strategy was regarded as the most suitable.

4.5.3 Time Horizons – A Cross-Sectional Study

In the development stage of the investigation, it is vital to contemplate the time horizon of the inquiry. It is imperative for the researcher to determine whether the ultimate findings of the study are to present a close-up taken at an appropriate point in time or results which are same keeping a record over the time. The 'snapshot' time horizon is termed as cross-sectional whereas the 'diary' perspective is known as longitudinal.

According to Saunders et al., Cross-sectional or one-shot studies contrasts with longitudinal studies. The earlier deals with projects meant for academic courses and which are unavoidably time constrained. The latter offers the capacity to study deviation and development.

It is a study in which data is collected once. This process takes place over a span of days, weeks and months, to answer the research question. Cross-sectional studies mostly use the survey strategy.

This research study aims to scrutinise a phenomenon at one specific time demonstrating the cross-sectional study. This study utilised a snapshot view of the Inland waterways. Hence, this investigation fulfils the standards and conditions in connection with the Cross-sectional study.

Time Horizons

A Cross - Sectional Study

4.5.4 Qualitative or Quantitative Methods

Any research study involves many research methods. Most of them are Quantitative Research and Qualitative Research method. The subsequent section examines process applied in using the most suitable way (qualitative vs quantitative) for concentrating on the research queries in this study. Below table showing some significant differences between both the methods is given below:

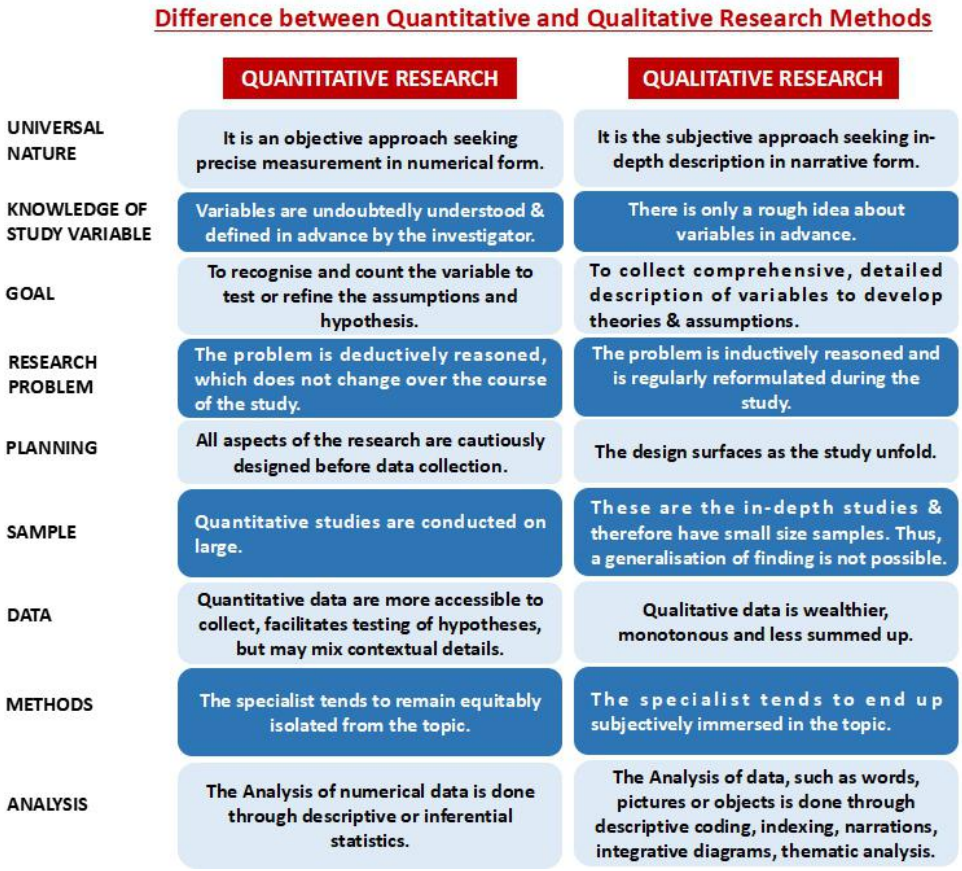


Table 4.3 Difference between Quantitative and Qualitative Research Methods (Author)

Quantitative research strategy emphasises quantification in the interpretation and the collection of information. Data-collection and investigation are less laborious, and decisions could be drawn over a much broader sample collection. It is an iterative procedure where the evidence is assessed, concepts are analysed, and technical improvements are made.

It requires the deductive approach. These methods involve testing of theory where the researcher undergoes identification of a relationship between variables and arrives at questions and hypothesis which are further administered with the help of surveys and experiments for an understanding of natural phenomena and research.

The primary objective of almost all the study is generalisation and recurrence, yet this research also tries to forecast and describe a phenomenon and to develop comprehension working with a post-positivist strategy. In a quantitative study, the

research queries and thesis are recognised after being invented from notions within the literature. These concepts are then tested and assessed from the use of statistics. The research queries and assumptions remains same which are addressed through qualitative methods during investigation.

The qualitative study approach main aim is to understand human nature and the motives that depicts human conduct. This approach usually highlights words instead of quantification from the collection and evaluation of information. It mostly hastens an inductive approach to the connection between research and theory, where the main stress is on the creation of concepts.

The strength of the qualitative research method is the inductive approach. The focus here is on circumstances or people which are very specific, and the emphasis is on words rather than numbers (Myers, 2013). Some characteristics of Qualitative research are as follows:

- It is naturalistic, i.e., it occurs in the natural world
- Employs various interactive and humanistic methods
- It is emergent rather than firmly anticipated
- It is essentially explanatory
- Views social worlds as universal or seamless
- Uses intricate reasoning that is multifaceted and iterative

This investigation fulfils all the parameters associated with the qualitative approach. Hence the qualitative method is used in addressing the research problems in this study.

In 2003, Yen recommended that qualitative approaches were appropriate for discussing ‘‘why’’ and ‘‘how’’ kind queries. The nature of the research queries in this discussion, ‘‘why poor adoption’’ and ‘‘how to develop an IWT based MMT system’’ are exploratory therefore qualitative research method is embraced for this objective. Subsequently, the research questions were the main factor in identifying this approach.

He also stresses that qualitative approaches are appropriate when checking a process. Here the research objective is to explore and identify various factors which will enable Inland Waterways based Intermodal Transportation system. It will help generate more profound perceptions and insights which forms the ground for theoretical development as no IWT based Intermodal Transportation System exists in India.

No previous research has recognised the relationships or concepts associated with the IWT based MMT system, and the number of experts in this field is insufficient. This study requires a close involvement with the subject, participants and postulates gathering a significant amount of valuable information, and this method will allow in-depth investigation of high adoption in some countries and low adoption of IWT in India.

Research Method Choice

The Qualitative Methods

4.5.5 The Qualitative Methods

(Creswell, 2003) Distinguishes qualitative methods in some categories which are mainly, ethnography, case studies/multiple-case studies, grounded theory, narrative and phenomenological. All these systems utilise an inductive approach and mostly focus on the procedure. Qualitative checking is typically based on an investigation in which data is recorded in a natural environment (e.g., interviews or observations). These ways are usually used for practical research and for explaining, spotting, classifying, theorising, mapping, solving and investigating concepts.

It is ideal to appoint qualitative methods when the variables are multifaceted and challenging to measure. Also, when the conclusions and discoveries are based on arrays uncovered in the data, qualitative techniques come into play. This part will briefly address all the qualitative methods. Finally, the justification for choosing the suitable way for our research study will be discussed.

Possible Qualitative Methods

• **Ethnography:** Normally this study uses and analyse a cultural area by examining them and their behaviours. It is oriented towards studying shared meanings and practices. It is applicable for investigating human groups and does not apply in our context. This method was not selected for this thesis.

• **Phenomenology:** The principal focus of phenomenology is to explore individual experiences of everyday phenomena. This approach is used to study and understand the human experience. It is usually focussed on developing patterns and relationships using a smaller number of subjects. It mainly focuses on individual knowledge, beliefs, and perceptions. Hence, it is not applicable in our case.

• **Case Study:** Case studies are the most frequent kind of qualitative method used in research which allow investigation in its actual context, mainly when the boundaries between context and event are fragile. They analyse one of several instances which are unique concerning the research topic. There is no prominent case in this research study. So, this method was also ruled out.

• **Discourse/Conversation Analysis:** It is the study of naturally happening discourse. It ranges from conversation to public events to existing documents. This study is also not applicable in our case.

• **Narrative Analysis:** This method is used to collaborate with contributors to create stories which portray their lives. Narratives (Story Telling) are used as a source of data which is not applicable in our case. Hence, it is also not used.

• **Grounded Theory:** This method is employed to investigate a process by achieving numerous data gatherings at various phases throughout the process. This method tries to recognise the inter-relationships of classes of info. The models generated using grounded theory are somewhat distinguishing from the conventional ones. It utilises inductive data collection and analytic methods. There is no available theory of framework for Inland Waterways based Multimodal Transportation system. So, this research did harness the features of the grounded theory.

Type of Approach	Defining Features	Applicability in our case
Phenomenology	* Focuses on individual experience, beliefs and perceptions * Text used as proxy for human experience	Study of conscious experience. Not applicable in our case.
Ethnography	* Oriented towards studying shared meanings and practices (eg. Culture) * Emphasis on emic perspective	Applicable for studying human groups. Not applicable in our context.
Case Study	* Analysis of one to several cases that are unique with respect to the research topic * Analysis primarily focused on exploring the unique quality	There is no prominent case in this research to study.
Discourse/Conversation Analysis	Study of naturally occurring discourse. * Can range from conversation to public events to existing documents	Not applicable in our case.
Narrative Analysis	* Narratives (Story Telling) used as source of data. * Narratives from one or more source	Source of data in not applicable in our case.
Grounded Theory	* Inductive data collection and analytic methods * Uses systematic and exhaustive comparison of text segments to build thematic structure and theory from body of text. * Analytic approach in qualitative studies	Can be applied. There is no available theory of framework for Inland Waterways based Multi Modal Transportation system.

Table 4.4 Different qualitative methods and their applicability to this study (Author)

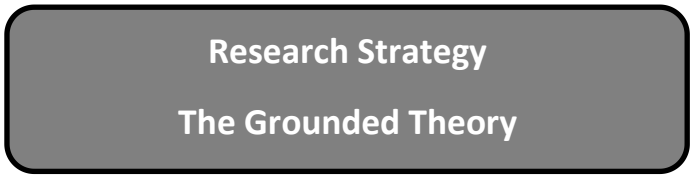
Why Grounded Theory (GT)?

Grounded theory is a particularly appropriate methodology to adopt in this study. In the following section, the motives for choosing grounded theory as the methodological framework for this study are reflected. Broad parameters of the methodology are set followed by the debates surrounding this theory and the rationale for adopting a grounded approach is described.

- There was a demand for comprehensive philosophy or description of a procedure. Grounded theory produces an argument when prevailing methods do not tackle the research problem. The theory behind the research problem is "grounded" in the data, and it delivers a more lucid clarification than a theory borrowed "off the shelf".
- The grounded theory is implemented for its epistemological strength to help accomplish this dissertation's purpose. Grounded theory is employed when one needs a comprehensive approach or analysis of a process. It is helpful when prevailing assumptions about a phenomenon are either insufficient or

non-existent (Creswell, 2008). There is no available theory of framework for Inland Waterways based Multi-Modal Transportation system. Hence, grounded theory is selected for this dissertation.

- Grounded theory permits the researcher to develop and generate a model for analysis of primary data. It aids in a disciplined development of new ideas. Grounded theory helps in finding method and structures where there is no prior guidance available regarding the research topic.
- This theory is perfect as it also allows the investigator to modify and improve investigation inquiries as additional things are acquired about the research problem. When operating GT, the hypothesis is regularly questioned and enhanced until theoretical saturation is attained.
- Grounded theory permits the researcher to explain the overall strategic planning process. As an outcome, this exposition contributes a model of grounded theory examination that can be utilised to produce future substantive or formal theory.



4.5.6 The Research Strategy – Grounded Theory

In 1967, Glaser and Strauss made in their grounded theory an entire thought of the epistemological and the exploration procedure in the field of sociology. It encompasses the whole process starting from research question to the creation of final report on the findings from the research. Data gathering, investigation, and preparation of the theory are closely related and progress hand in hand.

Grounded theory has developed as an effort to create new assumptions based on grounded evidence. A number of approaches to grounded theory technique has been expanded over the years, with a choice of research problems and methods. Over time, grounded theory kept on picking up force as a personal plan ending up progressively prominent in human science as well as other different disciplines in numerous fields.

4.5.6.1 Different versions of Grounded Theory

There are 3 main versions of GT available in the literature. The systematic design connected with (Strauss and Corbin, 1998) and (Corbin and Strauss, 2008); the emerging model, associated with (Glaser, 1992); and the constructivist method advocated by (Charmaz, 1990, 2000, 2006).

1. Systematic approach:

This version of Grounded Theory is widely used in the educational study. The procedures here were first suggested by Strauss and Corbin in 1990 and were subsequently more detailed in their later editions in 1998 and 2008. This method provides a framework for data gathering and analysis using the three steps of coding - open, axial and selective. This method provides a consistent standard and a graphic representation of the emerging theory.

2. Emerging design:

Although Glaser along with Strauss first propagated Grounded Theory in their book in 1967, later he differed with the Strauss's systemic design concept and wrote a thorough assessment of the Strauss approach. Glaser (1992) felt that Strauss approach had excessively underscored standards and systems, a biased structure of classifications. Glaser stresses the significance of giving a hypothesis a chance to rise out of the information as opposed to utilising specific, pre-set groupings.

3. Constructivist approach:

This approach is supported and clarified by Kathy Charmaz. She centres around the significance of implications people ascribe to the focal point of the examination. In this strategy, the specialist takes a gander at the members' considerations, emotions, qualities, perspectives and attestations by applying dynamic codes instead of social occasion certainties and depicting acts.

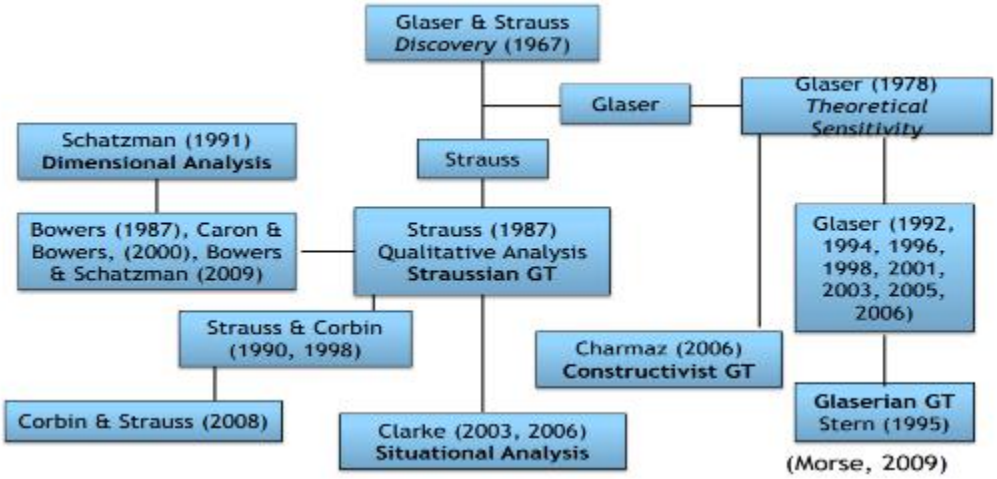


Figure 4.5 Different types of Grounded Theory Techniques (Morse, 2009)

Among methodological users, there is a lack of agreement on which version of grounded theory should be employed due to a whole range of social science paradigms, academic disciplines, and fields of study.

Concerning this dissertation, Grounded theory method which is chosen is a Systematic approach (Strauss and Corbin, 2008). Its systematic design, suggestions are developed through an arrangement of data-collection, coding, and the pictorial representation of categories that group codes. This method enables construction of a specific set of verifiable set propositions based on qualitative data. GT calls for continuous evaluation, thus allowing the scholar to state their hypotheses and uniformly show the information. This method provides the grounding density, and combination essential to produce a rich, tightly intertwined, descriptive theory that approximates reality.

4.5.6.2 The tenets of Grounded Theory

Grounded theory has some distinguishing procedural features contrasted with other qualitative approaches. It is a rigorous approach because it outlines a series of steps concerning how to gather, collect and analyse the data.

Grounded theory is used to investigate a process around a substantive topic. Synchronized data collection and analysis results in sampling. Several stages are involved in grounded theory.

- First, it is decided if the grounded theory strategy best focusses on the research problem and then a process is identified for study.
- A theory is generated which exceeds the literature and creates it at the same time, as it takes on more significant possibility and depth than previous research. In this process, the grounded theory investigator gains more extensive coverage by integrating generated theory with documented literature.
- Data collection is the vital step in research design. There are various data collection approaches applied in GT. Information accumulation is to assemble data that can aid the improvement of an opinion.
- Making notes about the information gathering.
- Coding (open, axial, selective) into segments and properties and information is recorded and coded when it is gathered.
- Memos and technical notes - Memos are notes the researcher writes during the research study to elaborate on philosophies about the data and the coded categories.
- Writing - Writing a grounded theory research report, which is guided by the sorting of data gathered.

4.5.6.3 Strengths and Limitation of Grounded Theory

All research designs have some strong points and limitations. The grounded theory also has its strengths and some weaknesses which are discussed here:

Strengths:

- The outcomes are rooted in the data.
- The theory is tested continually through constant comparison.
- It employs a practical strategy to develop new hypotheses and understand new happenings.
- Conclusions and study methods are clarified.
- It follows a thorough and logical procedures for data accumulation, interpretation and theorising.

- The emerging theory and propositions assist in generating future research ideas in the domain of the study.
- This method requires the researcher to be open minded and study the data from various lenses.
- Grounded theory is useful for exploration. It helps in finding method and structure in domains where there is no a priori guidance.

Limitations:

- It involves enormous volumes of data.
- It is a time consuming and need to follow a strict method of data collection and analysis.
- A high amount of noise and disorder is present in the data.
- It may be practically challenging to determine when the theory is adequately developed.
- At times it is not possible to commence a study without some concepts or theories around the topic.
- It demands a high level of expertise, endurance and understanding on the researcher's part.
- Grounded theory is not suitable for hypothesis testing.

The Final Research Methodology

To conclude the Research Methodology discussion, based on peeling off various layers of Sounders research onion, we arrive at the following Research Methodology**.**

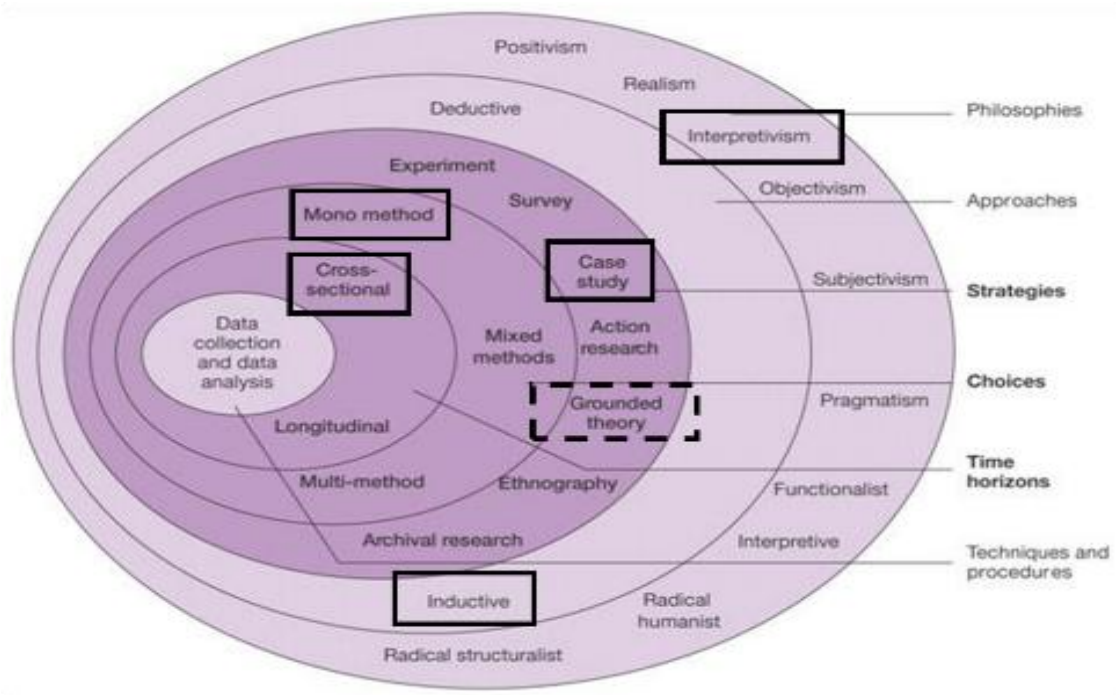


Figure 4.6 The peeled Research Onion (Saunders et al., 2009)

A Summary of the Final Methodological Approach

	Final Approach	Reasoning
Philosophical Positioning →	Interpretivism	An approach which will reveal contributors' understandings of behaviours that held reality for them. To reveal IWT investigator's understandings and awareness of their reality paired with an ontology that would link contributor experiences with different levels of reality.
Approach →	Inductive	To create a perception and clarification of the nature of relationship forming, analysing data as defined by the subject matter.
Time Horizon →	Cross-Sectional	A retrospective review of the IWT and Intermodal Transportation fulfilling the cross-sectional criteria.
Strategy →	Qualitative	This study contemplates the thoughts and approaches utilised by different performers within the IWT based IMT System. A qualitative approach would address the need for excellent and applicable research within the field with data being gathered using appropriate methodologies.
Methodological Choice →	Grounded (Theory Building)	Grounded theory is a technique to develop new theories based on grounded evidence. GT is very suitable hen there has been little research and methods on the subject like in this study.

Table 4.5 A Summary of the Final Methodological Approach (Author)

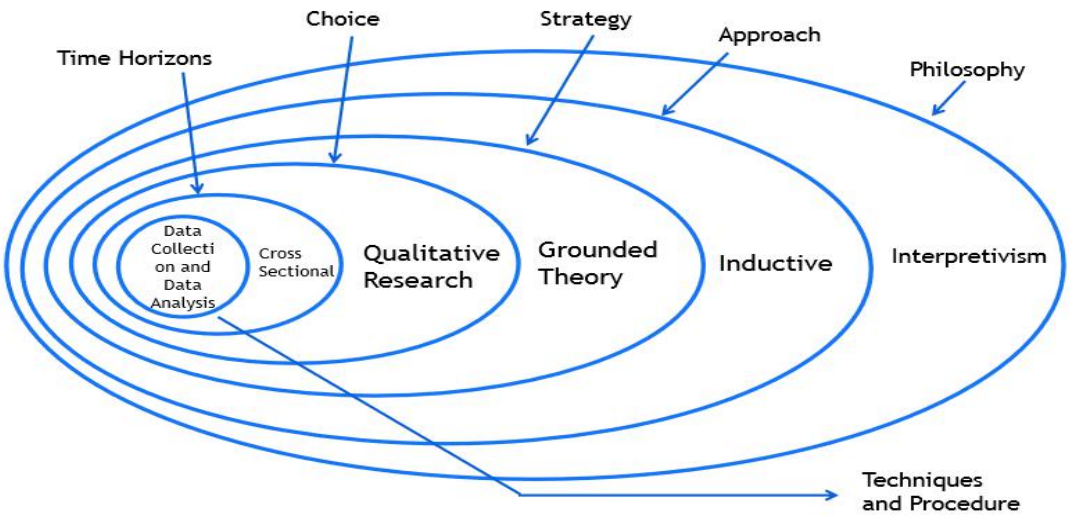


Figure 4.7 The final Methodological Approach (Author)

4.6 The framework of Research Design

The Research model is an outline or summary for directing the research. It postulates the of the procedures for obtaining the information required to structure and solve research problems.

The research design segment provides a complete sight of the system chosen for the research and the reason for this choice. The research design will be the general idea for addressing the research questions. It will contain clear goals, acquired from the examination questions, indicate the sources from which information gathering is planned, and consider the requirements and ethical issues. Vitally, it ought to mirror the reality of utilising the specific research outline. Research configuration must have legitimate purposes behind all the examination outline choices. The defence ought to dependably be founded on the examination inquiries and targets and being reliable with the exploration logic.

It ought to be exhibited that every one of the issues concerning the strategy and their relationship to the exploration goals is comprehended. In any case, it isn't essential for the proposition to incorporate an exact detail of the technique which will be utilised, for instance, the substance of observation schedules or questionnaire questions. An announcement should be embedded in the adherence to any moral rules.

4.7 Data Collection Methods

In 1967, Glaser and Strauss highlighted the need for the collection of quality data in qualitative research. This section details out as to what were the various options for data collection and which options were exercised and how. The following are different dominant methods of data collection in the case of qualitative research.

Figure 4.8 Data Collection Methods for Qualitative Research (Author)

Researcher elected to employ interviews for data collection for the following reasons:

- The number of specialists in this field is limited in India.
- The study required close interactions with the participants to evoke stories that represent rising ideas and uncover unsaid and concealed observations
- The study may require multiple interactions with the respondents. Follow up questions may arise as we progress through the coding process.

In this dissertation, the conceptual lens is developed, and then data is collected through pilot and core interviews. In pilot interviews, the initial questionnaire is generated based on literature review and Conceptual Lens. This questionnaire is then piloted with one expert. The response was coded and analysed. In Core Interviews semi-structured interview questionnaire based on critical issues is developed, and the various stakeholders like Govt, Shippers, Terminal and Barge Operators and Multi-Modal Transport Operators were approached. Coding and analysis of responses are done.

4.7.1 The Interview Process

In this study, the researcher utilised the method of the active/dynamic interview for data collection. The dynamic interview considers interviewers and interviewees as equal partners in an interview. This interpretation changes a range of components in the interview process from the way of viewing a sample of how the conversation may be managed and the results are analysed.

(Holstein and Gubrium, 1995) Can be attributed to Active Interview Theory. Active interview process of examining a subject is different from interrogation. They denied the outlook of a research interview as something used to expand material, to gain respondent knowledge. They argued that an interview discussion is not only for transferring information. Instead, it is a social encounter to generate reportable knowledge.

They described the active interview as an interpretive practice. According to these scientists, it is a collaborative discussion where the interviewer and interviewee engage in a meaningful conversation and construct collective learning through a set of questions.

The active interview is impromptu and instinctive yet structured within the loose framework provided by the researcher. The conversation is supposed to bring out the respondent's story, his experiences and his perspectives on various topics of discussion. Active interview of more than just a probe where pre-determined questions are asked to complete answers.

The role of interviewer in an active interview is to activate narrative production. It is significant for the researcher as an interviewer to engage and suggest the respondent various perspectives, orientations and precedents during the discussion. The researcher should guide the respondents through connections between the topic and experiences. It is essential for the researcher to listen well and be attentive and responsive.

The format of each meeting will include an introduction to the research, main interview discussion, wrapping up and request for further talks. The duration of

interviews was between one and one and half hour for initial meetings and between twenty to forty minutes in later stages. Different subject matter experts were interviewed during this dissertation. A proper interview protocol was developed.

During each interview, additional questions were asked to either elaborate closer on exciting and relevant concepts or to guide the interviewee in the right direction towards the topic of interest. The respondent was provided with a brief in advance about the research project. The respondents were infromed of the aim of research which is to understand the integration IWT with other modes of transport to create an intermodal transportation system and the negligible share of containerised transportation on IWT in India.

The interview lasted about an hour, and questions were asked regarding the role of Government, Waterways, Barge and Terminal operations, the possible lanes and how to promote this solution to shippers and consignees.

The results from previous interviews were referred to, as necessary, in later interviews. Conversations were recorded and transcribed. The text from the interaction was sent to respondent for verification and approval.

4.7.2 Sampling Procedure

Purposeful sampling technique was used in this study to select the interviewees. Purposeful sampling is a non-probability sampling where the respondents are subjectively chosen based purposes of the study and characteristics of the population. (Bogdan & Biklen, 1998) Describe purposeful sampling as a technique where subjects are selected from as they are believed to expand the developing theory. This technique is useful where the researcher needs to reach the target population quickly, and proportionality sampling is not a key concern. During the initial stages of research, heterogeneous purposeful sampling was deployed to identify a diverse range of experts who could provide different insights into the phenomenon under study. As the purpose of this research was to create a theory for IWT based intermodal transportation in India, experts in IWT field and intermodal transportation were chosen for interviews. Experts from the various Government

sector, the private sector, lending agencies, educationist were selected to provide diverse views on the subject.

The sampling procedure is designed to select the prospective participants in the data collection method. (Patton, 2002) Suggested that the size of the sample in qualitative research is connected to the purpose of the inquiry and what is useful in the study. It is also compared with what the researcher wants to know and what will provide credibility. What can be done with resources that are available also determines the sampling procedure?

In the Grounded theory study, the total number of participants cannot be known in advance. It is restricted by theoretical saturation, which transpires when data analysis no longer generates new variations, theories, or categories.

Subsequent participants were selected entirely through theoretical sampling and referral by other participants. Selection criteria were contingent upon the emerging theory and could not be predetermined (Simmons, 2009). Further, participants were decided based on their connection to the emerging approach. Data collection included interview data to construct analytic codes and categories, use of constant comparison, and simultaneous efforts through all stages of data analysis.

4.8. Data Analysis Strategy

The first indication of the GT is to obtain theoretical concepts from qualitative analysis of raw data. Empirical data is divided into components to carry out an investigation. These components are further examined with the determination to recognise their assets and dimensions. Finally, the information regarding the elements and their features is used to infer the studied phenomenon.

The data analysis is an active process comprising, evaluating various ideas, removal of some, and expanding on other philosophies before reaching any inferences. As the qualitative data is fundamentally rich in nature, more than one interpretation of the information is possible. Different investigators focus on various elements of data, interpret them differently, and recognise distinctive and unique meanings.

After data-collection, grounded theory analysis encompasses the following required steps:

1. **Coding text**: In GT research the search for the theory begins with the code. It picks a small part of the text which is then line-by-line is coded. Valuable concepts are recognised where essential phrases are highlighted. The ideas are named. After this step, next piece of text is taken, and the steps indicated above are repeated. This process deals with dividing information into conceptual components.

2. **Memoing and theorising**: Memos are the field notes about the concept in which the expert puts out their perceptions and bits of knowledge. Memoing begins with the primary idea that has been recognised and proceeds with directly through the way toward breaking the content and building the theory.

3. **Integrating, refining and writing up hypothesis**: When coding classes surfaces, the ensuing stage is to interface them together in theoretical models around a critical category which holds everything together.

4.8.1 Constant Comparative Analysis

In the GT investigation, the controlled procedure for data analysis is called constant comparative study. The overall objective is to ground the categories in the data. The researcher analyses the information by continuous comparison, firstly of data with data, data with concepts, concepts with concepts, concepts with categories and categories with categories as he analyses more and more data. This constant comparison between the collected data, concepts, codes and categories help to crystallise ideas to become part of the emerging theory.

Constant comparison is an inductive method of data analysis in grounded theory research of creating and relating groups by analysing and comparing occurrences in the information to other incidents, incidents to categories, and categories to different types.

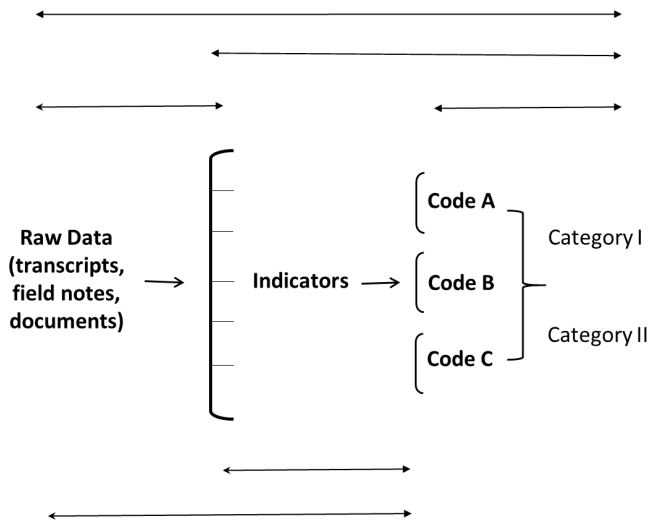


Figure 4.9 Constant Comparison Process in Grounded Theory (Creswell, 2013)

This technique is comparative as it entails methodical comparison of pieces of research, indexes, to each other and, data accumulated at another phase of a collection. Consequently, in an interview study, the investigator could begin analysis during the initial interview utilising Memoing and would continue by reducing all the information gathered from the microscopic investigation. The aim is to find similarities and differences that enable inductive coding and the creation of concepts, categories, theories, and perceptions.

This method is constant since in every stage the researcher continually reverts to the start stage of investigation and continues the practice of comparison. Also, in each step, the researcher is finding similarities and deviations, composing memos, and coding. The researcher is continuously concurrently, involved with the methods of assessing, analysing, and abstracting from the information.

4.8.2 Coding

The coding scheme will abide by the procedures positioned out by Corbin and Strauss (1990). The process of coding consists of a three-step process of open coding, axial coding, and selective coding. The research commences with open coding which progresses into axial coding and finally evolves in selective coding (Strauss, 1987; Corbin & Strauss, 1998).

During open coding, various categories within the data will be acknowledged, segregated, compared, and conceptualised. Additionally, the classes will be explored in a specific style to reveal the dimensions and properties of the classes evolving during the open coding phase.

During the axial coding, the information will be put back together, and the correlations between categories will be made. The final step of the procedure is selective coding. During this phase, the theoretical model of the represented relationships will be created, and connections will be authenticated or validated as per the data.

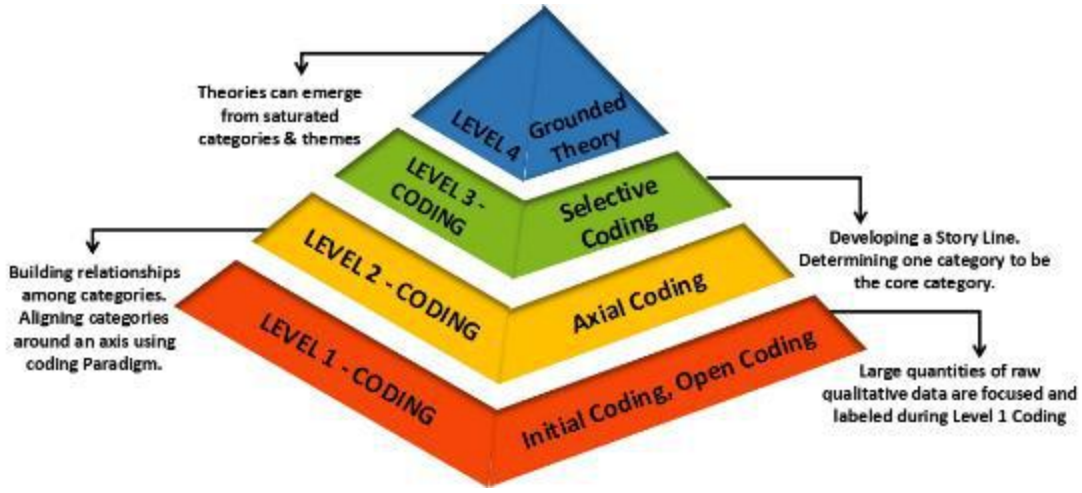


Figure 4.10 The coding stages in Grounded Theory (Author)

This process will be completed when theoretical saturation is reached. Theoretical saturation is attained when no new data emerges from the categories.

4.8.2.1. Open Coding

This stage manages Identifying, naming, ordering and depicting phenomenon found in the content. Each line, sentence, and the section is examined looking for the appropriate answers. Information is deconstructed into the uncomplicated shape conceivable, analysed for shared traits and arranged into classifications. Open Coding incorporates marking ideas, characterising and itemising classifications considering their properties and dimensions. A property is a general or specific attribute of classification, while a dimension means the area of property along a continuum or range (Strauss and Corbin, 1998).

The information is divided into fragments and afterwards inspected for shared characteristics that reflect classifications or topics. After the data is sorted, they are additionally examined for properties that separate every category. Open coding is a technique for reducing the data to a little set to depict the event under scrutiny. It offers units to dissect shifts from an individual word, line-by-line, a few sentences or sections.

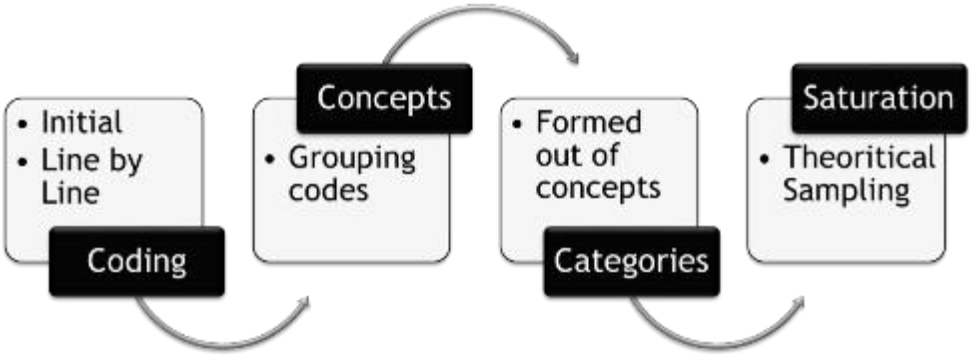


Figure 4.11 Open Coding Process (Author)

In Initial Coding, appropriate labels or codes are given to different parts of the data as they are analysed. Initial coding focuses on the words of the participants. It also makes the codes fit the data rather than forcing the data to fit them. During Open Coding, codes or concepts emerge from the raw data which are later grouped into categories. The aim of open coding is to build a multi-dimensional preliminary framework for subsequent analysis. Line by line coding also identifies the gaps in data collection.

Grouping of concepts which seem to related is the process of Categorization. Category can be named in vivo by using participant's terms or can be abstract term based on what it is representing. Open Coding stops when theoretically saturated category appears.

4.8.2.2. Axial Coding

According to Corbin and Strauss, Axial Coding is the process of connecting categories to their subcategories and relating categories at the level of properties and dimensions. Strauss and Corbin mention this as grouping the open codes around points of intersection or specific axes.

This stage helps to improve and distinguish concepts that are already available and grants them the status of categories. One category is in the centre, and a network of relationships is developed around it.

Axial coding is used primarily in the middle and later stages of an investigation. Like open coding, axial coding is applied to short textual segments to more considerable extracts or the entire text. Data are reassembled based on logical connections between categories. Axial coding aims to add depth and structure to existing categories.

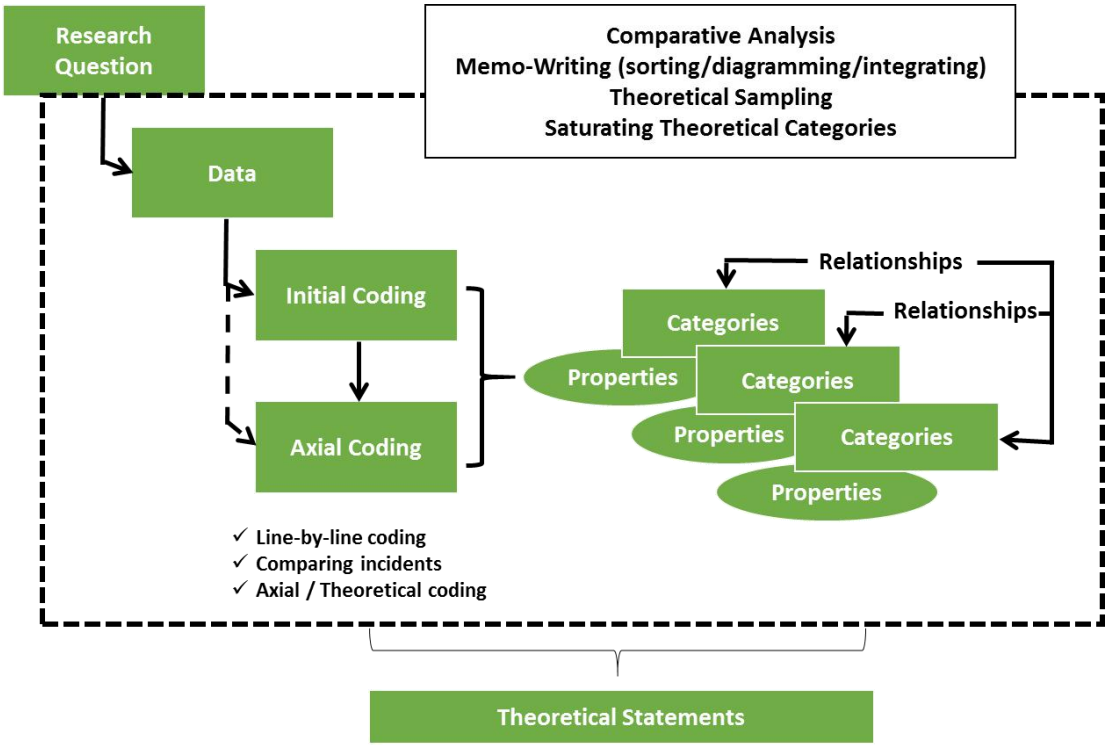


Figure 4.12 Building relationships, properties and dimensions among categories during Axial Coding (Author)

Corbin and Strauss suggest drawing a coding paradigm, which depicts the correlation of causal circumstances, approaches, intervening and contextual conditions, and consequences. The model has six boxes of information:

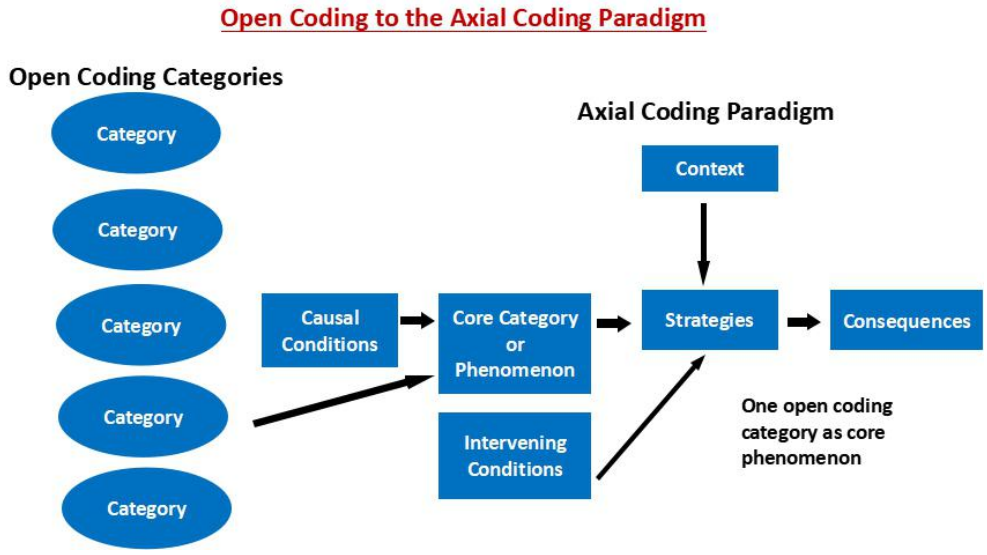


Figure 4.13 Coding Paradigm as suggested by Creswell (2000)

4.8.2.3. Selective Coding

Selective coding is the stage of Grounded Theory where one category is identified as core category and all other categories are related to this core category. The primary objective at this stage is to build a storyline around which everything else can be woven.

There is a belief that a core concept always exists. The core illustrates the principal concern highlighted by the participants. After the core category is chosen, data is selectively coded with the core guiding the coding and not bothering about concepts which are less critical to the core and its sub-cores.

In this phase the researcher uses categories, coding notes, memos, diagrams so far established to identify the core. Selective coding can be managed by going over old field notes or memos which are already coded at an earlier stage or by coding newly collected data.

Strauss and Corbin (1998) state that at this stage the scholar directs the various code clusters selectively and decide their correlation and what stories they tell. Thus all outcomes of investigation condensed into a few sentences that seem to explain what this research is all about.

4.8.3 Theoretical Sampling

One of the remarkable characteristics of the grounded theory method is the use of theoretical sampling. Grounded theory utilises a kind of purposive sampling, called theoretical analysis, where subsequent participants are chosen by the researcher based on initial findings. Initial investigation of data shows issues that require research; subsequently, the inspecting procedure is directed by the continuing hypothesis advancement.

Information accumulation and investigation occur in exchanging arrangements. Grounded scholars test hypothetically utilising a methodology including the simultaneous and consistent gathering and examination of information. Theoretical Sampling implies that the researcher picks types of information accumulation that will produce content and pictures which are essential in creating a theory.

Theoretical sampling is deliberate and concentrated on the generation of theory. Theoretical sampling comprises sample groups based on where to go to take the next appropriate piece of data. The underlying postulation that sampling will conclude when theoretical saturation is reached suggests restraint of oversampling, that is, unnecessary redundancy in the information due to extreme numbers of participants or observations.

In most grounded theory interview-based studies, theoretical inspecting appears to interview additional members or coming back to past members for clarification and elaboration of prior meetings. Nevertheless, it should be noted that studying in the theoretical sampling also incorporates continued return to existing data to select events or incidents with which to analyse the emerging hypothesis and unites data accumulated from various elements of the data accumulation procedure.

4.8.4 Memoing

Memos are short reports that researchers write to themselves as they proceed through the analysis of a corpus of data. Memoing plays a very important part in the Grounded Theory as it the reflection of the researcher of the gathered data and the relationship among the categories as they are built. Memos can form the basis of the grounded theory. Following up on ideas and questions that came up while they were recorded will push the work forward (Charmaz, 2006).

Memos emphasise writing about what's being observed in the data. Memos are means of elaborating where the researcher is during the investigation and probable interpretations of the data. There are no specific guidelines about how they should look, but they should be free-flowing. Data collection, analysis, and memoing are ongoing steps, and they overlap with each other. Memoing helps in keeping track of ideas, relationships between codes and new concepts.

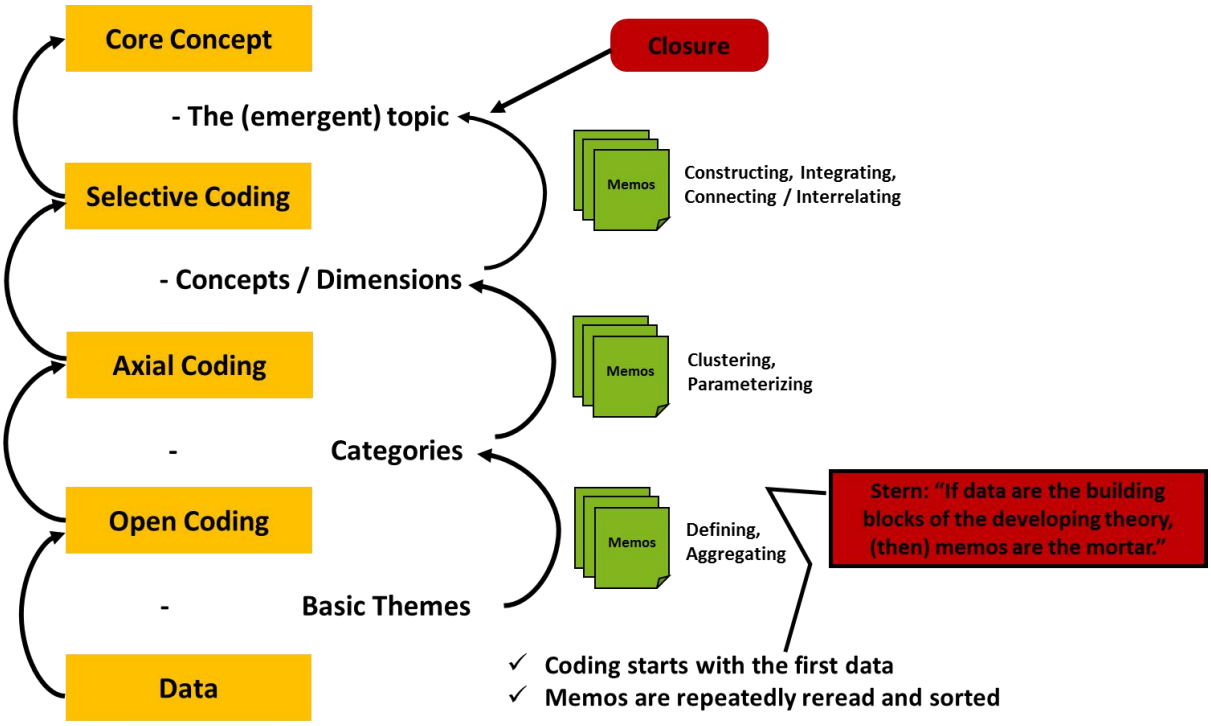


Figure 4.14 Memoing as part of every stage of the Grounded Theory process (Author)

In a GT study, researcher employs memos to document his thoughts on important issues which emerge during the interviews and coding process. It helps researcher identify the gaps in the data collected during the Open coding phase. Memoing also helped in building the relationships among the categories during the axial coding

stage. Sorting of memos aided in the generation of the conceptual framework for the effort.

4.8.5 Theoretical Saturation

Saturation is a phase when the researcher realises that new data won't give any further information or bits of knowledge for the creating theory. It attests to the testing of theories to the point that all the information gaps are complete and connections between classes are constructed and approved. Theoretical Saturation is accomplished when additional sampling fails to yield useful insights.

Data is accumulated until the point when theoretical saturation is attained, until no new data emerges concerning a category and associations between categories are developed. Theoretical Saturation is the time when the researcher stops testing and sampling, whereby categories and their properties are considered adequately dense, and data gathering no more creates new clues (Glaser and Strauss, 1967).

The saturation point thus indicates a level of theoretical stability whereby the core category values for as much empirical variation in the data as possible. It is critical to understand that these notions and hypotheses are still openly changeable within the substantive area. New data, whether it is from further theoretical sampling in the field, extant literature or collegial feedback, will always have the potential to modify the theory. Thus, the final grounded theory is acknowledged as an ongoing process rather than a completed entity, where the saturation is only a gap in the never-ending course of generating theory.

4.8.6 Generating Theory

In 1967 Glaser and Strauss postulated two essentials of creating a theory. The first essential element is general groups and their assets. Another one is theories or overall interactions between the groups and their features.

Initially, the theories may be unrelated, but as properties and categories appear, and become associated, their amassing interrelations form a cohesive central framework which is the centre of developing theory.

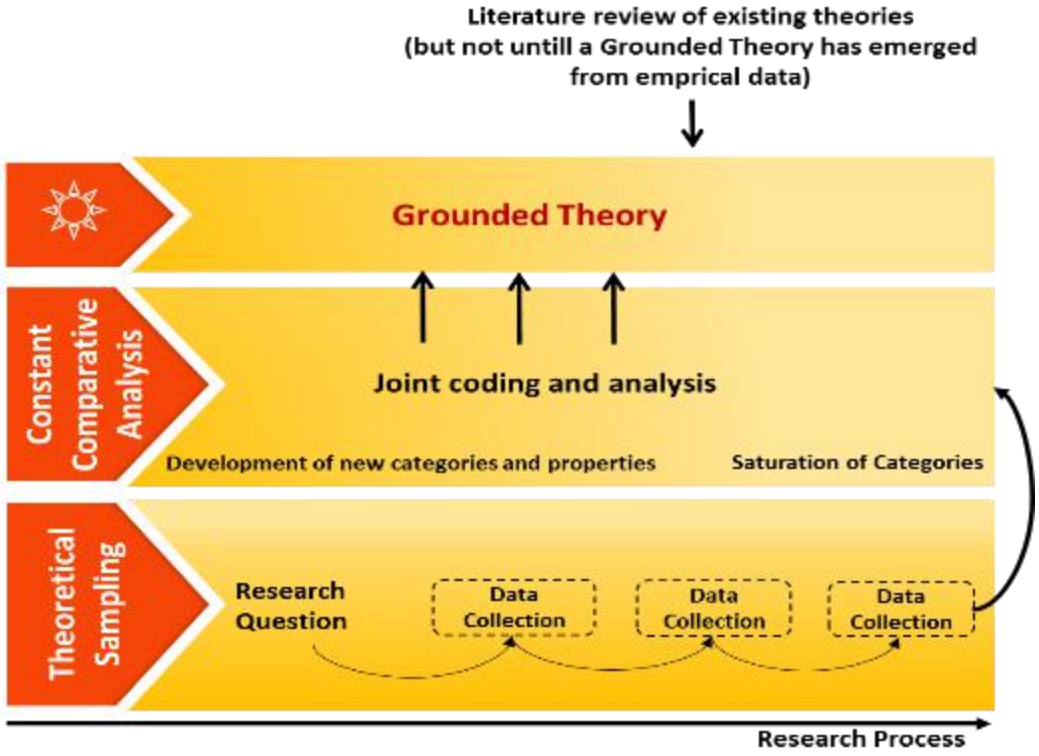


Figure 4.15 The procedure for producing a Grounded Theory (Author)

The subsequent stage after the creation of the hypothesis is the formulation of the argument. It includes an amalgamation of categories and perceptions into an evolving theory. According to Glaser & Strauss formal theory is concerned with the more extensive system and must never be forced. The result is ‘‘crystallisation’’ of this core as a skeleton and assembling of groups arise rapidly.

In 2008, Corbin and Strauss suggested that the critical characteristic of progressing from explanation to concept is in acknowledging that theory is explanatory. Rather than merely unfolding the phenomena, the investigator as theorist must concentrate on explicit assets and clarify why relationships and aspects of features contribute to kinds of results. They endorse scripting an informative storyline and then moving to a theoretical explanation.

4.9 The role of Researcher

Part of a researcher in a study is highly significant. A researcher is a data collection instrument who takes notes and decides what topics to record. The researcher must

set the agenda and assert what is important. Implicit/explicit theories of the researcher drive the analysis and favoured analysis methods.

With respect to qualitative research, the scholar performs all the functions in contrast to quantitative analysis where the survey or experimental action is the tool that brings forth the information and deductions. For this purpose, as stated by Creswell in 2007, it is necessary to communicate who the investigator is, to establish what predispositions and philosophies may have been present throughout.

A pressing concern is the part of the scholar with the participants in the investigation. The Straussian method calls for an investigator dynamically involved with participants. The researcher, to be productive, must be conscious of his or her prejudices and must act to dismiss them and need to evaluate the obligations compared to the benefits of using a preliminary literature review.

(Corbin and Strauss, 2008) dealt with the scenario where the participants and researchers shared a common culture and asked, since it is not viable and impractical to entirely negate our brains of the general experience, so why not use this expertise for our gain?"

They didn't advocate that the investigator adds her or his proficiency to the information instead they indicated that the investigator's expertise ought to be employed to be the cause of bringing up additional possibilities and show something new to consider which will allow us to face our assumptions concerning information. The crucial thing is to let the study be familiarised by experience on a conceptual level instead of at the amount of data.

The participants in this study had no professional relationship with me, and none were employed in the same organisation. The idea of my picked explore outline and strategy utilising grounded theory limited any inclination that I may have held concerning the recognised research inquiries for this examination. I used email and telephone to contact initial participants and included required convention data, guaranteeing comprehension and clarity concerning the idea of this examination and explanation of their choice as a member.

My responsibility as the scholar of this classic grounded theory study was to:

(a) Conduct interviews, collect, and code data,

(b) Manage data analysis through constant comparison methods.

(c) Perform best-rehearse specific coding as laid out in this part.

(d) Sort the written memos and discover best-fit hypothetical codes.

(e) Review, evaluate and integrate relevant literature with the substantive theory through specific coding.

My emphasis intently remains on showing and executing my professional competence, trustworthiness, and moral benchmarks all through the whole paper travel. I am writing this scholarly thesis and conducting this study to advance new knowledge. I have no interest in any monetary gains.

4.10 Validity of the Research

The two main significant and vital features of the measurement process are validity and reliability. The degree to which an analysis determines what it asserts in measuring is known as Validity.

An examination must be legitimate for the outcomes to be interpreted and employed. A statistic doesn't limit validity, but it is restricted to a frame of study that illustrates the link connecting the behaviour and the test, it's devoted to measuring. The objective of this topic will be to present the conceptions of validity and reliability and comprehend the research problems.

Validity is the most significant asset of measurement. Overall, the validity is involved if a measuring device computes what it is set to quantify the situation. The character of validity is a highly debated topic in social science study because no one definition of this term exists. Hammersley gave a frequently quoted definition of validity. A tool is valid or accurate if it represents these characteristics of the happenings accurately, that it's meant to explain, define or theorise (Hammersley, 1987). In 2006, Hair et al. suggested that Validity estimates the amount to which the array of indexes explicitly represents a paradigm. Validity was expressed as the point to

which an assessment determines what it professes to quantify. It's quintessential to examine a range of the assortment of definitions provided by top writers to comprehend the selection of meanings connected to validity. Fisk and Campbell say an arrangement between two attempts to measure precisely the identical thing is validity. According to (Black and Champion, 1976), it is the degree which is supposed to be regulated by an instrument.

(Joseph A. Maxwell, 1992) Described five kinds of validity in qualitative research. Though additional investigators also have explained several categories, Maxwell's 5 groups present the finest clarification inclusive of conceptualisation.

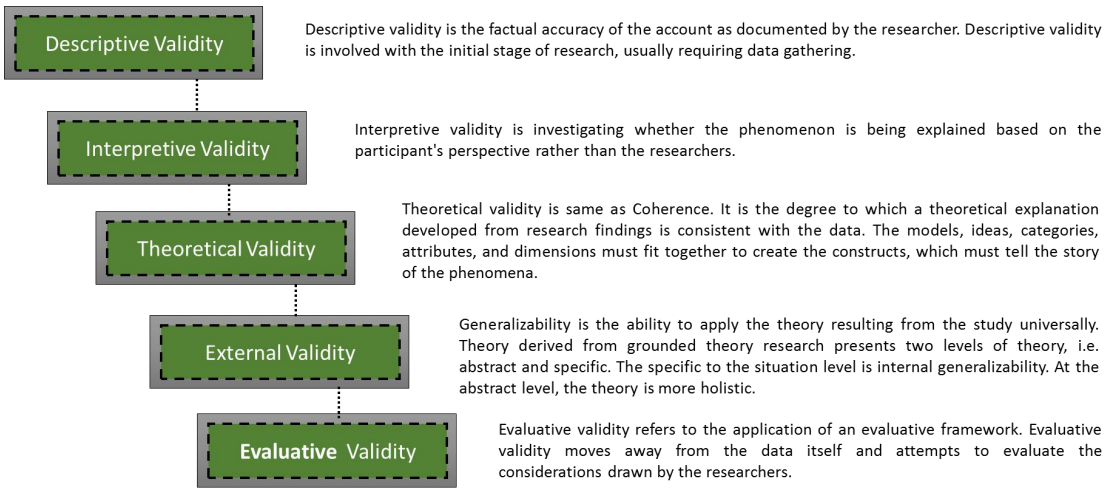


Figure 4.16 Five types of validity used in this study (Joseph A. Maxwell, 1992)

A detailed account of how all the five validities were met is present in chapter 7 of the thesis.

4.11 The choice of Software for the research

(Bryman and Bell, 2012) believed that since the middle of the 1980s, one of the most noteworthy improvements in qualitative research is the upsurge of computer software which is capable of aiding in the analysis of qualitative data.

A computer investigation of qualitative data implies that investigators use computer software to expedite the procedure of storing, examining, classifying, and indicating the data. With the expansion of these digital programs, there is an extensive debate if the coding needs to be done manually or through computer software.

Some computer packages are established to support the interpretation & organisation of qualitative data. Still, there is a debate among qualitative scholars regarding the implementation of computer programs according to Seale. Few examiners fear that they will impose an unbending structure on their analytical procedure provided that they started in the quantitative statistical paradigm. The profits of utilising such computer programs in grounded theory studies are acknowledged increasingly as said by Seale in 2005 and Corbin in 2008. (Seale, 2005) Records that these packages aid in the procedure of information administration and simplifies theoretical sampling & eternal judgment across cases. Corbin's (2008) updated version of grounded theory textbook *''Basics''* includes one new chapter setting out the relevance of computer software to conduct grounded theory analysis.

The decision of using software depends on several factors. A computer program is used when an extensive database is analysed, and there is a requisite to organise and keep track of comprehensive information. A clear review of every single term and line to apprehend definite citations or passages is required.

PC Applications that are qualitative do not analyse the information. Nevertheless, they supply numerous valuable characteristics that assist the data evaluation. A qualitative data analysis computer software is software that stores and organises the information. It enables the researcher to name codes or tags into the data. The program facilitates searching through the data and finding specific words or text.

Many software programs for qualitative data analysis are available today. It is imperative to locate a program that's uncomplicated and straightforward to use, which will take both the text documents (out of records) & graphics (from images). A program which permits the investigator to study and observe the text and categorise it, and which finds and assorts text or image passages efficiently and readily for the qualitative report.

Description of main programs considered is as follows:

1. Atlas.ti: URL- (www.atlasti.com). This Software program empowers the examiner to sort out the content, graphic, sound, and visual information records, alongside the coding, updates, and discoveries, into a venture.

2. HyperRESEARCH: URL- (www.researchware.com). It is accessible for both Mac and Windows. It is a simple and simple qualitative programming set that codes and recovers, manufacture hypotheses, and direct examinations of the information.

3. MAXQDA: URL- (www.maxqda.com). This Software computer program is a capable device for data investigation that can be utilized for grounded theory based on "code and recover" examination and additionally for more complex content investigation.

4. Nvivo: URL- (www.qsrinternational.com). This software helps in the proficient administration of non-numerical, unstructured information with intense procedures of ordering, hypothesising, and looking. It is useful for analysts to understand complex data. NVivo offers an extensive toolbox for fast coding, careful investigation, and stable administration and examination. This program can make content information frameworks for reviews which are exceptionally helpful.

QSR International, the developer organisation for NVivo programming, gives the product to overseeing qualitative data. The organisation asserts the following (QSR International, NVivo):

(a) NVivo grants the examination to access, arrange, and separate unstructured data in material, for example, records, pictures, sound, video, spreadsheets and dataset tables; and

(b) NVivo does do not provide a reason for you; it only helps you to investigate your data, so you can make new disclosures and at last, better choices. The coding

process can progress and transform in NVivo, through the multiple tools that are *method-free* and yet, support numerous methodological decisions.

Based on analysis of features of various software's, Nvivo was found to be most suitable for this report and selected as the package for assessment on the information.

4.12 Audit trail

An audit trail is an unambiguous clarification of the investigation steps and actions taken from the commencement of the project, progress and reporting of decisions. These records are kept establishing what was done in the research. The usage and practice of an audit trail are substantial to guarantee conformability (Lincoln & Guba, 1985).

A few analysts suggest the advancement of an exploration review trail. (Koch, 2006) Proposes that an examination's reliability might be approved if a peruser can review the occasions, impacts and activities of the scientist, while Akkerman et al. in 2006 prescribed that audit trails speak of a method for ensuring quality in subjective investigations. The audit/review trail idea comes from the possibility of the monetary survey, where autonomous evaluators verify a company's records and inspect these for the likelihood of fault or scam.

Audit trails report the improvement of the completed investigation. In building up a review trail, a scientist gives a record of all investigation choices and exercises all through the research. He or She clears all the options and selections taken about logical, procedural and investigative decisions (Koch, 2006). Analyst inspects the examination procedure and the result of a request to decide the discoveries reliability.

To produce a point by point review trail, a scholar should deal with a record of all exploration exercises, keep up investigate diaries, create notices and memos, and record all information gathering and examination methodology amid the investigation. In 1985 Guba & Lincoln reported six types of data which should be convened to inform the audit progression.

• Primitive data which includes all information and written field notes.

• Data reduction and analysis products integrate synopses like summarised notes, unitised information, general summaries and calculable reviews.

• Data synthesis and reconstruction products comprise the formation of groups (themes, relationships and definitions), choices and consequences and a concluding report incorporating connections to existing works and integration of perceptions, associations, concepts and explanations.

• Process notes contain methodological and procedural notes (methods, strategies, procedures, motives and explanations), dependability notes (associating with acceptability, reliability and similarity) and review trail notes.

• Materials relating to objectives and behaviour including demand recommendation, personal notes (instinctive notes and motivations) and potentials (conjectures and points).

• Instrument advancement data including pilot frames, preparatory timetables, perception designs.

By monitoring these data groups, a scholar can evaluate if the investigation's discoveries are grounded in the data if the interpretations are reasonable and much more. Consequently, the audit trail entails explanation and it empowers a scholar to contemplate on exactly how the research unfolded.

4.13 The principles of Ethics applied to this research

During this research, ethical assessments were considered initially at the commencement of the course of study then around conceptualisation and plan of research strategy. Also, throughout the investigation concerning data compilation &

analysis, and finally towards the end of the process in contemplating stating methods as reported by Edwards and Mauthner in the year 2002.

The determination was to accurately code, systematise, analyse, and describe the data of this study. As described earlier, interviewees were clarified over the telephone in the first contact, what they were consenting to perform by engaging, their rights to cancel the interview and withdraw their involvement, and some other factors of significance.

Fundamental principles of an ethical approach incorporated into the study design include informed consent, privacy and secrecy. These universal principles were involved in the context of this research (Beauchamp and Childress, 2001).

The Process of seeking informed consent deals with the voluntary arrangement to take part in a study based on complete and accessible information (Christians, 2005). It states that those taking part in research should not feel compelled to do so. Providing detailed information about the intention of the experiment and its outcome for the person if they participate, allows participants to make a careful and informed choice about whether they want to take part (Goodwin 2006). The decision should be undertaken voluntarily, in the complete knowledge of what the implications would be for the participant (Green and Thorogood, 2004).

In this study, individuals were enabled to make an informed decision in several ways: the provision of an information pack setting out the purpose of the study; the reasons for being invited to participate; the reassurance that they were not obliged to attend.

The principle of confidentiality encompasses the expectation that information disclosed during a research relationship will not be shared with unauthorised parties without the participant's consent (Jones et al. 2006). In research that involves in-depth interviews that may reveal sensitive information, the assurance of confidentiality is paramount to protecting participants‟ privacy and engendering trust (Patton 2002).

The grounded theory focuses on concepts rather than people. Rather than presenting in-depth descriptions, the emergent grounded theory provides theoretical conceptualisations that remain abstract of people, places and times. Participants are thus assured of anonymity in the presentation of this thesis and any subsequent publication.

Conclusion

This study commences by recognising and introducing the research problem, questions and objectives. The research methodology for this research was arrived using Saunders research onion. The philosophical positioning, the research style, and the methodology selection were centred on the research objectives. This chapter revealed the rationale for the choice of qualitative method and detailed discussion on the option of using a grounded theory study. This chapter has outlined the fundamental methodological steps in grounded theory.

The context of the grounded theory methodology has been described, offering Straussian grounded theory, as the most suitable procedure for this thesis. The depth with which this has been explored is evidence of a thoughtful and informed decision to select the best methodology for this study, providing a rationale for the final choice and enunciating the perspective of the researcher.

The fundamental tenets of the grounded theory methodology were explained and addressed. My role as a researcher was described and included certainties regarding potential researcher bias. Information regarding participant selection and the sample size was presented, followed by a thorough and comprehensive description of data collection, management and analysis.

Finally, ethical considerations were addressed, extending upon the three essential principles of informed consent, confidentiality and anonymity.

Chapter 5

Data Collection and analysis

'The objective is to turn data into information, and information into insight' -

***(Carly Fiorina*, 2004, Para 11)**

Introduction

Theories which are grounded in data emerge by plying the crude information, making correlations, creating classes, taking part in hypothetical inspecting lastly incorporating all investigation into one substantiated theory (Charmaz, 2005). This particular chapter continues from chapter four by offering a detailed account of the approach taken for data-collection and data-analysis for study. This particular chapter provides the comprehensive strategy on collection of information as well as the examination "for creating a conceptual framework for Integrating Inland Waterways with various other modes to produce an Intermodal Transportation System". As the approach for this research has been inductive Grounded Theory approach, data collection happened mainly through interviews with eminent experts of this field. The rich collected data went through the drills of the coding process to finally derive a conceptual framework for an IWT based Intermodal Transportation System.

5.1 Steps for Data Collection and Analysis

Researcher went through a very systematic process in collecting and analyzing of data at each and every step. Below are the steps followed by researcher throughout his research:

			Description	Output
Phase 1 Data Collection	Step 1	Develop interview protocol	The first step is in design the interview protocol based on Conceptual Lens and Literature Review	Rich Data available for further analysis
	Step 2	Data collection	Choosing carefully experts for discussion. Conduct pilot interview followed by core interviews	
	Step 3	Transcription of Data	Transcripting all interviews for further analysis on research topic.	
Phase 2 Data Analysis	Step 4	Data Analysis thru -	Analyse the data through -	
		(a) Line by Line coding	- detail coding line by line	
		(b) Open coding	- develop concepts through open coding	
		(c) From Concept to Category	- develop categories and sub categories from the concepts	
		(d) Properties & Dimensions of Category	- assign each category and sub category against their respective properties & dimensions	
	Step 5	Constant Comparison	Generating and connecting categories by comparing occurrences in the data to other occurrences, occurrences to categories, and finally categories to other categories.	
	Step 6	Theoretical Sampling	Choosing what information to gather next and where to find that information with a specific end goal to build up the hypothesis as it rises.	
	Step 7	Memoing	Researcher ideas about categories and their relationships	
	Step 8	Axial Coding	Relating the categories and sub-categories on the basis of properties or dimensions.	
	Step 9	Theoretical Saturation	Identifying the core and subcategories to create an integrated theoretical scheme.	Saturated core categories
	Step 10	Selective Coding	Create substantive theory from core categories. Building a story line interconnecting the categories.	
	Step 11	Theorising and Conceptualisation	Abstract theoretical understanding of the studied experience	Grounded Theory
Phase 3 Literature comparison & write up	Step 12	Validation your theory	Checking whether your new hypothesis carries Validity	
	Step 13	Writing theory	Writing final research report based on findings.	

Table 5.1 Steps of Data Collection and Data Analysis (Author)

5.2 Data Collection

The goal of this stage was to collect rich data which can be subsequently used for data analysis purposes. While selecting the participants' researcher attempted to identify participants with diverse backgrounds in the area of Inland Waterways to bring in a wealth of information.

5.2.1 Selecting the Participants

A purposeful sampling procedure was applied to identify respondents for this research. Purposeful Sampling may be explained as carefully selecting participants who researcher believes will aid in building a theory. While the objective of this examination was to cultivate a model of Inland waterways, subjects included individuals, who had strong understanding in the field of study of Inland Waterway. Participants reported years of experience ranging from 15 to 35 years.

Nine proficient specialists working in Inland Waterways assisted as the primary members in the study. Seven more were interviewed, as part of theoretical sampling. Out of selected members, one first served as the pilot respondent. Since there was no critical change in the pilot interview questions, his reactions were incorporated into the study.

As the researcher sought general views on IWT from the participants and no classified or confidential information was sought, no formal written consent from participants was obtained. The members were reached through phone or messages. The members were explained he motive behind the research and their verbal concurrence was obtained.

5.2.2 Profile of the Participants

All the sixteen people interviewed were senior professionals ranging from Deputy General Manager to Chief Operating Officer to Retired Managing Directors. Below Table gives a full insight about the interviewers. They possessed rich experience of at least 15 years in their field.

The researcher travelled across the country to the town of the interviewee to conduct the interviews. Though the bulk of the interviews were conducted at Delhi and NCR, which was the base location of the researcher, however five interviews were conducted in other towns.

Interview No.	Designation	Place of Interview
1	Senior Professor, University of Petroleum & Energy Studies	Dehradun
2	Retd. Vice Chairman, Indian Government IWT Authority	Delhi NCR
3	Director, Indian Government IWT Authority	Kochi, Kerala
4	Deputy General Manager, River Engg MNC firm.	Delhi NCR
5	General Manager, Transport Infrastructure Consultancy Company	Delhi NCR
6	Joint General Manager, Transport Infrastructure Consultancy Company	Delhi NCR
7	Chief Operating Officer, Maritime and Logistics Infrastructure Sponsor Company	Delhi NCR
8	Deputy Director, Indian Government IWT Authority	Guwahati
9	Former Director, Indian Government IWT Authority	Guwahati
10	Former CMD of Rail Container Transportation Company	Delhi NCR
11	Director, Private Sector Barge Company	Kolkata
12	Deputy General Manager - SCM, Large Electronics Japanese MNC	Delhi NCR
13	Vice President - SCM, Power Solutions MNC	Delhi NCR
14	Vice President – North India, Large Shipping Company	Delhi NCR
15	Chief Executive Officer, Terminals Company	Delhi NCR
16	Director, A Transport and MTO Operators organisation	Delhi NCR

Table 5.2 Profile of the participants in Data Collection (Author)

5.2.3 Conducting the Qualitative Interviews

Data collection method primarily used was participant interviews. Meetings with respondents, endeavoured to accomplish “cooperation" amongst questioner and participant in the spirit of a benevolent talk. An effective interview is just not an exercise of asking questions and capturing answers, it includes seeking clarifications and digging deeper into the exchange. It is a period of moving into someone else's reality so as to see things from their point of view. It happens in a convenient setting where both questioner and participant influence the procedure of information accumulation.

5.2.3.1 Interview Setting

The researcher conducted one interview with each participant, the duration of which varied from approximately 40 to 100 minutes. All interviews were face to face interactions. None of them were conducted over telephone. Interviews were audio-taped using the sound recorder feature of the smart mobiles. A semi-structured process was used during the interviews which allowed both interviewer and interviewee to expand upon any area during the discussion process. Almost all the participants were interviewed at their office. This ensured that they are comfortable with the setting for the interview.

5.2.3.2 Pilot Interview

Pilot interview was conducted with one subject matter expert to test the interview questions and interviewing skills. The participant was chosen as he not only a subject matter expert but also was an acquaintance of the researcher. After the interview feedback was sought from the participant on the interview questions, flow of interview and interviewing skills. As the final interview protocol was not too different from the pilot interview protocol, the response to the pilot discussion was part of the final coding and analysis.

5.2.3.3 Establishing Rapport

It's been argued that establishing rapport in the job interview environment is essential to the quality of information emerging out of the discussion. To build the rapport, the interview usually started with informal conversation. Overall talk regarding history of Participant and Researcher was done in order to place them at ease in the interview environment and then to create a rapport with them. Any query regarding the intent behind the interview had been resolved.

(Patton, 2002) recommended utilizing educated assent conventions and opening statements in the interviews covering the following inquiries:

1. What is the motivation behind this information accumulation?
2. By what means will the data be utilized?
3. What is the substance of the inquiries?
4. In what capacity will privacy be maintained?
5. What are the risks and advantages of the participants?

Researcher aim was making the interviews as collaborative, as recommended in grounded theory techniques (Strauss and Glaser, 1967). The intent was to conduct what (Holstein, 1995) term as "active interviews" - deliberations where both interviewer and interviewee are engaged in creating a meaning.

5.2.3.4 Conducting the Core Interviews

In total, sixteen interviews were conducted during data collection stage of this study. Out of these sixteen interviews, fourteen had been captured for coding and analysis purposes. Two of the interview weren't captured as participant denied to record discussions with them. Rest all interviews had been conducted on site at the participant's office and later transcribed. Large notes had been taken during each interview. Notes taken were utilized later to assist the coding process of the interview. Throughout the interview, researcher would additionally view body language or maybe tone or voice intensity; the researcher recorded these kinds of observations in his interview notes, which became a part of the collections during detailed study of the coding of the interviews.

The last interview protocol comprised of forty-nine open ended issues as mentioned in Annexure A. Probes were additionally used with a few questions to make certain that all things had been covered. These protocol questions were divided into six primary themes are indicated below-

1. Introduction
2. Geographical reach
3. Role of Government
4. Terminal Operations
5. Barge Operations
6. Meeting Shippers requirements

All the interviews ended seeking any additional inputs from the respondents on any topic not covered during the discussion and their final views on the subject.

5.2.4 Transcription of Interviews

Interviews could be transcribed at various levels & thus choices have to be made regarding the amount of information to capture (Mishler, 1986). The nonverbal part of the discussion like expression, tone of the voice and body language are the most difficult part of the engagement to capture. In any qualitative research, the accuracy of data captured is essential. To capture an accurate account in the study the entire interview had been transcribed verbatim by the researcher.

In total, there were 138 pages transcribed information from the captured data. Twenty-seven pages of notes which were handwritten during the interviews also formed part of the analysis. The 138 pages had been transcribed directly into Microsoft word by one undergraduate student. The handwritten notes were compared to the interview transcripts to make certain the reliability of the transcriptions done. No major discrepancies were found between hand written notes and interviews transcriptions. The mistakes were mainly around spelling and use of abbreviations.

Interview No	Pages	Words
1	14	5372

2	18	8195
3	16	7792
4	7	3719
5	6	2304
6	2	159
7	2	985
8	7	3486
9	11	4565
10	9	3999
11	16	9122
12	6	2413
13	7	3783
14	6	2702
15	5	1846
16	6	2216

Table 5.3 Transcription of Interviews Summary (Author)

5.3 Data Management

Qualitative data are compendious and unruly if not managed well. The process of data analysis is dynamic, intuitive, creative, and requires inductive reasoning (Basit, 2003). Coding is a critical aspect of data analysis; however, unlike the analysis process, which must be done manually, electronic tools for coding data have been available for several years. Software programs can assist the researcher in their task of analysing data, but they cannot analyse the data for the researcher (Leech & Onwuegbuzie, 2007). Software developed specifically for qualitative data facilitates effective and efficient data management.

In the context of this particular study, NVivo was effectively utilized. It's meant to assist in organising, discovering and analysing insights in qualitative or unstructured details as interviews, open ended survey responses, articles, social networking as well as web articles.

(Edhlund, 2008) identified key advantages of NVivo, a software program for qualitative data management:

- organization of data for ease of retrieval,
- order and structure to comprehensive material,
- accuracy in analysis,
- documentation facilitates theoretical emergence and verification,
- visual representations of ideas and connections, and
- intuitive and user friendly interface.

The key advantage of these packages is that they bring transparency to the whole process as to how the coding was conducted and results were reached.

In this research, Nvivo 11 assisted in a number of ways. In the beginning, NVivo11, allowed the researcher to map ideas to codes, codes to concepts and concepts to categories. During the end, the researcher broke down the consequent categories for revelation of the main themes, and for disclosure of key theories emerging from the analysis. Furthermore, Microsoft Excel was also continuously used along with Nvivo 11 to support the entire analysis process.

5.4 Data Analysis

The following sections detail the methodology used for analysis of the data in this research. GT as analytical tool is non-linear process. GT methodology is a parallel and iterative process as data-collection, data-analysis and conceptual-theorising occur concurrently from start till end. This process continues through the entire research process till a theory grounded in data is developed.

Grounded theory is a method of deconstructing, structuring and reconstructing data to develop a new understanding of phenomena. As per methodology suggested out by Strauss and Corbin for data analysis in grounded theory procedures, the following process was followed in the present study as indicated in figure 5.1.

This following sections describe how data was broken down and subsequently reorganized to provide an understanding of integrating IWT with other modes of transport.

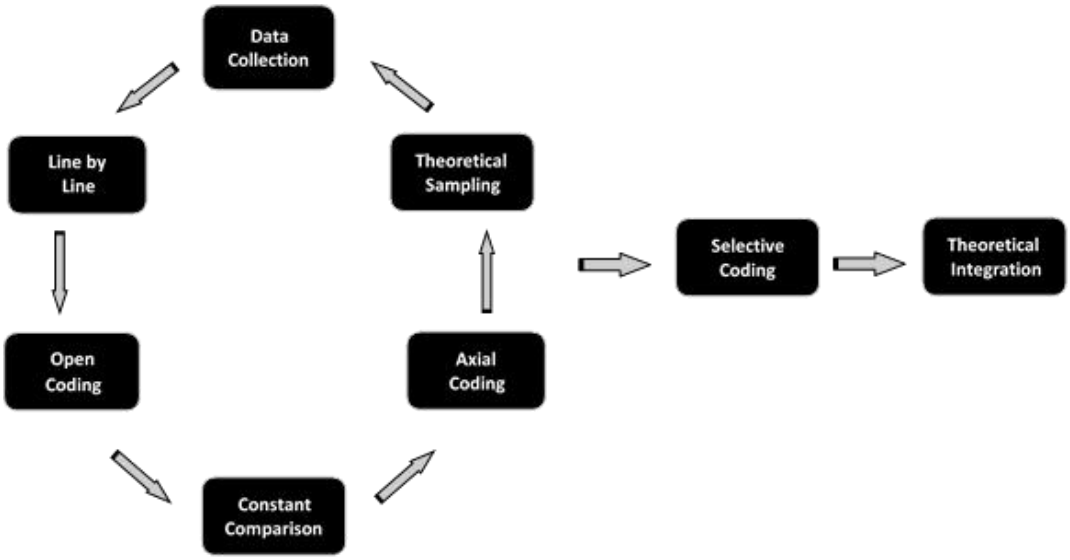


Figure 5.1 The data Analysis Process followed (Author)

Analysis of the data follows three stages, namely (a) open coding, (b) axial coding, and (c) selective coding. There is a cyclic association among the three stages, and thus it follows a non-linear process of analysis, starting with open coding, it follows a back-and-forth between further types of coding until a theory emerges which is rooted in data.

In addition to coding, Strauss & Corbin recommend the use of technique of memo-writing. Memos are notes to self which allow the researcher to compare, contrast and relate emerging categories. Memos enable the researcher to ponder the procedure, and give perspectives and lucidity for subsequent phases of the written process. To effectively and gainfully achieve these coding and update memos, the researcher used two software applications, Nvivo11 and Excel.

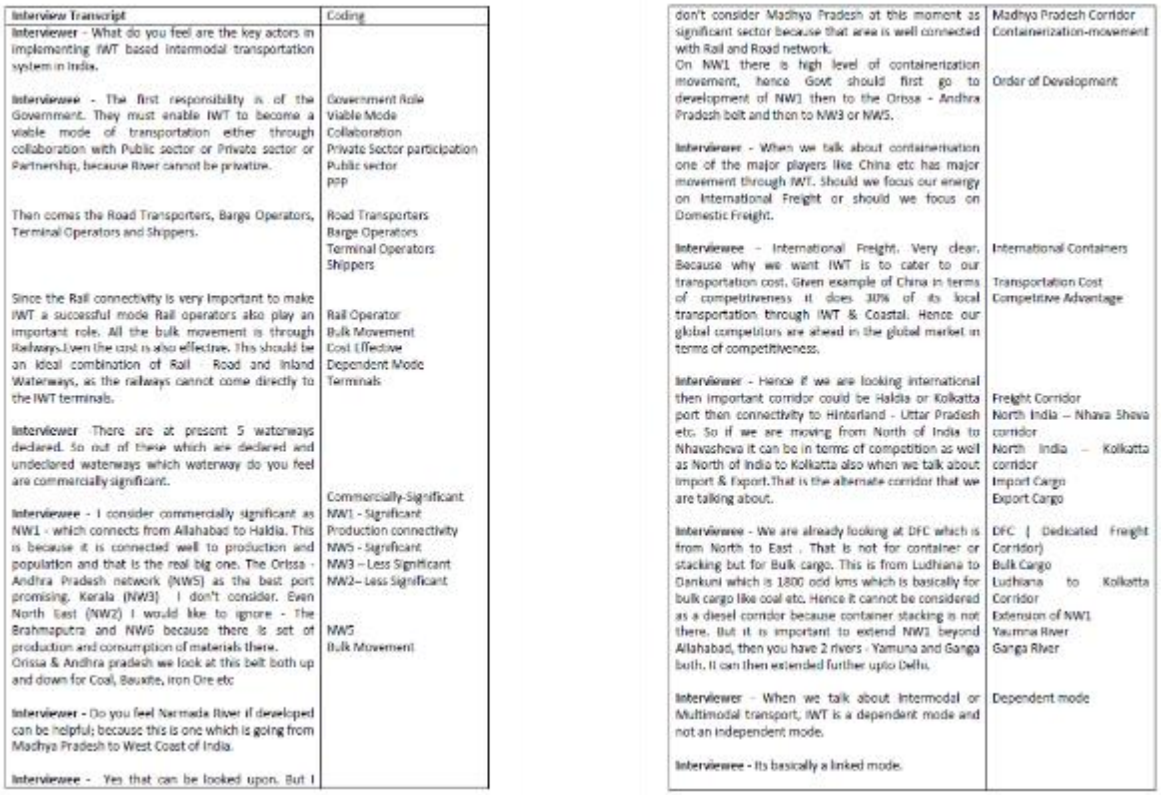
5.4.1. Line by Line Coding

The starting point of grounded theory methodology is to read and re-read the transcripts generated through set of interviews and label variables called concepts.

The first step in data analysis by grounded theory procedures is line-by-line coding. This step requires examining the transcripts from the respondent's interviews line-by-line. The important part of the texts is marked and labelled appropriately as 'codes' to be used for further analysis. This stage of the coding focuses on the words of the participants to ensure that codes match the data instead forcing the vice versa.

Initial Coding concentrates on naming words, lines, segments as well as incidents conducted word-by-word and line-by-line. The codes created are actually provisional in nature. Line-by-line coding likewise helps to recognize gaps in information collection. It can help to create the bones of analysis for more stages.

While examining the transcripts, 'indicators' are what the researcher scans the transcripts for. An indicator is a part of the content which is making an assertion worth considering. An indicator may be as short as single word or as long as few sentences. Nvivo really help in indicator management. It allowed to highlight a segment, label them appropriately and then place them at appropriate place. As indicators gets accumulated, if some of them are found to be similar, they can be grouped together as a 'concept'. Figure 5.2 is an excerpt of line-by-line coding from one interview. A comprehensive line by line coding for full interview is actually supplied in Annexure B.



Interview Transcript	Coding
Interviewer - What do you feel are the key actors in implementing IWT based intermodal transportation system in India.	
Interviewee - The first responsibility is of the Government. They must enable IWT to become a viable mode of transportation either through collaboration with Public sector or Private sector or Partnership, because River cannot be privatize.	Government Role Viable Mode Collaboration Private Sector participation Public sector PPP
Then comes the Road Transporters, Barge Operators, Terminal Operators and Shippers.	Road Transporters Barge Operators Terminal Operators Shippers
Since the Rail connectivity is very important to make IWT a successful mode Rail operators also play an important role. All the bulk movement is through Railways.Even the cost is also effective. This should be an ideal combination of Rail - Road and Inland Waterways, as the railways cannot come directly to the IWT terminals.	Rail Operator Bulk Movement Cost Effective Dependent Mode Terminals
Interviewer - There are at present 5 waterways declared. So out of these which are declared and undeclared waterways which waterway do you feel are commercially significant.	Commercially-Significant
Interviewee - I consider commercially significant as NW1 - which connects from Allahabad to Haldia. This is because it is connected well to production and population and that is the real big one. The Orissa - Andhra Pradesh network (NW5) as the east port promising. Kerala (NW3) I don't consider. Even North East (NW2) I would like to ignore - The Brahmaputra and NW6 because there is set of production and consumption of materials there. Orissa & Andhra pradesh we look at this belt both up and down for Coal, Bauxite, Iron Ore etc	NW1 - Significant Production connectivity NW5 - Significant NW3 – Less Significant NW2– Less Significant NW5 Bulk Movement
Interviewer - Do you feel Narmada River if developed can be helpful; because this is one which is going from Madhya Pradesh to West Coast of India.	
Interviewee - Yes that can be looked upon. But I don't consider Madhya Pradesh at this moment as significant sector because that area is well connected with Rail and Road network. On NW1 there is high level of containerization movement, hence Govt should first go to development of NW1 then to the Orissa - Andhra Pradesh belt and then to NW3 or NW5.	Madhya Pradesh Corridor Containerization-movement Order of Development
Interviewer - When we talk about containerisation one of the major players like China etc has major movement through IWT. Should we focus our energy on International Freight or should we focus on Domestic Freight.	
Interviewee – International Freight. Very clear. Because why we want IWT is to cater to our transportation cost. Given example of China in terms of competitiveness it does 30% of its local transportation through IWT & Coastal. Hence our global competitors are ahead in the global market in terms of competitiveness.	International Containers Transportation Cost Competitive Advantage
Interviewer - Hence if we are looking international then important corridor could be Haldia or Kolkatta port then connectivity to Hinterland - Uttar Pradesh etc. So if we are moving from North of India to Nhavashova it can be in terms of competition as well as North of India to Kolkatta also when we talk about Import & Export. That is the alternate corridor that we are talking about.	Freight Corridor North India – Nhava Sheva corridor North India – Kolkatta corridor Import Cargo Export Cargo
Interviewee - We are already looking at DFC which is from North to East . That is not for container or stacking but for Bulk cargo. This is from Ludhiana to Dankuni which is 1800 odd kms which is basically for bulk cargo like coal etc. Hence it cannot be considered as a diesel corridor because container stacking is not there. But it is important to extend NW1 beyond Allahabad, then you have 2 rivers - Yamuna and Ganga both. It can then extended further upto Delhi.	DFC (Dedicated Freight Corridor) Bulk Cargo Ludhiana to Kolkatta Corridor Extension of NW1 Yaumna River Ganga River
Interviewer – When we talk about Intermodal or Multimodal transport, IWT is a dependent mode and not an independent mode.	Dependent mode
Interviewee - Its basically a linked mode.	

Figure 5.2 Example of line by line Coding-1 (Author)

Figure 5.3 Example of line by line Coding-2 (Author)

5.4.2 Open Coding

This stage is to broke down the data into components, analysing them, comparing them with other components and making further inquiries. Open coding is the process of 'opening the data' by identifying, marking and labelling the indicators as suggested by thee data. The output of this stage are concepts which have been created by categorising and naming the indicators. Concepts form the basic element for further stages of Grounded theory.

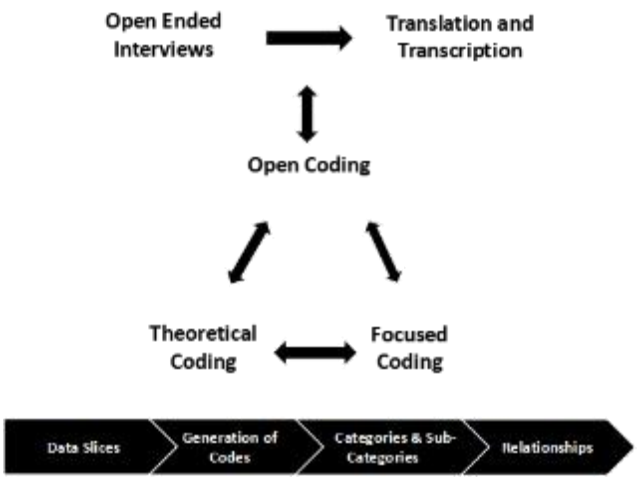


Figure 5.4 The steps of Open Coding (Author)

Memoing is a key enabler in implementing Open coding. The researcher writes note as he interprets the data. For each concept being explored, key attributes like how, what, why and when are inquired. This also forms the first stage of constant comparison. Conceptualizing is the first step in theory building. Open coding breaks data down the raw data in the form interview transcripts into concepts.

5.4.2.1 From Concepts to Categories

The analysis process moves forward by grouping concepts to form categories.

- Group concepts seeming to be related - Categorizing
- Name of the Category
  - Using theoretical ideas from writeup
  - Participant's terms – Invivo

The following figure shows instances of creating groups from ideas of this particular study.

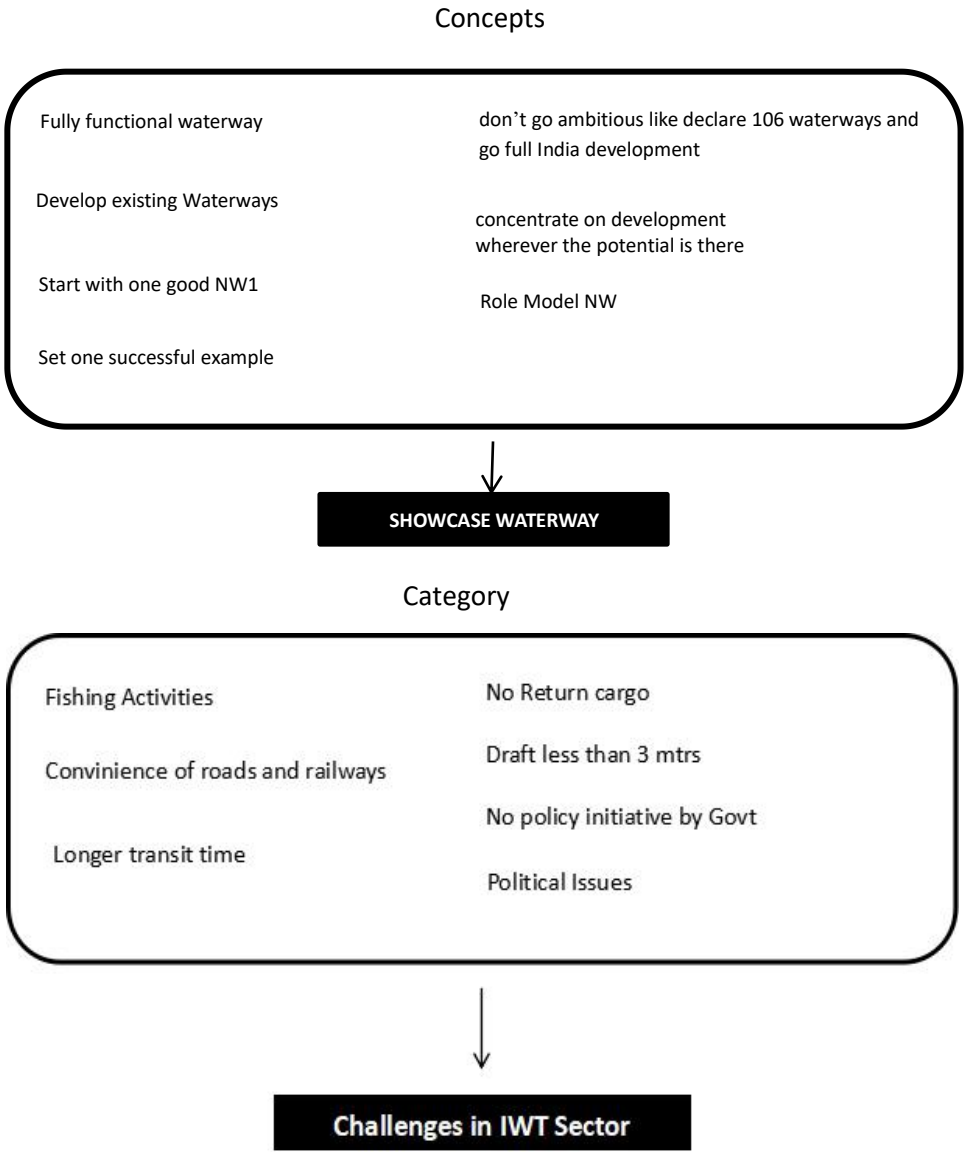


Figure 5.5 Developing categories from Concepts (Author)

5.4.2.2 Categories developed from Open Coding

Initial set of categories are developed from first set of interviews. Further interviews are coded against the category list already generated. Categories endorsed repeatedly by participants were explored and non-representative were eliminated.

For example, consider the "Challenges in IWT Sector" category. The note for this category included information gained from the data that addressed the modal share

of Inland Waterways in India in comparison to other modes and evaluating commercial viability of the mode.

Using the open coding process approximately 200 categories were identified. The list of categories generated in this stage are enclosed as Annexure C.

5.4.2.3 Properties & Dimensions of Categories

A property may be defined as a general or specific characteristic of a category, whereas a dimension signifies the location of a property alongwith a continum or range (Strauss and Corbin, 1998). Following table shows an example of properties and dimensions. Detailed properties and dimensions of all categories as derived after axial coding and final saturation are part of Annexure E.

Category	Property	Dimensions		
Barge Operators	Barge Ownership	PPP	Private Sector Participation	Public Sector Participation
Terminal Operators	Terminal Intermodal Connectivity	Bimodal Terminal	Quadmodal Terminal	Trimodal Terminal
Navigational Infrastructure	Least Available Depth	LAD Greater than 2.5 metres	Existing LAD levels	

Table 5.4 Property and Dimension of the category (Author)

5.4.3 Constant Comparison

In grounded process, the analyst participates in the methodology of data collection, organising them to classifications, gathering extra data and contrasting the new data and raising classifications (Creswell, 1992). The process of gradually creating

categories of the data is the constant comparison process. Constant comparison is the strategy in grounded theory in which new categories are developed by comparing components in the data to other components, components to categories and categories to previous developed categories. Comparing new sections of data for similarities and differences against previous set of abstracted data is an analytical process called Constant comparison. This strategy is fundamental for challenging the developing concepts and addressing the risk of bias from the researchers own perspective.

This method is relative since it incorporates, first, deliberate examination of units of data and comparison to each other and, second, guides for data gathered to be gathered next phase of the collection. In this study, the procedure of constant comparison carries on from open-coding to axial-coding till selective-coding. Initial conceptual categories were created and a constant comparison was applied on subsequent data till the principal categories were adequately saturated and further data collection, coding and constant comparison produces no new meaningful concepts. A constant comparison additionally improves the properties and dimensions of the emerging categories.

As shown in the figure below, raw data took shape into indicators – little pieces of data that came from various individuals. These indicators were then arranged into codes, and then converted into theoritical categories (such as, Category I, Category II).

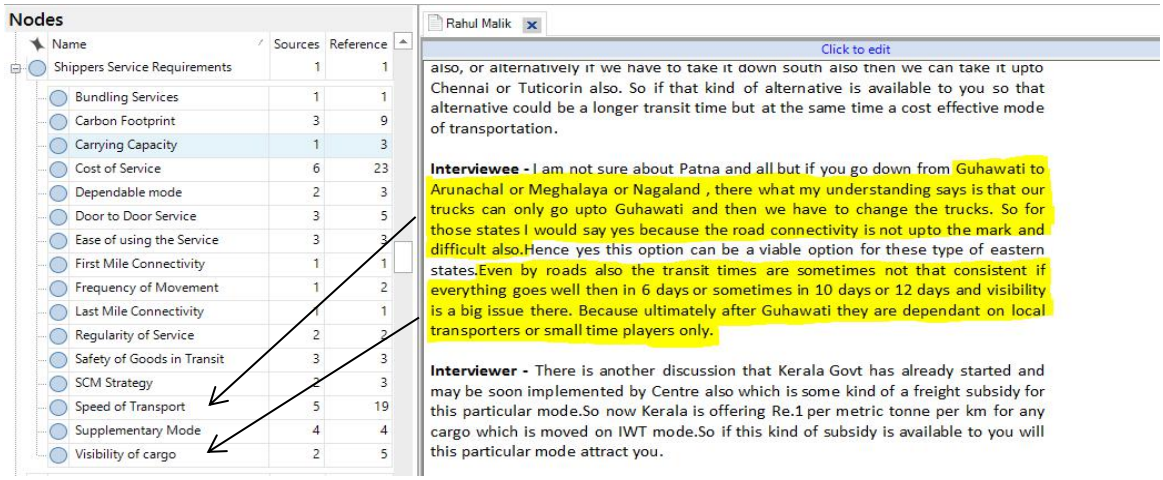


Figure 5.6 Example of Constant Comparison (Author)

As we analyse the interviews and constantly compare the new text with old categories we keep building the various categories. Following are examples of various categories with coding from the transcript. Following figures shows sample Participant Response Indicators to Codes.

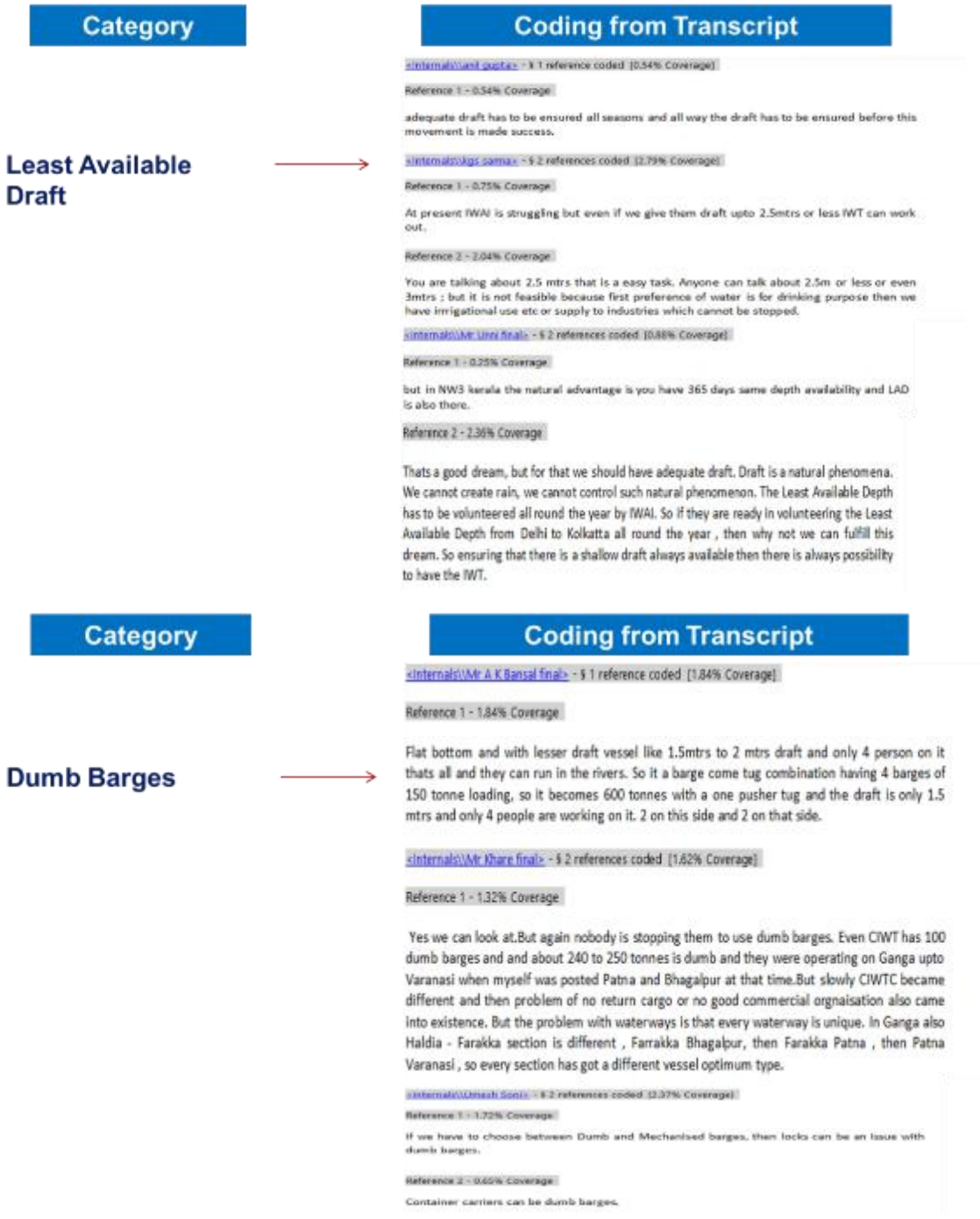


Figure 5.7 Sample Participant Response Indicators to Codes (Author)

5.4.4 Theoretical Sampling

Fassinger (2005) accepts Theoretical Sampling as one of the primary characteristic of the Grounded Theory Methodology. This process of constantly gathering data is done with the intent of rationalizing and justifying arising concepts is defined as theoretical sampling. This procedure normally includes, selecting certain respondents or information gathering sources which will support additional data on the specific constructs being checked.

During the coding process, researcher come across several unanswered questions and recognises the gaps in the data collected. To address these gaps, the investigator pursues additional data from newer respondents through the methodology of theoretical sampling. Theoretical sampling achieves better understanding and intensifies the emerging categories (Ford, K. M., 2010).

Theoretical sampling differs from purposeful sampling. During purposeful sampling, researcher chooses participants which based on certain criteria or conditions which he has set at the beginning of he research process. However, during theoretical sampling, researcher chooses participants who can help him to illuminate certain categories or fill in the gaps in his collected data.

“Theoretical sampling” represents a procedure of choosing what information to gather, as we conduct gathering, coding, and breaking down analysis (Glaser and Strauss, 1967). Purposeful sampling process of data accumulation includes personalized choices of interviewees chosen in light of the subject or problem area. Constant comparisons are being done to guide further need of information. In case of Grounded Theory methodology, as the theory emerges, the accumulation of data cannot be planned in advance. The subsequent steps are guided by the emerging theory.

In this analysis, theoretical sampling is conducted in following ways. In this analysis, the first set of professionals who were interviewed was IWT subject experts. As the information was broken down, the need was felt to talk with experts in other modes who can guide on integrating IWT with their mode of expertise. Refer following tables. The first set of interviews constitutes part of purposeful sampling and the last set of interviews constitutes part of theoretical sampling.

Interview No.	Interviewee Area of Expertise	Nature of Sampling
1	MMT Expert	Purposeful Sampling
2	IWT Expert	Purposeful Sampling
3	IWT Expert	Purposeful Sampling
4	IWT Expert	Purposeful Sampling
5	IWT Expert	Purposeful Sampling
6	IWT Expert	Purposeful Sampling
7	IWT Expert	Purposeful Sampling
8	IWT Expert	Purposeful Sampling
9	IWT Expert	Purposeful Sampling
10	Rail and Container Expert	Theoretical Sampling
11	Barge Owner and Operator	Theoretical Sampling
12	Shipper	Theoretical Sampling
13	Shipper	Theoretical Sampling
14	MTO Operator and Shipping Line	Theoretical Sampling
15	Terminal Operator	Theoretical Sampling
16	MTO Operator and Road Transporter	Theoretical Sampling

Table 5.5 Theoretical Sampling applied in this research (Author)

5.4.5 Memoing

The researcher creates memos throughout the data collection and analysis stages in the grounded theory methodology. Composing memos is like a dialogue which researcher conducts with himself. A Memo is a note that a researcher composes during the analysis procedure to expand on thoughts about the coding and emerging categories. Through memos, the analyst investigates his thoughts and reflections, continually hunting for the broader explanations on the phenomenon under study. Memos guide the researcher towards additional source of information in case of gaps are found, assist him in developing ideas.

A memo can be short as few words or long as many sentences, more speicifc and linked to concepts and categories, or extensive and theoretical. A Memo provides

innovativeness in building a broader framework. Memoing were constantly used during the constant comparison process and guided the formulation of meaning and ideas for my study. Glaser used the term moment capture to define a critical element of memoing.

Writing memos is fundamental for the advancement of the grounded theory since they can be utilised to note impressions of the information and accumulate questions, keeping in mind the end goal to expand upon and investigate diverse thoughts. In the investigation, I utilised memos to capture my thoughts on issues which arose while analysing the interviews. Following are some illustration of memo chalked out during the coding process.

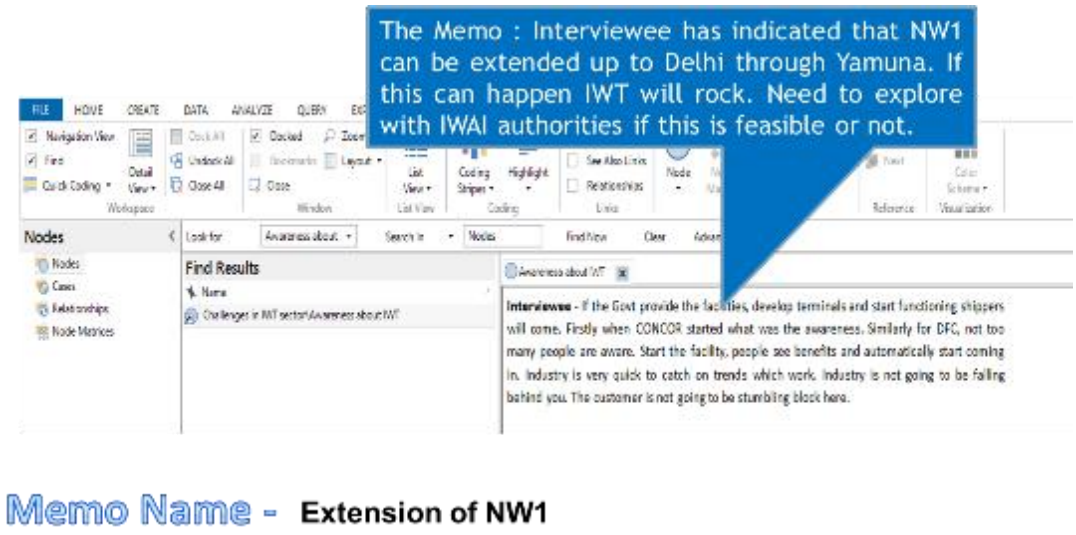


Figure 5.8 Sample Memo-1 (Author)

Figure 5.9 Sample Memo-2 (Author)

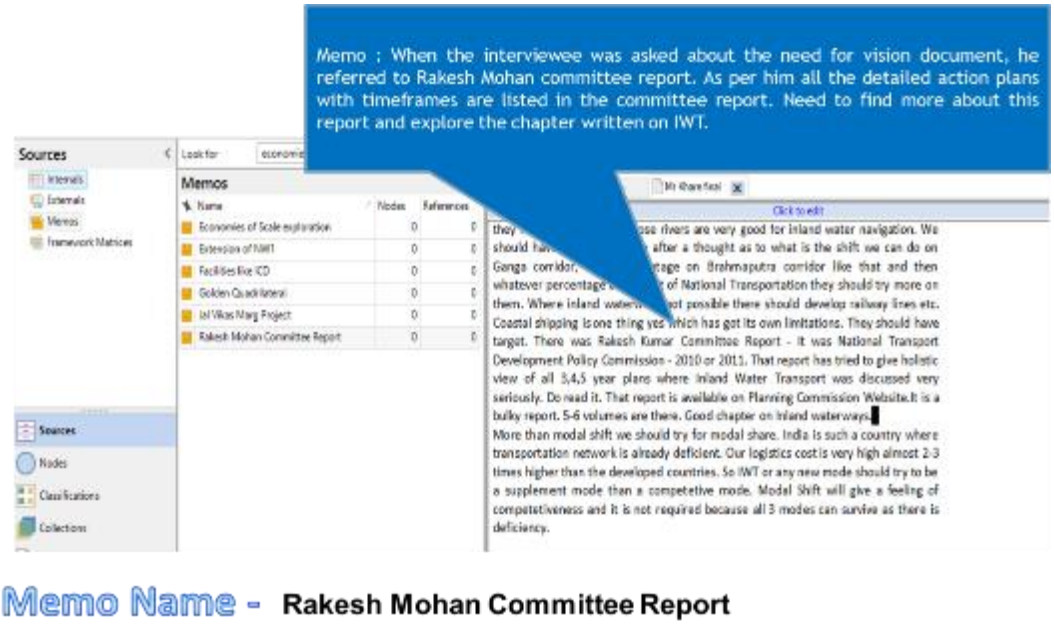


Figure 5.10 Sample Memo-3 (Author)

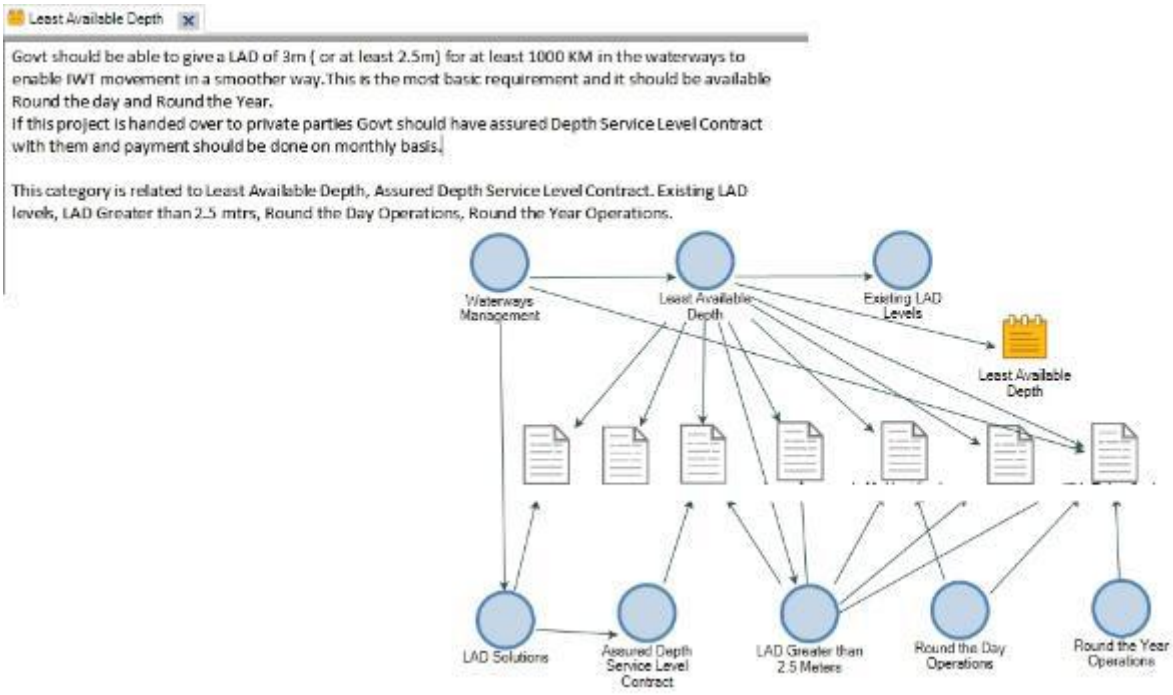


Figure 5.11 Sample Memo about Categories and Interconnections-1 (Author)

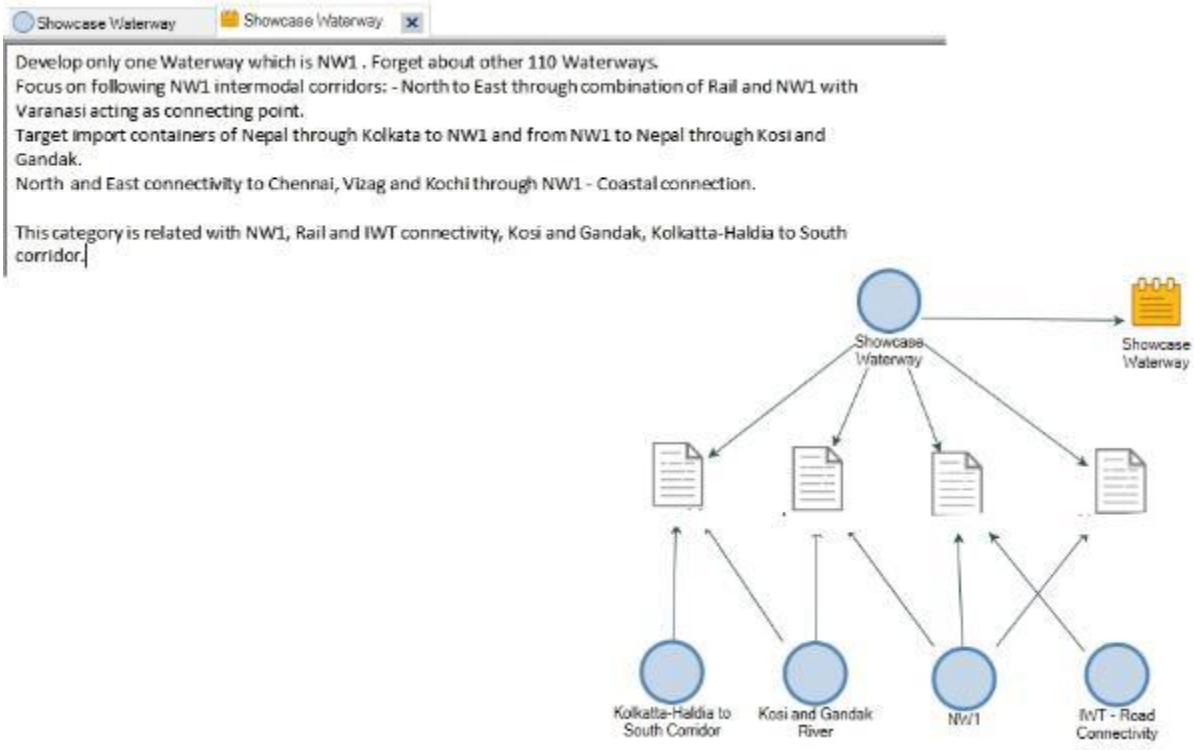
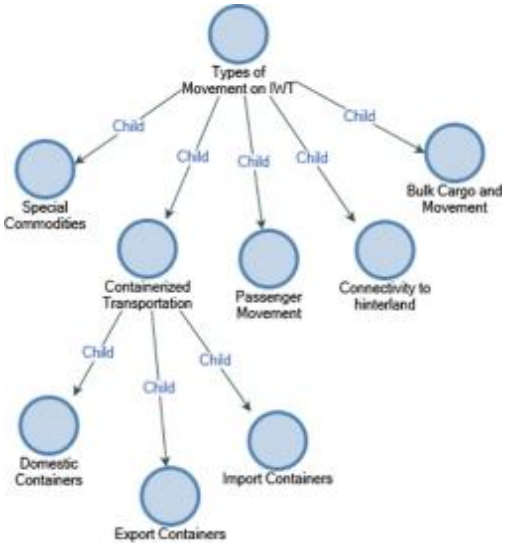


Figure 5.12 Sample Memo about Categories and Interconnections-2 (Author)

5.4.6 Axial Coding

The next phase of the GT Methodogy is the stage of “Axial coding” which comprises of identification of relationships among the categories using a combination of inductive and deductive thinking. Axial coding is the process of assembling the open codes along specific "axes" or points of intersection (Strauss and Corbin, 1990). The information which has been separated into individual categories during line by line coding is reassembled during the Axial coding.

Axial coding offer answers to questions of who, where, when, why and what. What represents the associations among the codes? It is the process of connecting categories to sub-categories along the lines of their dimensions and properties. The objective is to add profundity and composition to existing classifications, relate categories to sub categories, determines the properties and dimensions of a category, and reassembles the information which have fractured during initial coding to provide coherence to the emerging analysis. Creswell states the aim of axial coding is to sort, synthesize and organize large amount of data, to be ‘re-assembled’ in new ways.



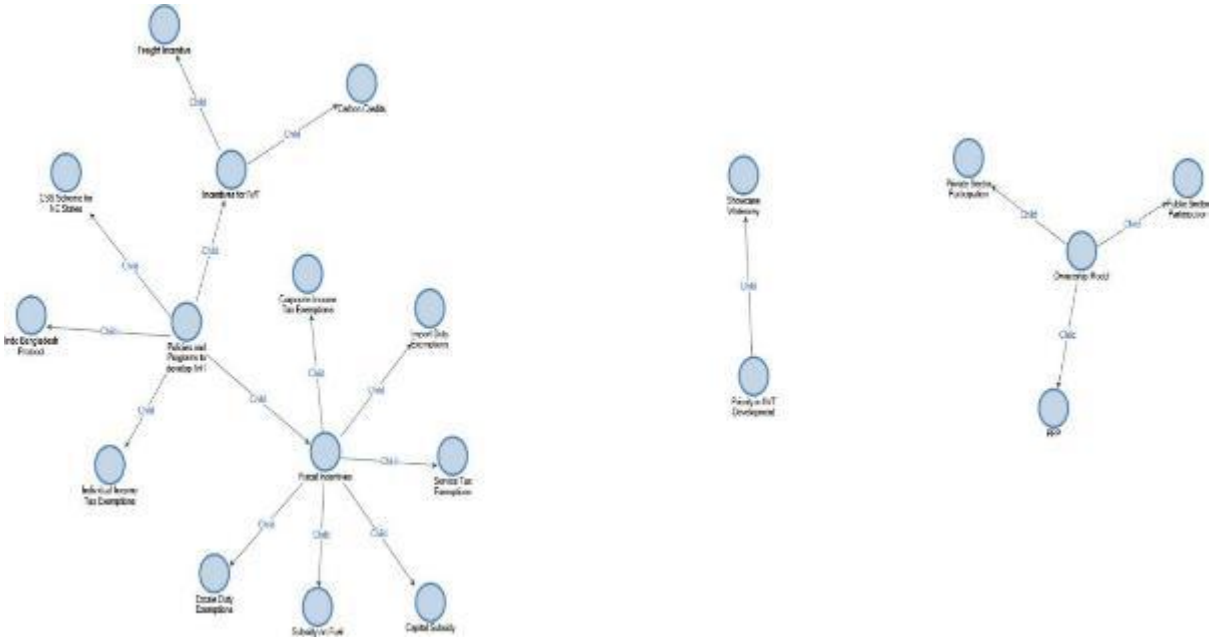


Figure 5.13 Examples of Relationship Building among categories (Author)

Grounded Theory analysis moves concurrently between open-coding stage and axial-coding stage. The analysis is not straight line but cyclical and simultaneous, with collection, analysis and theory generation occurring in parallel from the start to end of the study process.

The key objective of axial coding is to build connection between the categories which will finally lead to the recognition of the "core" category. During axial coding categories and sub-categories are continuously questioned and compared, with the objective of identifying the main category and its relationships with others (Hunter et al, 2011).

As the relations were built among categories they got bucketed into seven major themes. Based on the constant comparisons and classifications of categories, seven core categories were identified:

- Navigational Infrastructure
- Terminal Operations
- Barge Operations
- Freight Corridors with Intermodal Connectivity

- Role of Government
- Intermodal Transport Operators
- Shippers Service Requirement

Following are examples of categories related with Barge Operations and Navigational Infrastructure.

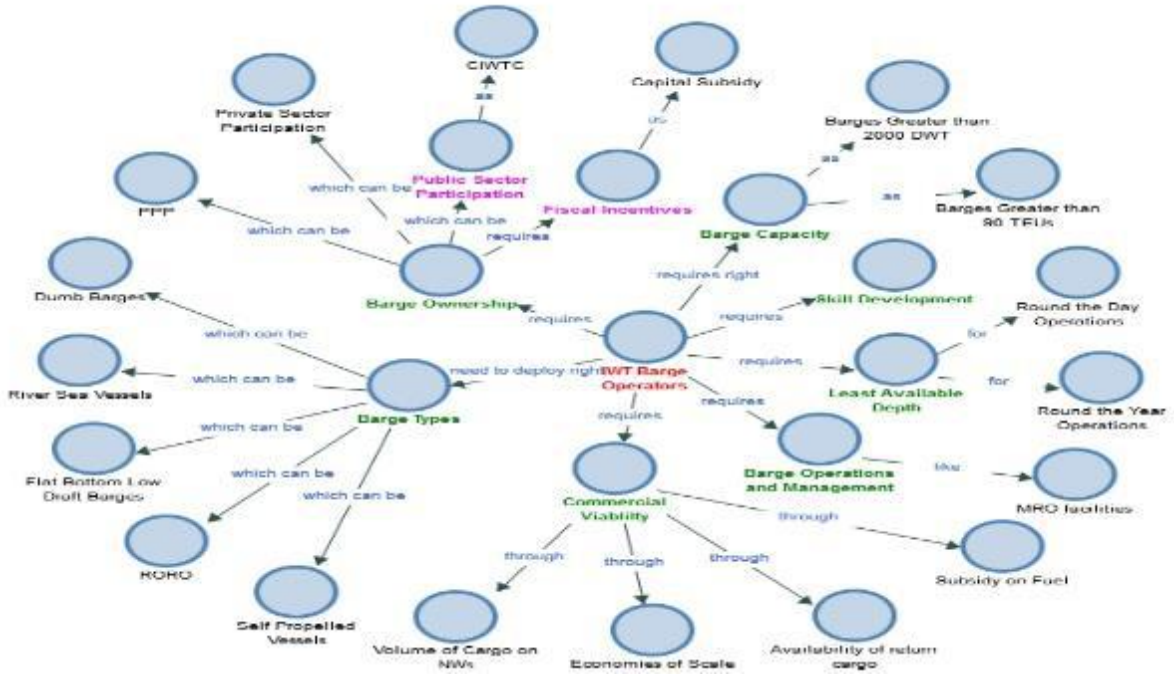


Figure 5.14 Relations Building among categories under Core Category Barge Operations (Author)

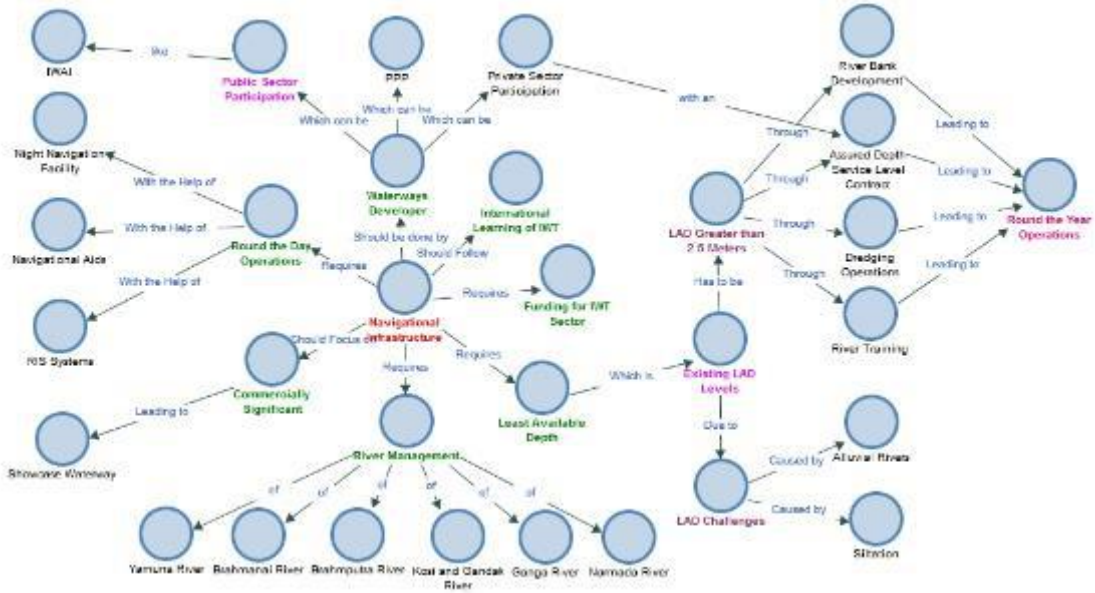


Figure 5.15 Relations Building among categories under Core Category Navigational Infrastructure (Author)

5.4.6.1 Coding Paradigm

Axial coding is an investigation of who, what, when, where, and why of the category (Strauss, 1987). Strauss and Corbin (1990) recommended that analysts to use coding paradigm, which depicts the inter-relationship of causal conditions, strategy, intervening condition on a central phenomenon and the resulting Paradigm providing a basic frame of generic relationships.

In coding paradigm, the researcher identifies one category at the centre of the process as a core phenomenon and tries to correlate other categories to it. These relating categories are causal conditions (elements which prompt the central phenomenon), strategies (activities taken in response to the central phenomenon), context and intervening conditions (particular and universal situational factors that persuade the methodologies) and consequences which comes from embracing the methodologies. Refer to the following figure which indicates the Axial Coding Paradigm.

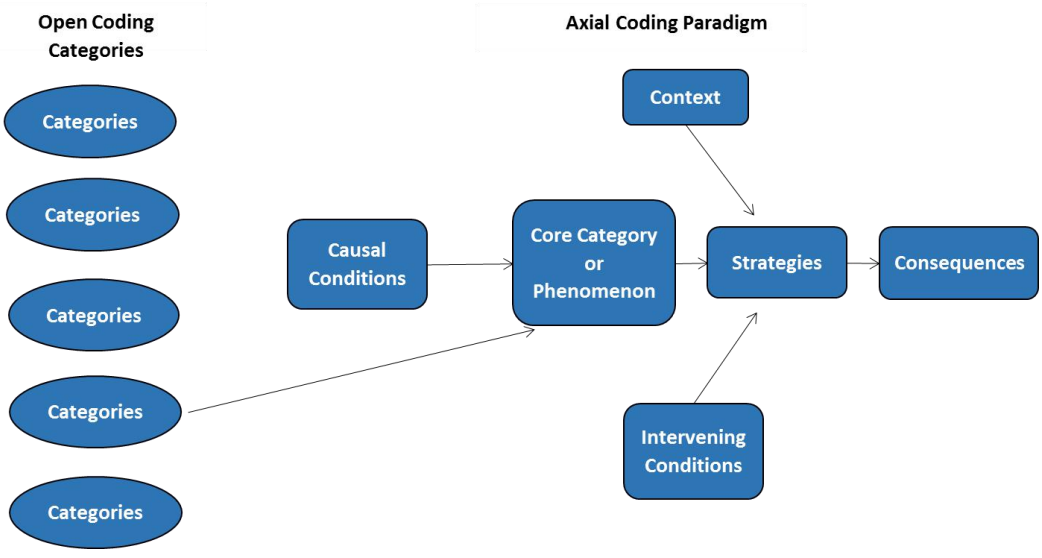


Figure 5.16 The Coding Paradigm (Author)

The following are various blocks of the Paradigm:

Element	Description
Phenomenon	Centre of the task being explored. The concept which keeps the bits together.
Causal conditions	These're the instances or perhaps things which prompt the event or perhaps development of the phenomenon.
Context	An arrangement of problems impacting the activity/technique. Analysts frequently create a refinement between powerful elements (causes) as well as foundation elements (context).
Intervening conditions	The basic contextual conditions which influence methods. We are able to acknowledge context with blowing elements and interceding conditions with intervening elements.
Action strategies	The intentional, unbiased situated workouts that operators perform in light of the phenomenon as well as interceding situations.
Consequences	These're the outcomes of the excitement methods, expected & unintended.

Table 5.6 The blocks of coding paradigm (Author)

The paradigm was drawn for all the seven core categories. The details of all seven paradigms can be found in the Annexure D. Following shows example of paradigms for two core categories:

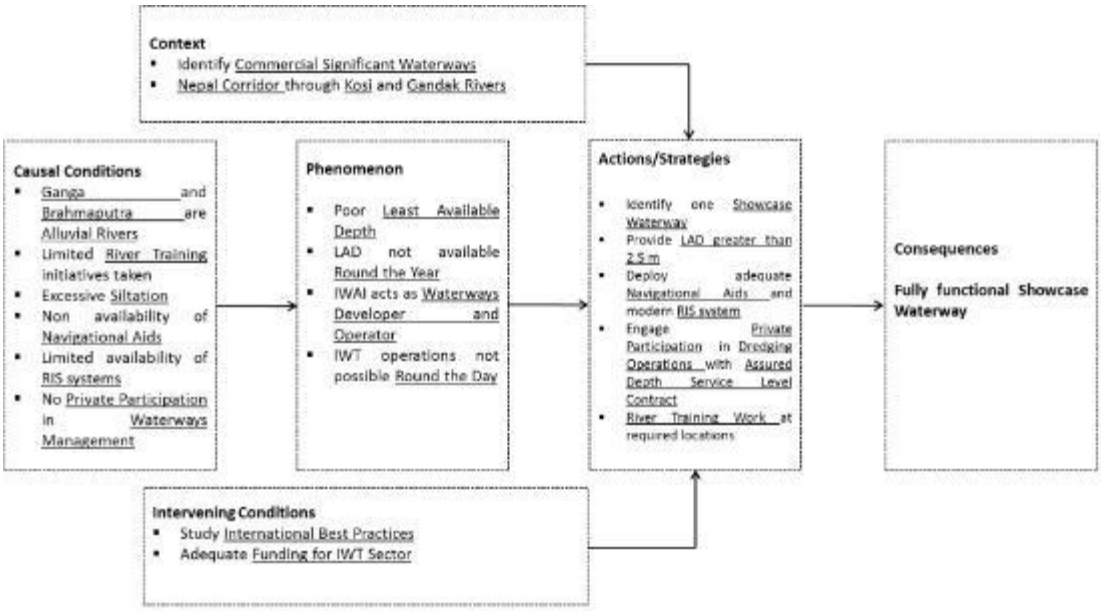


Figure 5.17 Coding Paradigm for Fully Functional Showcase waterway (Author)

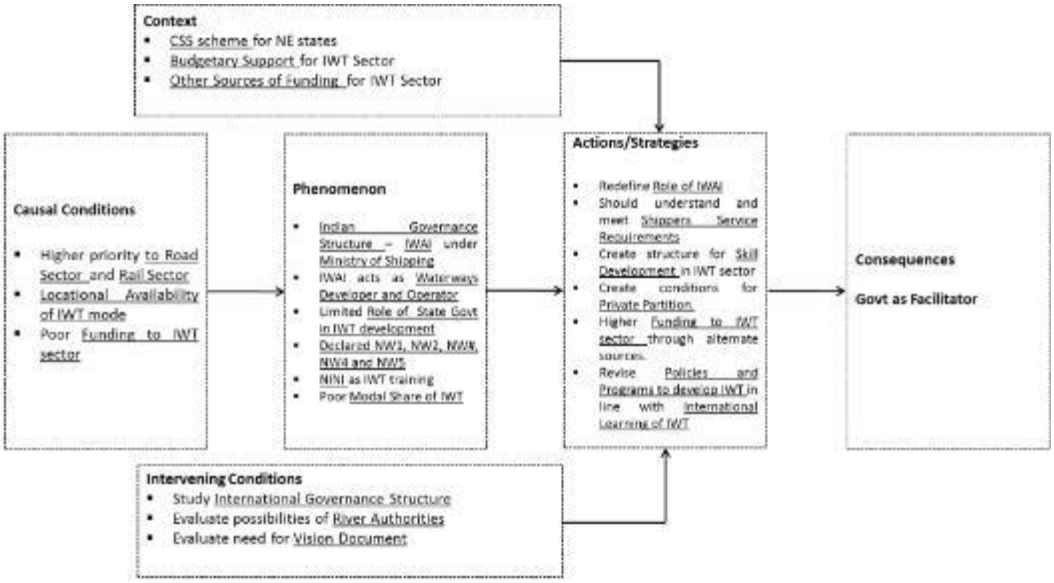


Figure 5.18 Coding Paradigm for Role of Government Paradigm (Author)

5.4.7 Selective Coding

The next stage of Grounded Theory Methodology is Selective coding is which the researcher formulates a hypothesis from the interconnection of the categories as established during the axial coding stage. This hypothesis furnishes a conceptual clarification of the procedure being studied in the investigation. It is a way toward refining the theory my methods like writing out the storyline that interrelates the categories and builds an explanation to the phenomenon under study.

Selective coding represents the approach of picking one category to be the central or core category and comparing it to every other. The key idea is to develop a storyline surrounding which everything in the study. There is a conviction that such a central thought exists. The guidance for building theory provides guidance for composing a story. Selective coding is tied in with obtaining the driver that actuates the story forward. Using an analogy of a novel, LaRossa has said that selective coding is the main plot and storyline. During this stage the essential mission is to recognise the core categories which can tie all of the other data together in a lucid, rational and logical entirety. According the LaRossa the stories which researcher puts forward should be convincing, eloquent and reasonable. The end result should carry linkages

between methods and concepts, should carry range and density and should be specific and general at the same time (Denzin, 2004).

Story line -

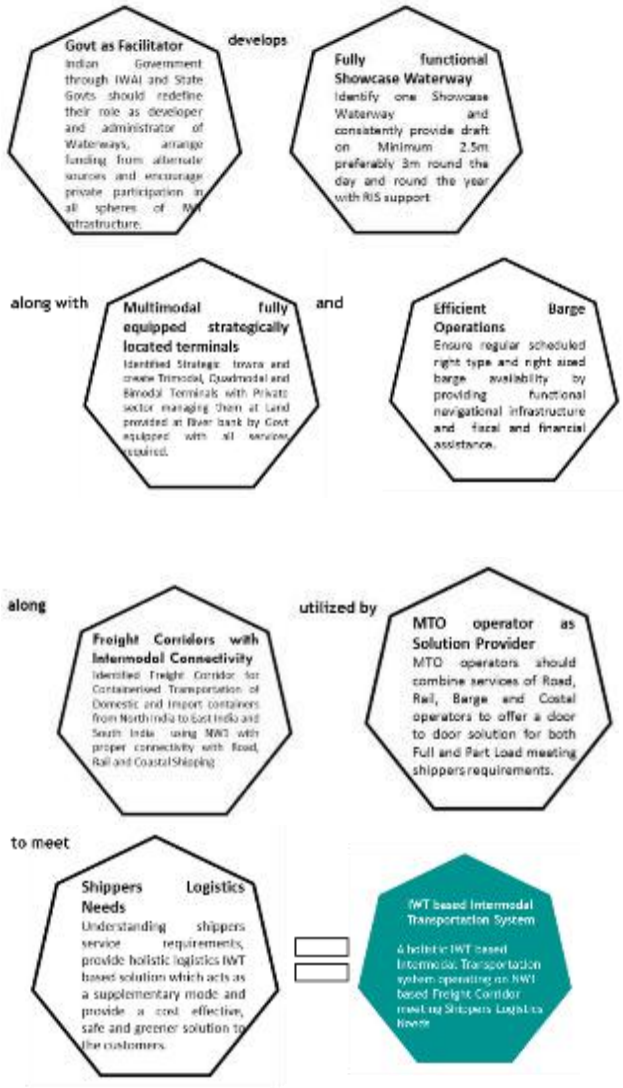


Figure 5.19 The story line as generated from Selective Coding (Author)

During this phase, the researcher develops a model connecting together the core categories which are identified in the earlier coding stages.

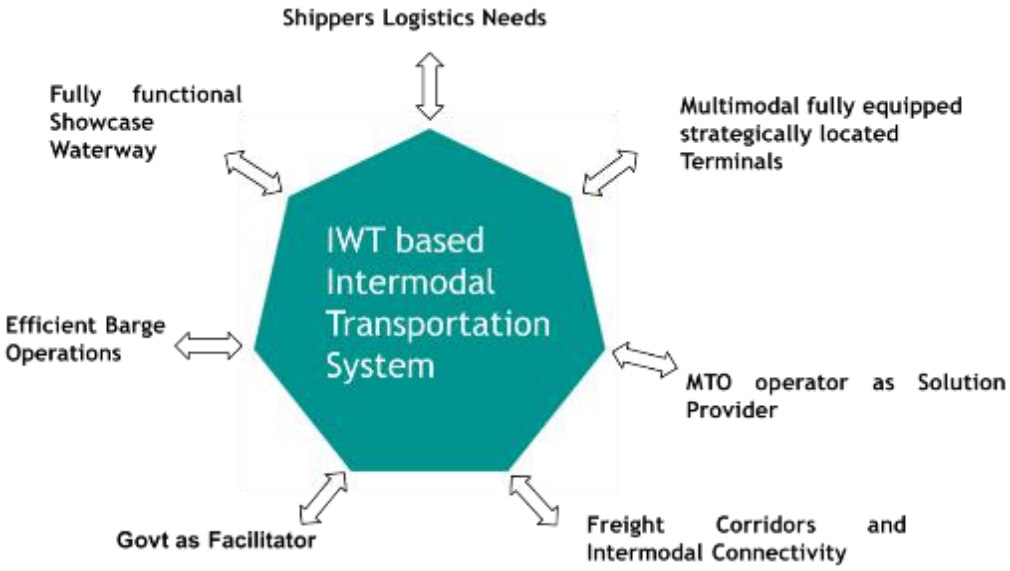


Figure 5.20 Selective Coding, seven core categories joining to form one central category (Author)

5.4.8 Example of end to end from Data to Selective Coding

Following table indicates an example from raw data to open-coding to axial-coding to finally selective-coding.

Raw Data (*Part of*)	**Initial Coding**	**Open Coding**	**Axial Coding**	**Selective Coding**
That is a Chicken - Egg situation if I want to buy a vessel and by definition we want to have either bulk cargo or container cargo and again by definition over waterways say from Haldia to Allahabad or Haldia to Varanasi it is 1300 kms long , it will take around 10 days to reach one side and 7 days to reach another side and if a party wants a few containers at Varanasi , it doesn't	- Lack of matching return cargo - Non availability of Bank loan due to profitability	Commercial Viability	Parent Code - Commercial Viability Child Code - Availability of return cargo, Economies of Scale, Volume of	Efficient Barge Operations - Ensure regular scheduled right type and right sized barge availability by providing functional

want me to come every twice a month , it will require at least alternate day or give him some 15-20 containers every alternate day. One vessel is not going to be sufficient for that. So I would need at least 10-12, 15-20 vessels. 15 vessels would require 150 to 200 cr of Rupees, now I would not have that naturally, I would like to have a loan . Bank loan I cannot get unless I show profitability. And the moment I do not have the return cargo from the Varanasi to Haldia, the container movement one way doesn't become viable.			Cargo on NWs	navigational infrastructure and fiscal and financial assistance.
And the moment I do not have the return cargo from the Varanasi to Haldia, the container movement one way doesn't become viable. Anyway CONCOR is having this issue for north-eastern states. Most of the containers come empty and that is a problem. There are less number of ICDs there. So it is easily said than done.	- Return Cargo - Vacant Return Containers	Availability of Return Cargo		
When we take advantage of IWT then it becomes a continuous affair. You make a reservoir and		Economies of Scale		

you make a lock system. There is cascade of reservoirs and then you can always navigate with the sufficient draft you were seeking. USA is doing like that.				
One challenge that we vessel owners face is to tap the right company who is willing like, we can't work for a private firm, as working with private firm is very difficult because the affordability of moving that much amount of cargo is not feasible for every private firm. So either there has to be company like Tata Steel, IOCL, Sail all these co like. So either you follow a carton kind of a thing between private companies and then move the cargo then we need bigger companies to work with.	- Non availability of cargo with Private companies - Need bigger players to put their cargo on IWT	Volume of Cargo on NWs		
In India dumb barges have a potential in large rivers like Brahmaputra and Ganga where you can have a chain of barges whereby you achieve better load to power ratio. Same power you can move more and they are using it when they are moving ODC cargo.	- Dumb Barges can operate on 2 rivers - Dumb Barges can carry ODC Cargo	Dumb Barges	Parent - Barge Type Child - Dumb Barges, RORO Vessels, Flat Bottom	

Most of the cargo from Vizag is moving to north east and presently it is coming through roads only. So if River Sea Vessels are developed those vessels can directly take the cargo from Vishakhapatnam area and can come up to Patna or up to this point. So those things are also in study. We are planning how to develop all these vessels. From Haldia to Chittagong port some agreement has been done with Govt of Bangladesh that river sea vessel will ply on that route.	- RSV as vessel Type - RSV can connect Port to Hinterland	River Sea Vessels	Low Draft Barges, River Sea Vessels	
I also think that this movement should also be looked for moving some RO-RO traffic, which already today is moving in road vehicles, if we can contain those road vehicle movements to shorter distances and move the same road vehicles with non-functional drivers on both rail as well as IWT then it would be a good thing.	- RORO Traffic moving by Road - RORO Traffic as potential for IWT	RORO Vessels		
NW1 is a tidal river up to a extent , so the engine of the vessel should also be like produced in such manner that it can go against the tide probably giving you cost	- Identify Barge type with Indian condition	Right Barge Type		

effective and fuel manage				
Flat bottom and with lesser draft vessel like 1.5mtrs to 2 mtrs draft and only 4 person on it that's all and they can run in the rivers.	- Low Draft vessels for Indian Rivers - Less manpowe r	Flat Bottom Low Draft Barges		
Dumb barges with tug is always good. Some 4-5 barges with tug. In USA and all you have 10 barges tied to one tug. But in India even if you have 2 barges also to one tug then also it is viable.	- Large tub and dumb combo in USA - Smallest combo viable in India	Dumb Barges		

Table 5.7 Example from raw data to open coding to axial coding to finally selective coding (Author)

5.4.9 Theoretical Saturation

In Grounded theory research the researcher collects and analyses the data immediately rather than waiting till all data is collected. What data to be further collected in on the basis on the data analysis done. Refer to following picture of "zig-zag data-collection". The analyst first gathers the data, codes it and finds the initial sets of categories. He then identifies immature categories and missing pieces of information and goes for further data collection from new set of participants. He then further refines his categories and fills the gaps. The analyst toggles between data-collection and data-analysis process till he saturates. Saturation is the stage

when the researcher by his subjective assessment feels that additional data will not add any new hypothesis for establishing categories (Creswell, 2008).

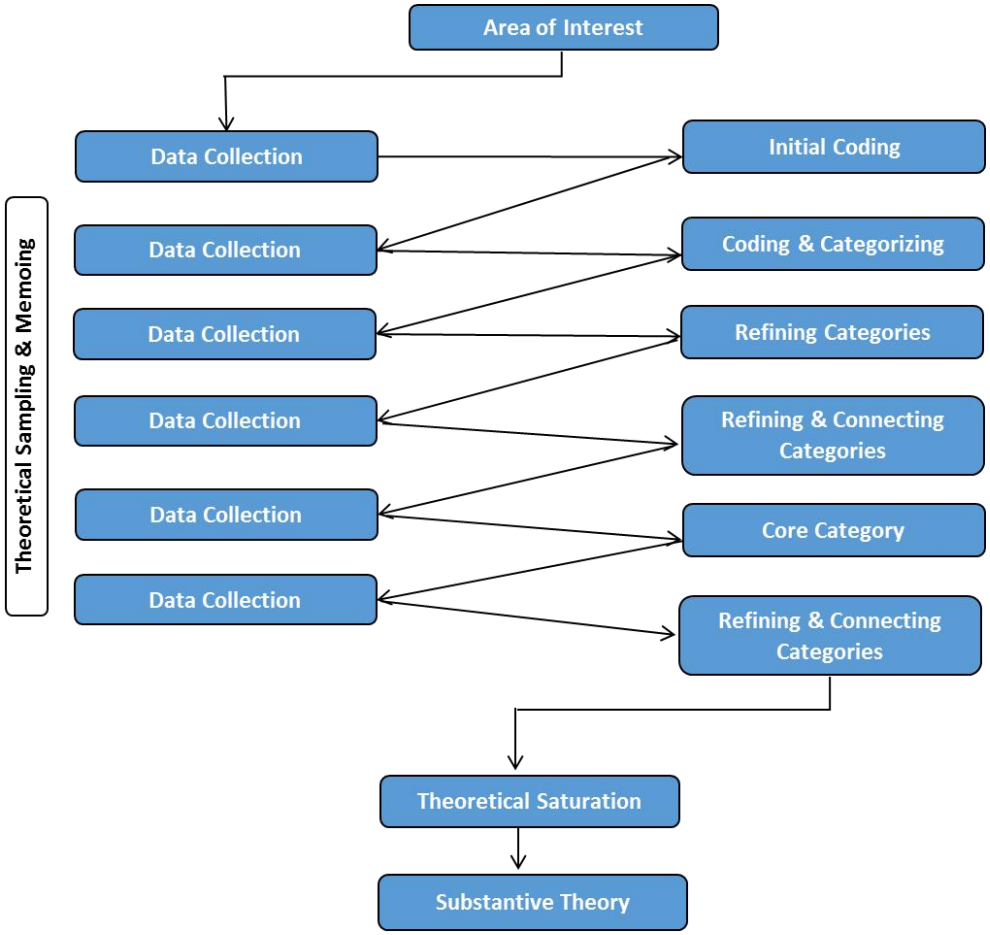


Figure 5.21 Process of Theoretical Saturation (Cresswel)

The realization of conclusion of theoretical-sampling resides in achieving theoretical saturation, the time when no supplementary information is obtained to enable the researcher to develop to advance properties. The sample adequacy can be judged by the width and diversity of the samples with a specific end goal to achieve saturation point (Glaser and Strauss, 1967). The sample size can be considered to be small when the resulting hypothesis is too thin and leaves too many areas with inadequate explanations.

Theoretical saturation is reached when additional information does not trigger new properties of the core categories and no new theoretical insights about the phenomenon is developed (Charmaz, 2006). (Morse, 1995) defined Theoretical

Saturation as 'data adequacy' that indicates the stage of accumulation of data until the point when no new information is obtained (Morse, 1995). The concept of saturation of categories in grounded theory supersedes that of sample size. In certain studies, even small sample may still fetch the pre-requisitess for the study. In the GT analysis it may be counterproductive to collect huge amounts of data. It may lead to large data going un analysed and the researcher may be overwhelmed by the sheer volume of the data.

In the current research the researcher found that no new categories and properties are developing from seventh interview. The researcher still continued with two more interview. As no significant facts were emerging from further interviews, researcher decided not to conduct any further detailed interview. All the further interviews were conducted as a part of theoretical sampling to fill in the gaps found in the research.

5.4.10 Theorising and Conceptualisation

The research work concludes in a "grounded theory" or an abstract theoretical understanding of the studied phenomenon. Theorizing is a tool to generate operational and working understandings of particular situations.

In order to achieve theorizing, the researcher identifies the major categories that become the building blocks of the emerging theory, categories which carry highest analytical weight and carry the theoretical power and reach.

A theory is distinct from the description. Description is an observation of a person which indicates the mental picture of events, objects and his experiences, whereas theory is general, conceptual and illustrative. Some research works, which claim to be grounded theory are only descriptive in nature and do not carry theoretical abstraction. A grounded theory must offer a conceptual account of the phenomenon in the study. It must explain not just describe the phenomenon.

The conceptual framework connects concepts to provide formulation of a theory. Conceptual Framework comprises of the ideas that are set inside of a coherent and consecutive plan. It talks about the formal structure and utilizes to contemplate which existing hypothesis is inapplicable or deficient as if, there should be an occurrence of the Grounded hypothesis explorers. Conceptual Framework is based on specific concepts derived from empirical observation.

In this study based on the previous stages, the researcher has derived the following conceptual framework explaining the IWT based Intermodal Transportation system in India. This framework would be explained in greater detail in chapter 7.

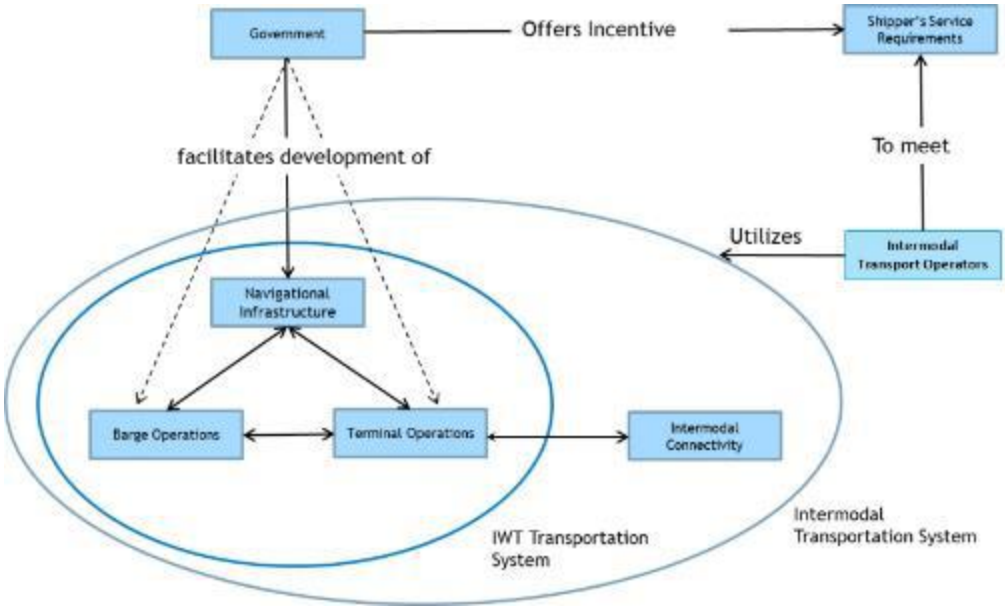


Figure 5.22 Conceptual Framework for IWT based Intermodal Transportation System (Author)

Conclusion

The discoveries and analysis displayed in this section of the study depended on meetings with sixteen topic specialists. A model which outlines IWT within Intermodal Transportation System has been characterized. The qualitative research strategies utilized in the examination were fitting for the aim of research. The utilization of reasonable strategies facilitated segregation of data in a suitable way and in this way determining the conclusion of the research done. The questionnaire

utilized as a part of methodology helped with evoking the correct responses. The Grounded theory gave the structure used to manage the research methodology. The iinvolved procedure was complex as well as conceptual in nature. In granting a record of the means taken in the research methodology, the part supports the legitimacy of its discoveries by exhibiting its thoroughness in the research activity.

Chapter 6

Research Outcome: Findings and Suggestions

"Small changes eventually add up to huge results."

"Fault Finding without suggestions for improvement is a waste of time."
Ralph C Smedley.

6.1 Introduction

This chapter of the thesis present results of the analysis of integrating IWT with other modes of transport. The findings from examination of the interviews are translated into ten propositions. As part of the presentation of findings, excerpts from interviews are provided. The findings of the study are clearly grounded in the data so the respondent's perspectives are presented while referring to my own interpretations.

The ten proposition cover the whole gamut of requirements from least draft requirement to skill development to create an IWT based Intermodal Transportation System in India.

6.2 Proposition Number 1

Starve your distractions, feed your focus.

Create one Marquee Waterway: One of the most important findings of this research has been that India as a country should focus only on one waterway, make it viable, build volumes and make it truly a Showcase Waterway. There is no need to expend our energies on other four or other 110 for a while.

> *In my opinion you should create one more Goa like waterways, don't go ambitiously for so many waterways, create one first (Respondent).*

The development of that waterway may not be just for cargo movement. The development could be far more comprehensive. The waterway should be used for

passenger movement, Tourism, smart cities and industries could be developed alongside a fully functional waterway.

Most of the people agreed that this one showcase Waterway has to National Waterway 1 on river Ganga for several reasons. It is the longest in stretch, connects North of India with East of India, passes through four major states of India, has a large population living on both sides and there is large amount of cargo flowing parallel to it which can be converted from Road or Rail to IWT. There are also several power plants close to NW1.

Figure 6.1 IWT on National Waterway 1 (Author)

Intermodal Connectivity

Build connectivity with Road: Waterways is not an independent mode like Road. Waterways like Rail needs Road for first mile and last mile connectivity. The terminals should be located close to State or National Highways and with proper connectivity by at least 4 lane roads connecting terminals with State or National Highways.

Build connectivity with Rail: Government is coming up with Eastern Dedicated Rail Freight corridor from Ludhiana to Kolkata. The research found that this freight corridor can be connected with NW1 at various points, the most important being Varanasi. Varanasi could be a trimodal terminal with Road and Rail connectivity with IWT.

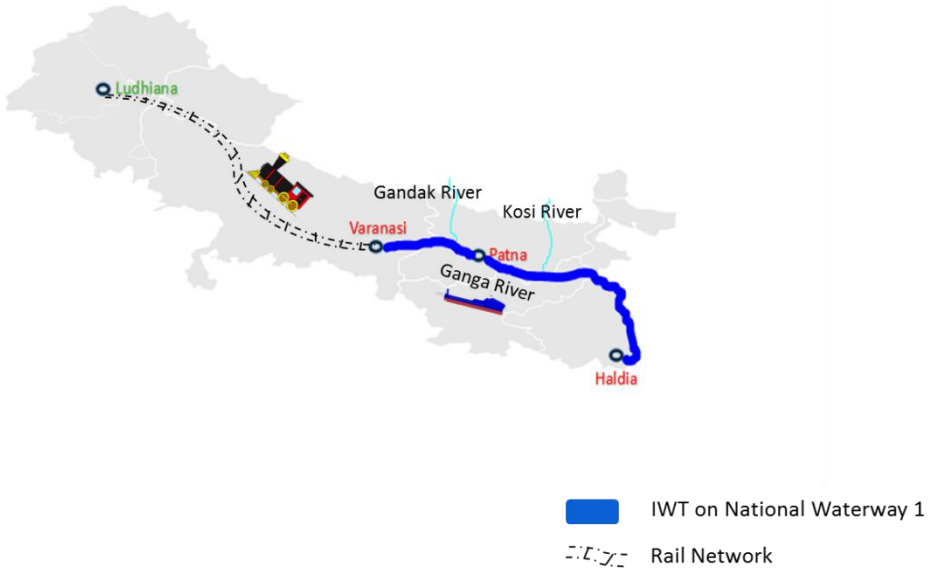


Figure 6.2 IWT and Rail Network on National Waterway - 1 (Author)

Build connectivity with Coastal Shipping: NW1 can be connected with Coastal shipping at Haldia terminal in West Bengal. This will allow containers to flow from IWT to Coastal shipping and vice versa. There could be either exchange of containers at terminal at Haldia port from IWT Barge to Costal shipping vessel or we can deploy River Sea vessels which can containers from River to sea in seamless fashion.

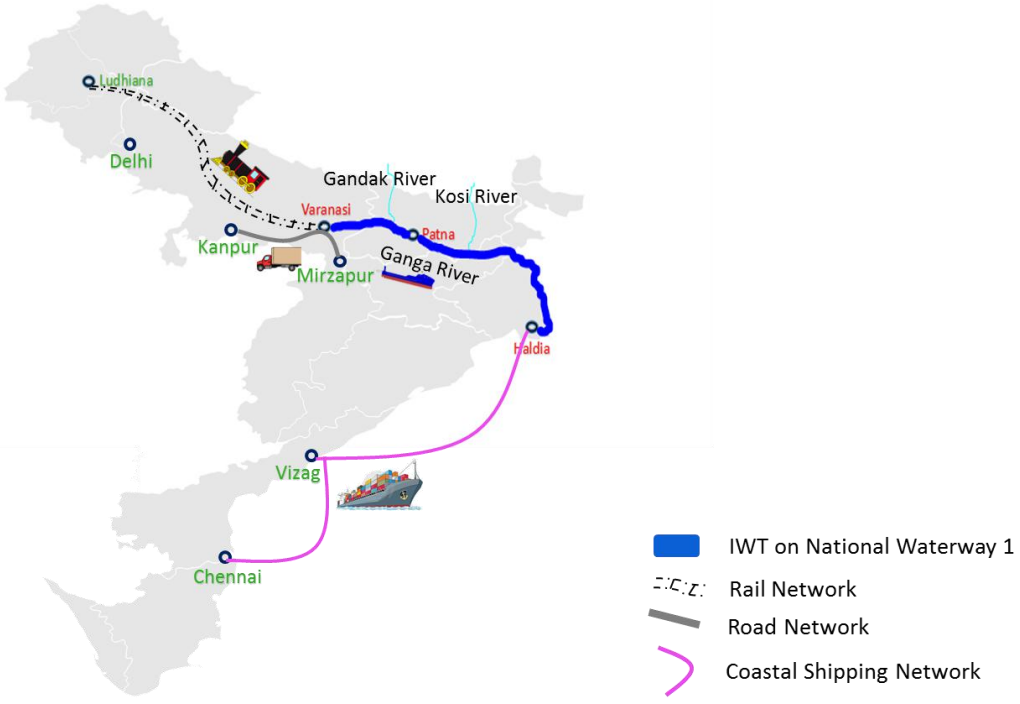


Figure 6.3 IWT on National Waterway 1 integrated with other modes of transport (Author)

Freight Corridors

North India to East India: North India can be connected with East India through a combination of Rail and IWT. Important towns in North India like Delhi, NCR, Ludhiana can be connected to towns like Kolkata by Rail up to Varanasi and IWT from Varanasi to Kolkata. A further link can be established up to Guwahati and North East using NW2 and Bangladesh Protocol. This will provide connectivity all the way from Ludhiana in Punjab to Tezpur in Assam through a combination of Rail and IWT and avoiding Road altogether and creating an alternate solution to overcome chicken's neck problem.

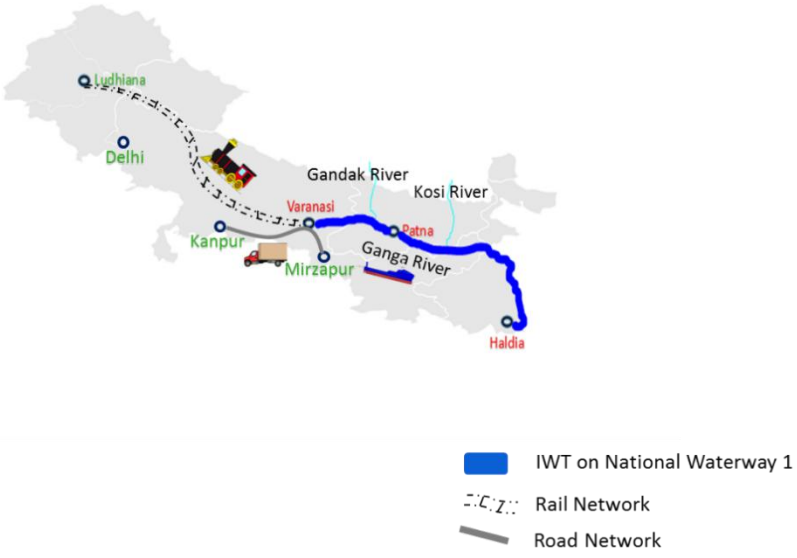


Figure 6.4 IWT on National Waterway-1 integrated with rail and road network (Author)

North India to South India: North India can be connected with South India through a combination of Rail, IWT and Coastal Shipping. Places like Chennai, Tuticorin and Vizag can be connected with Delhi through this combination thus providing a supplementary route to move cargo between North and South of India.

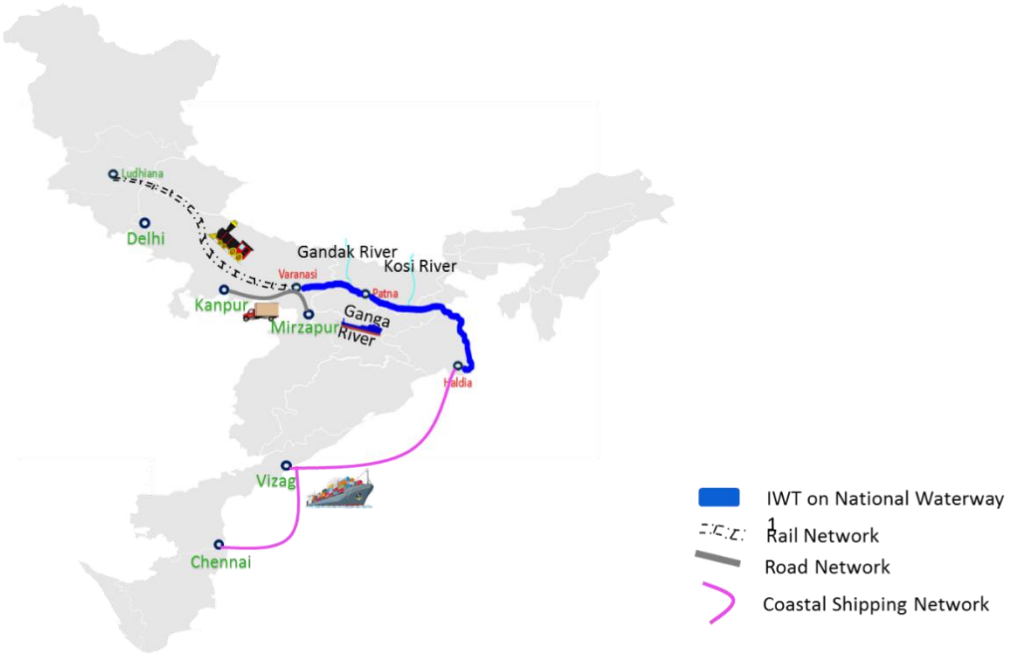


Figure 6.5 IWT on National Waterway-1 integrated with other modes of transportation (Author)

Kolkata to Nepal: Currently all containers meant for Nepal move through Road from Kolkata to Nepal. NW1 provides an alternate route where the containers can move from Haldia or Kolkata to Nepal using combination of NW1 and rivers like Kosi or Gandak. These two rivers have also been declared as national waterways in the newly declared list of waterways creating a possibility of them getting developed along with NW1.

> *The containers are moving by road from Haldia to Nepal crossing various check posts. So these containers can be shifted to Kosi - Ganga link. These are Himalayan rivers so it is flooded at times, so they are to be maintained all round the year (Respondent).*

Cargo Types

The above freight corridors can be used to move both International as well as domestic cargo.

International Containers: The containers imported at Chennai or Vizag or Haldia can move to North India through this freight corridor providing a strong alternate to already congested route of Nhava Sheva - Delhi through Concor and Railways at this

point of time. Similarly, the export containers from North India meant for Far East can perhaps be exported through Haldia port thus cutting down transit times and transit costs. Similarly, the import containers for Nepal can be targeted through IWT mode.

Domestic containers: Concor and other private players can use the above corridors to move cargo between North India and East and South India and vice versa. This would create an alternate solution and release the stress on already congested Road and rail networks. A consolidation services can be planned, which will combine less than containers loads (LTL) shipments from various shippers and move between North and East and South and provide an alternate solution to Road based Parcel services.

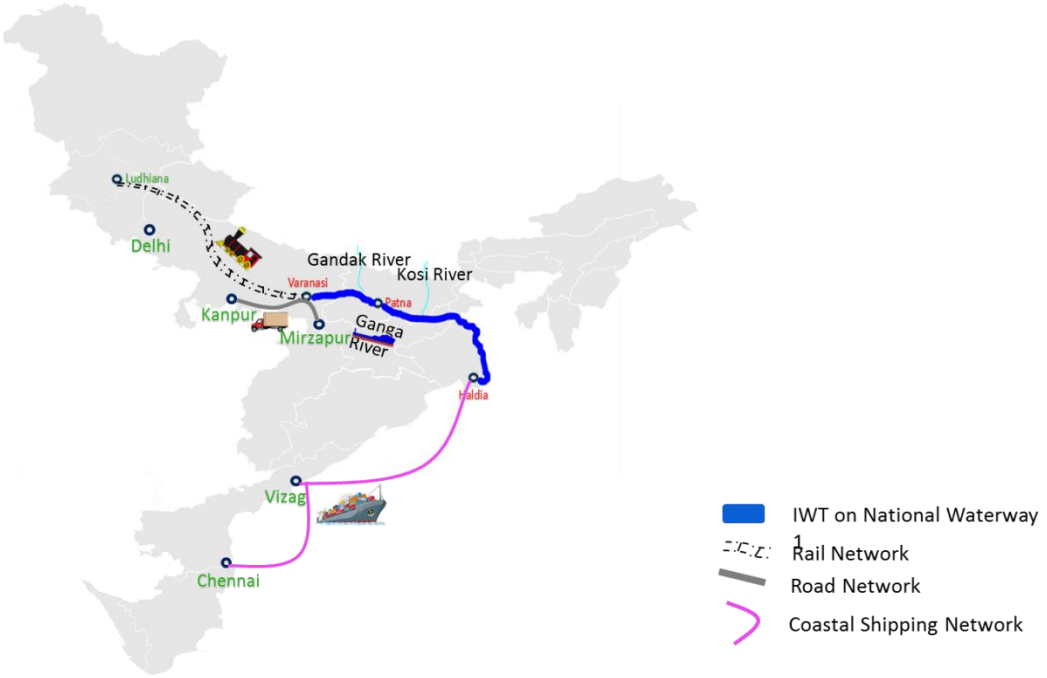


Figure 6.6 IWT on National Waterway-1 integrated with other modes of transportation (Author)

6.3 Proposition Number 2

Fill it, Shut it, Forget it. Least Available Depth

Least Available Depth (LAD) is equal to Largest Applicable Demand (LAD). LAD or the draft is the single most important problem in IWT progress in India.

The key requirements highlighted by various speakers has been:

1. **A draft of 3m is a fundamental requirement**: IWT is competitive and economically viable only if cargo vessels of capacities of at least 2000 DWT are able to navigate the waterways, moving barges of 300-600 DWT does not prove to be viable compared to competitive modes like road and rail sectors. A rail freight rake has a capacity to carry about 3000 to 3500 tonnes. To make IWT viable the barge has to have at least a capacity of 2000 tonnes. Further the channel should be wide enough to allow two-way movement of barges. However, the key requirement to run a vessel of above 2000 DWT is the Least Available Depth (LAD) of 3m for all seasons.

   > *For 2000 DWT we need 3-meter depth. But again what we can be done is to go in incremental manner. You fix a target of 2 metres for this period and then 2.5 and so on for next period. To get you have to sustain. Whatever the grade and mark you get, first you consolidate it and then try to get it. Too much experimenting will not help.*
   >
   > *If you are maintaining 3 metres then the major benefit on this will be the current vessels that we have even those can then sail. If you restrict to 2 metres then you will have to bring in new technology to sail on that. Majority vessels can go up to Farakka throughout the year. If I give you an example of JITS in which coal is moved their major vessels can go up to 2000-2200 DWT. But due to lack of water, they have to go under load.1800 is something that they load maximum in peak monsoons. But then otherwise they have to restrict themselves to max 1500-1600 tonnes. So now you can imagine the increase in cost (Respondent).*

2. **The draft has to be available round the day and round the year:** In past we have been struggling to provide draft during non-monsoon months. We cannot have a mode which does not work throughout the year. Business works round the year and so has to the case for transportation.

Because we cannot have a business which is running 3 months a year or 9 months a year. This is not viable. We need to have draft round the year (Respondent).

Further, night navigation facilities have to be there so that barges can move throughout the night and provide competitive transit times. We cannot have situation where barges move only during the day as very succinctly put it by one of the respondents:

You don't buy the car without the headlight, as you will drive only in daytime. You will drive in both day and night. Same way barge is a big investment. You have to use it day and night. NW3 is 24 hrs, but NW1 has got some patches (Respondent).

3. **Alternate strategies need to be developed for development of Navigational Infrastructure**: Currently IWAI is the agency which is responsible for providing navigational infrastructure on this country. Their record has not been too great in providing consistent LAD. We need to look for alternatives which could be even in the form of private sector participation in maintaining waterways.

There is a distrust with IWAI that 3m draft indicated is actually not possible for them to give. I would recommend to give it to Private sector and make them accountable to provide the same all-round the year. Have penalties imposed on them for non-compliance of the same. Similarly introduce incentives for maintenance of the same and have monthly payment structure. River training programmes can help a lot (Respondent).

6.4 Proposition Number 3

Plug the hole, look at the whole

The groom for this entire IWT system is finally the shipper. Unless and until he is convinced about this mode and solution, nothing will work. While designing the

entire IWT solution we have to keep the requirement of shipper in mind. His needs are paramount in any solution we propose.

The salient points which emerged from discussion with various respondents and shippers:

1. **IWT solution has to be looked from holistic point of view**: Shippers indicated that waterway being cheapest mode does not make it cheapest for them. One need to combine the costs of a. First Mile and Last Mile costs b. The Terminal handling costs c. The cost of extra transit and thus inventory cost to arrive at final cost. The final cost may be lower or higher than existing competitive mode of transport.

   When we are comparing costs we should not just look at Waterway cost but end to end cost from point A to point B. IWAI should provide logistics solution and not just IWT solution. We should look at complete customer supply chain and map our solutions rather than just looking at part of his cost (Respondent).

2. **IWT mode can be used as a supplementary or additional mode**: Shippers indicated that they are using Road and Rail as their primary mode of transportation. However, there could instances when something goes wrong with these modes. In such scenarios IWT as a supplementary mode could be a great advantage.

   Yes, main corridor will be the one which gives an optimum cost and optimum lead time. As a backup or a secondary corridor we can definitely look into alternatives. However, secondary corridor should offer me competitive, if not exactly replicable like the first corridor, cost and lead times (Respondent).

   The challenges are associated with the mode of transport we use which probably is relevant here to discuss because we are dependent on rail to bring the cargo to Dadri either on Rail or on the road transportation. Road transportation has its own challenges in terms of

seasons, breakdown, availability, also cost is an issue. Rail may be cheaper than road but then rail also at times and during season in particular can be inconsistent. There is congestion built up at port, movement not happening, in holiday seasons engines not available, these kind of challenges can push up the transit times. But if we have a third source against this road and rail which may be waterways and I personally feel that restriction or challenges of seasons and availability or lead time however will be much lesser in IWT over other modes (Respondent).

3. **Marketing of IWT mode to shippers**: The awareness of this mode among shippers is not every high at this point of time. However, it was felt that there is no need to do a formal marketing campaign to create awareness for this sector. All that needs to be done is to create a strong IWT solution. If a solution exists, Industry will catch it on its own.

   If the Govt provide the facilities, develop terminals and start functioning shippers will come. Firstly, when CONCOR started, what was the awareness. Similarly start the facility, people see benefits and automatically start coming in. Industry is very quick to catch on trends which work. Industry is not going to be falling behind you. The customer is not going to be stumbling block here (Respondent).

   Who created the Goa waterways? There was requirement, cargo was there, system was there and hence waterway was made. Govt involvement was not there (Respondent).

4. **Considerations which shippers have in choosing a mode**: Shippers have several considerations in choosing a unimodal or an intermodal solution for their transportation requirements. Cost is undeniably important. However, transit time is an equally important consideration. Shippers are very particular about the safety of their cargo during transit.

   For the person responsible for the movement of goods, cost is of course one important factor, second is then transit time because we

are mainly in telecom sector and their time is very critical. Logistics comes to the last leg of whole process. So whatever the delay is there it comes to logistics and then people expect it should happen overnight. Transit time is equally important and then third is the safety of the goods. Almost 65% of our raw material is imported. If there is damage in transit, there is not only the hassle of insurance claims but bigger loss is time and opportunity. It is so difficult to re-manufacture and procure from overseas again (Respondent).

Beside above there could be other considerations for shippers like ease of using a mode. Too many documentation and regulations can hamper the usage. IWT at several places still constrained with large documentation requirements.

6.5 Proposition Number 4

Terminal is not the end; it is the start.

Terminal is where the IWT world connects to rest of the world. Terminals are the **points of interchange** which insure a continuity of the flows. Terminal are locations where freight either originates, terminates, or is handled in the transportation process. Terminals are central and intermediate locations in the movements of freight. They require specific facilities and equipment to accommodate the cargo they handle.

In the current study three types of terminals were suggested by respondents based on the location and requirement:

Bimodal Terminal: A bimodal terminal links river operation to hinterland by road. These kind of terminal have the advantage of limited investments and has a potential of larger presence in every corner of the waterway network. The respondents indicated that bimodal terminal should be close to the National or State Highway with a connectivity of at least 4 lanes road.

Trimodal Terminal: Trimodal terminal links Waterways to Rail along with Road. Trimodal terminals are attempted in European Waterway network. An ideal

Trimodal terminal should allow the movement of container from one environment friendly mode of Rail to another without the use of road transport, as indicated by a respondent:

> *IWT Terminal should have full rail sidings which are located very near to the banks so that transfer are possible from rail to vessels and vice versa (Respondent).*

In this study such terminals are being suggested at strategic locations such as Varanasi which will allow a connectivity of NW1 with Eastern Dedicated Freight Corridor. NW1 is limited to Allahabad. Varanasi terminal will allow the connectivity of the entire Eastern India with Northern India all the way up to Delhi and Ludhiana.

Quadmodal Terminal: Haldia offers a possibility of creating a quad model terminal with additional connectivity to Coastal shipping along with Rail and Road. This kind of terminal opens up the possibility of connecting a location in Haryana or Punjab to location in TN or Kerala through the use of four modes. The container can do the first mile by road to nearest rail terminal; Travel by Rail to Varanasi. Travel from Varanasi to Haldia via Waterway and then to Chennai by Coastal shipping and again last mile through Road.

> *We have to make a terminal at Haldia where smaller vessels can be parked. Like as of now at Haldia Berth No.5 is for North. That is designated terminal for smaller vessels. But that can only accommodate one smaller vessel at one go. Rest wherever you will see are mother vessels. So there has to be a designated area where at least you can berth 4-5 smaller vessels at one go where the transhipment or any such movement can take place (Respondent).*

Facilities at Terminals

The research indicated that the terminals need to offer far more than just piece of land and equipment's for exchange of containers. The Terminals can carry some or all of the following features:

1. **Customs**: The availability of Customs at Terminals will allow it to act as an ICD and will allow to and fro movement of Import and export containers. The

Exim containers can be brought to terminal, custom cleared and moved forward.

> *Number one, customs is very essential at all terminals irrespective whether they are getting import or export cargo. Because at some point or other, there will be import or export from each and every terminal (Respondent).*
>
> *As done for Rail, we have to duplicate the ICD model. We need ICD's near IWT (Respondent).*

2. **Empty container Yard**: Ready availability of empty containers or yard for storage can substantially enhance the usage of the terminal.

> *If you are talking about containers, then it should be both Exim as well as domestic. So all the custom facilities should be there. Empty container yard should be there. Warehousing should be there (Respondent).*

3. **Warehouses**: The availability of warehouses at terminals will allow the terminal stuffing and destuffing of containers and storage of material.

Beside the above some of the other requirements related to terminals could be in terms of availability of adequate parking facilities, Truck and Barge repair facilities, Bonded area, Scalability and others.

> *Every Terminal should have all the required facilities like warehousing, maintenance yard, consolidation & deconsolidation services, parking facilities, customs etc so that there is no stop for cargo at any point of time (Respondent).*

Terminal Ownership, Maintenance and Operations

Various possible models of terminal ownership are possible. It could be either be completely owned by Government through IWAI as well operated and managed by them.

> *If you give it fully to the Govt nothing will happen and they will leave it like that. There are so many terminals in the country if you see nothing much happening (Respondent).*

An extreme alternate could be all three activities being managed by private sector. Based on the research most of the respondents indicated that it is best that the terminal land is provided by the Government and Maintenance and Operations is done by private sector players.

> *I am of the firm view that the terminal land to be provided be the Govt, management can be given to the Private party. So party operating it should be expert, so that their objective is very clear. What will be required is the party managing should have excellent relations with railways as well as the shipping companies or the barge operators, so that they are a perfect link between the many agencies which will be involved. It is the success in managing these different agencies which will be very crucial for making this movement a regular movement (Respondent).*

6.6 Proposition Number 5

Make it Large, get me the Barge

Barge is to IWT what Truck is to Road Transportation. Barge transport operators, terminal operators and pre- and end-haulage operators execute the actual transport and handling operations.

As a country India is facing acute shortages of Barges. Even the neighbouring country of Bangladesh has higher fleet of barges then us. The public sector firm owning and managing barges, CIWTC went defunct and had to be closed down. The private sector is not too keen to invest due to inconsistent draft and cargo availability.

> *As far as vessels are concerned some waterways are economically feasible and viable, so people will buy themselves come forward put*

the money and buy the vessels. Why 400 vessels were operating on Goa waterways and why not on Ganga or Brahmaputra. People are not coming forward there but people are coming forward on Goa waterways. Goa waterways is just 32 kms only and you have 400 vessels plying whereas on 800 kms you have no vessel (Respondent).

There is an acute need to do something about the barge availability in India for IWT to thrive. The research found following recommendations made by the respondents.

1. **Availability of consistent draft of the most fundamental and non-negotiable requirement:** IWAI still does not enjoy a great confidence in the eyes of the Barge operators for their ability to provide round the year consistent draft. Unless a consistent draft is available barge investment does not become viable.

   Number one dredging and maintenance has to take place in a right manner so that companies start believing in waterways. Number two requirement is that there has to be long term contracts with parties. Personally speaking the vessel, we are intending to build, a small amount is not involved in that. It's a big amount of investment, say 10 cr. I am ready to invest 50cr in this industry if we get the promise of water from the Govt and regular cargo from the third party. Mainly if I get these 2 things, proper navigation facilities, proper infrastructure and if I get proper cargo then I can go ahead (As stated by a Barge owner).

2. **Ownership including maintenance should be with Private sector**: The experiment of Govt with CIWTC has not been too successful. The Barge ownership should remain with private sector. However, conditions need to be created where they can make money into the business.

3. **Govt need to provide subsidies or incentives to kick start the process**: Considering that Barge industry is not doing well, Government need to provide subsidies and incentives to kick start the process. The subsidies could

be in the areas of capital subsidy for building vessels or alternatively in the areas of fuel subsidies to cover running costs.

> *Barge investment is more money and there has to be some assurance but again the Govt can issue some subsidy. Already an order has come Sept 2016 to reinstate capital subsidy. The subsidy will go to vessel building Yards. You can visit website of Ministry of shipping, new order of sept 2016. 20% subsidy scheme is there. This is for vessel building (Respondent).*

4. **Target higher capacity Barges only**: There is no point in running lower capacity Barges. A 1000DWT or less sized barges do not bring the benefit of moving through IWT. In other advanced countries with developed IWT, Barge sizes are 1500 DWT and above. We need to provide adequate draft and work on deploying higher sized Barges.
5. **Explore alternates Barge Types**: We need to explore alternate technologies like Dumb Barges and RSV.

> *Barge use depends on the river characteristic also. What is the velocity and discharge in the river and what is the power required to tow it? In India dumb barges have a potential in large rivers like Brahmaputra and Ganga where you can have a chain of barges whereby you achieve better load to power ratio. Same power you can move more and they are using it when they are moving ODC cargo (Respondent).*

6.7 Proposition Number 6

Least Governance, Maximum Performance

In spite of existence of a formal body to promote IWT for over three decades, this sector has not been very successful in India. This raises several questions marks about the governance structure for IWT in India. Is this structure correct or does in need changes? In the current structure we have IWAI as apex organisation under aegis of Ministry of shipping to develop IWT in India. IWAI has been responsible for development of navigational infrastructure including the terminals. Another body of

government called CIWTC was responsible for providing barges till 2017. The role of State Governments has been minimal till date. Based on the inputs from various participants following are the key suggestions:

1. **IWAI should continue as Apex organisation**: Different countries following different structures. In China we have Ministry of Transport under which the Yangtze and Pearl Basin river commissions exist to manage IWT in these two rivers. In Europe Rhine and Danube river commissions manage these rivers. Though the respondents did question the agility and delivery of IWAI but everybody agreed with continuance of IWAI as the apex organisation. However, the respondents agreed that the focus of IWAI has to be far sharper and IWAI should not focus on non-core activities. The respondents also agreed that core area for IWAI has to be creation of and maintenance of Waterways in India.
2. **Iwai as a facilitator**: Today IWAI has been creating and maintaining Waterways, creating and maintaining terminals. CIWTC has been responsible for providing barges. The respondents suggested that Government should exit from the area of terminals and barges. They should however create environment and conditions which should facilitate larger participation of private sector into this area. If IWAI can deliver a consistent 3 meter of draft it will be the largest contribution from Government.
3. **The role of State Governments**: There are certain states which have IWT possibilities and termed as riverine states. The concept of National Highways can be applied for Waterways too where The National Government can be responsible National Waterways and State Government can be responsible for State Waterways. The respondents suggested that riverine states can have state maritime boards to manage navigation. In many of the states there is no separate body to manage navigation which is the need of the hour. An irrigation department cannot be given an additional responsibility of managing navigation. These are two different subjects and require different focus and skills to manage it.

4. **The funding requirements for IWT sector**: The funding till date for IWT sector has been meagre as compared to Rail or Road sector. As the funding has been limited, IWAI never took large projects in hands. The biggest has been Jal Vikas Project with assistance from World Bank. If we have to create one show case waterway, the funding also has to be equally provided. A showcase waterway would require lot of river training works which would need funding. The respondents felt that there is a need for Government to once spend a large amount on one showcase waterway and watch the magic of it.

6.8 Proposition Number 7

Intermodal Operator, the true Co-operator

Intermodal Operator is the one who concludes intermodal transport contracts; organises movement over different modes and accepts liability as a carrier. Shipping Lines, Freight Forwarder and NVOCC Operators usually act as Intermodal operators.

This research indicates Intermodal Operator is an extremely critical clog in the entire Intermodal transportation chain. Intermodal Operator has several roles to play in the IWT based Intermodal Transportation system:

1. **Act as face of IWT based Intermodal solution to the shipper.**

   The shipper will not directly interact with Barge owners or Road hauliers. He need an agency or a carrier who undertakes door to door service and provides a complete solution. Intermodal operators are the face to Shippers. They are the ones who contract with the shippers, provide them with solutions, pricing and tracking till delivery.

2. **Need to provide holistic solution**

   Shipper does not need a terminal to terminal solution. Two terminals on IWT network will surely not suffice his requirements. He needs a door to door solution. Intermodal operators are the ones who will interact with various modes and terminals and provide holistic solution to the shipper. Refer to

following para which indicates requirement of a complete solution by a shipper:

> *In fact if you see for a company like us where we have big chunk of total import coming from Thailand and I don't think from Bangkok to Kolkatta total transit time should be more than 5-6 days. However, if we bring it to Mumbai or Chennai it takes about 14-15 days. That additional one or two days taken by waterways can be compensated here. But for me it is from Origin port to my factory. That is my total consideration. So if all the aspects are taken into consideration and two aspects are there and 3rd aspect is taken care of I will go for it. Also being an environmental friendly company even if I have to compromise on something I am ready to go for it (Respondent).*

3. **Need to work with various operators – Rail Road, Coastal and IWT.**

Rail, Road and IWT are all modes independent modes. A barge operator is not directly talking to a Road haulier to Rail Transport company. Intermodal operators are the one who brings them together under umbrella of one solution. A barge operator, who acts like an Intermodal operator and explains how he provides complete solution to his customer to keep his Waterway service going:

> *Whenever we have a meeting with any organization, we tell them that we are ready to give last mile connectivity up to the place required because we are capable of doing that and we are willing to do that. There is lot of paperwork involved in this sector. Till now they were just sending the cargo through normal trucks, but the moment port comes in there is altogether a different set of paperwork comes in. There are different charges that you need to pay. So if they have to unload cargo from my barge and clear it, then it will be an additional headache for them. I am providing them the documentation solution as well as I am providing them first mile to last mile connectivity so that it will be much easier for them. I am giving him a complete*

logistic solution. I am not giving him just a waterway solution (Respondent – Barge Owner).

4. **Offer Bundling Services for small Shippers**.

Small shippers may not have full container loads. Intermodal operators are the ones who will combine smaller loads from various shippers and build them to container loads as one of the respondents indicated:

Container corporation is operating through business associates, who consolidate cargo received from various shippers and then they book the container. I think similar kind of things would have to come here, like freight forwarders and business associates who can approach individual customers, combine the cargo and offer it for movement by barges (Respondent).

If we want IWT to succeed in India, it is imperative to have strong Intermodal operators who are committed to this mode for long and ready to innovate and come up with customised solutions.

6.9 Proposition Number 8

"Keep it Private"

Almost all participants advocated private participation in some spheres of IWT operations. Government cannot do all the things all the times. However, the onus is with the government to create conditions which will attract private investments. Most of the participants indicated that Barge and Terminal operations are two areas who are best suited for private involvement.

You have to understand that in waterways there are 3 main components - waterway, terminals and the barges. Waterway as such is to be provided by the Govt. Don't expect much of private sector in this regard. You can have people setting up terminals and operating it, you can have people running barges. These two are the areas where private participation is possible (Respondent).

Further some kind of Government and Private partnership has been propagated by some of the speakers particularly in the areas of Terminal operations.

> *I am of the first view that the terminal on which land to be provided be the Govt, management can be given to the Private party under the build-operate and transfer model. So party operating it should be expert, so that their objective is very clear (Respondent).*

With regards to Barge operations, respondents highlighted not so successful participation of Government in Barge operations through CIWTC.

> *Second area is off course the management of barges that also according to me in long term, looking at the experience of CIWTC which has not been really a success, it would be better to develop a fleet of barge owners and operators who are efficient. In India there is shortage of barges. So if the agreement is done with the private players who can manufacture the barges and who can put the barges in the river and who can tie up with the industries for movement of this material (Respondent).*

However, all private participation can only happen if we have navigable round the year waterways. This is the most fundamental requirement. If this does not happen no private participation will happen.

> *You bring private participation by first making the rivers navigable, commercially viable size of vessels, which means vessels carrying 1000 tonnes capacity. That is the minimum. Upto 1000 tonnes you need a minimum depth of 2.5 meters; which we have only up to Patna. So we should give assured depth and then like we did in Farakka port coal transportation project. We should have some down turn commitment because bank is not going to give loan to parties who are going to buy vessels unless he has some workable project and there cannot be any workable project if there is no assured cargo (Respondent).*

Another suggestion has been to sign service level agreements and outsource the waterways maintenance to private sector. The onus will be on this party to conduct continuous dredging and de-siltation and deliver LAD as committed through the year.

> *The contracts should be like that your nature of payments and everything should be spread over a span of 5 years. Otherwise to be very frank what private parties will do they will do proper dredging first year and will give you 3 meters' draft throughout the year and after that again there will be siltation. So there has to be maintenance contracts. Every month or every quarter payment based on completion of work. In fact what I would suggest is that our aim should be to have min 3 meters draft and we should not rely on monsoons to get those 3 meters. In monsoon if we are getting 4 meters that is a benefit for us. But the 3 meters has to be constant. 3 meters including monsoon rain that's not something should be our aim (Respondent).*

6.10 Proposition Number 9

Don't be Argumentive, Offer Incentive

Most of the respondents agreed that there is a need for incentives and subsidies to kick-start this sector. Incentives can act as mother's milk for the initial growth of this sector. As they say, Incentives change the way people act towards things. Incentives indicate an encouragement or seriousness of Government towards this sector. With encouragement and a rewards system, Govt can inspire people to change things and increase adoption. Encouraging means more of a thing, discouraging results in less.

1. **Incentives on Movement**: Most of the participants propagated Kerala like model of offering incentives. Kerala offers incentive at the rate of Rs 1 per Ton per KM on movement of cargo on IWT.

   > *Yes, I think the proposed move to give Re.1 per tonne per km on anything moving on IWT mode is a welcome step (Respondent).*

2. **Subsidies for Barge Sector**: The capital subsidies for Barge procurement which existed during the 2002-07 Five Year Plan need to reinstated. Barge is a

major investment in this sector and a subsidy would really help. As one of the respondent indicated:

> *As far as my knowledge the subsidy is not there now. It will be a major boost if re-instated. See suppose if I have to make a 8 crore vessel, if I take an emi for 36 months on it , it will be almost 35 lacs. Say 32 lacs if I remember the figures correctly. Now if in 8 cr I get 30% subsidy then automatically that EMI saver comes down drastically. Now me as a private company would definitely look forward to a subsidy given by Govt and in all fair means it would be a moral boost plus a financial boost to a private company plus the risk involved will become lesser because as we all know it's a very premature industry (Respondent).*

Another option in case of Barge sector is to offer subsidy for fuel instead of capital subsidy. Fuel compromise the large part of the operating cost for Barge. A subsidy there can also reduce the cost of Barge operations.

> *Subsidize fuel. Because out of my total expense 60% is on the fuel. As you say 70% is on bunkers. So if Govt can subsidize this in any manner then it will be a major cost reduction (Respondent).*

3. **Other Areas**: Beside Movement Incentive and Barge Subsidies, respondents also indicated help in certain others areas of IWT including Income Tax benefits for people employed in this sector.

> *They can give small incentives, tax exemptions like service tax exemption or excise duty exemption or trade tax benefits etc. So that people are encouraged towards IWT (Respondent).*

> *We have 1400 ships in India with a total of 21000 MT freight. So we have an average of 700 MT freight. That's it. This is total all over India we are talking about. So why to build in everything here. Use Global resources. Bring in duty free import. Give Tax Exemption. One of the biggest drawback of coastal shipping is we treat them as domestic employees. Incentivise the finest people to get into IWT. Permit all*

equipment's of IWT under duty free import including all navigational aids, signalling system to track ships etc (Respondent).

Most of respondents also indicated that incentives and subsidies should be clearly defined, should have a fixed time duration, should not be randomly withdrawn and should be easy to implement.

6.11 Proposition Number 10

Impart Soft and Hard skill, succeed he will. Skill Development

Like any other sector, Skill Development is critical for development of IWT sector in India. skill building is an important instrument to increase the efficacy and quality of manpower for improved productivity and growth of Waterways in India.

The National Inland Navigation Institute (NINI) has been set up by Inland Waterways Authority of India (IWAI)at Patna, Bihar in February 2004 with a view to develop human resource for the Inland Water Transport sector including development, maintenance and management of waterways.

The interactions with the respondents indicated that as far skill development for IWT sector is concerned:

1. **Start Regional Training Centres**: One NINI is not sufficient, we need many more training institutes at various state levels to sustain growth of IWT sector.

   But it is sufficient only because IWT is very small. When IWT will really grow then NINI itself will not be sufficient. Our vision with NINI was to be just an apex body like IWAI. IWT is not self-sufficient unless state Govt really wants to participate. So we had a vision that along with NINI we should have State Crew Training Centre in all important states. Every important IWT state like Goa, West Bengal, Maharashtra should have 4-5 training crew centres under NINI. Some connectivity should be there or all of them should be there under Indian Maritime University. That vision was there and that also will come into picture when our sector enlarges. But yes provision is NINI at the apex body - the guiding force, at the centre (Respondent).

2. **Provide Wider Curriculum**: What is being taught at NINI is about river engineering and Waterways management. However, there are several other aspects of IWT which also need training. This could be around Management and commercial aspects – Financial, Sales and Marketing of IWT services. It could be around Technology aspects of IWT – RIS and other systems.

> *It is dredging, river engineering, river training, it can also be other aspects of navigation like RIS, then the commercial aspects, maintenance aspects, environmental aspects. Everything all-encompassing course should be there. NINI is giving more of a crew level training. It is not that B.Tech graduates or somebody going for training. You will know this when you go to different offices and talk to the people. You will not find much people in India with comprehensive knowledge of the subject. People may have specific knowledge, not comprehensive knowledge. India is such a large country. You don't manage with 5 consultants and 20 engineers. If you look at NTPC. Thousands of engineers are there who are very good in power production and distribution. Railways etc. So this is also PAN India business. So this is one big area which is missing (Respondent).*

Conclusion

"If there is water and if there is fish in it people will catch it. You don't have to tell people to go there and do fishing".

"Industry is very quick to catch on trends which work."

The above two statements from two participants capture the gist of the findings. As a country India need a fully functional showcase waterway. A waterway which operate twenty-four, through the year, carries a depth of 3 meters at least and has a distance enough to make an impact. The day we are able to do this, all other things will fall in place and the IWT magic in India begins….

Chapter 7

Results, Conclusions and Recommendations

We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time.
--T. S. Eliot, 'Little Gidding'

(Denzin and Lincoln, 2009) reported which the conclusion of a research like this does mean the final word, but a pause just to take a breath. This particular analysis provides a grounded concept of making an IWT based intermodal transportation system and in so doing provides insight as to just how IWT mode may be integrated with other modes of transport. This last chapter spotlights on what has been key outcomes of the study and how these conclusions are addressing the main research goal.

The aim of this last chapter to conclude the analysis and highlighting the results of this research towards the main objective of the study. Research Questions and research Objectives as reported in Chapter four are revisited. The methodological and theoretical contributions of this particular study is highlighted in Section 7.4. Shortcomings of this particular study are established in Section 7.6, and the directions for future exploration are suggested in Section 7.7.

7.1 Research Summary

This chapters sums up the findings of the study. This research set out to meet the twin objectives of -

a) To identify various factors which will enable Inland Waterways based Intermodal Transportation system
b) To develop a conceptual framework for Inland Waterways based Intermodal Transportation system in India.

The study also attempted to address the research problem originating from the theory underpinning this research. The study identifies the key factors and suggest a conceptual framework for an IWT based Intermodal Transportation System. The framework though developed with Indian context can be universally applied for any IWT based Intermodal Transportation System.

7.2 Addressing Research Questions

This particular analysis set out to answer specific research questions. The following research questions guided this grounded theory research:

1. What are the factors which enable integrating Inland Waterways with other modes of transportation?

2. How to create Inland Waterways based Intermodal Transportation system in India?

Research Question one: What are the factors which enable integrating Inland Waterways with other modes of transportation?

The first research question addresses the variables which impact the integration of IWT with other modes of transport. Participants discussed various factors which allow IWT to work efficiently in India and enable its integration with other modes. Following is the summary of factors identified from this research.

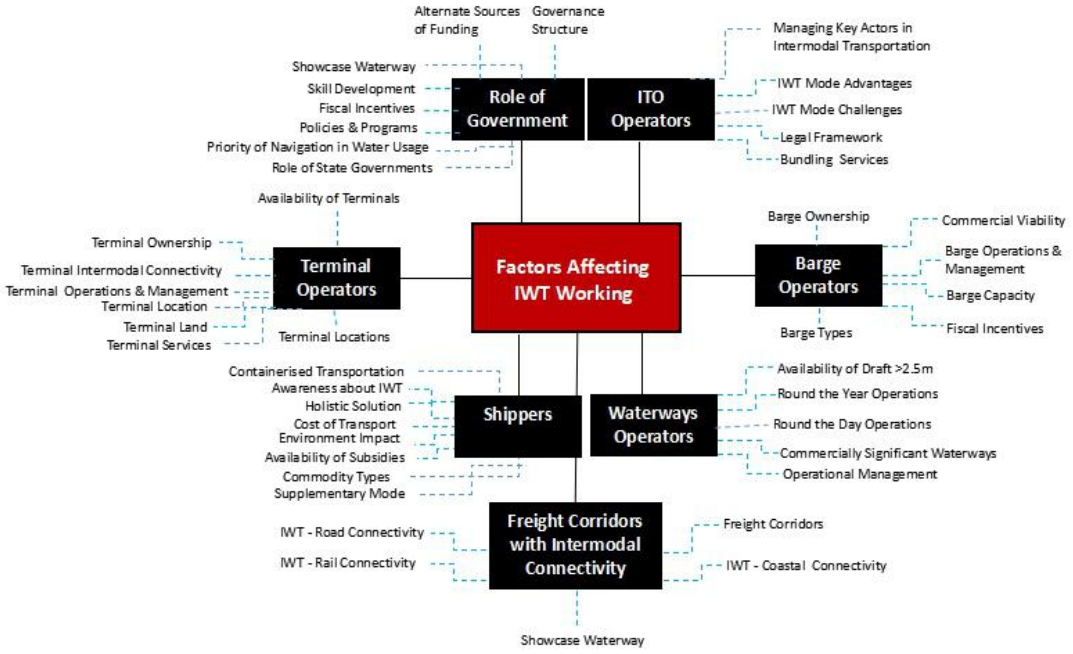


Figure 7.1 : The factors enabling integrating Inland waterways with other modes of Transport (Author)

The factors as they emerged from initial conceptual chart and later with the discussion with various participants were bucketed into seven categories.

1. **Barge Operations**: These set of factors indicated what is required to create a pool of and run an efficient barge system barges in India. The factors identified were around who should own, operate and manage the Barges. The size, types and capacities of the Barges and incentives required from the Govt to run the barges. The final list of factors which emerged under this heading are as under:

Head	Factors
Barge Operations	Commercial Viability
	Barge Ownership
	Barge Operations and Management
	Barge Capacity
	Barge Types
	Fiscal Incentives

Table 7.1 The factors enabling integrating Inland waterways with other modes of Transport – Barge Operations (Author)

2. **Terminal Operations**: Terminals are critical clog in the entire Intermodal Transportation System. These group of factors point towards set of requirements to create a network of IWT terminals in India. The factors were around who should own, operate and manage the Terminals. Who should provide Land for the Terminals. What kind of services should be available at the Terminals? Ideal locations for Terminals in India. The final list of factors which emerged under this heading are as under:

Head	Factors
Terminal Operations	Terminal Intermodal Connectivity
	Terminal Ownership
	Terminal Operations and Management
	Terminal Land
	Terminal Services
	Terminal Locations

Table 7.2 The factors enabling integrating Inland waterways with other modes of Transport – Terminal Operations (Author)

3. **Role of Government**: All participants highlighted the key role which Government needs to play to kick start the IWT in India. The factors identified were around the Governance Structure to manage IWT in India. The role of State Government in developing IWT. What kind of policies, programs and incentives Government needs to run? The priority of IWT in Government scheme of things. The funding for development of this sector. The final list of factors which emerged under this heading are as under:

Head	Factors
Government	Governance Structure
	Skill Development

	Alternate sources of Funding
	Fiscal Incentives
	Policies and Programs
	Showcase Waterway
	Priority of Navigation in Water Usage
	Role of State Governments

Table 7.3 The factors enabling integrating Inland waterways with other modes of Transport – Role of Government (Author)

4. **Shippers Service Requirements**: Consignors and Consignees are finally the user of these services. There needs to be paramount in designing any solution. The factors identified under this head were around how to create awareness among user about IWT. What kind of considerations they have in choosing a mode of transport? What kind of commodities suit this mode? The impact of offering subsidies or incentives to shippers to use this mode. The final list of factors which emerged under this heading are as under:

Head	Factors
Shipper	Awareness about IWT
	Holistic Solution
	Cost of Transport
	Environment Impact
	Availability of Subsidies
	Supplementary Mode
	Commodity Types
	Containerized Transportation

Table 7.4 The factors enabling integrating Inland waterways with other modes of Transport – Shipper Service Requirements (Author)

5. **Navigational Infrastructure**: This is a critical requirement for success of IWT in India. Without a minimum draft available through the year, this mode will not succeed. The factors identified under this head were around who should

manage and develop waterways. What is the minimum draft required? The requirement for creation of showcase Waterway in India. The final list of factors which emerged under this heading are as under:

Head	Factors
Waterway Operations	Availability of Draft > 2.5 m
	Round the Year Operations
	Round the Day Operations
	Commercially Significant Waterways
	Operational Management

Table 7.5 The factors enabling integrating Inland waterways with other modes of Transport – Navigational Infrastructure (Author)

6. **Intermodal Transport Operators (ITO)** : They are the ones who combine various modes and create a seamless solution for the shippers. The factors identified under this head were around whom Intermodal Transport Operators should be managing to provide a holistic service. The legal framework around which they can operate. IWT advantages and disadvantages should consider in designing a solution. The bundling they can offer beside the Full Container loads. The final list of factors which emerged under this heading are as under:

Head	Factors
Intermodal Transport Operators	Managing Key Actors in Intermodal Transportation
	IWT Mode Advantages
	IWT Mode Challenges
	Legal Framework
	Bundling Services

Table 7.6 The factors enabling integrating Inland waterways with other modes of Transport – Intermodal Transport Operators (Author)

7. **Freight Corridors with Intermodal Connectivity**: This head specifies the need to identify the corridors to run IWT based Intermodal Transportation System.

This head also designates factors required to create Intermodal Transportation System through connectivity among various modes. The final list of factors which emerged under this heading are as under:

Head	Factors
Freight Corridors with Intermodal Connectivity	IWT - Road Connectivity
	IWT - Rail Connectivity
	IWT - Coastal Connectivity
	Freight Corridors
	Showcase Waterway

Table 7.7 The factors enabling integrating Inland waterways with other modes of Transport – Freight Corridors with Intermodal Connectivity (Author)

Research Question two: How to create Inland Waterways based Intermodal Transportation system in India?

Based on research conducted, researcher came up with the following conceptual framework to implement Intermodal Transportation system in India.

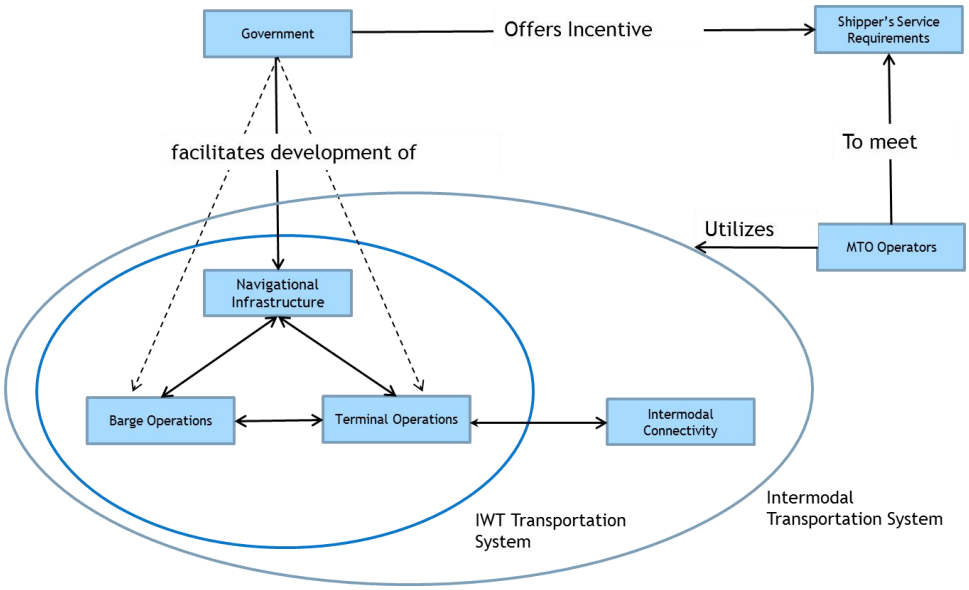


Figure 7.2 Conceptual Framework for Intermodal Transportation System (Author)

At the centre of the framework is the IWT Transportation system which includes Barge operations, Terminal Operations and Navigational Infrastructure as its key sub systems. All the sub systems are interacting with each other and together they are forming a complete system. Barges need LAD or adequate navigational infrastructure to operate. Terminals are required for Barges to load and unload cargo. Ideal locations are identified to build terminals during the course of river flow.

When this IWT Transportation system combines with other modes like Road, Rail or Coastal shipping it forms an Intermodal Transportation System. The connectivity with other modes are built at the terminals which could be bimodal, trimodal or even quadmodal. IWT is not an independent mode and by its nature and hence needs Roadways for first-mile till last-mile connectivity. Beside the Road connectivity with IWT can be built with Rail and Coastal shipping. Connectivity of IWT with Air may be not be practically feasible.

Intermodal Transport Operators is the entity which utilizes the Intermodal Transportation System to meet the logistics requirements of the shippers. He is one who is interacting with road hauliers, Barge operators, Train operators and Terminals to create a comprehensive solution for the shippers. He manages the rate contracts, service level agreements and documentation of various modes and terminals to provide one single rate and documentation to the shipper.

Shippers and consignees are ones who are user of these services and systems. Shippers have various requirements from transportation cost, transit time, carbon footprint, percentage of damages, safety of the cargo, reliability and capacity of services to ease of using the service. All the factors are evaluated in choosing a transportation solution. The Intermodal needs to ensure that the solution he is submitting is meeting shippers need on these parameters.

An important piece of this entire puzzle is the Government. Their role is critical in Intermodal Transportation System. Government has several parts to play. The basic

and most important is to develop and maintain Waterways. The second is build terminals or create an eco-system which allows private sector to participate in the Barge and Terminal operations. Thirdly they need to offer incentives to shippers and operators to attract them to this mode.

7.3 Research Problem

At the beginning of research, the researcher set a research problem which this study needs to address. General Systems Theory was the guiding light for this entire research. The area of the General Systems Theory which this study identified and tried to address is as under:

'The orderly and coordinated development of various elements of system elements will lead to total function of the system'.

In chapter 3 we studied that System has 9 main characteristics – Components (Sub-systems),Input, Output, Inter-relationships, Interface, Boundary, Constraints Purpose, and Environment.

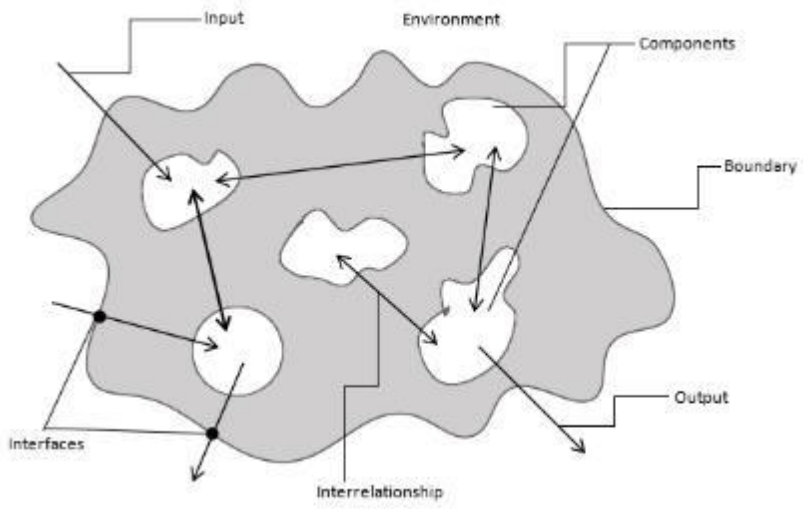


Figure 7.3 Characteristics of a typical System (Author)

In case of Intermodal Transportation System, the various characteristics of the system can be identified as under:

1	Components	Also known as sub system, in case of Intermodal Transportation System, the components are Barge Operations, Terminals Operations, Navigational Infrastructure.
2	Interrelationships	The sub systems are interrelated to each other. Barges need adequate draft to travel and terminals to load and unload the cargo. The Terminals are created on river banks to connect rivers to rest of the world.
3	Boundary	The boundary of this system would start at shipper's door when the container is loaded and released. The boundary will end when the container is destuffed at consignee end or at an warehouse at a terminal.
4	Purpose	The objective of this intermodal system is to safely transport the cargo from shipper to consignee with zero damage in least possible time and cost.
5	Environment	This Intermodal Transportation System is affected by several factors like Government Policies, Legal Framework, Fuel Prices, Interest Rates etc.
6	Input	The inputs which goes into building a IWT based Intermodal Transportation System are Rivers and Canals, Land for Terminals, IWT Barges, Rail, Road, Coastal Network.
7	Output	The output from this system is Transported Container, Cost of Transport, Carbon Footprint and Transit Time
8	Interface	The Intermodal Transportation System interfaces with its environment at several places like fuel for barges, documentation requirement for movement, the priority for water usage.
9	Constraints	Constraints in case of IWT based Intermodal Transportation System could be in the form of low priority of rivers for navigation, no bank funding available or limited draft

		available or low height bridges on the rivers.

Table 7.8 Characteristics of an Intermodal Transportation System (Author)

Based on the above following IWT based Intermodal Transportation System was drawn.

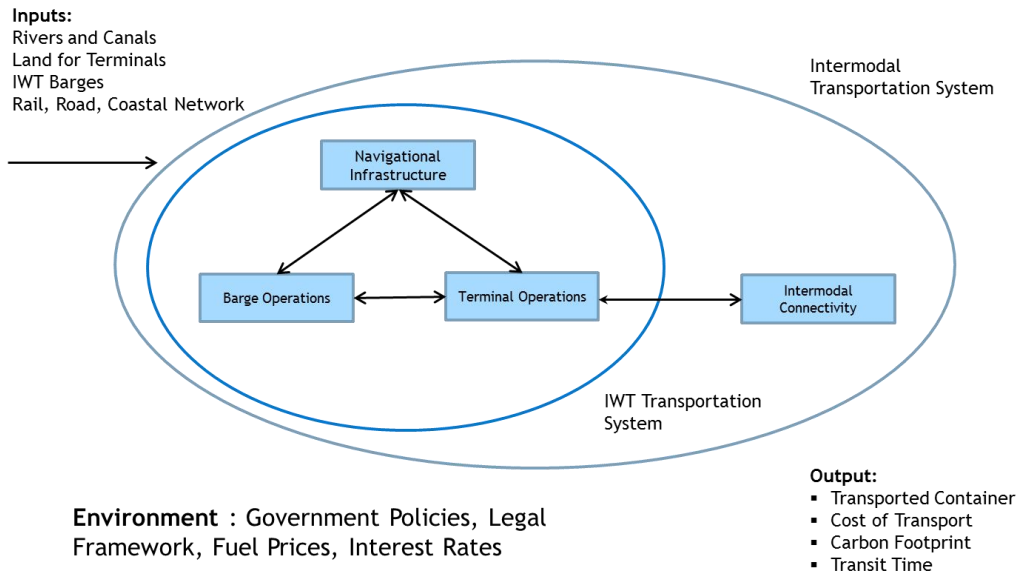


Figure 7.4 A System's view of Intermodal Transportation (Author)

System diagnosis - In spite of existence of this system in India for over three decades the share of IWT in total transportation has been meagre. Obviously some part of the system is constrained causing this disappointing performance.

Based on inputs from various respondents and the grounded theory, the study found that the key component which is causing sickness to entire system is the navigational infrastructure. It is due to lack of this component, barges are not being deployed, the shippers are not getting attracted and finally the share remains abysmally low.

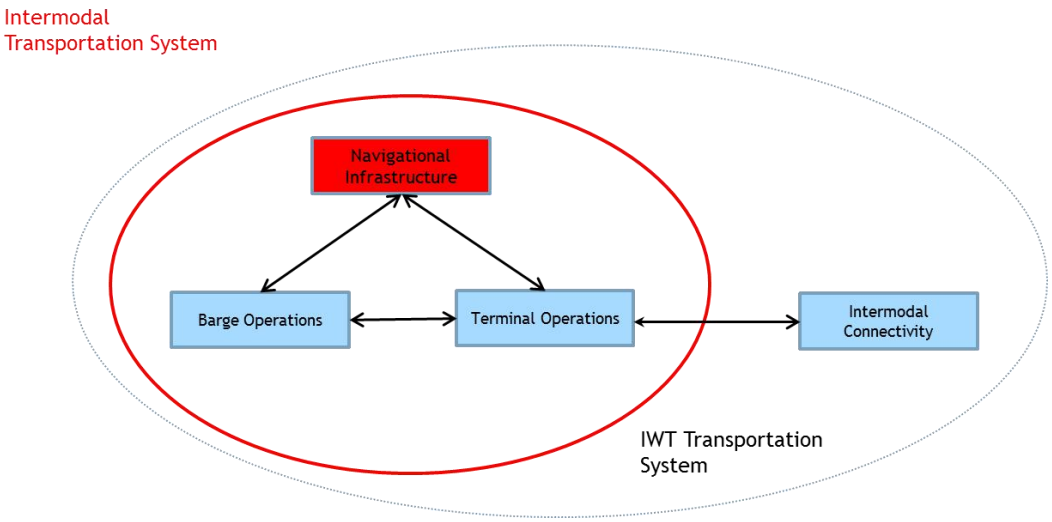


Figure 7.5 Diagnosis of Intermodal Transportation System in India (Author)

System Interventions

The key and foremost intervention required to correct the system is to correct the sub system of navigational infrastructure. Unless that happens nothing else will function. This intervention can be followed by other interventions like, with creating Barge population by providing commercial viability and incentives, building Terminal network at right locations with right infrastructure and creating connectivity with other modes of transport.

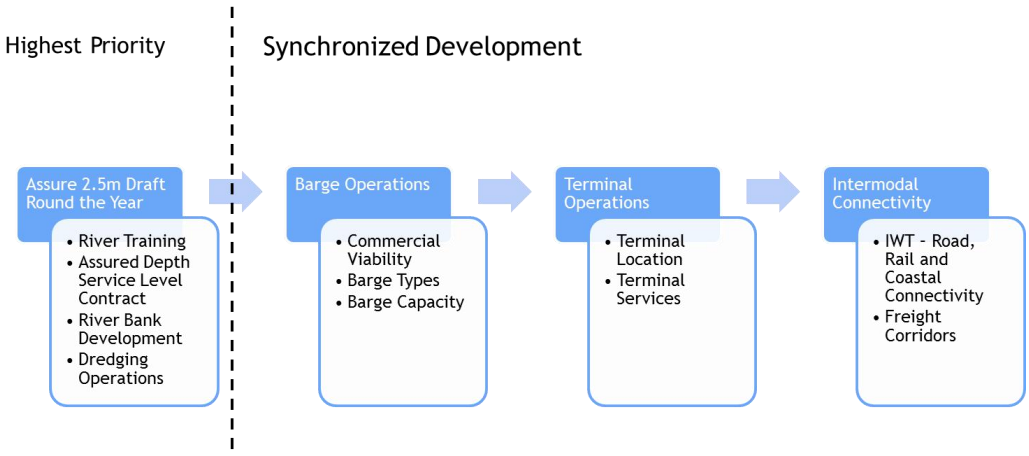


Figure 7.6 Interventions required to correct Intermodal Transportation System in India (Author)

The study proves that:

- There exists a coupling mechanism among sub-systems.
- The sub-systems promote and restrict each other.
- Interactions of the parts is not static and constant but dynamic processes.

and thus

"The orderly and coordinated development of Navigational Infrastructure, Barge Operations, Terminal Operations and Intermodal Connectivity will lead to IWT based Intermodal system meeting Shipper's service requirements."

and hence addressing the research problem of

'The orderly and coordinated development of various elements of system elements will lead to total function of the system'.

7.4 Theoretical and Practical Outcomes of the Study

Theoretical Benefaction

The theoretical offerings of this study include an addition to General Systems Theory by applying it in the field of intermodal transportation and showcasing its usefulness beyond the Medical Sciences and Biology where the theory has its roots. The proposed conceptual model of Intermodal Transportation, attempts to explain the relationship among various sub-systems of the system and level of interaction with external environment. The model can be summed as an augmentation to the limited number of models and frameworks available in the literature in the area of Intermodal Transportation.

There are several tenets which guide Systems Theory. This research identified one such tenet as research problem for this study. The study examined this tenet through the research process and finally substantiated this tenet. This dissertation is a contribution to the aforesaid tenet of the General Systems Theory.

Grounded Theory as a methodology is not common in the area of Logistics and Supply Chain system. This study's use of Grounded Theory for analysis of data and

building a theory may be regarded as methodological contribution in the field of SCM.

The main goal of GT technique is exploring, in order to expand as well as to increase insight and understanding regarding a phenomenon with efforts to create theory from empirical information. The field of Supply chain management generally, and in Intermodal transportation particularly, is recognized by restricted current theories and understanding, this particular strategy appears to be highly appropriate. Grounded Theory is found to be most appropriate when there is a lack of consistent terminology, absence of a single characterization and limited insights about the phenomenon. This particular study has contributed to broader application of the technique in the area of logistics/ SCM and contributed to building theoretical ideas, alternative frameworks & empirical models.

Practical contributions

In spite of its existence for many decades, the share of IWT in Indian transportation pie still remains miniscule.

The Goal of this research was to **Create a Conceptual Framework in Integrating Inland Waterways with Other Modes to Create an Intermodal Transportation System in India.** This research provides set of suggestions and a conceptual model to Government of India and practitioners of IWT in India to integrate IWT with other modes and create a robust and sustaining Intermodal Transportation system.

The effort reveals facets of the phenomenon of IWT based Intermodal Transportation System which haven't been previously been explored and offers new insights to earlier understandings. Findings have the potential to be looked at in other countries also. Theorising entailed engaging with the experts as well as the studied occurrence and of building abstract understandings about IWT based Intermodal Transportation System. The resulting hypothesis is actually a meaningful idea that elaborates understanding of IWT as well as the assimilation of its with many other modes.

With its smaller contribution, IWT is little researched subject in India. This research augments the research efforts in the area of IWT in India. IWT is universally acknowledged as the most environment friendly and cost effective mode of transportation. IWT mode definitely deserves a much larger share in the Indian transportation market and larger share of research efforts.

In India, IWT as a mode has been predominantly used for transportation of bulk and ODC cargo. This research provides framework for promoting containerised transportation on IWT.

This research identifies freight corridors from North to East and North to South which can be connected using the IWT and provide alternate solutions to already congested and over utilised Road and Rail networks.

This particular research offers an extensive list of variables to be looked at in integrating IWT with others modes for an Intermodal Transportation System. This particular summary of elements might be extended as well as utilized at every other state and context. The significance of the list is actually in the comprehensiveness of its - different contextual variables have been previously studied in relation to intermodal transportation, though the outcomes are usually fragmented when the emphasis of research commonly lies on limited number of variables.

7.5 Validity of the research

Quantitative and Qualitative are two broad methodical choices available to any researcher. As discussed in chapter four, qualitative methodology was found to be applicable to this research as it was exploratory in nature and sought answers where not much research has been done in the past.

Qualitative research is guided by data which could be interpretative, subjective or contextual in nature, whereas quantitative methods seek to exclude any such

elements. Thus, level of validity and reliability rigor that can be applied to quantitative study may not be possible for qualitative study (Strauss & Corbin, 1998). Thus to address this concern, qualitative researchers have tried to develop validity measurement techniques in line with the qualitative process (Maxwell, 1992).

Joseph A. Maxwell (1992) created 5 parameters to examine the validity of qualitative hypothesis: descriptive validity, theoretical validity, interpretive validity, generalizability, and evaluative legitimacy. Though different quantitative researchers have created different parameters to ascertain validity in quantitative research, the researcher found that Maxwell's five classifications as most appropriate.

7.5.1 Descriptive Validity

Descriptive validity alludes to the precision of the information (Maxwell, 1992). The information should precisely reflect what the member has said or done. What is being watched and experienced must be precisely portrayed. The detailing of the information must mirror a similar precision, the interpretation ought to be an exact record of information disclosed and the way in which it was said including the stress and pitch of member's discourse. Descriptive validity would be questionable, if different researchers compiled different data of the same proceedings and occurrences (Maxwell, 1992). This validity forms the base of any research, if the formative data is inaccurate, everything else becomes irrelevant.

Descriptive 'validity' is done in the primary phase of research, amid information gathering and translation. In the current research the analyst ensured descriptive validity through following measures:

- All meetings were audio recorded except two. Every one of the respondents agreed for audio recording with the exception of two members.
- The researcher conducted all interviews through personal one to one meeting and not through telephone or email.

- Though the interview was voice recorded, the researcher also still took hand notes. This allowed to label the salient points which participants highlighted during their speech.
- All interviews were transcribed later. In order to build the credibility of the information collected the recordings were heard and re-heard and the transcribed notes were matched with the recorded data.
- During the interview, researcher collected several hand written notes. These were compared with transcriptions to ensure factual accuracy. The transcribed interviews were used for data analysis and coding purposes.
- The participants were re-contacted in case of any clarifications sought.

7.5.2 Interpretive Validity

"Interpretive Validity" catches how accurately the researcher reports the respondents' sense of incidents, objects and conducts (Maxwell, 1992). The aim is to ensure that the data gathered and the transcriptions reflect respondents' view and not researcher's interpretation. This Validity is innately a matter of surmising from the actions and words of members in the circumstances examined. For the researcher to guarantee an exact assessment of the demonstration he needs to search for pieces of information in the transcript or in non-verbal communication. This validity is also termed as 'conformability' and 'justifiability'.

In the current research the researcher guaranteed interpretive validity through after measures:

- The context of the discussion was sent to respondent for check and endorsement before the interview.
- The researcher included the key themes said by the participants in his transcript. One of the participant was very emphatic on the role of the government and their failure to develop IWT in India. The participant expressed Government role with lot of frustration and anger. In one other interview, participant was very keen not to look at IWT in isolation but to look at the whole in a holistic fashion.

- The researcher did not guide the participants to respond in any specific manner. The participants were free to express what they wanted to say and were not encouraged in any fashion.
- The theoretical framework for intermodal transportation was created in a conceptual way making use of the interviewees' perspectives on IWT.

7.5.3 Theoretical Validity

As compared to interpretive and descriptive validities, theoretical validity is more abstract concept. This validity travels past the obvious and addresses the constructs and concepts which researcher develops during study (Maxwell, 1992). For the given phenomena, theoretical validity targets to appraise the theorized relationships among the concepts and the validity of researchers' constructs.

This validity is also named as 'coherence'. Dimensions, properties, categories, constructs and the patterns should fit in manner to produce the concepts to express to the story of the phenomena.

For instance, if an information emerges that showcases a year by year fall in market share of a business but the researcher theorizes that loss of market share is actually because of low motivation amounts of the workers. Subsequently the researcher must be in a position to create facts which supports the theory of his, if not then they've failed to' fit' the concept to the present information.

The theoretical validity of the analysis was evaluated by evaluating how the framework built in this particular study compares with studies of similar nature. Two similar studies of building conceptual models in the areas of IWT and Intermodal Transportation were applied.

The model shown in figure 7.7, is illustrating the components which comprise an ideal inland waterways system. (Islam El Nakib and Charles Roberts, 2015) proposed this conceptual model which shows the set of components which determine the

presence of an ideal inland waterways system. It showcases the balance between the various components to create the ideal IWT system. For example, a nation can easily manage its operational aspects, strategies and logistics to build its inland waterways program but on the other hand, a nation can't easily influence the international conventions associated with its drinking water resources particularly in case it's shared with various other nations. Thus, the model suggests a selection of uncontrollable and controllable components, an ideal inland waterways product can continue to exist by balancing the connection of the components (Islam El Nakib and Charles Roberts, 2015).

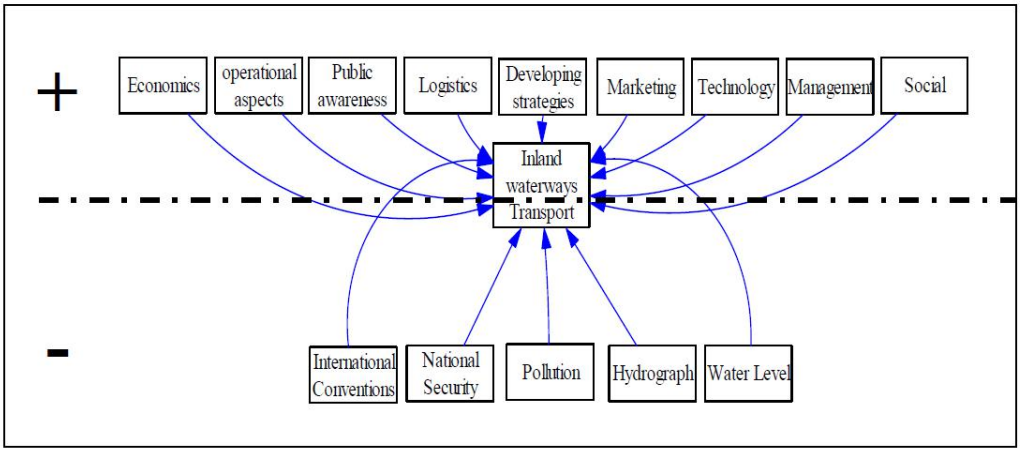


Figure 7.7 A conceptual model of elements of ideal Inland Waterways System (Islam El-Nakib and Charles Roberts, 2015)

This model proposes similar to findings in this research. Water level, Hydrography, Management and Operational aspects in the form of Navigational Infrastructure affect IWT. Similarly, Government intervention through International Conventions, National Security and Economics. Management help to Market and create public awareness to Shippers, the users of the IWT.

The following figure (7.8), indicates the Intermodal Transportation System using Rail, Road and IWT. It shows a set of seven terminals connected through various modes of transport. Some of the terminals like terminal 3 are bimodal with IWT and Road connectivity. Some other nodes or terminals like terminal 1 are trimodal with Rail, Road and Waterway connectivity.

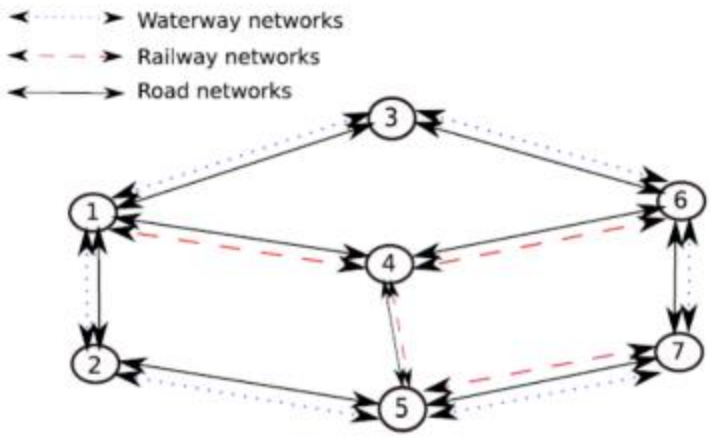


Figure 7.8 A general framework for modelling intermodal transport networks (Le Li MSc, Dr. Rudy R. Negenborn, Prof. dr. ir. Bart De Schutter)

The above framework suggested above is in congruence with what is being suggested in this study. We have set of bimodal and trimodal terminals connecting Road, Rail and IWT together.

Thus the emerging model from this research are consistent with similar efforts on this subject.

7.5.4 External Validity or Generalizability

Qualitative study results in a theory. The ability to apply the resulting theory universally is called 'Generalizability'. This validity is also termed as 'transferability'. During sampling process, the findings from sampled members of any experiment or survey are generalized and applied to wider population. Such generalization of findings is possible to the entire population, only if the members have been chosen randomly. In case of quantitative research, one of the most frequent tests of validity, is the ability of the findings to be applied to wider group and situations.

Generalizability in case of qualitative research is a challenge. As Qualitative research is dependent on the views and characteristics of a selected group, its findings may be applicable only to a similar group and may not be universally applicable. Purposeful

sampling, as practiced in qualitative research, identifies participants who can provide necessary knowledge on the subject under study, to comprehend the phenomena and develop a theory (Maxwell, 1992).

Grounded research provides two levels of theory – abstract and specific-to-the-situation. Maxwell (1992) names external generalizability to the theoretical or abstract level and internal generalizability to the specific to a circumstance. Repetitive themes and patterns which are applicable to similar situations produce internal generalizability. However, every circumstance carries unique characteristics which might affect the applicability of the theory. At an abstract level, the theory is far more holistic in nature and the constructs can be widely applied.

In the current research, a set of ten prepositions have been made, factors have been identified to integrate IWT with other modes of transport and a conceptual framework has been developed. The set of prepositions made are more specific to India and may be more relevant and applicable to circumstances and situation prevailing in India. These are internal generalisations emerging from this study.

The factors identified to integrate IWT with other modes of transport and a conceptual framework for IWT based Intermodal Transportation System are abstract concepts and can be universally applied to various countries and situations.

7.5.5 Evaluative Validity

"Evaluative validity" distances itself from the data and efforts to assess the appropriateness of the assessments drawn by the researcher (Maxwell, 1992). These validity checks of the findings of the study are based on the data and not researcher's own interpretations. As an example, a researcher studying an organization may draw a conclusion about steep loss in profit to market conditions. This may be based on researchers own comprehension of the situation and may not be backed by data collected, this failing to meet evaluative validity.

In the current research evaluative validity was ensured through following measures:

- Evaluative validity was ensured by closely observing the coding process during the data analysis part of the research.
- Process for coding interview was as per procedures.
- Additionally, instead of relying on manual process, Nvivo was extensively used for coding hence the idea-themes and relationship-patterns were uniform.

Qualitative researchers realise that the Methodogy is interpretive and findings from their research efforts are not completely objective but little subjective. They do realise that being part of the process they do affect the results. However, by applying these five categories of validity, the study has been kept as objective as possible.

7.6 Limitations of the study

In typical with all analysis, but possibly much more so in nascent aspect of academic growth and business, this particular analysis suffers from a selection of limitations. While these limitations don't take away the significance of the outcomes, it will be unfair not to highlight them at some stage in this dissertation. The research journey wasn't without its challenges; hence, it will be wrong not to accept some of limitation encountered throughout the analysis process. To acknowledge the limits of this particular analysis doesn't reduce the worth of the study, but enhances it by making the basic postulations as well as assumptions transparent as open to critique.

The study aimed to determine various dimensions of intermodal transportation and IWT in India. The scope as well as findings of the analysis had been restricted to the following ways:

1. **Sampling Issues:** A purposeful sampling strategy was utilized to recognize participants holding sizable expertise in a variety of gamut of Intermodal Transportation along with IWT. Because the topic of IWT is emerging in India, the amount of professionals out there weren't huge. Additionally, although the majority of action in India on IWT is actually taking place in Eastern part of India, the

researcher was constrained by the physical presence of his in Northern India. Although the researcher travelled once to Guwahati as well as Kolkata to seek inputs from specialists there.

2.Number of participants: The fewer number or respondents in this study may be regarded as a limitation. However, the no. of participants interacted in this study is in line with some of the other grounded theory studies. Further the interviewing process continued till we reached the theoretical saturation stage. Lesser number of participants also allowed the scholar to interrogate each participant in greater depth. In case of grounded theory, the beauty lies in the richness, depth and sufficiency of the information instead of number of participants selected.

3.Other stakeholders: This study didn't consider the views of some of other stakeholders, like consignees, Road haulers, Ministry of Shipping and this also can be viewed as a restricting element to the study.

4.Effective utilization of Grounded Theory: Grounded theory offers a very strong tool to the researcher to translate qualitative data into conceptual theory. However, finally a methodology is only as good as the researcher employing it. While significant effort was invested to increase theoretical sensitivity through reading in other fields, it is important to acknowledge that, in the early stage of one's research career, the breadth, depth and comprehension of multiple theoretical codes may have been limited.

5.Researcher bias: Being part of the research process, and the whole process goes through his personal lens, researchers' positioning in the study process cannot be completely eliminated. Researcher is resolved by making the role of researcher transparent as well as unambiguous via reflexivity.

6.Domestic Transportation: The analysis mostly centred on identifying the concern areas for intermodal transportation for domestic trade in India. Hence the problems of international trade as well as air transport haven't been explored in depth.

7.Break bulk Cargo: Containerized of cargo is a prerequisite for intermodal transport system and was the focus of this study. Break bulk cargo and other cargo types haven't been considered in this research.

8.Legal Aspects: The study didn't address legal considerations of IWT and intermodal transport methods.

9.Cost Benefit Analysis: The research has identified a conceptual framework to implement IWT based Intermodal Transportation System. The present study has not been able to get into details of the cost benefit analysis of the various suggestions made in this research. A more detailed study of required to understand the costs associated with various prepositions suggested and their practical feasibility in implementing.

10.Publications: As the share of IWT in India is actually meniscal, not a lot of research continues to be carried out on the topic in India. Thus the publications found in the field of were limited.

11.Cross Sectional Study: Lastly, the current study was a cross sectional study current study as it was carried out at a certain moment on time. Longitudinal study might be used to indicate just how participant's perceptions of intermodal Transport operation change over time.

To wrap things up, recognizing the restrictions of the examination does not reduce the centrality of the discoveries of this investigation. The observational discoveries of this specific investigation are really solid and definitive to India alongside other comparable nations. This is because of the way that the respondents had been business leaders as well as industry experts of the area of supply chain, transport and logistics. The limitations serve two main purposes with respect to thesis. First of all, they spotlight the general breadth of theoretical insight attained by the

researcher and next, they serve as a provocation for more investigation on the subject.

7.7 Opportunities for Further Research

IWT as a subject hasn't attracted much research in India. Literature review on this particular topic doesn't throw a lot of documents on the topic in India. The findings of this study give a host of opportunities for more detailed research and efforts to create more contributions to the subject of IWT and Intermodal transportation. Though the choices of research are practically unbounded in any field, discussion within this part is going to be restricted to those subjects that are directly connected to the last findings, contribution and the limitations in the previously discussed section.

This researcher has following recommendations for future and further Study:

- This research develops a framework for intermodal transportation. Additional research may be done to compare the costs, transit times and ease of operations of the IWT based intermodal solution with unimodal and alternate intermodal solutions. They may throw light of the competitiveness of the framework being suggested.
- The suggestions made and the framework developed has been more from Indian point of view. Further research may be done to develop a universal model which could fit all countries.

- Several of the countries as EU and China have been much more productive in implementing IWT based Intermodal Transportation System. Though this research does try to imbibe some of the best practices from these countries, a more detailed research can be done to understand the policies and programs implemented by these countries and their applicability in India.

- No specific cargo or commodity was considered in this research. Intermodal solution may be searched for special commodities which have a large movement along the corridors where rivers flows in India.

- This research focused mainly on the domestic trade. Research may be conducted on how IWT can be used to promote international logistics with neighboring countries and other countries in South Asia. This may push volumes flowing on IWT.

- IWT hasn't been a too successful method of transportation in India till date. As no substantial research to the area presently exists, additional analysis is necessary to collect a lot more empirical information on the problems that involve reduced share of IWT in India.

- Several participants in this research have suggested creating a showcase Waterway in India and recommended of potential of NW1 as a showcase waterway. Future research may be done to create a detailed road map to translate NW1 into a showcase waterway. This should carry suggestions from Navigational infrastructure to Terminals to Barge operations.

- Shippers are central to any transportation solution. Future research may be done to better understand the present and future requirements of consignors and consignees and how IWT can be geared to meet these expectations.

Conclusion

"River knows this; there is no hurry, we shall get there some day". **- A A Milne**

This sentence emboldens the Inland Waterways progress in India. In spite of carrying rich history of river based transportation in India, in spite of formally promoting this mode for last three decades, we are still not there. However, 'as the river says, there is no hurry, we shall get there some day'…….

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Annexure A

INTERVIEW PROTOCOL

Introduction

Good morning (afternoon). My name is Aditya Gupta. I'd like to thank you once again for being willing to participate in the interview. As I have mentioned to you before, my study seeks to understand how we can integrate IWT with other modes of transport to create an intermodal transportation system for containerised transportation in India. As you are aware the share of containerised transportation on IWT in India is almost negligible, whereas in Europe and China, IWT is a very strong mode to connect ports with hinterland. The aim of the research is to formulate a model to implement IWT based intermodal system in India. The interview will last about an hour and I will ask you questions regarding the role for Government, Waterways, Barge and Terminal operations, the possible lanes and how to promote this solution to shippers and cnees. Hope you will have no objection to my recording this interview.

Questions

Background of the interviewee

1 Who do you feel are the key actors in implementing IWT based intermodal transportation system in India.

Geographical context

2 Which waterways do you feel are commercially significant. Examples
4 Would be possible freight corridors which we should target for IWT based MMT
5 What is more important for India, International or domestic containers movement through IWT
6 How to integrate IWT with other modes - Road, Rail and Coastal
7 Should we have ICDs and Container Terminals along the River Banks.
8 NW1. Should Jal Vikas Marg Project be extended to Delhi.

Government

9 What should be the governance structure for IWT management.
10 Should Govt create a vision document for IWT.
11 The modal spilt in India is very bad. Should Govt take target of transferring cargo from one mode to another.
12 What should be quantum of funds allocated to IWT by Govt
13 What should be the source of funding for Govt
14 Does IWT policy of 2001 still hold good. What are the changes required?
15 What should be various other policy initiatives required from Govt to create market for IWT.

16 Any changes required in MMT act or any new Act required.

17 How can Govt ensure better private participation.

18 Role of state Govt in IWT development. Why not CSS to other states.

19 Other authorities or agencies required to manage IWT.

20 When it comes to river usage, Navigation gets the last priority after drinking, irrigation. How should MOS interact with other ministries so that navigations gets the priority it deserves.

Fairway

21 Should waterway development and maintenance remain with Govt only.

22 What should be the LAD that Govt should be targeting

23 In EU and US, the rivers are trained. Why not in India.

24 How should Govt ensure availability of waterways 24 x 7 x 365

25 Any other river or corridor which is significant from containerized transportation

Terminals

26 Who should own, maintain and operate terminals.

27 Would could be possible terminal locations.

28 Should we target to have ICDs there.

29 Connectivity with which other modes.

30 What services should they offer. (Customs, Empty containers, consolidation, trans loading, light transformation)

Barges

31 Who should own, maintain and operate terminals

32 What should the size of the barges.

33 Should 30% capital subsidy be reinstated

34 What steps to be taken to improve Barge availability.

35 Should we go for Dumb Barges or Mechanised Vessels

36 Should we follow vessel standardisation program like China.

Shippers

37 How to create awareness about IWT. To attract them to IWT. How to make it presence felt.

38 How to integrate IWT in shipper supply chain.

39 Should it act as alternate transport chain.

40 How much cost benefit should it give for shipper to shift from road to this mode considering longer transit time.

41 Can IWT help to reduce the carbon footprint and make greener supply chain of shippers

42 Should incentive be offered to attract shippers to IWT

43 First and Last mile costs and handling are so large that they kill all the benefits.

Others

44 Will bundling services (PTL) help IWT based MMT

45 Should we target some specific commodities like hazardous, steel pipes.

46 RIS system. How should Govt go about it.

47 Skill development. Is NINI able to do its job. Should there be other universities of colleges participating.

48 How to create transportation markets or Industrial areas near IWT

49 Last comments summarising the steps to create a IWT based MMT system

Other Topics Discussed:

_____

_____

Documents Obtained:

_____

Post Interview Comments or Leads:

_____

_____

Appendix B

Sample line - by - line coding of one interview transcript

Interview Transcript	Coding
Interviewer - What do you feel are the key actors in implementing IWT based intermodal transportation system in India.	Government Role Viable Mode Collaboration
Interviewee - The first responsibility is of the Government. They must enable IWT to become a viable mode of transportation either through collaboration with Public sector or Private sector or Partnership, because River cannot be privatize.	Private Sector participation Public sector PPP
Then comes the Road Transporters, Barge Operators, Terminal Operators and Shippers.	Road Transporters Barge Operators Terminal Operators Shippers
Since the Rail connectivity is very important to make IWT a successful mode Rail operators also play an important role. All the bulk movement is through Railways.Even the cost is also effective. This should be an ideal combination of Rail - Road and Inland Waterways, as the railways cannot come directly to the IWT terminals.	Rail Operator Bulk Movement Cost Effective Dependent Mode Terminals
Interviewer -There are at present 5 waterways declared. So out of these which are declared and undeclared waterways which waterway do you feel are commercially significant.	
Interviewee - I consider commercially significant as NW1 - which connects from Allahabad to Haldia. This is because it is connected well to production and population and that is the real big one. The Orissa - Andhra Pradesh network (NW5) as the best port promising. Kerala (NW3) I don't consider. Even North East (NW2) I would like to ignore - The Brahmaputra and NW6 because there is set of production and consumption of materials there. Orissa & Andhra pradesh we look at this belt both up and down for Coal, Bauxite, iron Ore etc	Commercially-Significant NW1 - Significant Production connectivity NW5 - Significant NW3 – Less Significant NW2– Less Significant NW5 Bulk Movement
Interviewer - Do you feel Narmada River if developed can be helpful; because this is one which is going from Madhya Pradesh to West Coast of India.	
Interviewee - Yes that can be looked upon. But I don't consider	

Madhya Pradesh at this moment as significant sector because that area is well connected with Rail and Road network. On NW1 there is high level of containerization movement, hence Govt should first go to development of NW1 then to the Orissa - Andhra Pradesh belt and then to NW3 or NW5. Interviewer - When we talk about containerisation one of the major players like China etc has major movement through IWT. Should we focus our energy on International Freight or should we focus on Domestic Freight. Interviewee - International Freight. Very clear. Because why we want IWT is to cater to our transportation cost. Given example of China in terms of competitiveness it does 30% of its local transportation through IWT & Coastal. Hence our global competitors are ahead in the global market in terms of competitiveness. Interviewer - Hence if we are looking international then important corridor could be Haldia or Kolkatta port then connectivity to Hinterland - Uttar Pradesh etc. So if we are moving from North of India to Nhavasheva it can be in terms of competition as well as North of India to Kolkatta also when we talk about Import & Export.That is the alternate corridor that we are talking about. Interviewee - We are already looking at DFC which is from North to East . That is not for container or stacking but for Bulk cargo. This is from Ludhiana to Dankuni which is 1800 odd kms which is basically for bulk cargo like coal etc. Hence it cannot be considered as a diesel corridor because container stacking is not there. But it is important to extend NW1 beyond Allahabad, then you have 2 rivers - Yamuna and Ganga both. It can then extended further upto Delhi. Interviewer - When we talk about Intermodal or Multimodal transport, IWT is a dependent mode and not an independent mode. Interviewee - Its basically a linked mode. Interviewer - So when we talk about Intermodal or Multimodal in terms of IWT it means its linking with other modes of transport. Its possible linkage can be with Rail mode or Road mode or with Ocean.Any of the 3 and all 3 are the possibilities with our country. Interviewee - Absolutely. Not only possibility but it is imperative.	Madhya Pradesh Corridor Containerization-movement Order of Development International Containers Transportation Cost Competitive Advantage Freight Corridor North India – Nhava Sheva corridor North India – Kolkatta corridor Import Cargo Export Cargo DFC (Dedicated Freight Corridor) Bulk Cargo Ludhiana to Kolkatta Corridor Extension of NW1 Yaumna River Ganga River

	Dependent mode
Interviewer - So if we combine with road or rail or ocean how should we go about it. Interviewee - Lets take one by one. If we talk about road then we already have plans for Golden Quadrilateral for cross country highway network. Unfortunately we all know that road is the one form of transport mode. The road is the most expensive and inefficient in terms of cost and also harmful to the environment. Hence the idea should be not to add any more roads further. The idea should be to support road to Inland water transport. That should be the gameplan of Government. Suppose we have 150 connections of golden quadrilateral to ports, similarly short linkages should be there to connect to IWT terminals as well. It can be in 4-6 lane connectivity. Now Rail, for this we have to duplicate the ICD model. We need ICD's near IWT. We are not looking at IWT for passenger travels. Its cargo movement for which is going to drive IWTs. You can have a small passenger terminal but side by side a major cargo terminal like we have internationally. It has to a duplicate ICD model with customs and everything. ICD's established at the Bank of the River. There should be an exchange with rail as well road both. On the other hand when it comes to coastal shipping that is also very essential. Because all ports does not have the same degree of economy and volumes. And economy needs to be built up differently. We have 7000 kms coastline and 200 ports both major and minor. If we average it out we are talking about 435 kms per port. It is ridiculous, because the impact of the port is about 30 kms of the coastline. So we have completely destroyed out coastline effectively. Essentially we have completely killed our coastline. What we should do is reduce the no. Of parts and develop the major ports. That is the key. The IWT outlet point which is the Ocean has to be connected with well developed port. Then only you will get economy otherwise you are not going to get economies of scale. Transhipment model is not the way forward. Dedicated berth facilities at port should be available. The foreign shippers who come and pay the forex will get the berthing, however, if the IWT barge or coastal ship is waiting, then the whole purpose is defeated. There should be separate berths for IWT or coastal barges even with shallow drafts. **Role of Government** Interviewer - What do you feel is an ideal Governance structure	Intermodal Connectivity is imperative Golden Quadrilateral Expensive and In-efficient mode Environment Unfriendly Road – IWT connectivity Short Linkages between IWT and Road Rail – IWT connectivity ICD Model Customs at Terminals ICDs at Bank of River Tri-modal Terminal Coastal – IWT

that they should adopt. Internationally if we look China has its own structure, USA has its own and similarly other countries also. In India we have Ministry of Shipping under which IWAI is there which is the nodal agency doing this job. Even Mr Nitin Gadkari says that speed at which IWAI works is not ideal. What should be the governance structure in India. Interviewee - According to me here we require realistic assessment of what we are trying to do. I just read an announcement that we are going to spend 70-80000 crores to develop 20000 kms Inland waterways Transport model. It cannot be done with just 3.5cr per km of sanction. So there has to realistic reasoning to it. Govt cannot give away rivers because there are issues of local people livelihood connected to use of rivers. So he Govt has to develop the IWT then handover the same to port authorities or terminal operators etc to run these terminals. The govt has to develop and give. Demarcation in terms of where shipping cannot be done and not done in terms of fishing, irrigational dams etc. I am not sure how Govt can do this, but it is the Govt who has to develop the infrastructure first. The infrastructure cannot be developed by private parties. Govt may use the know how of private parties. Perhaps the know how is also not very developed in India. Perhaps we have to look outside. If we look at the movement of containers in Shanghai. About 1200 kms they are able to use on the Yangzte River. So this is Phenomenal. That cannot be developed just like that. So Govt has to put the efforts to make the system. Interviewer - China came with a document - "Vision 2020". So they came up with this document and for 15 years they are working on this document.Do you feel that Govt should also come up with such kind of Vision Document and work on it. Interviewee - I don't know whether Vision Document or any other document will help, but there is a thought process developing. Once we talk about developing 100 waterways, that is not a vision. This is unrealistic. It is impractical to make such a announcement. This is not a vision document. First we develop what we have. Then go beyond that. First let's at least have one waterway functional which can be considered as waterway. One waterway that can be considered is from Delhi all the way to Kolkatta. We already have a DFC moving that way. The entire length of the river can be developed and properly used. First produce that and then come to a vision Document. If we cannot get even one functional what is the use of vision document.	connectivity IWT outlet connected to developed port Economies of scale Trans-shipment model Dedicated Berth Facilities Shallow Drafts Governance Structure International Governance Structure IWAI IWT priorities Funding to IWT Per KM funding of IWT Control over Rivers Govt as IWT infrastructure developer Transfer of terminal operations IWT Infrastructure developer Private sector as IWT Infrastructure developer International examples of container movement. Vision Document

Interviewer - So what we have understood is the Govt should be responsible to develop, manage and maintain the fairway at first, provide proper depth all year. The terminals and barge could be in PPP. .	
Interviewee - Yes. The barges operators, terminals, handling equipment's can all be privatized. ICDs etc. CONCOR is running perfectly well. Even CONCOR can be asked to manage this, or even private parties ok, but the River has to be managed by the Govt. You cannot afford to have locals intervening in it. See we need the adequate draft round the year. Our biggest issue is this that we don't have draft round the year. So Govt should maintain that and ensure that we have adequate draft round the year. How does rivers in Europe looks like. They look like canals. We have traffic moving this way towards up and we have traffic moving this way down very similar to roads. There are demarcated lighting systems with 24hrs navigation system which is completely lacking in India. So they have to demarcate the river such that, part of river is for passage of cargo and part for the local use only. Some mechanisms should be there to keep the locals off the IWT passages. Like for example we have Road expressways or even toll roads, but we have all kind of mixed traffic coming on it. So half the advantage of Expressway we lose when we have mixed traffic on it. That same should not happen to waterways that's the point I am making.	New 101 waterways Fully functional waterway Delhi to Kolkatta Corridor Develop existing Waterways Develop, manage and maintain Waterway
Interviewer - Sir if you look at what China has been spending on IWT and what India has been spending on IWT there is no comparison at all. So if we looking at IWT development then funding has to be quiet large. So what do you say in this regard is it supposed to be budgetary support or something else.	CONCOR River Management Local Intervention Draft round the year
Interviewee - Absolutely. The Govt has to allocate that. Not only allocate but they have to improve on it year to year. Our budget is large enough. Just to develop Delhi to Kolkatta waterway would cost about 60-70000 crores. The Govt is talking about developing 20000 kms but I will be very happy if they can develop just 4000 kms only at first, a proper systematic IWT I am talking about with all facilities. So 60-70000 crores over a period of 6 yrs that is the estimated budget with 10000 cr per year to develop one IWT from Delhi to Kolkata. Close your eyes on rest now. Develop one model right now and then go to next after establishing it. Forget about the Vision Documents. This can be work only in those countries which can implement So develop one model, experience it in developing then have a vision document for the next ten years thereafter.	River like Canals Traffic movement on Waterways Lighting System Navigation System Demarcated Waterway channel China funding on IWT India funding on IWT Funding requirements for IWT development
Interviewer - Any other Programs or Policies you feel that Govt	

should run to develop this IWT sector. Interviewee - They can give normal exemptions because IWT will not have economies of scale initially. So they can just incentivize. Tax exemptions like service tax , excise duty or income tax or trade tax benfits etc. so that people are encouraged towards IWT. Duty free imports of right quality barges. The kind of vessels we use. We have 1400 ships in India with a total of 1 million DWT. So we have an average of 700 MT freight. Thats it. This is including Coastal. IWT there is hardly anything. This is total all over India we are talking about. So why to build in everything here. Use Global resources. Develop waterways, bring in duty free import, give Tax Exemption even on spares. One of the biggest grouses of coastal shipping is we treat them as domestic employees and tax them as people working on domestic rates. Whereas people working on foreign ships are not charged same tax Extend those kinds of benefits. Incentivize the finest people to get into IWT. Permit duty free imports of all equipment's for IWT all navigational aids, signaling system etc. Interviewer - One of the differences between India and China is that China has Ministry of Transportation (MOT) that is the nodal agency which is a Consolidated Transport System. This we are lacking in India. In China even provisional Govt or Sate Govt is actively involved in IWT development. In India State Govt hardly participate in IWT development. So what do you feel whether State Govt should participate in IWT development or should it be a completely Central Govt subject. Interviewee - I believe it should be Central Govt who should take complete control of it, because there is National perspective to it. Because one state will seek approval from another state so it will delay the whole system in approvals only. Hence Central Govt has to take the main initiative and control. Then only we can have integration of major ports, coastal shipping etc. Then only there can be uniformity in policies and though process require for this entire thing. When I am talking about subjects like tax benefits, duty free structure, bunker, spare parts etc so that all can be uniformly handled by Central Govt only and not State Govt. Interviewer - At present under Ministry of Shipping IWAI is the only nodal agency which is working for IWT. Do you think is this structure fair enough or any changes are required further in this.	Budgetary Support Source of funding Increase in funding Priority in Funding Priority in Developing Waterways Policies to promote IWT Tax exemptions on barges including spares Duty free Imports Average size of vessels in India Tax on employees working in IWT sector Tax exemptions on navigational aids and signaling systems. China Governance Structure Role of State Govt in Development of IWT Role of Central Govt in Development of IWT National perspective Inter Sate disconnects Uniformity of Policies and approach Alternate Governance

Interviewee - IWAI is a complete failure. May be they don't have the support of the Govt or whatever, I don't want to be critical but after two and a half decades what have they given us. We have not moved the forward. We are where we were. Nothing really moved. Interviewer - We have MMT (Multi Modal Transport0 here also in India. Do you feel this is any change required or is that enough. Interviewee - No I don't think so. MMT Act as it stands today is fine. There is an issue with MMT operators today. It has not really taken off well in India. MMT operators feel that the liability limits have not been defined well and circumstances when liability would be applied are not clearly defined. Operators feel that MMT licenses need to be renewed too frequently. By and large our act is in line with international practices. There is no reason to fiddle with the ACT all the time. Interviewee - One of the things where we have failed with IWT in the last 15-20 years is that we were not able to activate or really encourage private participation in the IWT sector. Where do we see we can have the change or where we can have private participation in this sector. Railways has tried it. Few Train and Terminal operators have already come in. Interviewee - Railways have actually not given away anything. They have retained control over everything. it fully. They have not given the locomotive part. We have actually not able to derive the complete benefit out of it. Actually nothing has happened. We had one or two companies like Gateway etc which are in absolutely shambles. It almost collapsed. If we really want to improve give complete control of DFC (Dedicated Freight Corridor) to private sector. If you can do that. Because that is a completely separate track. Otherwise Railways can always say that we have national and social objectives to work upon as far as passengers are concerned, this will always be used as an excuse to Interviewer - So this was as per the rail part was concerned. How can we privatize in terms of IWT. Interviewee - Privatize everything except the river management. Because that you cannot do. The Govt should not get involve in other things. Whether it is barges or terminals or anything. Everything else should be free market. Interviewer - Right now the Private operators don't see any	Structure Iwai performance. Changes in MMT Act Liability limits of MMT operators Circumstances for applying liability of MMT operators Frequency of MMT licenses Private Sector Participation Privatize all other IWT operations except

profitability or prospect in IWT. So how should we encourage them. Interviewee – The scale is not there, hence private sector is not coming. The Govt should first make basic infrastructure then only they will come. You need to have the kickstart from the Govt side at first. Put the fuel and light the fire, let the light spread ,that is how it has to work. One good River with one good draft all the year around availability will be the best solution. One good Public Water Transport Company network and then encourage Companies to use this economic mode. Let Maruti Co use this for transportation from Delhi to Haldia by IWT. Get those kind of ships or Barges like RO-RO vessels, wherein the cars can be rolled on directly into the barges. Have cheaper economy mode. Automatically the truck operators can build those massive trucks. They can get into business of Barges because they will know that there will not be duty on import and business will be viable. Also focus on the type of cargo you want to move. Example you want to move the containers, containers cannot be the starting point, it has to be manufactured goods of some type. East does not form a large part of export movement. Like NW1 is not going to connect to JNPT - where 50% of the container traffic move. So container traffic is not going to be starting point for IWT. Interviewer - If we consider North India suppose. It is the largest contributor to Import and Export. When it comes to connectivity we are connected by Road, or Rail to JNPT. But if tomorrow we are able to connect North of India with Kolkatta through NW1, then it becomes an alternate port of transport. Interviewee - For this to develop we need a strong coastal shipping network then use either Vizag or Chennai or may be Vanarpadam which is going to be a deport. Then connect foreign companies and tell them that we will give you scale there. which also means connecting the DFC from west side extending it to Valapadam. That is good idea. Valapadam should focus on connecting from both sides of the country. North via the west and North via the east. Both sides. You should for example vizag terminal, I don't know why Vizag is developed for just half a million container. Is this some kind of scale we are doing. Next to JNPT it should be Valarpadam. May be Valarpadam is also ideally located for international shipping. Create good IWT, good coastal shipping and start moving. Once we starts moving the economies will start to come. Then people will get interest in it. The Govt must demonstrate that. Interviewer - If we look at NW1 it has got draft of 1.5 mtrs some	Waterways. ROI for private Operators. Lack of Scales Initial push to sector from Govt Start with one good NW1 Set one successful example. Right kind of barges Reasons for Private sector to enter Type of cargo to move on IWT NW1 does not connect to JNPT largest container port. Alternate freight corridors Strong coastal shipping Coastal shipping ports – Vizag, Chennai and Vallarpadam Vallarpadam connecting to both sides – east and West Economies of scale will build once we have a good well oiled functional system.

part, the end part has 2.5 mtrs. Whereas when we look internationally like China they have draft upto 3.5 mtrs. If we are talking about 1000 or 3000 DWT vessels then the minimum LAD should be 3.5 mtrs. Even on NW1 if we want to move bigger vessels we need to have draft of 3m minimum. Interviewee – 3.5 meters minimum. As we are doing barge vessels we require lower drafts. I believe 3 mtrs or a more half metre is required. 2.5 m for vessel and 1 meter as space. The waterways need to be continuously dredged, segregated, clear it out through the sides, through the depth and they have to make sure that it is there. They should have proper navigational aids, lights, 24 hrs signaling system. Interviewer - Another problem that we face is we don't have waterways round the year. It can be 300 days, 330 days and during floods and rains we struggle on it. So any thoughts around this. Interviewee - There has to be an overall thought process around how navigation can be inter-linked to irrigational system and power generation system. If we look at NW1 by and large when we come Delhi down there is no Hydel Power Generation dam. Hydel power whatever is happening is happening earlier. Power generation is not the main issue. What is the main interference here is irrigation and for that we need to have a clear thought process. As to what we want to give priority to first. Segregate some amount of river water to irrigation and the balance make sure is the IWT passage with 3.5 mtrs draft. Because we cannot have a business which is running 3 months a year or 9 months a year. This is not viable. We need to have draft round the year. **Terminals** Interviewer - We will have discussion about Terminals also.If I talk about NW1 then obviously Delhi to Kolkatta. So what will be the key terminal locations in that market. Interviewee - Delhi to start with - Yamuna upto Allahabad. Ganga upto where I don't know, because it will be intervening. We are not going to have terminal at Delhi and then at Allahabad. We obviously need an intervening terminal perhaps Agra, Kanpur, Allahabad or Varanasi or there can be Patna even. These terminals should be exactly like ICD type with all facilities possible. Interviewer - When we talk about terminals, there are 3 parts of terminal. One is maintain the terminal, operate the terminal and	Least Available Depth (LAD) Vessel sizes Vessel sizes as function of LAD. Navigational Aids 2 hrs signaling System Round the year movement Navigational interplay with Irrigation and Hydel Power Terminal Locations Delhi as Terminal location Agra as Terminal location Allahbad as Terminal location Varanasi as Terminal

own the terminal. Do you think this should be all done through private party, or is there merit in Govt to own it and give it to private party to run and operate it. Interviewee - It should be all done by private party. They can lease out the land to private party and then they can develop and manage and run the facilities required there. Because ultimately they will managing the show and not the Govt. The Govt can take a part of land for their infrastructure to manage customs etc. There should be both rail and road connectivity to it always. One of the issues is going to be handling bulk material and therefore rail connectivity is going to be major linkage as bulk materials don't move so much by road. Interviewer - Any thought about in particular as to what kind of equipment's should be there on particular terminal. Interviewee - Handling equipment's, storage area, repairing and maintenance area. Exactly like and ICD it should be there. Over and above the ICD for bulk materials transport and handling system should be there. That is important. Interviewer - Would like to talk about part load or bundling. A container movement could be a complete container movement, it can be a import - export movement, or it can be a combination of part loads. Do you feel IWT could be a potent mode for part load movement. Interviewee – Absolutely. ICD model also has Consolidation and De-consolidation process. It should be applied here very much. We should provide all facilities for RORO also. Part container also, consolidation also and full container also, postponement also including a bonded area should be placed at this area. **Barges** Interviewer - When we talk about Barges, again who should own, run and maintain barges. There was one Govt agency CIWCT to run barges which was not so successful. Interviewee - It should be absolutely run by private party. Govt does not have a great track record in managing this. They should own then, run them. Govt should encourage them by giving duty exemptions. After all viability and capacity utilization is their concern. Govt should maintain the waterways and give it. That's the best support Govt can give. Then is the policies and exemptions to encourage IWT. What is the harm Govt has in supporting. What is Govt going to lose, some duty exemption	location Patna as Terminal location Kolkatta as Terminal location Own the Terminal Operate the terminal Maintain the terminal Private Sector participation Land Leased out Customs at Terminals Trimodal Connectivity Rail Connectivity Road Connectivity

but they are getting revenue from this business. Why are we getting stuck on minor things? How many thousands of crores of exemption people are going to take. Not very much. Interviewer - USA and other countries have Cabotage law. Do you feel we should also have such similar Cabotage law. Interviewee - We already have the Cabotage law. We just waived it for some temporary part of the things. Whether privatise model is there or not there. Foreign shipping companies consider it a different centre. Which are the ports shipping companies are interested in moving cargo. Are our volumes or are our economies of scale. Does the foreign companies concerned about that Cabotize law. Really if you develop the process for inland waterway as we discussed I think you don't have to worry about the Cabotize law. **Shippers** Interviewer - Talking about shipper. If we develop the facilities, terminals also and everything. Then we look at industry also. They are not much aware about IWT or IWT is not into their supply chain system. How do we create such awareness amongst them. Interviewee - If the Govt provide the facilities, develop terminals and start functioning shippers will come. Firstly when CONCOR started what was the awareness. Similarly for DFC, not too many people are aware. Start the facility, people see benefits and automatically start coming in. Industry is very quick to catch on trends which work. Industry is not going to be falling behind you. The customer is not going to be stumbling block here. Interviewer - IWT is slower movement. Transportation time on longer on IWT as compared to rail and road. Obviously benefit from IWT is cost. If one has to do a toss between loss of transit time and cost advantage what should the balance be. Interviewee - When compared to Road, Road has many hindrances like check nakas, RTO they neutralize the benefits of transit. When talk about a transporter what is the average distance he moves in a day. Roughly 300 km in a day. So I think IWT will take care of that thing. So I don't think IWT will be slower. In case of Railways also, passenger trains take precedence. They also have issues on service regularity and schedules. I do not think IWT will really be a slower mode. Rather efficiency will be a bonus. Actually the damages, accidents etc will go down. So we will be actually be helped by	Handling equipment's at Terminals Storage area at Terminals Repairing and maintenance area at Terminals Part Load Movement ICD Model Consolidation and De-consolidation services at Terminals RORO services Postponement at Terminals Own Barges Operate Barges Maintain Barges Private Sector participation Duty Exemptions Viability Capacity Utilization Cabotage Law Awareness among shippers about IWT Integrating IWT into Supply Chain Fully Functional Waterway Industry catches trends fast IWT slower as compared to Road and Rail Balance between Cost

IWT. Interviewer - One more thing which is happening is that lot of companies particularly MNC are looking for greener supply chain. This could also be a major benefit from IWT. Interviewee – Absolutely. Look at it this way. How much it will save in your fuel resources. As a country you are 80% dependent on imported oil, how much will it save on oil, huge amount. Interviewer - Sir another thing is RIS (River Information System). So if a person is moving the ship and gets to know what is the flow, what is the wind speed etc. So who do you think should be responsible in developing a good RIS system. Interviewee - That part is of the Govt to maintain and develop the complete river. So RIS is part of the river management. It is like Air Traffic control. Alongwith the entire navigation system that complete part should come under Govt. Interviewer - Another part of this business is skills of the people involved in running this. At this point of time we have "NINI" at Patna which the Govt is running. What else can be done for developing skills as far as Govt is concerned? Interviewee - I think the business is not different. Anybody with a basic knowledge of transport can manage pretty well. And there are enough people in this country who are looking at commercialization of highways or ports etc in that area, I think the same set of people is going to be involved in managing this area too. Ultimately this is a business model and traffic management model and I don't think there will be any difference. Only the biggest issue is going to be regularity of schedule. There is no point of talking about IWT if there is no systematic schedule. Interviewer - At times we do target specific commodities for IWT like hazardous commodities or building material etc. Do you think we should target particular commodities for IWT. Interviewee - We can actually look into manufactured goods. As far as manufactured goods are concerned we can look at components moving, we can look at finished goods going downstream, we can look at movement of coal, ore etc, we can look at cement and bulk items. Major focus should be on bulk. What we should consider here is what is going to give us economies of scale here. Initially consolidation might not give you economy on scale. Initially there has to be stand along business which should give you economies of scale. Later once	and Transit time Road Hindrances Average per day distance on Road Rail Hindrances Less damage and accidents on IWT Greener Supply Chain IWT brings saving on fuel cost RIS systems Government Role RIS like Air Traffic Control Skill Development NINI People working in other modes Regular and Systematic Schedule Target commodities for IWT Hazardous cargo Manufactured goods Target Separate cargo upstream and downstream Bulk Cargo Economies of scale Industrial Hubs at River Banks Multimodal Logistics Park

you get economy on scale then consolidation or de-consolidation will get added up. So we should target major groups and look at that. Interviewer - When we say creating ICDs at the banks, do you suggest Govt should also encourage creating industry hubs or manufacturing centres at the banks of river or near IWTs. Interviewee – The route we are talking about there are no industrial hubs alongside. The whole concept of this ICD are the essential multimodal logistic park. If you can have one or two parts and later can have bulk shipment hub created. I don't think we really require industrial parks , what we are looking is for rail transshipment hub . May be Allahabad or Kanpur or Patna and Kolkata. Two or three can be major transit hubs or intermodal transshipment point created. Rest enough industrialization or consumption is happening along side this belt. Interviewer - Any final thoughts from your end as to how we can encourage containerized transportation on IWT or anything that we have not covered in the discussion. Interviewee - I don't know whether this will happen or not but I am really seeing IWT a big opportunity. What we are using IWT is 0.3% or 0.4% of actual cargo handling. Govt does not really know what they are doing. They need to get their act together. Actually Govt should not look for a Vision document but create one properly implemented, workable on the ground model and then see how it goes. At present we should leave all the other NW and according to me develop one NW i.e NW1 . The volume is likely to get on NW1 extended upto Delhi. If you do that you have a better workable solution and chances of people accepting that idea will be more. Have one role model NW. People will be clamoring for that to work with. Impact is going to be huge. Transport cost on IWT is going to be very low. If there is no cross subsidization, IWT is likely to bring freight cost to 1/3rd. We are roughly paying Rs.6 to Rs.7 per kg and for a full container from Delhi to Kolkata. An IWT mode can save about USD 1000 per container. Which is huge saving.	ICD concept Intermodal transshipment point IWT is a big opportunity Volume of cargo on IWT Fully Functional IWT Role Model NW Freight Cost reduction from IWT Saving per container.

Appendix C

Open Coding Categories and Codes

Categories identified from Open Coding			
1	106 New Declared Waterways	97	Least Available Depth
2	Agra	98	Legal Framework
3	Allahabad	99	Locational Availability of IWT Mode
4	Alluvial Rivers	100	Low Value Commodity
5	Assured Depth Service Level Contract	101	Madhya Pradesh Corridor
6	Availability of return cargo	102	Manufactured Goods
7	Awareness about IWT	103	Ministy of Shipping
8	Barge Availability	104	MMT Act
9	Barge Capacity	105	Modal Share of IWT
10	Barge Operations and Management	106	MRO facilities
11	Barge Ownership	107	MTO Operators in IWT Sector
12	Barge Types	108	Multimodal Logistics Park
13	Barges Graeter than 2000 DWT	109	Narmada River
14	Bimodal Terminal	110	National perspective
15	Bonding Services	111	National Waterway Grid
16	Brahmanai River	112	National Waterways
17	Brahmputra River	113	Navigational Aids
18	Budgetary Support	114	Navigational Infrastructure
19	Bulk Cargo and Movement	115	Night Navigation Facility
20	Bulk Materials Transport and Handling System	116	NINI
21	Bundling Services	117	NW1
22	Cabotage law	118	NW2
23	Capital Subsidy	119	NW3
24	Carbon Credits	120	NW4
25	Carbon Footprint	121	NW5
26	Carrying Capacity	122	Other Sources of Funding
27	Challenges in IWT sector	123	Ownership Model
28	Chennai Port	124	Parking Facilties
29	CIWTC	125	Passenger Movement
30	Coastal Shipping Operators	126	Policies and Programs to develop IWT
31	Commercial Viablilty	127	Postponement Services
32	Commercially Significant	128	PPP
33	Connectivity to hinterland	129	Priority in IWT Development
34	Consolidation and De-consolidation Services	130	Priority of Funding
35	Container Handling equipment’s	131	Priority of Navigation in Water Usage
36	Containerized Transportation	132	Private Sector Participation

37	Corporate Income Tax Exemptions	133	Public Sector Participation
38	Cost of Service	134	Quadmodal Terminal
39	CSS Scheme for NE States	135	Rail and Road Connectivity
40	Customs at Terminals	136	Rail Mode
41	Dadri	137	Rail Mode Challenges
42	Dedicated Berth facilities	138	Rail operators
43	Delhi	139	Regularity of Service
44	Dependable mode	140	Reliability of Service
45	Dependent Mode	141	Repairing and Maintenance Area
46	Domestic Containers	142	RIS Systems
47	Door to Door Service	143	River Authorities
48	Dredging Operations	144	River Bank Development
49	Dumb Barges	145	River Management
50	Ease of using the Service	146	River Sea Vessels
51	Economies of Scale	147	River Training
52	EDFC (Eastern Dedicated Freight Corridor)	148	Road Mode
53	Empty Containers Yard	149	Road Mode Challenges
54	Excsie Duty Exemptions	150	Road Transporters
55	Export Containers	151	Role of Government
56	First Mile Connectivity	152	Role of State Governments
57	Fiscal Incentives	153	RORO
58	Flexibility	154	Round the Day Operations
59	Freight Corridors	155	Round the Year operations
60	Freight Incentive	156	Safety of Goods in Transit
61	Frequency of Movement	157	SCM Strategy
62	Funding for IWT Sector	158	Self Propelled Vessels
63	Ganga River	159	Service Tax Exemptions
64	Goa Waterways	160	Shippers
65	Golden Quadrilateral	161	Shippers Service Requirements
66	Governance Structure	162	Showcase Waterway
67	Guhawati	163	Siltation
68	Haldia	164	Skill Development
69	Hazardous Commodities	165	Slower Mode of Transportation
70	High Value Commodity	166	Source of funding
71	ICD Model	167	Special Commodities
72	Import Containers	168	Speed of Transport
73	Import Duty Exemptions	169	Subsidy on Fuel
74	Incentives for IWT	170	Supplementary Mode
75	Indian Governance Structure	171	Terminal Intermodal Connectivity
76	Indian Vessel Act	172	Terminal Land
77	Individual Income Tax Exemptions	173	Terminal Location
78	Indo Bangladesh Protocol	174	Terminal Operations and Management
79	Industrial Hubs	175	Terminal Operators

80	Intermodal Connectivity	176	Terminal Ownership
81	International Governance Structure	177	Terminal Services
82	International Learning of IWT	178	Transshipment Model
83	IWAI	179	Trimodal Terminal
84	IWT - Coastal Shipping Connectivity	180	Tug & Barge Combination
85	IWT - Rail Connectivity	181	Types of Movement on IWT
86	IWT - Road Connectivity	182	Vallarpadam Port
87	IWT Barge Operators	183	Varanasi
88	IWT mode Advantages	184	Visibility of cargo
89	Jal Vikas Marg Project	185	Vision document for IWT
90	Kanpur	186	Vizag Port
91	Key Actors in Intermodal Transportation	187	Volume of Cargo on NWs
92	Kolkata to North India Corridor	188	Warehousing Services
93	Kolkatta	189	Waterways Development and Maintenance
94	Kosi and Gandak River	190	Waterways Management
95	LAD Graeter than 2.5 Meters	191	Withdrawn Approach
96	Last Mile Connectivity	192	Yamuna River

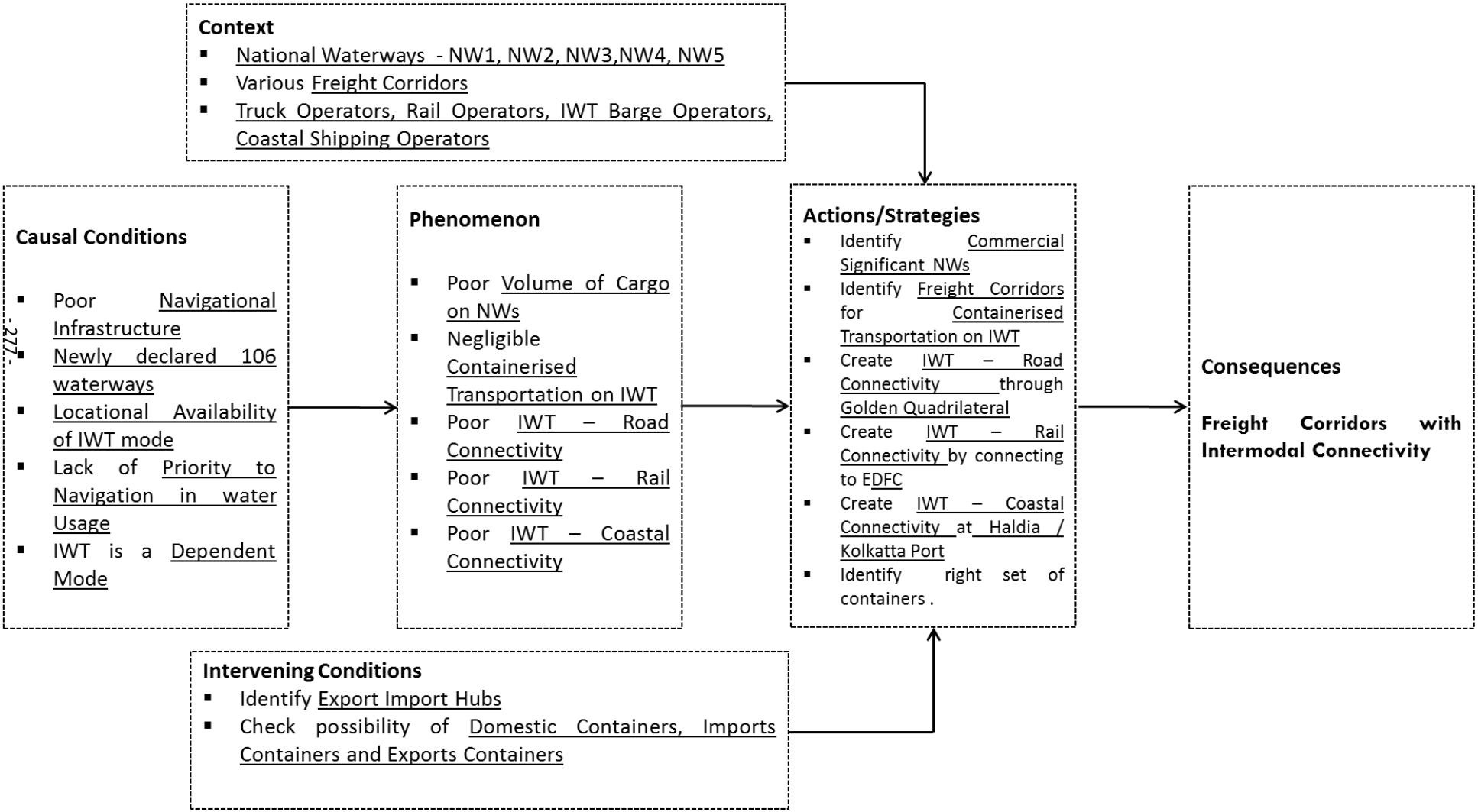
Annexure D

Coding paradigm applied to seven core categories

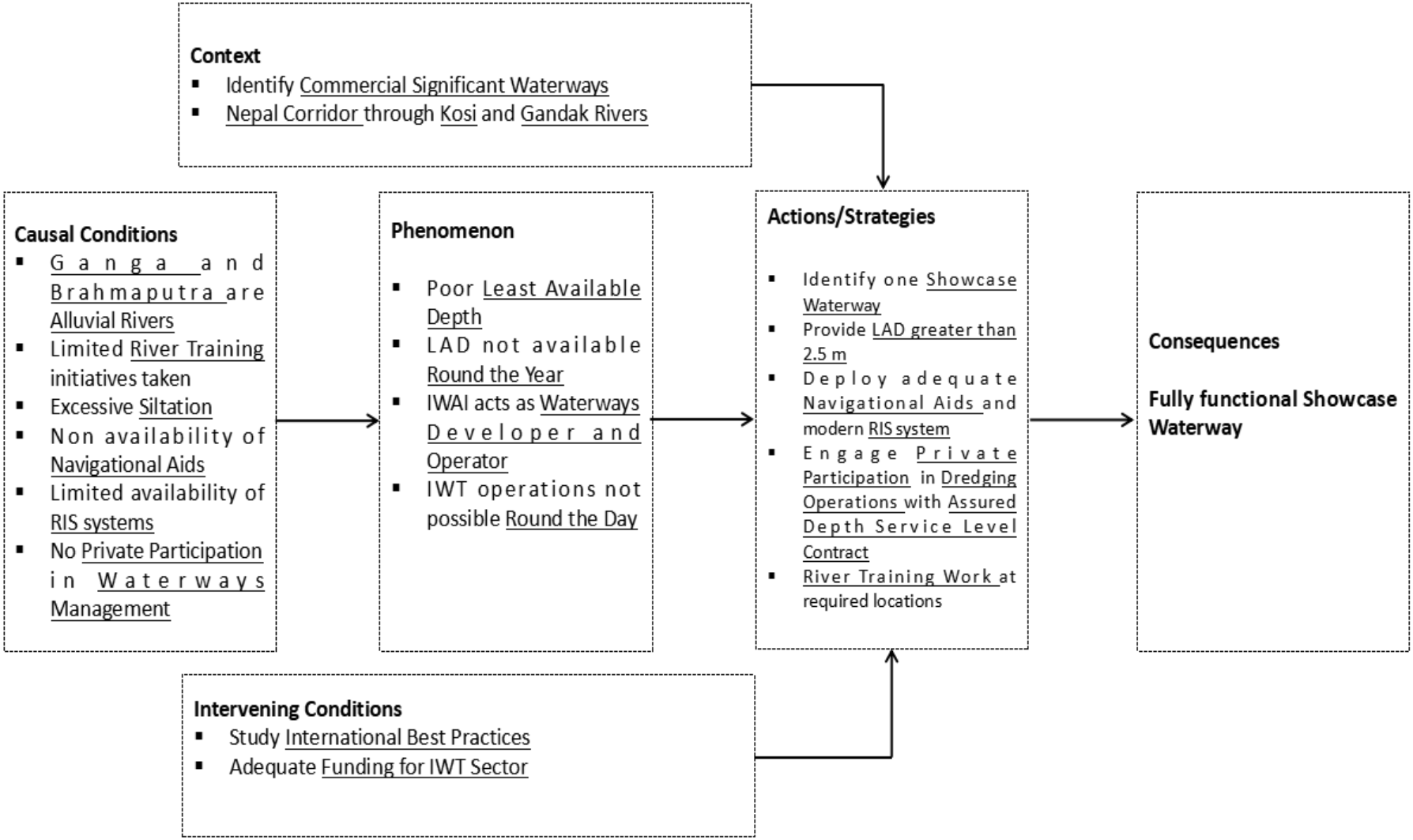
Axial Coding – Key Themes Identified

- Freight Corridors and Intermodal Connectivity
- Waterways Operations
- Terminal Operations
- Barge Operations
- Role of Government
- MTO Operators
- Shippers Service Requirement

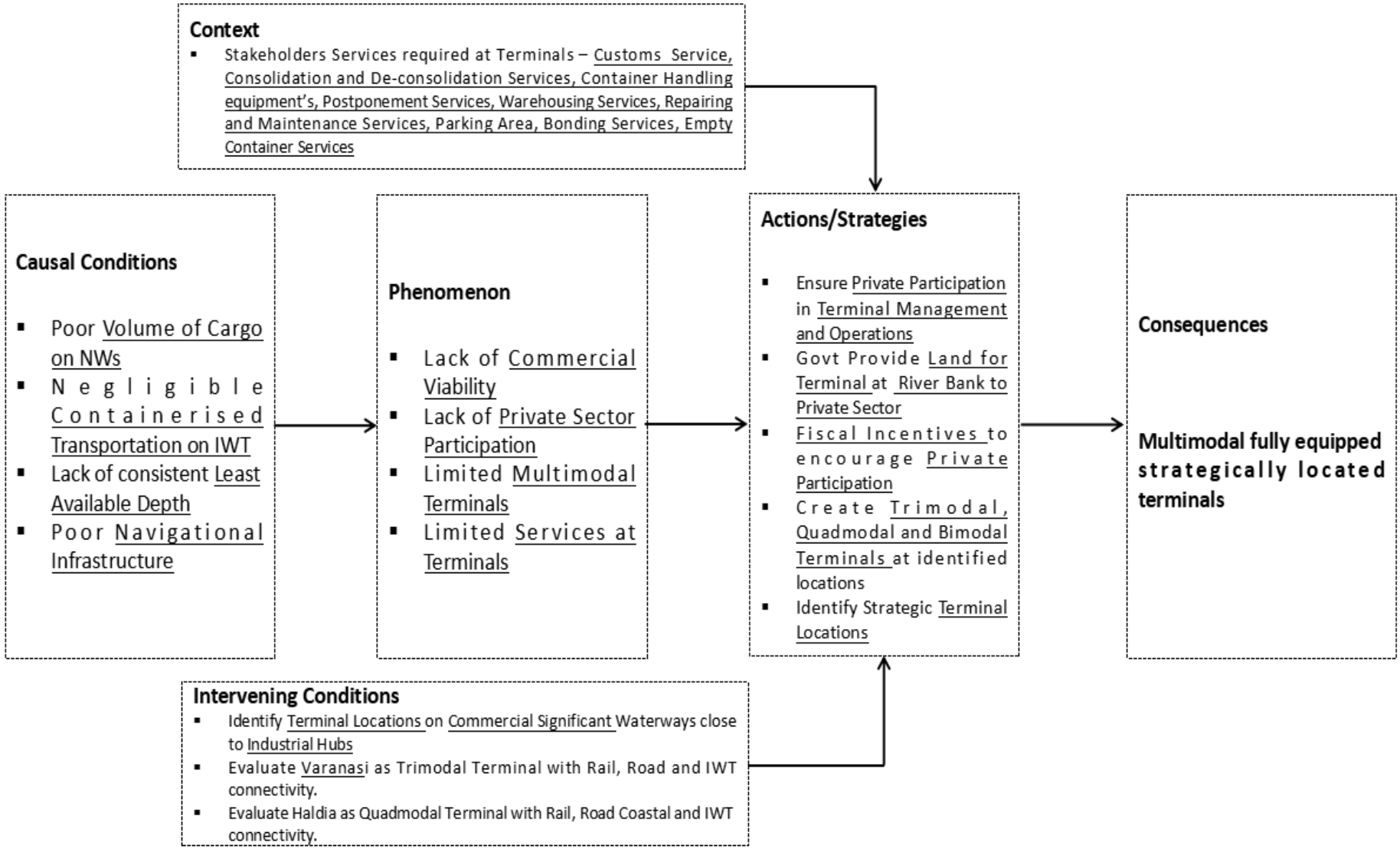
Freight Corridors with Intermodal Connectivity – Paradigm



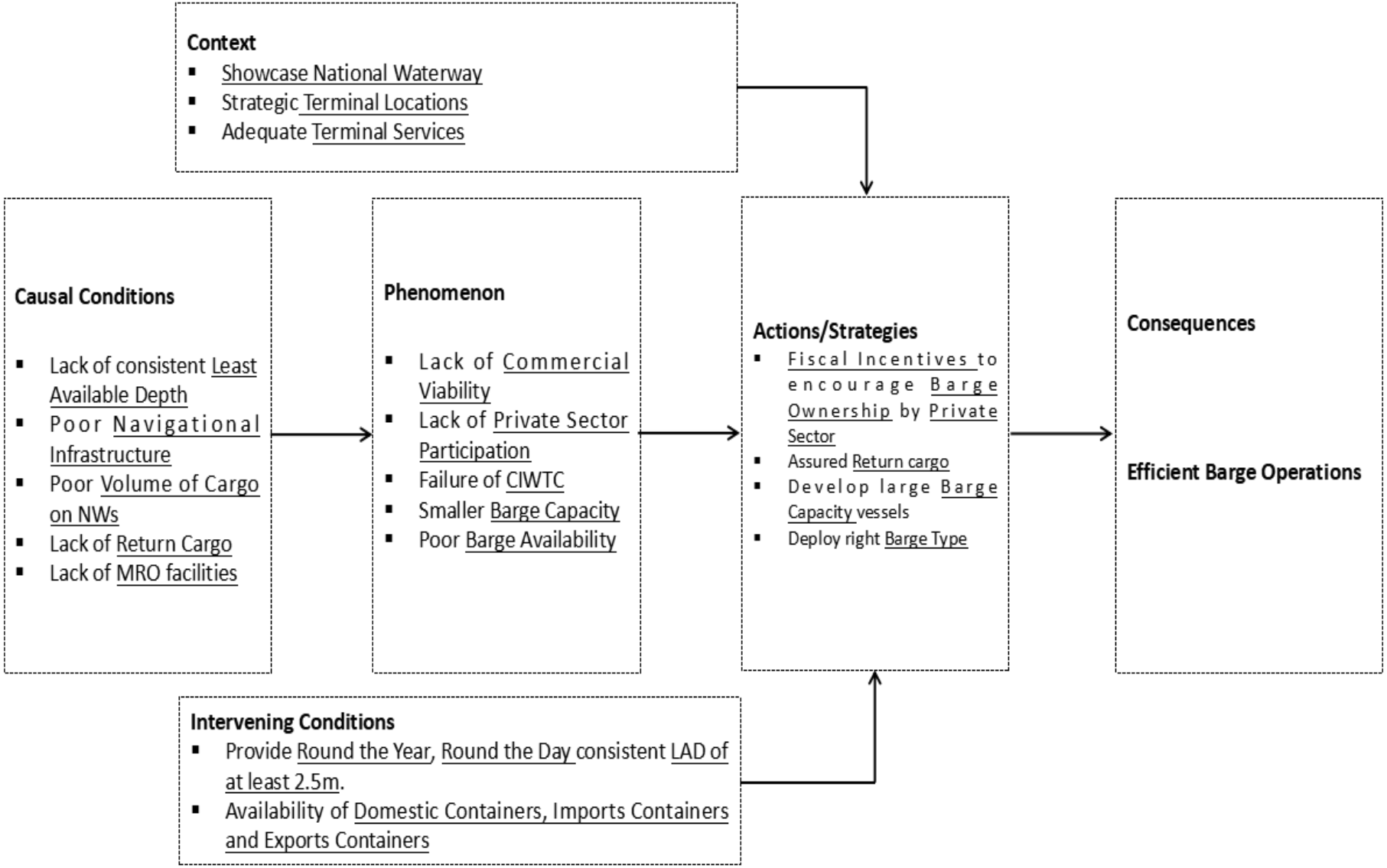
Waterways Operations



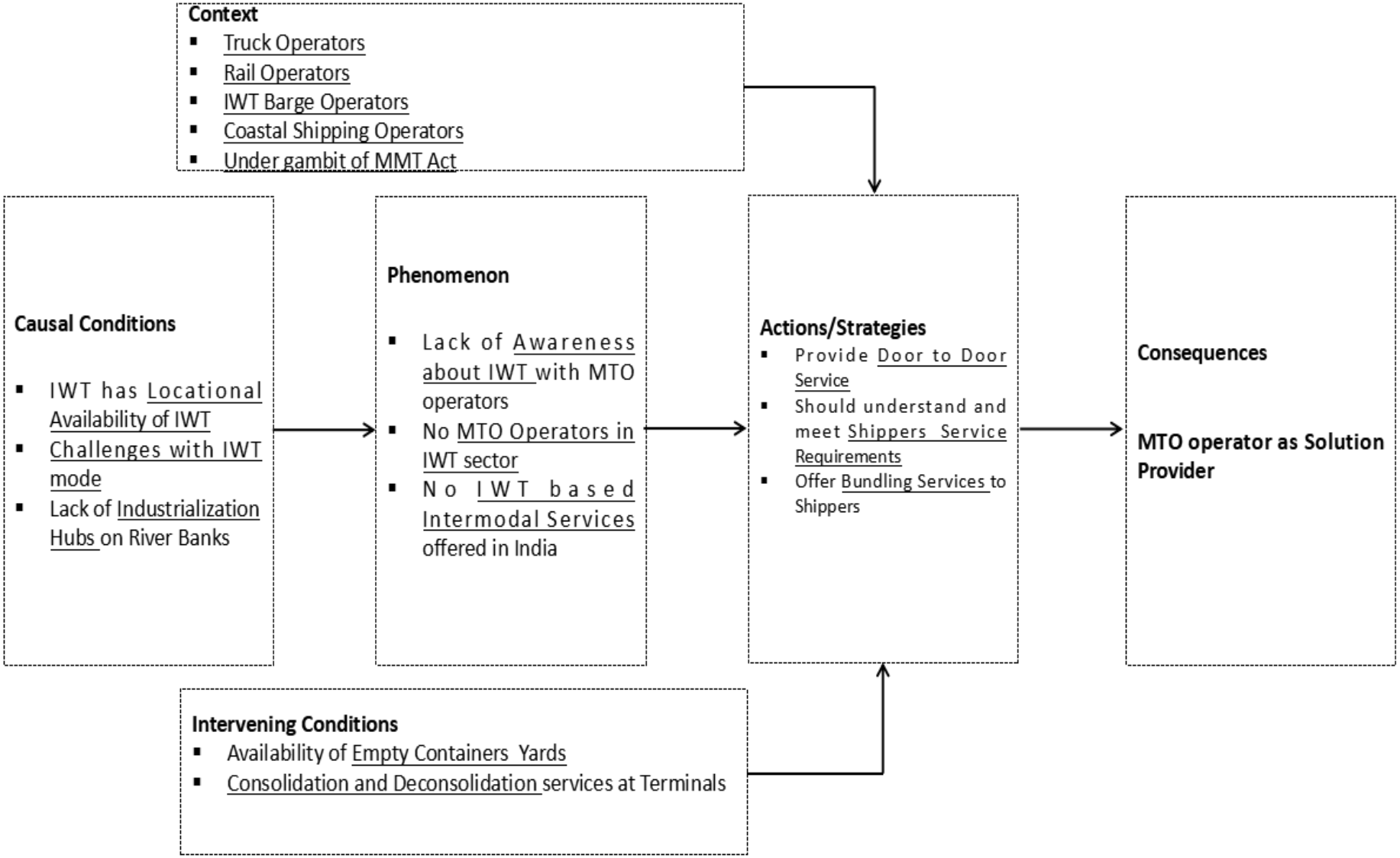
Terminal Operations



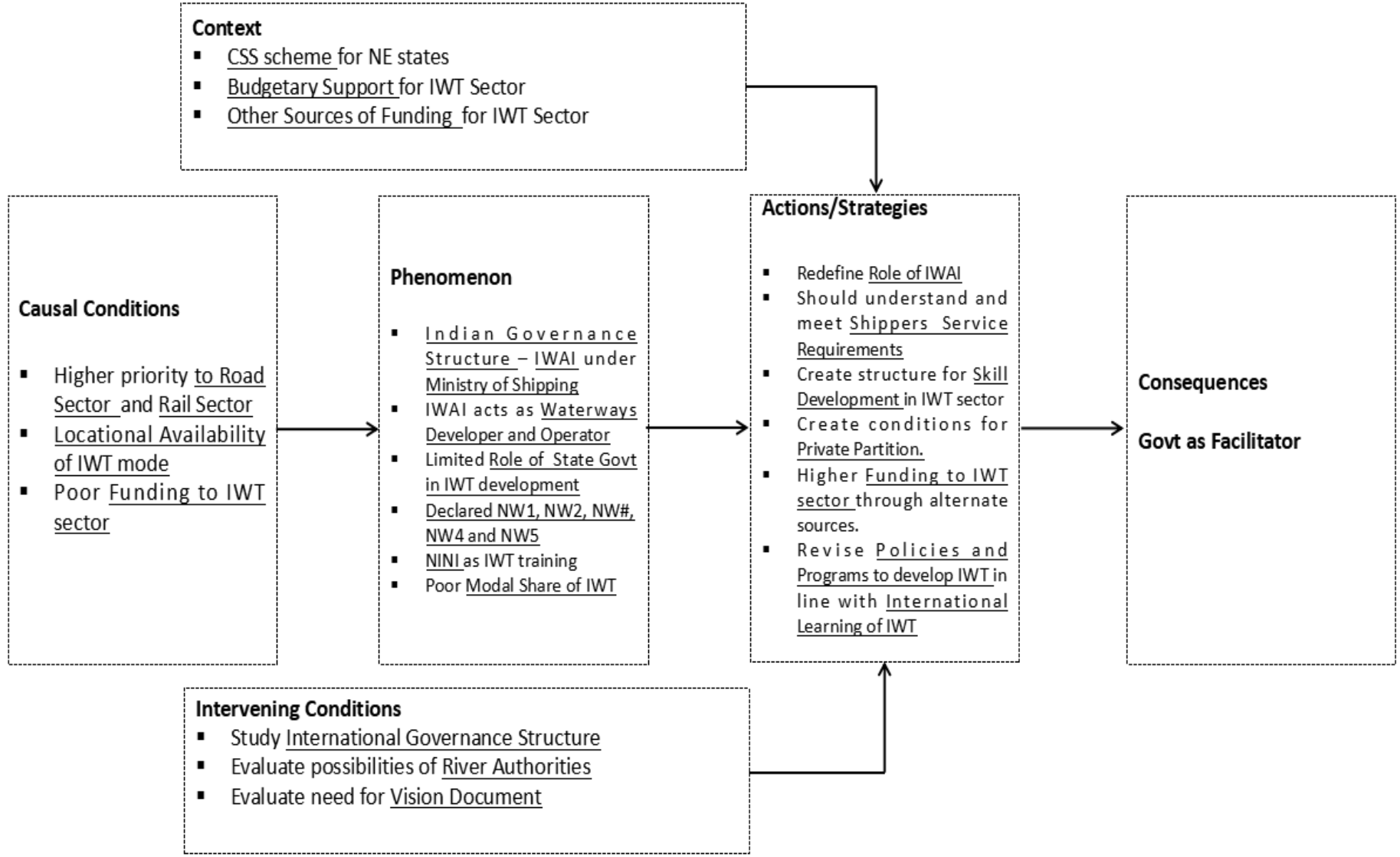
Barge Operations



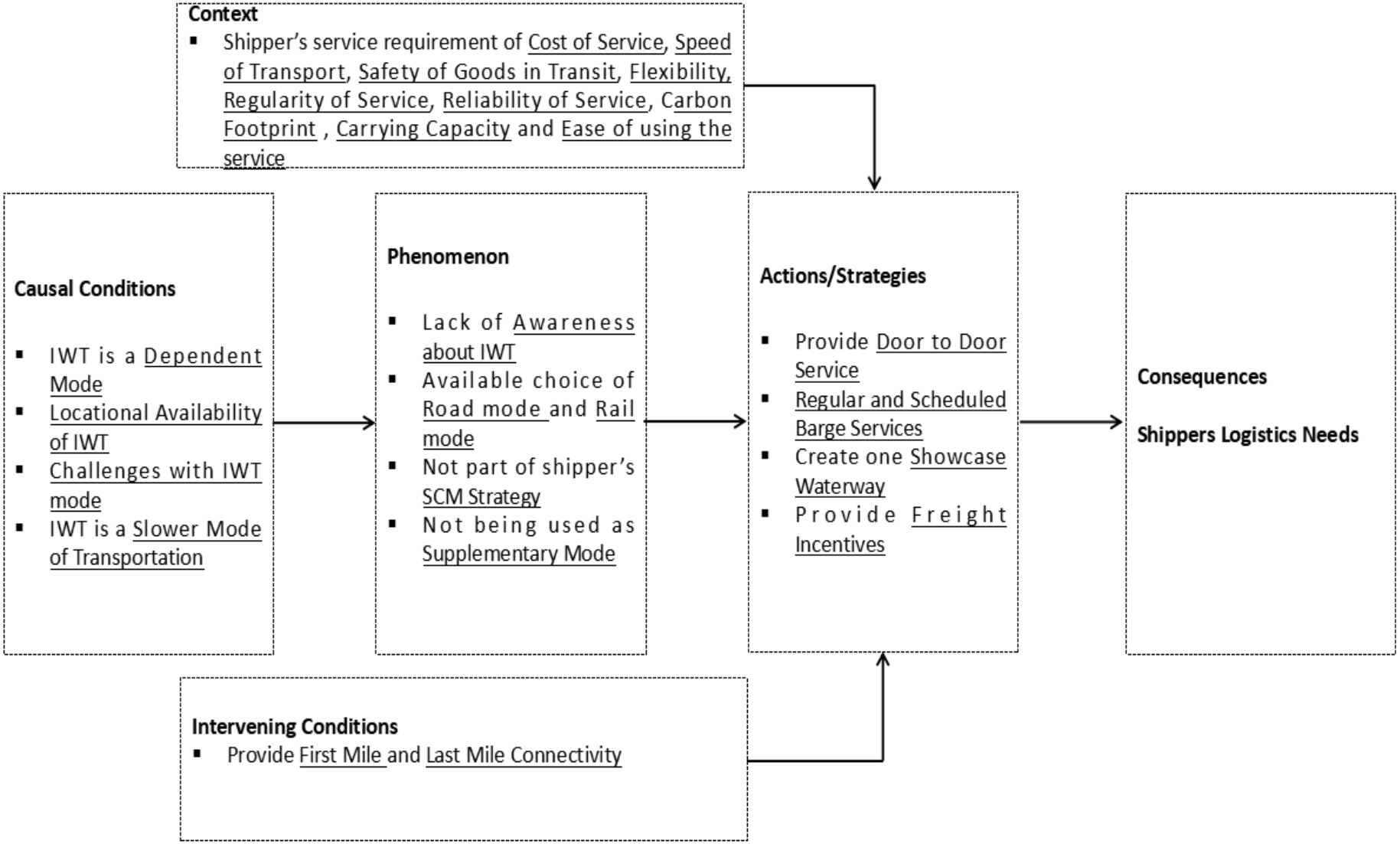
MTO Operators



Government Role



Shippers Service Requirements



Annexure E

Properties and Dimensions of Core categories

Property	Dimensions											
IWT Barge Operators												
Barge Ownership	PPP	Private Sector Participation	Public Sector Participation	CIWTC								
Barge Types	Dumb Barges	River Sea Vessels	RORO	Self Propelled Vessels	Flat Bottom Low Draft Barges							
Barge Operations and Management	MRO facilities											
Barge Capacity	Barges Greater than 2000 DWT	Barge Greater than 90 TEU										
Commercial Viablilty	Availability of return cargo	Economies of Scale	Volume of Cargo on NWs									
Fiscal Incentives	Capital Subsidy	Subsidy on Fuel										

Property	Dimensions											
Terminal Operators												
Terminal Location	Agra	Allahabad	Delhi	Guhawati	Haldia	Kanpur	Kolkatta	Varanasi				
Terminal Intermodal Connectivity	Bimodal Terminal	Quadmodal Terminal	Trimodal Terminal									
Terminal Services	Bonding Services	Bulk Materials Transport and Handling System	Consolidation and De-consolidation Services	Container Handling equipment's	Customs at Terminals	Dedicated Berth facilities	Empty Containers Yard	Parking Facilties	Postponement Services	Repairing and Maintenance Area	Warehousing Services	Bundling Services
Terminal Ownership	PPP	Private Sector Participation	Public Sector Participation	Terminal Land								
Terminal Operations and Management	ICD Model	Multimodal Logistics Park	Transshipment Model									

Property	Dimensions											
Shippers Service Requirements												
Shippers Service Requirements	Visibility of cargo	Speed of Transport	Door to Door Service	Ease of using the Service	Carrying Capacity	Flexibility	Frequency of Movement	Carbon Footprint	Regularity of Service	Reliability of Service	Safety of Goods in Transit	
SCM Strategy	Supplementary Mode	Dependable mode										
Cost of Service	First Mile Connectivity	Last Mile Connectivity										
Containerized Transportation	Domestic Containers	Export Containers	Import Containers	Connectivity to hinterland								
Types of Movement on IWT	Special Commodities	Hazardous Commodities	High Value Commodity	Low Value Commodity	Manufactured Goods	Bulk Cargo and Movement	Passenger Movement					
Awareness about IWT												
Incentives for IWT	Carbon Credits	Freight Incentive										

Property	Dimensions											
Navigational Infrastructure												
Least Available Depth	LAD Greater than 2.5 Meters	Existing LAD Levels										
LAD Challenges	Siltation	Alluvial Rivers										
LAD Solutions	Assured Depth Service Level Contract	Dredging Operations	River Training	River Bank Development								
River Management	Yamuna River	Brahmanai River	Brahmputra River	Ganga River	Kosi and Gandak River	Narmada River						
Round the Day Operations	Navigational Aids	Night Navigation Facility	RIS Systems									
Round the Year operations												

Property	Dimensions											
MTO Operators in IWT Sector												
Key Actors in Intermodal Transportation	Coastal Shipping Operators	Rail operators	Road Transporters	Waterways Operator								
IWT mode Advantages	Rail Mode Challenges	Road Mode Challenges										
Challenges in IWT sector	Dependent Mode	Locational Availability of IWT Mode	Priority of Navigation in Water Usage	Slower Mode of Transportation	Priority to Rail and Road Sector							
Commercially Significant	NW1	NW2										
Legal Framework	Cabotage law	Indian Vessel Act	MMT Act									

Property	Dimensions											
Intermodal Connectivity												
IWT - Road Connectivity	Golden Quadrilateral	National Waterway Grid										
IWT - Rail Connectivity	EDFC (Eastern Dedicated Freight Corridor)	Syncronisation between Barge and Rail										
IWT - Coastal Shipping Connectivity	Chennai Port	Vallarpadam Port	Vizag Port	Kolkata Port	Haldia Port	Syncronisation between Barge and Vessels						
Freight Corridors	Kolkata to North India Corridor	Madhya Pradesh - West Coast Corridor	Kolkatta/Haldia to South Corridor	Nepal Corridor								
National Waterways	106 New Declared Waterways	Goa Waterways	NW1	NW2	NW3	NW4	NW5					

Property	Dimensions											
Intermodal Connectivity												
IWT - Road Connectivity	Golden Quadrilateral	National Waterway Grid										
IWT - Rail Connectivity	EDFC (Eastern Dedicated Freight Corridor)	Syncronisation between Barge and Rail										
IWT - Coastal Shipping Connectivity	Chennai Port	Vallarpadam Port	Vizag Port	Kolkata Port	Haldia Port	Syncronisation between Barge and Vessels						
Freight Corridors	Kolkata to North India Corridor	Madhya Pradesh - West Coast Corridor	Kolkatta/Haldia to South Corridor	Nepal Corridor								
National Waterways	106 New Declared Waterways	Goa Waterways	NW1	NW2	NW3	NW4	NW5					

Property	Dimensions											
Role of Government												
Governance Structure	Indian Governance Structure	Ministy of Shipping	IWAI	Role of State Governments	River Authorities	International Governance Structure						
Policies and Programs to develop IWT	Jal Vikas Marg Project	CSS Scheme for NE States	Indo Bangladesh Protocol									
Priority in IWT Development	Showcase Waterway	Vision document for IWT	Industrial Hubs	International Learning								
Governance Challenges	Modal Share of IWT	Priority of Navigation in Water Usage	Withdrawn Approach									
Ownership Model	PPP	Private Sector Participation	Public Sector Participation									
Skill Development	NINI	Regional Training Institutes										
Fiscal Incentives	Capital Subsidy	Corporate Income Tax Exemptions	Excsie Duty Exemptions	Import Duty Exemptions	Service Tax Exemptions	Individual Income Tax Exemptions						
Funding for IWT Sector	Priority of Funding	Source of funding	Budgetary Support	Alternate Sources of Funding								

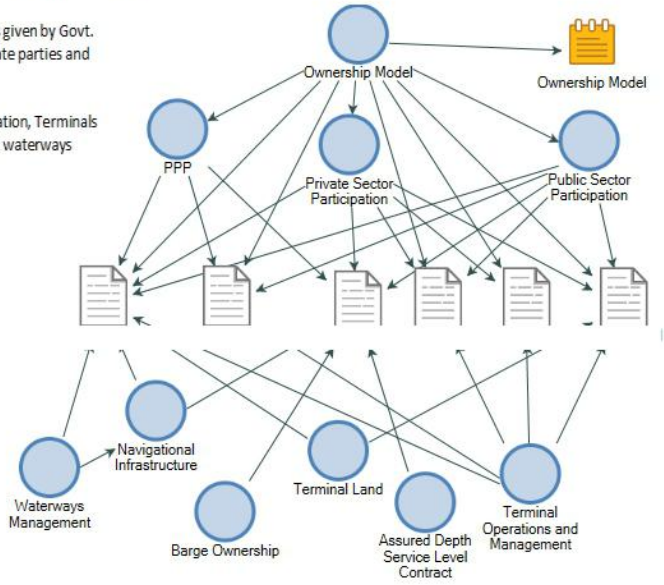
Annexure F

Memo Samples

Ownership Model | Ownership Model

There can be 3 Ownership models - Public Sector , Private sector and PPP.
Waterways needs to be owned and maintained by the Govt on a whole. Even the draft maintenance is given to Private parties there should be assured depth contract signed and payment should be done on monthly basis.
Barges can be owned and maintained by private parties with the help of subsidies given by Govt.
Terminal land can be under the ownership of the Govt which is leased out to private parties and completely managed and operated by the private parties.

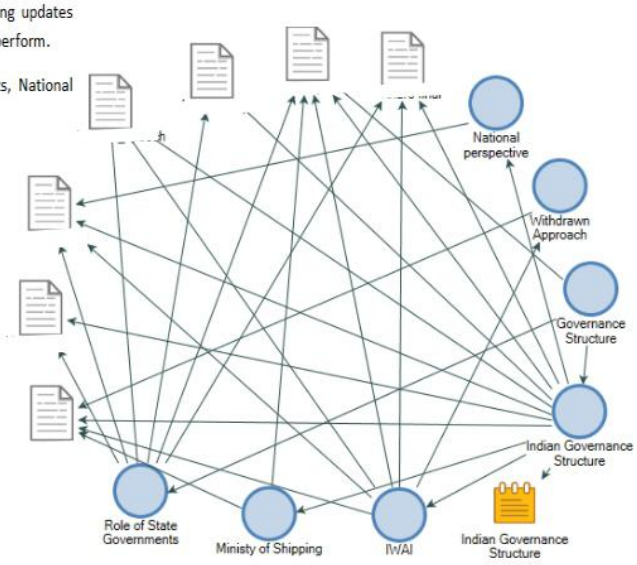
This category is related to PPP, Private Sector Participation, Public Sector Participation, Terminals operations and Management, Terminal Land, Barges operation and management, waterways management, navigational infrastructure, assured depth service level contracts.



Indian Governance Structure | Governance Structure

The Governance structure of India has Ministry of Shipping at the apex and under that we have IWAI who is fully responsible for managing and operating and declaring the waterways.But IWAI has not been able to meet the expectations even after two and half decades of operation. IWAI has to be developed as a true technical organisation with its core team getting updates and training on regularly basis, then only they can perform as they are supposed to perform.

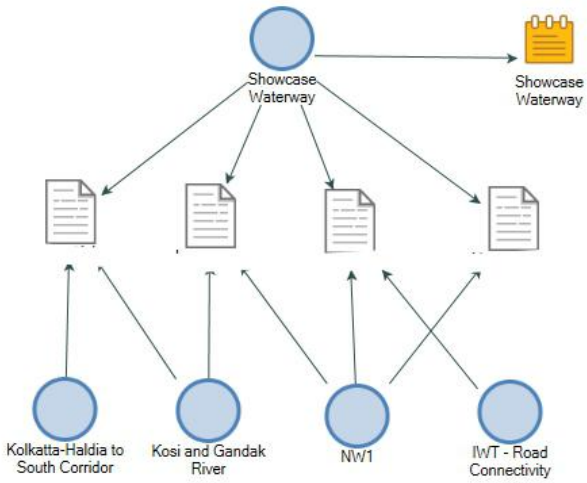
This category is related to IWAI, Ministry of Shipping, Role of State Governments, National Perspective and Withdrawn approach.



Showcase Waterway | Showcase Waterway

Develop only one Waterway which is NW1 . Forget about other 110 Waterways.
Focus on following NW1 intermodal corridors: - North to East through combination of Rail and NW1 with Varanasi acting as connecting point.
Target import containers of Nepal through Kolkata to NW1 and from NW1 to Nepal through Kosi and Gandak.
North and East connectivity to Chennai, Vizag and Kochi through NW1 - Coastal connection.

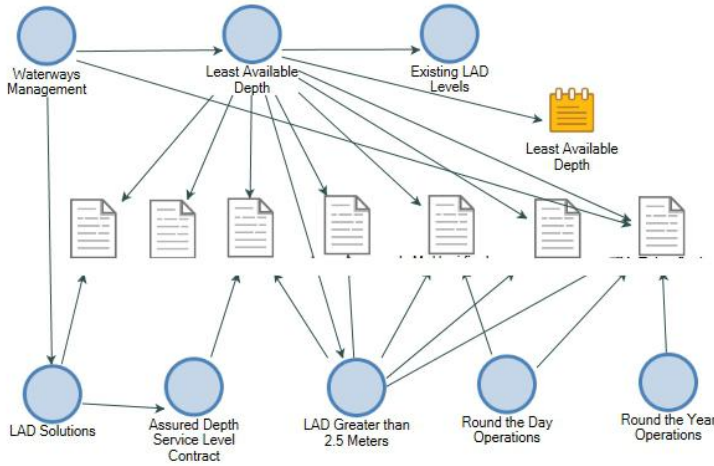
This category is related with NW1, Rail and IWT connectivity, Kosi and Gandak, Kolkatta-Haldia to South corridor.



Least Available Depth

Govt should be able to give a LAD of 3m (or at least 2.5m) for at least 1000 KM in the waterways to enable IWT movement in a smoother way.This is the most basic requirement and it should be available Round the day and Round the Year.
If this project is handed over to private parties Govt should have assured Depth Service Level Contract with them and payment should be done on monthly basis.

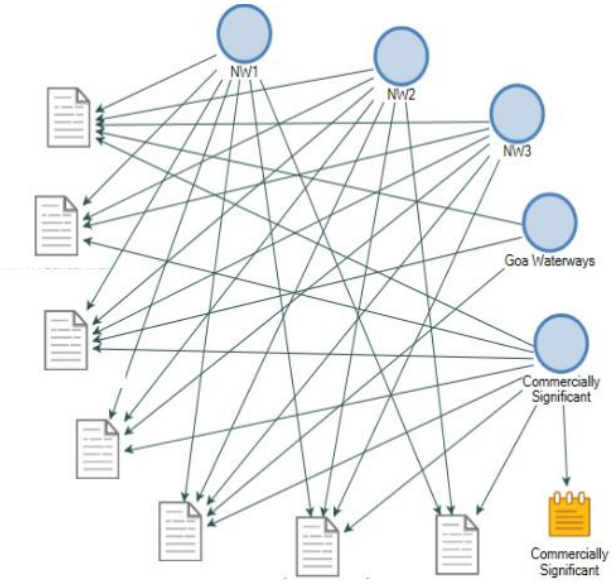
This category is related to Least Available Depth, Assured Depth Service Level Contract. Existing LAD levels, LAD Greater than 2.5 mtrs, Round the Day Operations, Round the Year Operations.



Commercially Significant | Commercially Significant

Currently, three major waterways in the country can be identified as commercially significant National Waterways: NW-1- the Ganga-Bhagirathi-Hooghly system from Allahabad to Haldia, NW2 - the Brahmaputra system in Assam and NW-3 - the West Coast canal system in Kerala. Commercially, the most important sector is the small tidal riverine system in Goa, comprising the Zuari and Mandovi rivers and the Cumbarjua canal. A number of other possibilities do exist, in terms of in-principle navigable waterways, but the ones that offer some potential (a mix of feasibility and some traffic possibilities) are the riverine inlets along the coast, especially the ones near ports and some of the canal systems as part of larger water resource development project.

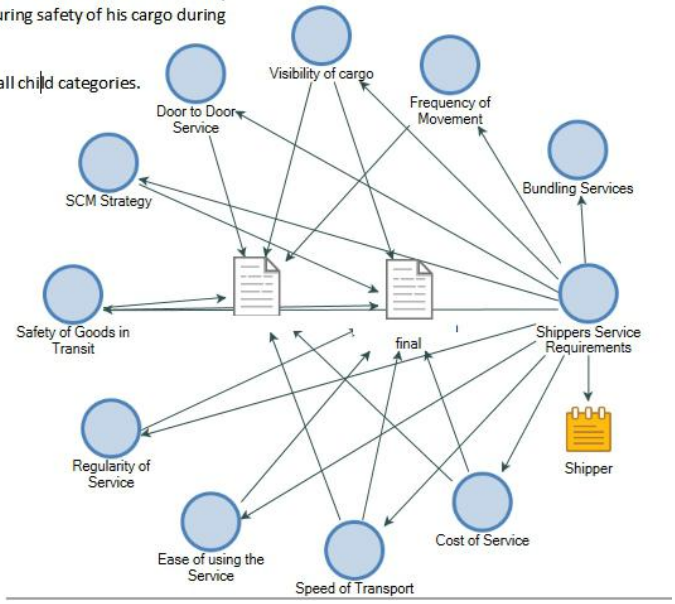
This category is related with NW1, NW2, NW3, Goa Waterways.



Shipper

The Shipper is already comfortable using the existing modes of transportation. Hence to shift him to this new mode of transportation apart from incentives we need to meet his supply chain requirements even. Shipper will require a holistic logistic solution giving him door to door service which is cost effective, regular in service, shorter transit time, visibility of cargo and also ensuring safety of his cargo during transit.

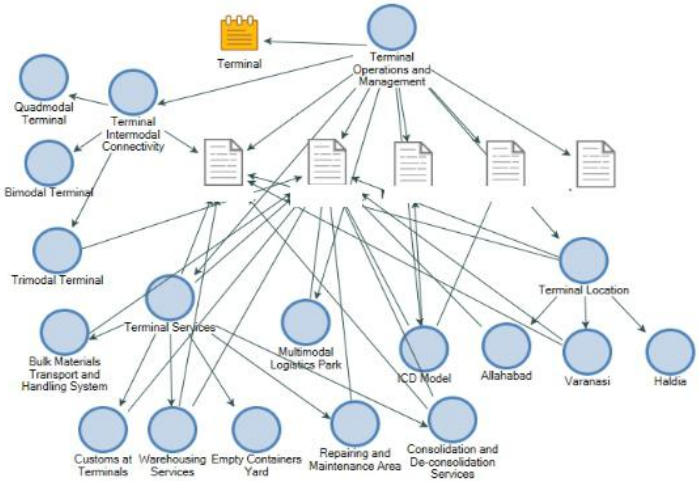
This category is linked to Shipper Service Requirements alongwith its all child categories.



Terminal

A well equipped terminal replicating an ICD Model is required on the banks of the river for effective functioning of IWT. Terminal can be Bimodal, Trimodal or Quadmodal at strategic locations like Haldia, Varanasi, Allahabad and Patna. They should provide services like Customs, Empty Container Yard, Parking facilities, Repairing and Maintenance area, warehousing services, bulk materials handling and bonding services.

This category is linked with Terminal services, Terminal location, Terminal Intermodal connectivity, ICD Model and Multimodal Logistics Park.



Annexure G

Sample Participant Response Indicators to Codes

Category	Coding from Transcript
Dumb Barges →	- § 1 reference coded [1.84% Coverage] Reference 1 - 1.84% Coverage Flat bottom and with lesser draft vessel like 1.5mtrs to 2 mtrs draft and only 4 person on it thats all and they can run in the rivers. So it a barge come tug combination having 4 barges of 150 tonne loading, so it becomes 600 tonnes with a one pusher tug and the draft is only 1.5 mtrs and only 4 people are working on it. 2 on this side and 2 on that side. - § 2 references coded [1.62% Coverage] Reference 1 - 1.32% Coverage Yes we can look at.But again nobody is stopping them to use dumb barges. Even CIWT has 100 dumb barges and and about 240 to 250 tonnes is dumb and they were operating on Ganga upto Varanasi when myself was posted Patna and Bhagalpur at that time.But slowly CIWTC became different and then problem of no return cargo or no good commercial orgnaisation also came into existence. But the problem with waterways is that every waterway is unique. In Ganga also Haldia - Farakka section is different , Farrakka Bhagalpur, then Farakka Patna , then Patna Varanasi , so every section has got a different vessel optimum type. - § 2 references coded [2.37% Coverage] Reference 1 - 1.72% Coverage If we have to choose between Dumb and Mechanised barges, then locks can be an issue with dumb barges. Reference 2 - 0.65% Coverage Container carriers can be dumb barges.

Category	Coding from Transcript
Indian Governance Structure →	§ 1 reference coded [1.35% Coverage] Reference 1 - 1.35% Coverage Our system was designed to work like this - Ministry of Shipping at the apex then Inland Water Transport. Basically IWAI was responsible for development and regulation of national waterways. Offcourse ours is apex body for entire waterway network but especially National Waterways. It is like crude comparison but very fine comparison with highway sector. The highway only the National Highway come under the Central Government. All other roads are coming under State Government, that is what we also wished initially that only few waterways should be under the National Waterways and other should remain with the State Government. - § 2 references coded [2.26% Coverage] **Interviewee** - IWAI is a complete failure. May be they don't have the support of the Govt or whatever, I don't want to be critical but after two and a half decades what have they given us. We have not moved the forward. We are where we were. Nothing really moved. - § 3 references coded [11.49% Coverage] Once if the network is not there and you create Commission, it will be waste, unnecessary paying salary to the commission will not work. Offcourse when the network is there then you can have all these Commissions and CONCOR as you said. These are all facilities only. You can have operators etc but if the system is not there then what they will do. Once the system is there then they you can create Commissions and operators.

Category	Coding from Transcript
Least Available Draft	- § 1 reference coded [0.54% Coverage] Reference 1 - 0.54% Coverage adequate draft has to be ensured all seasons and all way the draft has to be ensured before this movement is made success. - § 2 references coded [2.79% Coverage] Reference 1 - 0.75% Coverage At present IWAI is struggling but even if we give them draft upto 2.5mtrs or less IWT can work out. Reference 2 - 2.04% Coverage You are talking about 2.5 mtrs that is a easy task. Anyone can talk about 2.5m or less or even 3mtrs ; but it is not feasible because first preference of water is for drinking purpose then we have irrigational use etc or supply to industries which cannot be stopped. - § 2 references coded [0.88% Coverage] Reference 1 - 0.25% Coverage but in NW3 kerala the natural advantage is you have 365 days same depth availability and LAD is also there. Reference 2 - 2.36% Coverage Thats a good dream, but for that we should have adequate draft. Draft is a natural phenomena. We cannot create rain, we cannot control such natural phenomenon. The Least Available Depth has to be volunteered all round the year by IWAI. So if they are ready in volunteering the Least Available Depth from Delhi to Kolkatta all round the year , then why not we can fulfill this dream. So ensuring that there is a shallow draft always available then there is always possibility to have the IWT.

Category	Coding from Transcript
Regional Training Institutes	- § 1 reference coded [1.58% Coverage] Reference 1 - 1.58% Coverage Yes definately unless some skilled personnels are involved in the IWT sector we wont be functioning smoothly. So that is the basis of every new cargo system when it comes into place. Sufficient amount of training mechanisms if it is going on round the year or even if it is periodical also then also ok. Training should be there.
Alluvial Rivers	- § 1 reference coded [0.58% Coverage] Reference 1 - 0.58% Coverage There are 2 types of rivers in India. One is large alluvial main rivers like Ganga and Brahmaputra and there are more self controlled rivers and they don't change their courses like Godavari etc they are navigable and fairly confined on banks and all.