Chapter 3
Objectives, Scope and Limitation

3. Objectives, Scope and Limitation

3.1 Need of the Study

In pursuit of the country's overarching goal of USD 35 trillion economy GDP by 2047, the Indian Logistics sector is poised to be a cornerstone in achieving the country's projections (PIB Release dtd. 16-Dec-2023). However, one of the key challenges in the logistics domain for a developing country such as India is the rising logistics cost. The foremost objective of the National Logistics Policy launched in 2022 is lowering the estimated logistics cost from 14% of GDP to around 8% by 2030 (PIB Release dtd. 29-June-2023). In order to have an effective control over logistics costs, it is essential to have the requisite infrastructure in place for all modes of transport. A balanced modal mix as well as collaboration among transport stakeholders is required for load and route optimization. For India, freight transport is largely accomplished through roadways and railways while only a negligible percentage (2%) happens through the waterways (PIB Release dtd. 17-Mar-2023). Despite being the most economical mode of transport, freight transportation in India vide inland waterway transport has not received its due importance. The inland waterway network spanning more than 20,000 kms is largely underutilized and there lies great potential in this domain. In the last decade however, government agencies and policy makers have understood the importance of the sector and have envisioned significant milestones in the development of the waterways mode of transport.

Considering the landlocked nature and locational disadvantages of the northeastern region, the logistics cost is among the highest in the county. With just a narrow strait connecting the Northeast to mainland India, a natural bottleneck is created for the transportation of goods, thereby leading to the higher logistics cost. However, the geographical proximity to the Southeast Asian countries is an encouraging factor promoting international trade. Accordingly, in the last decade, thinktanks and policymakers have focused on developing Northeast as the gateway to South East Asia. In this context of infrastructure development, there has been a renewed focus on developing the waterways which have been natural endowments for the northeastern states, particularly Assam. The state has fifteen national waterways out of which there are a few major ones which have been designated international trade route by virtue of the Indo Bangladesh protocol. Accordingly, the waterways have been given significant importance

and the waterways infrastructure in the state is presently going for upgradation. Initiatives such as Act East Policy, Advantage Assam and the Waterways Conclave has been able on drawing investor's attention by highlighting infrastructural requirements and areas of development for inland water transport. Although a large potential lies in Northeast India and Assam in connecting South East Asian trade and commerce to the mainland by means of water transport, research evidence concentrating purely on this subject matter seems to have not been undertaken. Despite the huge potential, Assam has limited freight transport supporting jetties along its main rivers with a single dry port at Amingaon, Guwahati. In context of the huge investments that have been envisioned for developing the inland water infrastructure along rivers Brahmaputra and Barak, it is pertinent to gauge the effectiveness. Unless public investments of this scale are judiciously planned and executed, the actual benefits from the same is difficult to be realized. Thus, there lies an immense need for exploring Assam's inland water transport system along the operational and non-operational waterways of the region. Also, since the domain is in its nascent stage of development, significant work can be carried out with respect to supply chain network design and optimization models for proposed port infrastructure. The key contribution of the work lies in providing key inputs for decision support in terms of investment prioritizing and operations planning for policymakers and practitioners.

3.2 Objectives of the study

The basic purpose of the study is to explore the inland water transport potential of Assam in terms of infrastructure developments and come up with inputs for developing a robust decision support system for key stakeholders.

Objective 1: To identify and rank key inland water ports along the major waterways of Assam using Analytic Hierarchy Process (AHP)

The primary objective lies in exploring the inland waterway transport infrastructure system in terms of the inland water ports along the key waterways of the state. Starting from shortlisting of the major waterways and consideration of inland water ports to validation of the criteria and sub criteria, the objective involves AHP methodology to calculate the ranks of the ports while checking for consistency. The final ranks of the criteria, sub-criteria and inland water ports reveal the significant factors impacting freight transport as well as investment and operations priority for policymakers and practitioners

respectively. The adapted AHP methodology (Saaty,1987) uses a mix of primary and secondary data for calculating the final priorities.

Objective 2: To identify dry port locations through a hub and spoke network design facilitating string planning for the top inland water ports

Dry ports play a key role in a country's economy and supports the water ports immensely in operations. The objective lies in exploring the hub and spoke transportation network design for identifying feasible dry port locations and its application to the state of Assam. For the inland water ports, a hub and spoke model is proposed while fulfilling the considerations of the dry ports.

Objective 3: To optimize the proposed port network system with the help of a location allocation network model

The final objective aims at optimizing the port network system for minimum distance through iterations of the probable dry port locations. Based on secondary data, alternative locations for dry ports are evaluated. The best-case scenarios are identified and proposed for the selected waterways, which can be used as decision support for the policymakers.

3.3 Scope of the study

Inland waterway transport primarily consists of passenger transport and freight transport. Particularly for the northeastern region of the country with difficult terrains, development of roadways and railways was a bit laggard as compared to mainland India. This led to utilization of the inland waterways for trade and transport even during the pre-independence era for this region. Gupta et al. (2017) provides evidence that Brahmaputra and Barak rivers were used extensively for trade and transport between northeast India and the port of Kolkata even during British rule. In this context, infrastructure for passenger transportation was fairly in place considering the unorganized form of public transportation. Ferry vessels and jetties along the major waterways of Assam have been supporting passenger transport for quite a long time now. However, although smaller cargo loads are presently being supported, the infrastructure and equipment for large scale movement of freight or containerized cargo is yet to be developed in this region. Thus, there lies a huge opportunity in capitalizing the inland waterways for effective freight transportation through justified investment decisions. The scope of this study is limited to the freight transport elements of inland waterway transport. Although there may be

common jetties or inland water ports supporting both passenger and freight transport, yet the focus of the study has been on the variables related to freight transportation. Passenger transport elements and the other waterways in Assam have not been considered for the study.

3.3.1 Geographical Scope

In tandem with the National Logistics Policy, different states have come up with the state level logistics policies which lays down the framework and plans for investments. The state of Assam introduced the Export and Logistics policy in the year 2019 which envisioned investments for modernization of the inland water infrastructure of Assam. The geographical scope of the study is limited to the state of Assam. More specifically, the scope covers inland water freight transport infrastructure along the two major waterways of Assam NW2 Brahmaputra and NW16 Barak. Although the two waterways may have their origin in different states, the scope of the study is limited to the geographical and physical boundaries of the state. The area of study has been the inland water ports along the two waterways in the Brahmaputra and Barak valley where inland water transport infrastructure elements has been provisioned. The waterways have been selected on the basis on cargo transport potential, waterways length and trade route presence. In terms of the inland water port infrastructure, all the designated inland water ports along the selected waterways have been considered for the ranking exercise.

3.3.2 Academic Scope

The academic scope of the study is limited to the utilization of the Analytic Hierarchy Process (AHP) for the port ranking exercise. Although other multi criterion decision making methodologies are available yet evidence has been found for the effectiveness of AHP model for port ranking decisions in different geographies (Lirn et. al, 2004; Ugboma et. al, 2006; Cruz et. al, 2013; Dyck and Ismael, 2015). The study is restricted to the selected inland water ports and the pairwise comparisons have been limited to the identified criteria and sub-criteria. The other hinterland ports and possible criterion are out of scope for the study, For the second and third objectives, the hub and spoke model has been considered for the inland water port dry port arrangement which has been optimized using the location allocation model. Though there may be other supply chain models, hub and spoke has been advocated by researchers working on similar problems of water transport (Konings, 2006; Zheng and Yang, 2016; Zhou et. al, 2023). In terms of

optimization, distance is an important factor in cost calculations and freight pricing is done based on tonnage transported over kilometers (distance). In the study, the optimization iterations have been carried out considering the distance element and any other cost parameter for optimization is not considered for the study.

3.3.3 Timelines under consideration

The primary data for the Analytic Hierarchy Process has been collected during the year 2022-23 through expert consultation during port and office visits. The secondary data for the objectives (excluding literature review) has been recorded during the years 2021-23.

3.4 Limitations of the study

De Oliveira Vargas and Mancia, 2019 highlights the importance of exploring research study limitations in terms of "study limitations" and "method limitations". For the current study, the "study limitations" comprise of the following limitations:

- Defining study geographical scope to the national waterways only in Assam and selecting existing inland water ports. Even in Assam, the study has been carried out on the two major waterways of the state and considering resource and time constraints, the other waterways in the state and northeastern region have not been explored.
- The consideration of freight transport elements for the study additionally limits the horizon of the study interpretation and application.
- The absence of specific research evidence in this domain of inland water port optimization in the country limits the comparability of the results and interpretation.
- Based on an extensive literature review of similar port ranking exercise, the researcher shortlisted variables for the criteria and sub-criteria of the ranking model. This shortlisting process is largely dependent on the researcher's judgement. Although every effort has been made to include all relevant variables, there is still a chance that a few may have been missed which in turn limits the applicability of the study.
- The primary data was collected through interactions from practitioners on the job and thus, the data collected is largely dependent on the respondent's judgement.
- In a few cases, language emerged as a limitation which was taken care of by translating the parameters of the research instrument in the vernacular medium.
- In terms of data collection, the initial planned field visits to the inland water ports was disrupted by the lockdown for COVID19 and the schedule had to be reworked.

The "method limitations" of the research work is described through the following points:

- The researcher used Analytic Hierarchy Process as proposed by Saaty (1970) and inherent limitations of the chosen method emerge as method limitations of the study.
- Inland water port optimization is a complex problem and all multi criteria decision making techniques have limitations while modelling and solving complex problems (Munier and Hontoria, 2021).
- The method chosen being a quantitative approach can capture only specific answers for the questions. There is no scope for analysis of open-ended responses and experiences of the practitioners.
- The traditional AHP model (Saaty, 1970) does not have scope of recording fuzzy inputs.
- As per AHP methodology, the experts were shortlisted based on their job cadre and experience in the domain which may be a limitation in the sense that the knowledge level has not been validated by means of any evaluative assessment.
- As this methodology is relatively new for the domain of inland water transport, the research instrument was not familiar to many respondents for whom additional effort had to taken to make them understand.
- AHP standard questionnaire comprises of similar repetitive questions and thus, an element of fatigue may have crept in for few responses. The complexity of the pairwise comparison process and consistency in decision making also poses an additional challenge. However, this limitation has been avoided by undertaking an informal interactive mode involving substantial time with the respondents.
- For the port ranking exercise, the calculated weights have been finally rounded off for the purpose of representing and interpreting the data which may lead to small variations in results.
- For the optimization model, the widely accepted and relevant hub and spoke model has been used to represent the inland water port and dry port network configuration while other distribution models have not been simulated.
- The simulations for optimizing the network have been based on the physical road distance only and other cost elements have not been included for the simulation model.
- As an inherent limitation of simulation methodology, the results providing the best-case scenarios may have limitation in terms of actual validation on field.

- The secondary data used for the calculations have been accessed from established government platforms and the accuracy largely depends on the sources.