Chapter 6

Identification of Dry Port Location and Optimization of the Network

6. Identification of Dry Port Location and Optimization of the Network

6.1 Preliminary identification of hubs and spokes

Identification of hub and spoke nodes play a pivotal part in accomplishing the optimization of the port infrastructure network. The selected inland water ports for objective 1 shall be considered as the spokes while the prospective dry port locations shall operate as the hub nodes. A preliminary region-specific identification of hubs was carried out and the same approach has been undertaken to expand the number of hub ports.

6.1.1 Selection of feeder inland water ports along Brahmaputra and Barak

As per shortlisting criteria of objective 1, a total of seven inland water ports on Brahmaputra and three ports on Barak have been considered as the feeder (spoke) ports for the optimization exercise.

Table 6.1: Key Inland Water Ports as feeder ports

Brahmaputra (NW 2)	Pandu, Dhubri, Jogighopa. Silghat. Biswanathghat, Neamati, Dibrugarh
Barak (NW 16)	Karimganj, Badarpur, Silchar

Source: Researcher's own compilation

6.1.2 Consideration of prospective hub locations (dry ports)

Dry ports play a significant role in supporting the inland water ports. To identify prospective locations for additional dry ports, simulations have been executed considering placement of dry port facilities at feasible locations supporting the hub and spoke network. The feasibility of the dry port alternates is based upon:

- Easy extension to inland water ports
- Proximity to rail and roadways
- Access to Customs
- Ease of transfer and distribution
- Presence of ancillary/supporting industries
- Market accessibility

6.1.3 Identification of hubs (dry ports)

For the identification of the hubs as per above consideration, a secondary data analysis was carried out and fitment of the prospective locations was checked in a similar way as done in the region-specific exercise.

Table 6.2: Prospective dry port locations (hubs)

Dry Ports Locations **Attributes**	**Jogighopa**	**Amingaon**	**Jagiroad**	**Tezpur**	**Jorhat**	**Dibrugarh**	**Tinsukia**	**Rangia**	**Bongaigaon**	**Badarpur**	**Karimganj**
Easy extension to inland water ports	High	High	Moderate	Moderate	High	Moderate	High	High	High	High	High
Proximity to rail and roadways	Moderate	High	High	High	Moderate	High	High	High	High	High	Moderate
Access to Customs	High	High	Moderate	Moderate	Moderate	Moderate	High	Moderate	Moderate	High	High
Ease of transfer and distribution	Moderate	Moderate	Moderate	High	Moderate	High	Moderate	High	Moderate	Moderate	Moderate
Supporting Industries	Moderate	High	High	Moderate	Moderate	Moderate	High	Moderate	High	Moderate	Moderate
Market Accessibility	Moderate	Moderate	Moderate	High	Moderate	High	High	High	High	Moderate	High

Source: Researcher's own compilation

6.2 Distance Matrix for the port network system

Upon identification of the hub and spoke ports, the distance matrix is developed using locational data from GPS applications for carrying out the optimization exercise.

Table 6.3: Distance Matrix for inland water and dry port alternates

	Proximity to dry port- alternates (in kms)										
INLAND WATER PORTS/ DRY PORTS	**Jogighopa**	**Amingaon**	**Jagiroad**	**Tezpur**	**Jorhat**	**Dibrugarh**	**Tinsukia**	**Rangia**	**Bongaigaon**	**Badarpur**	**Karimganj**
Dhubri	115	220	284	358	532	657	700	234	107	517	540
Jogighopa	5	146	204	280	452	590	632	128	42	437	460
Pandu	144	8	64	183	314	444	494	46	175	298	321
Biswanath	357	238	198	82	170	228	271	232	339	416	439
Silghat	320	185	116	24	139	279	321	177	284	344	367
Nematighat	466	326	255	176	6	131	174	331	430	408	440
Dibrugarh	579	453	422	300	137	3	48	450	557	543	566
Karimganj	461	323	330	370	426	566	608	360	467	25	5
Badarpur	438	297	307	346	400	543	585	337	444	5	25
Silchar	452	310	349	331	388	528	570	350	458	28	51
MINIMUM (kms)	5	8	64	24	6	3	48	46	42	5	5
MAXIMUM (kms)	579	453	422	370	532	657	700	450	557	543	566
CUMULATIVE DISTANCE (kms)	3337	2506	2529	2450	2964	3969	4403	2645	3303	3021	3214
Cumulative Distance - Waterway wise (kms)	1986	1576	1543	1403	1750	2332	2640	1598	1934	58	81

Source: Researcher's compilation from GPS data

6.3 Optimisation of the network

From the distance matrix, simulations are carried out for different combinations of the n-hub scenario models with an objective to minimize the total transportation distance.

6.3.1 One (1) Hub Scenario Model

For the as-is configuration of dry ports in the state of Assam, a 1 hub scenario model was evaluated for the cumulative distance from the inland water ports.

Table 6.4: 1 Hub Scenario Model (with existing dry port at Amingaon)

1 HUB SCENARIO	**Proximity to dry port (in kms)**
INLAND WATER PORTS/DRY PORTS	**Amingaon**
Dhubri	220
Jogighopa	146
Pandu	8
Biswanath	238
Silghat	185
Nematighat	326
Dibrugarh	453
Karimganj	323
Badarpur	297
Silchar	310
Minimum (kms)	8
Maximum (kms)	453
Cumulative Distance (kms)	**2506**

However, an alternate configuration of the 1 Hub Scenario Model has approached a lower cumulative distance with the prospective Hub location at Tezpur.

Table 6.5: 1 Hub Scenario Model (alternate)

1 HUB SCENARIO	**Proximity to dry port (in kms)**
INLAND WATER PORTS/DRY PORTS	**Tezpur**
Dhubri	358
Jogighopa	280
Pandu	183

Biswanath	82
Silghat	24
Nematighat	176
Dibrugarh	300
Karimganj	370
Badarpur	346
Silchar	331
Minimum (kms)	24
Maximum (kms)	370
Cumulative Distance (kms)	**2450**

The alternate configuration of one (1) Hub Scenario model provides a cumulative distance saving of 56 kms.

6.3.2 Two (2) Hub Scenario Model

From the distance matrix, considering the relative distances between the inland water ports and the dry ports, the consideration of Tezpur and Badarpur as the hub ports emerged as the best configuration for hub ports in the simulation for the two hub scenario model.

Table 6.6: 2 Hub Scenario Model

2 HUB SCENARIO	**Proximity to dry port- alternates (in kms)**	
INLAND WATER PORTS/DRY PORTS	**Tezpur**	**Badarpur**
Dhubri	358	517
Jogighopa	280	437
Pandu	183	298
Biswanath	82	416
Silghat	24	344
Nematighat	176	408
Dibrugarh	300	543
Karimganj	370	25
Badarpur	346	5
Silchar	331	28
Minimum (kms)	5	
Maximum (kms)	358	
Cumulative Distance (kms)	**1461**	
WATERWAY	**NW2 Brahmaputra**	**NW16 Barak**

Source: Researcher's own compilation

For a two-hub scenario model, the cumulative distance was calculated as 1461 kms for the port network system

6.3.3 Three (3) Hub Scenario Model

From the distance matrix, considering the relative distances between the inland water ports and the dry ports, three simulations of the three-hub scenario model were carried out namely:

- 3 Hub Scenario (Hubs at Jagiroad, Tezpur and Badarpur)
- 3 Hub Scenario- alternate (Hubs at Jagiroad, Jorhat and Badarpur)
- 3 Hub Scenario- with existing dry port (Hubs at Amingaon, Tezpur and Badarpur)

Table 6.7: 3 Hub Scenario Model

3 HUB SCENARIO	**Proximity to dry port- alternates (in kms)**		
INLAND WATER PORTS/DRY PORTS	**Jagiroad**	**Tezpur**	**Badarpur**
Dhubri	284	358	517
Jogighopa	204	280	437
Pandu	64	183	298
Biswanath	198	82	416
Silghat	116	24	344
Nematighat	255	176	408
Dibrugarh	422	300	543
Karimganj	330	370	25
Badarpur	307	346	5
Silchar	349	331	28
Minimum (kms)	5		
Maximum (kms)	300		
Cumulative Distance (kms)	**1192**		
WATERWAY	**NW2 Brahmaputra**		**NW16 Barak**

Source: Researcher's own compilation

Table 6.8: 3 Hub Scenario Model (*alternate*)

3 HUB SCENARIO	**Proximity to dry port- alternates (in kms)**		
INLAND WATER PORTS/DRY PORTS	**Jagiroad**	**Jorhat**	**Badarpur**
Dhubri	284	532	517
Jogighopa	204	452	437

Pandu	64	314	298
Biswanath	198	170	416
Silghat	116	139	344
Nematighat	255	6	408
Dibrugarh	422	137	543
Karimganj	330	426	25
Badarpur	307	400	5
Silchar	349	388	28
Minimum (kms)	5		
Maximum (kms)	284		
Cumulative Distance (kms)	**1039**		
WATERWAY	**NW2 Brahmaputra**		**NW16 Barak**

Source: Researcher's own compilation

Table 6.9: 3 Hub Scenario Model (*with existing dry port*)

3 HUB SCENARIO	**Proximity to dry port- alternates (in kms)**		
INLAND WATER PORTS/DRY PORTS	**Amingaon**	**Tezpur**	**Badarpur**
Dhubri	220	358	517
Jogighopa	146	280	437
Pandu	8	183	298
Biswanath	238	82	416
Silghat	185	24	344
Nematighat	326	176	408
Dibrugarh	453	300	543
Karimganj	323	370	25
Badarpur	297	346	5
Silchar	310	331	28
Minimum (kms)	5		
Maximum (kms)	300		
Cumulative Distance (kms)	**1014**		
WATERWAY	**NW2 Brahmaputra**		**NW16 Barak**

Source: Researcher's own compilation

6.4 Identification of optimal port locations for the network

From multiple iterations of n-hub network models, the best case in terms of distance minimization has been approached for the port network system through the following configurations.

Table 6.10: Comparison of cumulative distances for the simulated networks

NETWORK TYPE	Cumulative Distance (kms)
1 HUB (with existing dry port)	2506
2 HUB (Tezpur, Badarpur)	1461
3 HUB (Jagiroad, Tezpur, Badarpur)	1192
3 HUB alternate (Jagiroad, Jorhat, Badarpur)	1039
3 HUB with existing dry port (Amingaon, Tezpur, Badarpur)	1014

Source: Researcher's own compilation

A three-hub network with the existing dry port at Amingaon is found to approach optimality in terms of cumulative distances between the spokes (inland water ports). Application of this model shall lead to substantial cost savings for the transporters.

6.5 Hub and spoke network for the optimized configuration

From the optimal three hub network configuration, the final hub and spoke model is developed which identifies the feeder ports for the dry ports.

Table 6.11: Hub-and-spoke model for the port network

Dry Ports Locations	Spokes connecting the inland water ports
Amingaon	Dhubri, Jogighopa, Pandu
Tezpur	Silghat, Biswanathghat, Neamatighat, Dibrugarh
Badarpur	Karimganj, Badarpur, Silchar

Source: Researcher's own compilation

The hub and spoke model with the above configuration of inland water ports shall lead to minimum relative distance among the nodes. This shall lead to cost savings and logistics infrastructure optimization.