
**A Study on Preferred Mode of Transport by Port Users for hinterland connectivity:
An Empirical investigation with reference to Gujarat**

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Abstract: -

This paper is investing important factors affecting carrier selection and negotiations in logistics. It focuses on crucial high quality of information to make decision and trust between freight forwarders and carriers. For Consignor/Consignee to manage constant service and supply chain integrity, stability in financial aspect and dependency are essential. In the same way competitive rates and flexibility in price are important factors that influence the outcome of negotiations and margin in profit for freight forwarder. Operational efficiency and fulfilling client expectation are important on providing better quality services and consistent scheduling. Effective logistics are supported by well-planned ports and competent infrastructure. As environmental sustainability gains more and more importance, Transporters are implementing strategies to reduce their footprint. To reduce delays and expenses requires a carrier's reputation for reliability and timeliness. These factors influence carrier selection and efficient supply chain management.

Moreover, cost, the volume of goods (quantity), turnaround time (delivery time), distance from the port to the destination, connectivity, and accessibility are essential factors to consider. The value of the cargo, the reputation and goodwill of the company, port capacity, infrastructure, and urgency also play a significant role in influencing decisions. All these factors collectively contribute to the efficiency and effectiveness of the logistics process, ultimately ensuring a seamless and sustainable supply chain.

Introduction: -

Port Expansion and hinterland logistics are crucial in identifying trade efficiency and economic growth in international supply chain. Unique approaches have been placed in different parts of the world to manage with special opportunities and problems related to important sectors. Considering the best examples on impact of regional policy taking strategic advantages to promote economic development is Gujarat which is part of India. The strategic location of Gujarat and its hinterland, the government implemented a policy on exclusion ports with the objective of expanding port operations to cater huge economic requirement of northern state.

Road transportation is increasingly popular but rail transportation is still more economical and environmentally friendly. This is because of rail's low performance, which is mostly caused by poor track conditions. Road transportation is commonly used

because of its performance is better in terms of operational costs, average speed and travel time- all while having a greater environmental impact. Plan to create intermodal hub facilities in service is clear example of need for important measures to repair train infrastructure. These kinds of programs are essential for facilitating the movement of freight from crowded origins and motivating the adoption of more environmentally friendly modes of transport.

The importance of precise and timely information in logistical decision-making is highlighted by a study on the roles of power, time and information in this discussion. This effect is in line with the larger body of research that highlight how important high-quality information is to getting the best possible bargaining results and guaranteeing smooth logistics operations.

Strategic planning and technology developments are important part in port performance. Through the review of major ports' capabilities, competitiveness and performance, studies offer important new perspectives on the factors which influence sustainability of port and its efficiency. These insights are important for ports to stay competitive in global trade which is changing quickly.

The selection of transportation Mode are based on factors like cost, volume, Turnaround time, Distance for cargo moving, connectivity available for hinterland, accessibility of facilities play significant role in this. Besides this factors Value of cargo, Good-will of company, Infrastructure and urgency to deliver the goods are also important when it comes to land transportation.

It shows the benefits and challenges that come with Transportation to connect hinterland and port development when taken as a whole. The global imperative is clear; in order to solve these issues, Country must invest in vital infrastructure, develop customized strategies the make utilise of their particular assets to secure long term economic growth and supply chain efficiency.

Literature Review: -

In the vibrant state of Gujarat, a significant policy initiative was undertaken to augment port growth and report the broader economic development needs of the northern states. Gujarat's strategic location and its wide-ranging hinterland, the government executed an exclusive port policy aimed at fostering economic development through increased port activity (Chudasama, 2020). This policy underscored the critical interplay between port operations and hinterland economic activities, emphasizing the need for further development to accommodate the growing demands of these states.

(Daramola, 2022) Studied both rail and road infrastructure stock fall short of standard benchmarks in physical planning in Nigeria. Road haulage charges are higher than rail freight charges and making it more environmentally friendly. However, freight throughput performance with respect to operational costs, average speed and transport time is higher on roads than on rail. To achieve the shift, rail tracks must be updated to the point that speed of train can be increase.

The Sagarmala initiative by the Ministry of Shipping aims to improve connectivity and upgrade ports, bringing them into the modern era. The goal was to enhance the efficiency

of commodity flow and trade by integrating port activities with inland waterway transport and coastal shipping (Government of India, 2015). (Chi-lok Andrew Yuen, 2012) Has carried out a

study on the competitiveness of ports in China and its major Chinese seaports and their performance and capability. There is a wide future scope ahead with respect to this research study by comparing and examine the competitiveness, capability, and performs of the other major ports of Asia.

In the same way (Soo Yong Shin, 2016) studied the dynamics between airlines and shipping companied in Korea which is focusing on the role of power, time and information in negotiations between carriers and forwarders. The study highlighted the importance of the forwarder view in decision- making process related to carrier selection in international logistics. At Global stage (Wayne K. Talley, 2017) highlighted the importance of port services and performance in carrier decision making. The study also noted the growing popularity of dry ports as a solution to improve congestion and improve handling processes at maritime ports. The logistics expenses associated with hinterland transport chains were crucial factors in the selection of intermodal carriers, sea ports, dry ports and overall supply chain efficiency.

(Hadi Ghaderi, 2016) Compared to government targets of 30 to 40%, the rail sector's contribution to container transportation between inland terminals and ports in Australia remains low, averaging about 11% in 2014. The main challenges that have been highlighted include inadequate infrastructure, inefficient operations, and inadequate transportation policy. According to the study, improving rail sharing can be accomplished by building more rail infrastructure, reorganizing intermodal the terminal networks, and establishing dedicated freight lines. It also emphasizes how important it is to remove obstacles and assess the possible effects of port privatization on the design of rail infrastructure.

(Roorda, 2021) examines how businesses in the Toronto region choose the kinds of vehicles they send by using discrete choice models and machine learning. Tractor-trailers and pickup/cube vans are the most precisely anticipated vehicle categories for road transportation, according to the author's data.

(RUTO, 2014) Examined the performance management of the Port of Mombasa, identifying the significant roles played by stakeholders such as the Port Authority, revenue authority, shipping lines/agencies, police, and others in enhancing port performance. In order to ensure the effectiveness and efficiency of any port, the study emphasizes the critical roles that resources, equipment, and skilled labour play.

(K. Hasan, 2016) begins with an overview of the significance of hinterland connectivity for port operations, port development overall, and port efficiency, and concludes with a brief analysis of Bangladesh's international trade patterns. Subsequently, this article has featured a comparative analysis of how well various surface transportation options perform in supporting the Maritime Ports' hinterland services. Lastly, the relative benefits of inland waterways to complement other forms of transportation and a logistical strategy to get around some of its shortcomings.

(Woodburn, 2017) The claim that there are fewer negative externalities per unit of transportation activity in the hinterland is strongly supported by the combination of the rise in the percentage of rail transportation and the gains in operational efficiency found in this

study. The previous analysis found that the rise in rail's participation of the UK port-hinterland container business since 2007 resulted in an estimated 34,000 tons of CO₂e savings in 2015. Because there were no particular emissions data available for the road and rail operations serving the port-hinterland container market, the computation relied on official modal averages.

When carriers and freight forwarders are negotiating, the accuracy of information is critical. Timely and accurate information helps in better decision making and builds mutual trust. According to a study on Korean freight forwarders, the most important element for effective procurement negotiations is the quality of information (S. Shin, 2016).

Shippers prefer carriers that demonstrate stability and dependability in their financial operations. This includes document accuracy and the overall performance of the carrier (Lu, 2013). These factors ensure that shippers can depend on carriers for consistent and reliable service, which is essential to maintaining the integrity of the supply chain. Flexible pricing schemes, such as those allowing adjustment based on demand, can also increase the efficiency of capacity allocation and improve negotiation outcomes (Gupta, 2008).

It is imperative for freight forwarders and shippers/receivers to maintain exceptional service quality and service consistency in logistics operations. The operation of logistics services requires careful attention to high-quality service delivery through proper oversight of paperwork and other logistics task management. Planning and routing are essential components of timely delivery of shipments and is critical to meeting the expectations of a shipper's client and overall supply chain efficiency (Fanam P.D., 2018).

According to (Chu, 2014), freight forwarders routinely consider the quality of infrastructure and the location of ports when selecting a carrier for transportation services in the logistics business sectors of varying scale, specifically the air freight business sector.

Objectives: -

Identify the effect of different factors for carrier selection and negotiation in transportation mode.

Research Methodology: -

a. Research Design

The study follows a Descriptive research design, utilizing survey methodology to collect data on factors influencing transportation mode selection for hinterland connectivity. The primary aim is to quantify the importance of various factors such as Quality of Services, Urgency Handling, Reputation, Port Capacity, Infrastructure, Connectivity, Accessibility, Cost, Volume, Distance, and Turnaround Time (TAT) in the decision-making process.

b. Sampling Method

A Convenient sampling technique used ensure that the sample represents different segments of the population involved in transportation mode selection, including Freight forwarder, Transporter, NVOCC, VOCC, Exporter/Importer, CHA.

c. Sample Size

Approximately 267 respondents to ensure the reliability and validity of the results.

d. Data Collection

Data collected using a structured questionnaire. The questionnaire includes Likert scale items (ranging from "Least Preferred" to "Highly Preferred") to measure the perceived importance of each factor in transportation mode selection. The survey conducted online to maximize response rates.

Data Analysis:-

Weighted Average:

In data analysis, a weighted average is used when different factors carry different weights or importance. This is often used when calculating an overall average that takes into account the significance of each data point.

ANOVA Test (Analysis of Variance):

ANOVA is a statistical test used to compare means between two or more groups to determine if there are statistically significant differences.

Reliability

The reliability of the questionnaire assessed using Cronbach's alpha to ensure that the items within each factor are consistently measuring the same underlying concept.

Scope of study:-

Research area is on Northern part of hinterlands in India. Rail and Road Mode of Transportation are Preferred. Focused on ports (sea port of Gujarat, which have both rail and road connectivity), their port users which includes Exporter/Importer, Freight forwarders, custom house agents, non-vessel operating common carrier, vessel operating common carrier.

Limitations

the study includes its focus on the northern hinterlands of India, which may not reflect the transportation dynamics in other regions of the country. The study specifically examines rail and road modes of transportation and ports in Gujarat, potentially overlooking other transport options and regional variations. Additionally, the focus on specific port users such as exporters, importers, and freight forwarders may limit the generalizability of the findings to a broader range of stakeholders involved in transportation mode selection.

Hypothesis:-

H₀= There is no impact of different factors on mode of transport selection.

H_a= There is impact of different factors on mode of transport selection.

Analysis: -

Reliability:-

As per mention in Table 1, A Cronbach's Alpha of 0.910 indicates that the questionnaire or scale made up of these 11 items has a very high level of internal consistency. Therefore, the items are likely measuring the same underlying concept or construct effectively.

Reliability Statistics

Cronbach's Alpha	N of Items
.910	11

Table 1

Weightage Average:-

As per mentioned in table 2, we have calculated the weightage average of different factors which affect the selection of transportation mode decision for hinterland connectivity. Weightage for highly preferred-5, Preferred-4, Neutral-3, Less preferred -2 and least preferred-1.

Below is a concise overview of the process for choosing a mode of transportation:

The most crucial component is the Quality of Services, which has the greatest average weightage of 4.48. This suggests that choosing a transportation mode with excellent service quality is of utmost importance. The need of handling urgency is emphasized, as indicated by an average weightage of 4.45. This underscores the necessity for a transportation method that can effectively handle time-sensitive goods. The reputation or goodwill of the company is highly influential in the selecting process, with an average rating of 4.34.

Port Capacity and Infrastructure are of similar significance, each with an average weightage of

4.31. This suggests that the capacity of a port and its infrastructure to efficiently manage traffic is a crucial factor to consider. Connectivity receives a little lower score of 4.28 on average, but it still plays a significant role in determining the most suitable form of transportation. The criteria of Accessibility and Cost both have an average rating of 4.15, indicating that they are essential but not as crucial as other considerations in the decision process. The variable "volume" carries a weight of 4.12, indicating its moderate significance in deciding the mode of transportation.

The Weight average for distance is 4.05, suggesting that proximity to the port is a consideration but not the most important aspect. Turnaround Time (TAT) is the least significant aspect among those mentioned, with an average weightage of 3.98. This implies

that although it is taken into account, it is not as important as the other criteria when choosing a transportation option.

Variables	Least Preferred	Less Preferred	Neutral	Preferred	Highly Preferred	Weightage Average
Quality of Services	9	7	18	45	188	4.48
Urgency Handling	0	21	14	56	176	4.45
Reputation / Goodwill of company	0	5	38	86	138	4.34
Port Capacity	0	4	64	45	154	4.31
INFRA	0	4	64	45	154	4.31
Connectivity	0	12	40	77	138	4.28
Accessibility	5	8	64	54	136	4.15
Cost	14	6	50	54	143	4.15
Volume	5	8	46	100	108	4.12
Distance	25	7	21	90	124	4.05
Turnaround time (TAT)	11	12	59	74	111	3.98

Table 2

Anova:-

As per table 3, If Sig. is less than 0.05, we reject the null hypothesis, indicating that the factor has a significant impact on mode selection. So based on above table Factors like Volume, Distance, Reputation/Goodwill, port capacity, infrastructure, cost, urgency, Turn Around Time have Significant value less than 0.05. Hence it impacts on transport mode selection.

If Sig. is more than 0.05, we fail to reject the null hypothesis factors like connectivity, Accessibility have significant value more than 0.05 which shows that these factors do not impact transport mode selection.

Variables		Sum of Squares	df	Mean Square	F	Sig.
Volume (Quantity)	Between Groups	19.441	2	9.720	12.340	.000
	Within Groups	207.960	264	.788		
	Total	227.401	266			
Distance	Between Groups	42.991	2	21.495	16.018	.000
	Within Groups	354.275	264	1.342		
	Total	397.266	266			
Reputation / Goodwill of company	Between Groups	10.403	2	5.202	8.845	.000
	Within Groups	155.260	264	.588		

	Total	165.663	266			
Port capacity	Between Groups	26.456	2	13.228	12.017	.000
	Within Groups	290.608	264	1.101		
	Total	317.064	266			
Infrastructure	Between Groups	18.303	2	9.151	12.681	.000
	Within Groups	190.514	264	.722		
	Total	208.816	266			
Cost	Between Groups	14.726	2	7.363	6.026	.003
	Within Groups	322.578	264	1.222		
	Total	337.303	266			
Urgency	Between Groups	5.497	2	2.749	3.382	.035
	Within Groups	214.570	264	.813		
	Total	220.067	266			
Turnaround time (TAT)	Between Groups	7.471	2	3.736	3.187	.043
	Within Groups	309.435	264	1.172		
	Total	316.906	266			
Quality of services	Between Groups	3.345	2	1.672	1.771	.172
	Within Groups	249.329	264	.944		
	Total	252.674	266			
Connectivity	Between Groups	2.588	2	1.294	1.684	.188
	Within Groups	202.902	264	.769		
	Total	205.491	266			
Accessibility	Between Groups	2.802	2	1.401	1.381	.253
	Within Groups	267.902	264	1.015		
	Total	270.704	266			

Table 3

Finding and Discussion: -

The findings suggest that service quality is the top priority for stakeholders when selecting a transportation mode for hinterland connectivity. This is closely followed by the ability to handle urgent shipments and the reputation of the transportation provider. These factors highlight a preference for reliable, high-quality service, even if it comes at a higher cost or longer distance.

Port capacity and infrastructure also play crucial roles, as they ensure that logistics

operations can run smoothly without delays at the port. Interestingly, cost is not ranked as high as one might expect, implying that companies are willing to prioritize efficiency, reliability, and service quality over the lowest price.

Turnaround time and distance are lower on the priority list, indicating that while they are considered, they do not outweigh the importance of quality and urgency in decision-making.

Based on the significance values, several factors—such as Volume, Distance, Reputation/Goodwill, Port Capacity, Infrastructure, Cost, Urgency, and Turnaround Time (TAT)—demonstrate a significant impact on transportation mode selection. These factors shape the decision-making process by addressing operational efficiency, service quality, cost management, and responsiveness to business needs.

On the other hand, factors like Quality of Services, Connectivity and Accessibility do not have a statistically significant impact on the decision. This suggests that while these factors are important in a broader logistical context, they may not drive the specific selection of transportation modes for hinterland connectivity as strongly as other criteria.

Conclusion: -

This research paper reveals that reliability, urgency, and service quality dominate decision-making processes in transportation mode selection with infrastructure and reputation also playing key roles. Cost, volume, and distance are important but are secondary to these factors. This indicates a shift towards value-driven logistics strategies where stakeholders are willing to invest in superior services to achieve operational excellence. It also reveals that decision-makers prioritize, cost, reputation, and the ability to meet urgent requirements when choosing transportation modes. Connectivity, accessibility and service quality although beneficial are secondary considerations that do not hold as much weight in the selection process.

The study's focus on the northern hinterlands of India may not be representative of transportation dynamics in other regions. It primarily examines rail, road, and port transportation in Gujarat, potentially neglecting other options and regional differences. The findings may not be applicable to a wider range of stakeholders involved in transportation mode selection.

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