# Investigation of transportation mode choice for domestic freight movements in India

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**Abstract:**

Freight mode choice plays a vital role in not only determining the vehicle flows, which helps in studying the traffic impacts and policymaking to mitigate the concerned problems, but also determining the emissions from freight transport, which helps in decision-making for sustainable freight transport. Usually, rail, sea, and inland water transport have less emission compared to road transport (Tavasszy & De Jong, 2013). India, one of the largest economies in the world, has a transport system that consists of different modes such as rail, road, coastal shipping, inland waterways, pipelines, and air transport. Rail and road transport are dominating by carrying around 87% of the total freight traffic in the country (National Transport Development Policy Committee, 2015). The Indian freight industry is suffering from many inefficiencies despite policy reforms and investments over the transportation sector by the government. India spends around 14% of its GDP on logistics and transportation, which can be reduced to 8-10%, which is equivalent to the expenditure by some of the developed economies by addressing the inefficiencies in the system (The World Bank Group, 2016). Despite having one of the world's largest rail networks, the share of freight/cargo transported by rail has declined from over 85% in the 1950s to 29% at present. As the railways could not build up the capacity to cope up with the growing market and due to subsequent investments in the road sector, the modal mix in India has evolved in a sub-optimal way. This trend of mode share, if unattended, leads to unsustainability. Hence, there is a need to identify the driving factors of freight mode choice and to model the mode share in the country, which can help in policy-making. This study can fill the gap of understanding the factors influencing the freight mode choice in developing countries like India, as there are minimal studies on freight transportation in India.

In the present study, a revealed preference shipper/freight-forwarder survey was conducted and the data on more than 800 shipments were collected. The shippers and freight-forwarders in Mumbai and Navi Mumbai were personally met and interviewed. Although the survey was conducted in the area of Mumbai, the shipments comprise the origins and destinations spread all over the country, as the companies are operating at a national and international level. Primarily, the shipment information comprises origin, destination, type of commodity transported, transit time, transport cost, mode of transport chosen. The data contain road and rail modes covering the freight movements within the country. Additionally, to identify the factors influencing mode choice in view of decision-makers, the interviewees were asked to state the various factors influencing the freight mode choice and were asked to rank and rate their importance. Based on the shippers/freight-forwarders' responses, various types of attributes were observed to influence the choice of mode, which can be categorized as mode

characteristics, commodity characteristics, and locational characteristics. In the category of mode characteristics, transport cost, transit time, and travel time reliability are found to be more important compared to other mode attributes such as service frequency, loss, damage, etc. The nature of commodity plays an important role in choosing the mode as it decides the importance of transit time: very important for a perishable good and less important for a non-perishable good. The locational attributes such as availability of mode at places of origin and destination also play an important role.

The popular approach used to model the choice behavior is discrete choice modeling underlying the concept of random utility maximization. Various forms of discrete choice modeling are proposed in the literature based on the underlying assumptions of unobserved utility; logit and probit models are widely used among them (Hensher, Rose, & Greene, 2015). In the present study, binary logit and binary probit models are developed to model the freight mode choice decisions between rail and road. The explanatory variables considered are mode attributes–transport cost, transit time; commodity characteristics–nature of the commodity; locational attributes–the distance between the origin and destination, availability of mode at origin and destination, haulage. The sensitivity of mode choice decisions for varying scenarios of cost and time is analyzed. This study will help in addressing the inefficiencies of the system in the prevailing sub-optimal mode share. This study helps in understanding the mode choice scenario in India and the driving factors behind it, which can help researchers and planners in decision-making related to policy reforms that lead to sustainability.

**References**

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