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

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Presented by

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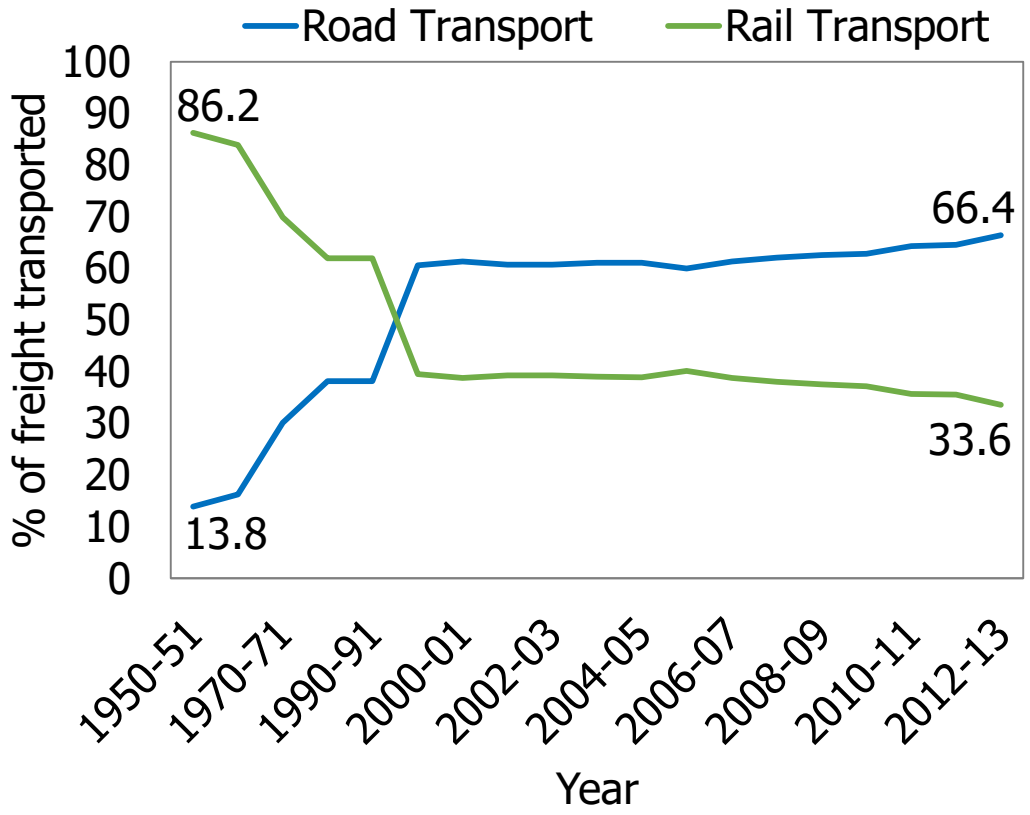
# Transport system in India

- India, one of the largest economies in the world, consists of a transport system comprising 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.


# Indian freight industry & mode share

- Many inefficiencies despite policy reforms and investments over the transportation sector
- Nearly 14% of its GDP is spent on logistics and transportation
- Share of freight/cargo transported by rail has declined from over 85% in the 1950s to 29% at present.
- This trend, if unattended, leads to unsustainability

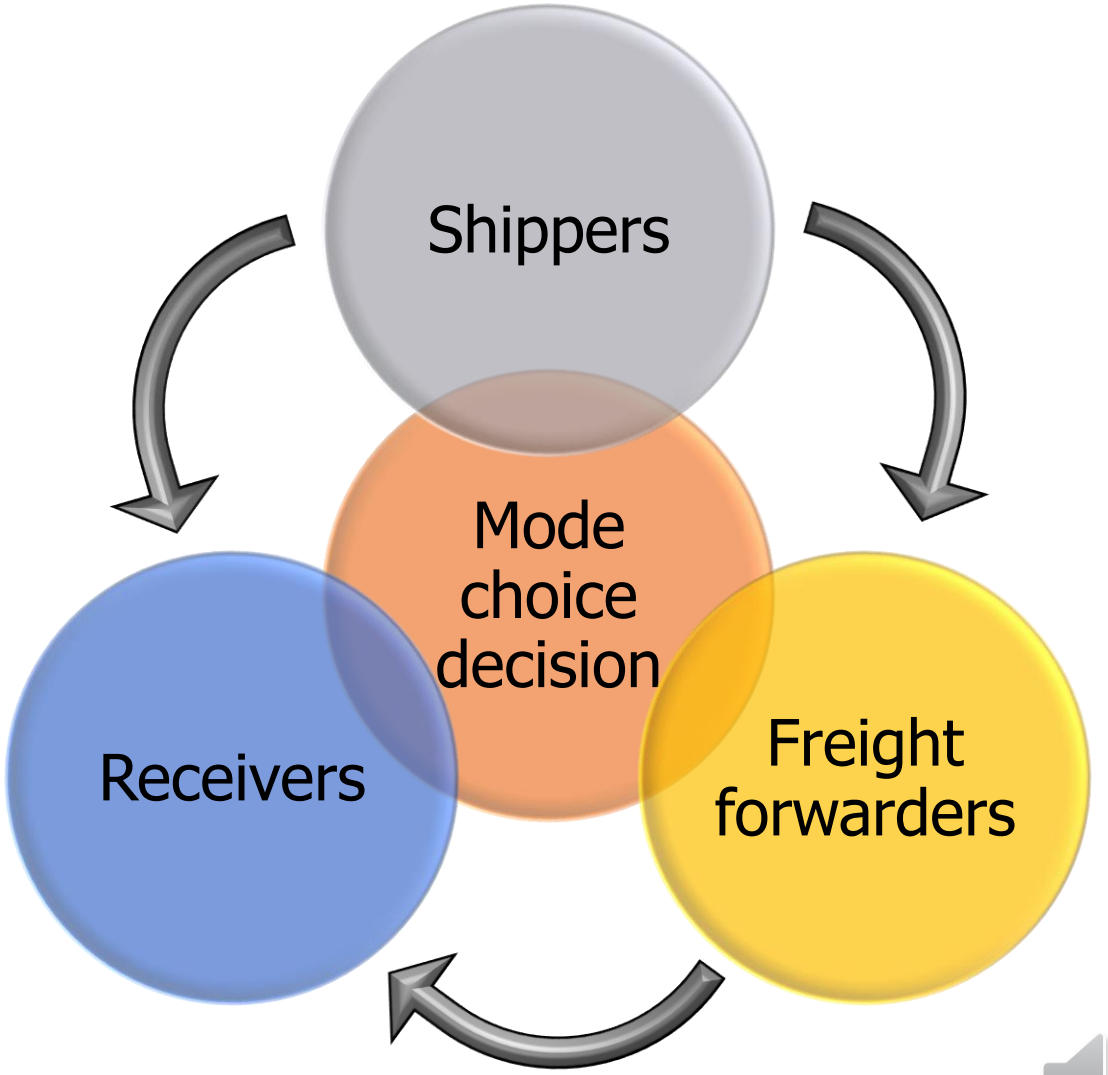


# Aim of this study

- There are minimal studies on freight transportation in India—most of them focussing on freight generation and at urban or port level.
- This study aimed to understand the factors influencing transport mode choice for domestic freight movements in India
- Shipper/freight forwarder survey—Revealed preference (RP) to identify their preferences and modal performance
- Scope: Road and rail modes, shipments transported within the country

# Complexity involved in mode choice decisions

- Decentralised freight industry
- Unorganised and highly fragmented with small and medium sized players dispersed across regions
- Private truck owners with very less fleet size



# Data collection

- Shippers and freight-forwarders in Mumbai and Navi Mumbai were personally met and interviewed.
- Origins and destinations spread all over the country, as the companies are operating at a national and international level; 32 O-D pairs across the country
- Primarily, the shipment information comprises origin, destination, type of commodity transported, transit time, transport cost, mode of transport chosen.
- Due to complex nature of mode choice, it is challenging to collect the data from Indian freight sector

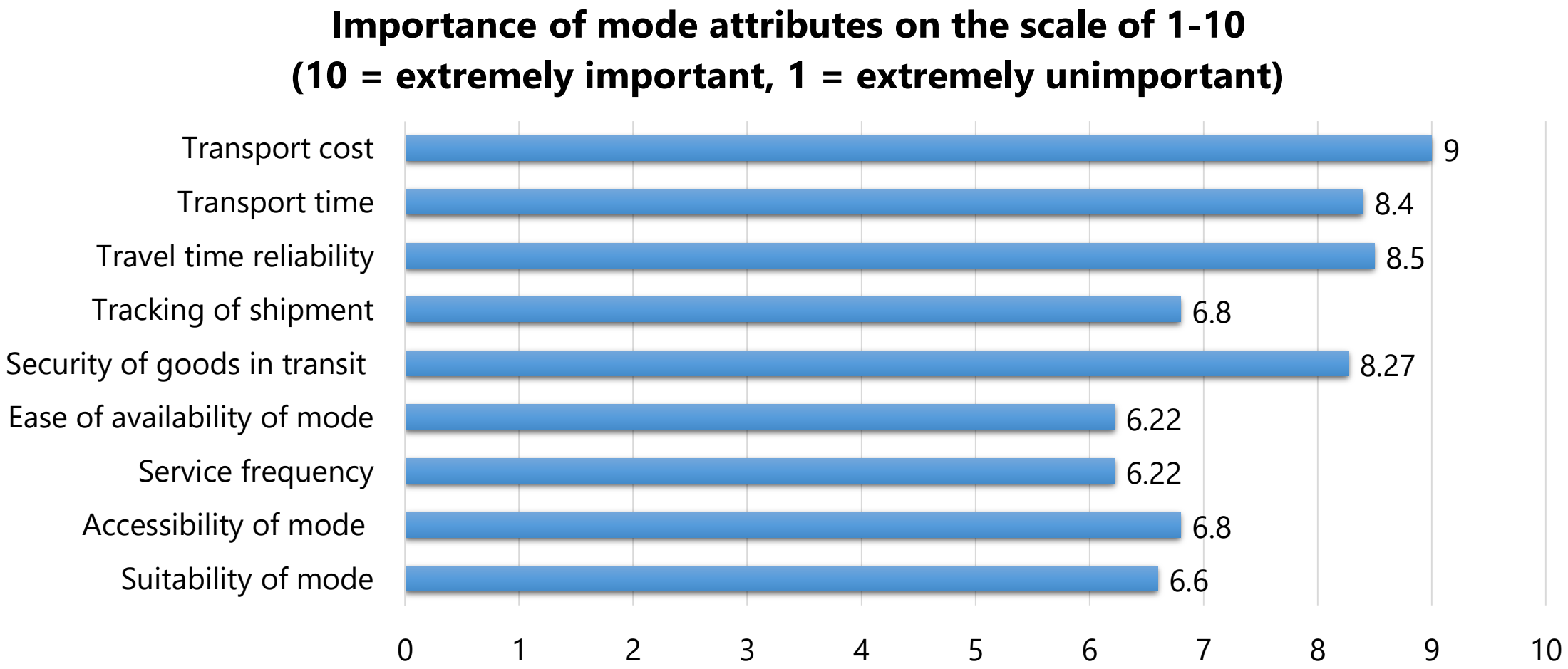
# Shipper Characteristics

- More than 60% of the companies studied have more than 500 employees
- More than 80% of the companies studied have a turn over more than 100 crores (~13.5 million USD)
- More than 60% companies have own vehicles for transport
- Commodities transported by road: Machinery, FMCG, FMCD, pharmaceuticals, automotive parts, computer peripherals, cement, steel, etc.
- Commodities transported by rail: Salt, steel, cement, clinker, computer peripherals, Agro products, etc.

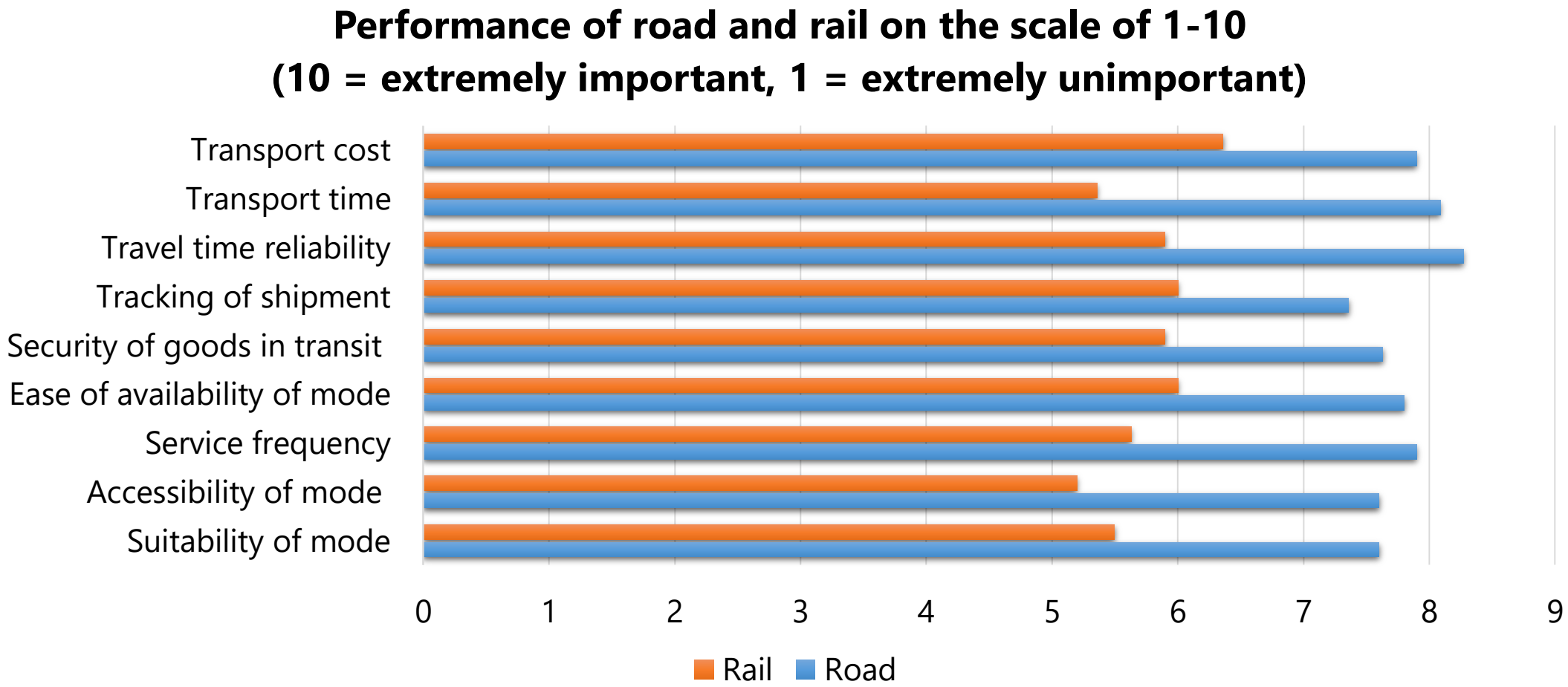
# Factors influencing transport mode choice

- Various types of attributes were observed to influence the choice of mode:
  - Mode characteristics,
  - Commodity characteristics, and
  - Locational characteristics.
- Mode characteristics: Transport cost, transit time, and travel time reliability—more important compared to others
- 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.

# Factors influencing transport mode choice



# Performance of road and rail as per shippers/freight forwarders



# Mode choice model

- Binary logit model is developed
- Modes: Road, Rail
- Utility functions:

$$U(Road) = asc_{road} + tt \times TT + tc \times TCKM + dt * \ln(DIST)$$

$$U(Rail) = tt \times TT + tc \times TCKM$$

- Where TT = Transport time in hours; TCKM = Transport cost per ln(DIST); DIST = Distance between Origin and Destination in km

# Model summary

Log likelihood function = -119.25; Constants only -183.8638
Estimation based on N = 488, K = 4; Inf.Cr.AIC = 246.5 AIC/N = 0.505
**R-sqrd = 0.351; R2Adj = 0.346**
Chi-squared[3] = 129.20830
Prob [ chi squared > value ] = .00000

| | Coefficient | Std. Error | z | Prob. \|z\|>Z* |
|---|---|---|---|---|
| $asc_{road}$ | 8.002*** | 1.470 | 5.44 | <0.000 |
| $TT$ | -0.237*** | 0.048 | -4.89 | <0.000 |
| $TCKM$ | -0.091** | 0.042 | -2.17 | 0.030 |
| $\ln(DIST)$ | -5.093*** | 0.917 | -5.55 | <0.000 |

Note: ***, **, * ==> Significance at 1%, 5%, 10% level

# Prediction accuracy

| | | Predicted | | |
|---|---|---|---|---|
| Actual | | Road | Rail | Total |
| | Road | 387 | 40 | 427 |
| | Rail | 40 | 21 | 61 |
| | Total | 427 | 61 | 488 |

- Overall prediction accuracy: 83.60%
- Prediction accuracy of rail shipments: 34.42%

# Factors discouraging the choice of rail mode

- Mostly, rail can carry bulk goods in containers and automobiles
- Necessity of a full rake load
- Rail is not flexible, fixed schedules
- Long advanced booking times
- Lack of first mile and last mile connectivity
- Handling charges, Pilferage, damages
- Nature of commodity; special and over dimensional cargo may not be suitable for rail
- Geography
- Bureaucracy is a problem

# Thank you