Analysis of Freight Mode Choice Decision: A Case Study of Islamabad and Rawalpindi

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Abstract

Pakistan has a very skewed modal transportation, with approx. 96% of freight moved by road. What led to the current situation is the technical and financial dependency of the institutions on the foreign donors that prioritized road infrastructure and private vehicles somewhere in 60's. The inertia continued even after seven decades with different story lines such as motorization for development, economic wellbeing etc. (Anwar, 2025). Owing to the increasing import bills, huge infrastructure portfolio in PSDP, emissions from fossil fuel and the shortage of foreign exchange leading to macroeconomic imbalances, a shift in the policy is a must. However, transportation systems, especially freight, are typically complicated, heterogeneous, and usually poorly understood. Implementing policies affecting such a complex system can result in ineffective attempts and frequently unanticipated consequences. The most effective strategy to avoid these results is to ensure that behavior research underpins freight policy. This study uses mix methods to examine the factor influencing mode choice decision of the firm and identify reform areas for railways freight business. For this purpose, interviews were conducted from different freight shippers based in Rawalpindi and Islamabad. The analysis through probit model shows that reliability, transportation cost, ease of access, probability of loss, damages, origin and destination are the factors that influence mode choice decision of the firms. Moreover, the thematic analysis shows that for railway to regain freight modal share investment, a digitally equipped customer-oriented railway is inevitable.

Keywords: Mode choice, Freight transport, Shippers, Forwarders, Islamabad, Rawalpindi.

JEL Classification: R41, R42, L92, C35.

1. Introduction

Transport has reshaped the human development since the beginning of human civilization. Freight transportation is vital to a country's economic prosperity and regional integration. Transport and logistics are important part of the economy in their own right contributing to growth and employment. The logistics business contributes $4.3 trillion globally, accounting for 8-10% of GDP, creating thousands of new employments, and significantly enhancing export competitiveness. Notably, the top twenty countries in Logistics Performance Index (LPI) are also amongst the world's top ten strongest economies. In Pakistan, it contributes more than 13% to GDP and 5.4% of total jobs with abysmally low contribution of railways. Existence of efficient freight transport enhances economic development and can boost the economic growth of a country (World Bank, 2011). This demonstrates the potential of the sector in Pakistan as it aims

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to increase exports. Amongst all means of transportation, trucking has emerged as the fastest growing segment. However, this expansion has a number of major negative consequences, including traffic congestion, pollution, and traffic accidents. On the other hand, Railways contribute less to environmental degradation as compared to road (Chapman, 2007), per ton of cargo rail freight produce 76% less CO_2 than road (Rail & Place, 2010). A well-functioning railways system facilitates business, lowers transportation costs, and helps ease road congestion; in fact, due to rail's higher capability, one freight train can generally replace 100 trucks. Rail transport is more fuel efficient and cost effective than road transport; less fuel is required to transport a tonne of goods by rail, which saves money and reduces greenhouse gas emissions; on average, a gallon of fuel can transport a tonne of goods 250 miles by rail, compared to 90 miles by road (NFLP, 2020). Also freight by rail can lead to less deterioration of roads. Thus, research on freight mode selection, particularly between truck and rail, is crucial for increasing the efficiency of the freight transportation system.

The demand for freight and passenger increases with the increase in population, economic development, industrialization, agriculture development and urbanization (Ramanathan, 2001). Thus the European transport plan focused on revitalizing rail transportation by creating a more competitive rail transport market through service liberalization in order to increase rail freight efficiency (Mäkitalo, 2011). Often, freight transportation is viewed as an input to the process of production. Thus the more efficient the freight transportation is, the lower would be the end prices for food and manufactured goods. Despite railways being more cost effective, road is the preferred mode. In this regard, it is crucial to understand the factors that is affecting freight mode choice

Understanding this choice of transport service is crucial to comprehending the transport market, building a competitive transport system, and making a shift toward multimodal transport in particular. Thus, it is crucial to establish which factors are most relevant for the customers. The modal choice is dependent on the combined performance of a variety of aspects, such as price and quality, with different actors having varying values, perceptions, and selection criteria for transport options (Woxenius & Bärthel, 2008). To comprehend the modal selection, one must therefore comprehend the underlying factors.

The objective of any transport policy is to increase economic efficiency and productivity while mitigating the negative effects of transportation. To achieve these objectives, the economic agents involved in the activity must adjust their behavior. However, in order for public policy to be effective in inducing desired behavioral changes, policymakers must have a clear ex-ante understanding of how the policy measure's intended target(s) will react (Holguín-Veras et al., 2017). Lack of knowledge of target groups' behavioral responses could result in unforeseen consequences or inefficient policymaking. For sound policymaking, behavioral research is required (Marcucci et al., 2018). Due to the complexity of freight transportation and the absence of a complete understanding of the agents' behavior, these issues are crucial. This lack of knowledge is caused by a variety of factors. It is difficult to examine the interactions between the different entities involved in freight operations, including shippers, carriers, and receivers, and the system is dynamic, as it is influenced by market fluctuations. The situation is further aggravated by the dearth of literature on such issues, especially in case of developing countries like Pakistan.

There are considerable trade-offs between shipping costs and the benefits of lowering transit time, enhancing on-time arrival reliability, and minimizing the risk of long arrival delays found by (Brooks et al., 2012). Several studies have been conducted over the last few decades to better understand the freight shippers' mode and carrier choice behavior, building on McGinnis' work (1990). In their literature review, (Cullinane & Toy, 2000) revealed a many of critical characteristics, including cost, transit quality, and reliability.

Qualitative characteristics such as service frequency, transport time, delivery reliability, carrier flexibility, and freight transport safety were examined by (Beuthe & Bouffioux, 2008) for their relative importance and value for freight shippers. They discovered that these qualitative characteristics had a considerable impact on mode choice using a stated preference experiment with Belgian transportation managers, however the effect varies amongst subsamples. (Danielis et al., 2005) published the findings of a study conducted in two Italian cities to analyze logistics managers' freight attribute preferences, which demonstrated a substantial preference for quality characteristics (time, reliability, and safety) over cost. However, cargo weight/size was proven to be a significant influence (Samimi et al., 2011) demonstrating that larger goods are more likely to be transported by train. (Combes, 2012) found that the size of the shipment and the mode of transport are decided at the same time in his study of 3,000 shippers in France.

To reduce energy consumption, air pollution, and traffic safety, significant effort is being undertaken to shift freight traffic from road to rail. As a result, plenty of studies on freight mode choice have looked into policy-sensitive characteristics that could be utilized to influence modal preferences. According to (Samimi et al., 2011) rail shippers in the United States are more cost aware, whereas truck drivers are more concerned with haul time. They also discovered that rising fuel prices make shippers less likely to convert from truck to rail. (Hwang, 2014) then looked into the impact of crude oil prices on mode choices. He discovered that a sevenfold increase in gasoline prices causes a 40% decrease in truck utilization and a 50% reduction in CO_2 emissions.

Studies of freight mode choice have gone beyond the cost-based simple selection to a more comprehensive view of logistics behavior, qualitative characteristics, and responsiveness to policy. In an early micro-analysis e.g. by Maggi and Bolis (1998), the shippers were found to make complex, logistics-integrated choices, rather than just simple cost-time trade-offs. Their results have revealed that willingness to pay is highly diverse due to the presence of the logistics structure of each firm that defines the basis on which heterogeneity is central in freight mode choice. Based on this, Blauwens et al. (2006) applied an inventory-theoretic model to show contact with the full supply-chain costs, rather than transport charges, determining model split. Their endeavor pointed out that productive modal shift (e.g. road to intermodel) takes combined policy interventions and the modal competitiveness and is influenced by commodity type (high-value vs. bulk).

Likewise, shifting to policy, Holguin-Veras et al. (2017) also stressed that the good freight policy should include the reflection of the real behavioral responses. Through the comparison of qualitative results and quantitative results, they contended that mixed-method solutions (IDIs - Focus Groups - Surveys) can enhance policy development by forecasting unintended impacts. Empirical research like the one conducted by Brooks et al. (2012) that determined the willingness of shippers to pay (WTP) based on important service attributes that included speed, frequency, reliability, and cost, demonstrates the trade-offs that users have to make when

deciding on land versus coastal shipping. More recently, Holguin-Veras et al. (2021) made a contribution to the field with confidential U.S. Census data and interviews to demonstrate that receivers rather than the shippers usually determine the size and mode of shipment - an important contribution to freight demand modeling. As previous researchers, they confirmed that freight rate and reliability are still the prevailing factors. Owing to inadequate freight data, scholars like Wang et al. (2013) relied on RP freight data in identifying the latent freight factors that underlie trucking vs. rail, and exhibited regional variations within the same state (Maryland). This is in line with the earlier findings by Winston (1981) who had previously established that disaggregated models are more effective than aggregate models in depicting real mode choice behavior.

Cullinane & Toy (2000) offered an approach to systematic content-analysis to determine modal attributes in SP research on methodology, enhancing the validity of follow-up surveys an approach followed by further SP-based studies (e.g. Kim et al., 2014; Shin et al., 2019). Researchers like Beuthe and Bouffioux (2008) emphasized the importance of qualitative aspects, including reliability, damage risk, flexibility and revealed that the mean values are not suitable to depict decision behavior which is supported by further research like Maggi and Bolis (1998).

The themes are furthered in regional studies: Kim et al. (2014) in New Zealand and Moschovou and Giannopoulos (2010) in Greece determined mode choice preferences to be sector and firm specific but both authors repeatedly found time, cost, access, and reliability to be key factors. Zeybek (2019) demonstrated that shippers and forwarders still use cost as a major criterion after EU rail liberalization, which confirms what is happening globally. As Fries et al. (2009) emphasized, the issues of environment are important but hardly are more significant than cost and quality-unless shippers are in close proximity to final consumers. Both Garcia-Menendez et al. (2004) and Shen and Wang (2012) used logit models to show the significant effect of cost, time, frequency and delay/damage on highway vs. maritime or rail decisions. Lastly, Shin et al. (2019) applied SP models to examine the adoption of a new freight mode and found that cost reduction can greatly increase adoption and freight value of travel time (VTT) is greater than had been thought valuable in planning modal transitions.

These studies taken collectively indicate that freight mode choice is a context-specific, behavior complex, and multi-dimensional, process. To come up with effective policies, one must not only grasp the cost, but also the entire logistics system, firm characteristics and supply chain structure. The mechanism for choosing the mode of transportation (mode choice) for a certain mode of transportation is critical to comprehending transportation behavior and affecting modal split. The natural question that arises is: "What are the factors that influence mode choice behavior of a firm?" How improvements can be brought about in PR to attract more freight business – A firms' perspective and its answer is imperative to policymakers. The rest of the article is organized as follows. Section 2 provides an overview of Pakistan's freight sector. The methodology and data are discussed in section 3, section 4 describes the empirical findings in detail, and section 5 concludes the study.

2. An overview of freight sector in Pakistan

There are two basic modes for freight transportation in Pakistan that is Road and Railways. While road is the most dominant mode for freight transportation, almost 96% of the freight is transported via road and the remaining 4% is transported through railways. The motorways and

the national/provincial highways constitute the major road networks of Pakistan. Less than 10 % of the whole road network is comprised of national highways and motorways, yet they transport nearly all freight traffic. Karachi to Torkham via the north-south N-5 highway is the busiest route. The route is approximately 1,760 kilometers long, carries around 65% of intercity traffic, and serves 80% of Pakistan's urban population.

2.1. Trucking Sector

The trucking sector in Pakistan is highly fragmented, with the majority of operators being small-sized and only a handful being medium- or large-sized. To maximize profits, truck drivers overload their vehicles, which has a substantial cost due to infrastructure damage. The largest operators in the trucking industry, National Logistic Cell (NLC), is in the public sector. NLC was established in 1978 to handle crisis management duties during natural disasters and unforeseen circumstances, such as strikes, shortages, port congestion, etc. NLC's fleet consists of 800 prime movers/heavy-duty vehicles. NLC is currently one of the largest transportation corporations competing with private operators. It has a 10 % market share in freight transportation, being the nation's largest and most resourceful fleet. The government of Pakistan has only approved NLC to transport products from Karachi to Torkham (final point of Pak/Afghan border from KPK region) or Chaman (last point of Pak/Afghan border from Baluchistan province). The other major players are Bashir Siddiqui Logistic (BSL) has more than 500 trucks, Agility Pakistan has 400 modern trucks with GPS tracking capability, and Shaheen Freight Service with a fleet of 250 vehicles. The services of the trucking sector are far below the world average. A travel in Pakistan takes three times as long as one in Europe because of the modest speed of aging fleet. The distance between the ports and the north of Pakistan by road (about 1400-1800 km) takes three to four days, which is twice as long as what it takes in Asia and Europe (World Bank 2006). In the absence of a modern fleet, 30-40% of the food is wasted due to lack of refrigerated transport, cold storages, low quality packing material. According to research done by the Ministry of Commerce in 2007, there are numerous causes of damage to perishable goods. The majority of respondents stated that 10 % of their shipments ended up with damage. Principal causes mentioned for the losses, in order of significance, were extended journey durations due to poor transport infrastructure (extremely low average speed), poor packaging, unhygienic transport conditions, and inadequate amenities (temperature control, etc.).

2.2   Pakistan Railways (PR)

Pakistan Railways (PR) is a national state-owned enterprise with headquarter based in Lahore. It was established in 1861. It is linked to the Ministry of Railways, which is responsible for the organization's planning, administration, and regulation. PR facilitates both passenger and freight transportation. Pakistan Railways has a 7791 km (4481 miles) track across the country, stretching from Karachi to Torkham. PR is one of the largest employers in the country, current employing 67,406 personnel. Long-distance and large-scale transportation of both products and passengers is a strength of railways worldwide. Until the 1970s, it was also the dominant form of transportation in Pakistan. Since then, the share of railways has decreased due to the government's preference for roads. During 2005-2010, budgetary spending on railways was only 45.5 billion PKR, while spending on national highways was 155 billion PKR. The percentage of inland freight traffic carried by railways has declined from 73 % in the 1970s to 4 % now.

Figure 1: Freight Carried by PR (Thousand Tonnes)
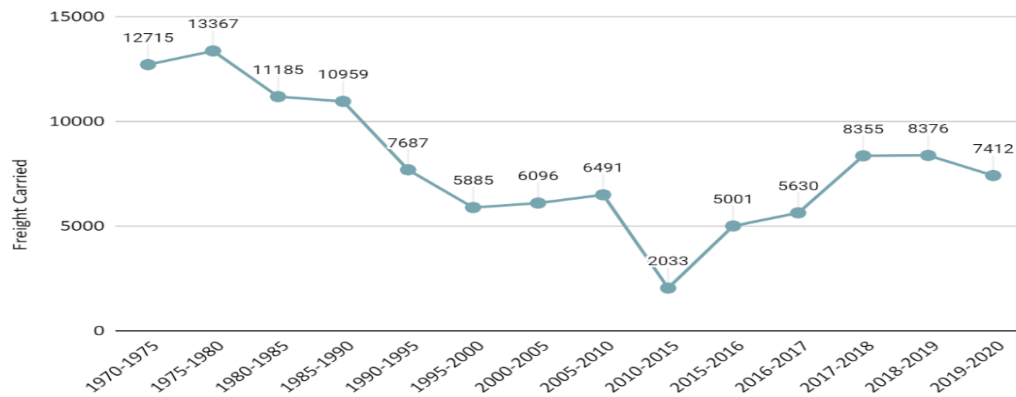
Freight has been an important source of revenue for Pakistan Railway (PR). However, the freight carried by PR has reduced over the years (Fig. 1). Freight carried by PR largely comprise of coke and coal and PR departmental commodities. Revenue from freight stands at 40% of total revenue, it was 65% in 1970's. In 1990's oil traffic shifted to pipelines leading to a further decline in traffic. PR has endured the worst crises in the period 2010-15 as the revenue from freight stood at 16%, the lowest ever recorded.

Table 1: Performance of Railway Freight Sector

Rail Freight	2015-16	2016-17	2017-18	2018-19	2019-20
Freight Carried (thousand tonnes)	5001.00	5630	8355	8376	7412
Freight Carried (TKM)	4733548	5031315	8080353	8303590	7369878
Average km travelled by a ton	954.44	893.65	967.06	991.25	994.22
Freight Wagons (no.)	15324	16085	16159	14327	14448
Locomotives (no.)	460	455	478	472	473

Table 2: Commodity-Wise Freight Carried (Thousand Tonnes)

Commodities	2015-16	2016-17	2017-18	2018-19	2019-20
Cement	283	239	247	195	222

Coke and Coal for public	881	1303	3899	4133	3357
Railway material and stores	661	848	625	565	541
Chemical manures (fertilizer)	107	234	94	135	195

Source: Year Book 2019-20

PR is currently suffering due to various reasons, some of them are continuous losses, depleting assets, consumer dissatisfaction, under investment, political interference, corruption institutional dichotomy and governance issues(Khaliq & Khan, 2020). According to (Anwar, 2021) PR has suffered1.19 trillion PKR losses in the last three years. In the year 2018-19 Pakistan Railway has suffered a loss of 32.7 billion PKR, 50.15 billion PKR in 2019-20 and 36.28 billionPKR in the initial eight months of the fiscal year 2020-21. Pakistan Railways' assets are deteriorating at a rapid rate, as the majority of them have outlived their useful lives, both in terms of infrastructure and rolling stock, significantly affecting their operational efficiency. Due to the age of the assets, a significant portion of revenue is spent on maintenance. On the other hand, the government invests more in road transportation. Thus, instead of being a commercial organization, Pakistan Railway evolved into a bureaucratic one, where responsibilities and processes take precedence above end results. Direct intervention in strictly technical matters by bureaucrats invariably results in inefficient service delivery. Additionally, running a business enterprise with political considerations cannot result in profit. Commercial considerations should guide operational decisions and development fund allocation, not political involvement. Political appointments or transfers have a detrimental effect on efficiency. Corruption is pervasive because those apprehended have extended reaches into the halls of power.

2.3   National Policies

Many policies are implemented by governments, the majority of which have never been assessed.

2.3.1 National Freight and Logistics Policy

This policy highlights that a balanced modal share can be achieved through 5'C's element which is connectivity, competitiveness, cross-border transit, communication technology and capacity building which is unfortunately lacking in context of Pakistan. Establishment of linkages between road and rail can ensure efficient flow of goods and help in alleviating road congestion.

It also emphasis that the different parts of the freight transport and the logistics value chain are currently being managed by numerous different ministries and government agencies/organizations, including the Ministry of Communications, Ministry of Maritime Affairs, Ministry of Railways, Aviation Division, Ministry of Commerce, Ministry of Planning, Development and Special Initiatives, Federal Board of Revenue (FBR), as well as the Provincial Governments. The absence of a unified ministry to lead the development of logistics is a significant barrier.

2.3.2 National Trucking Policy, Axle Load Policy

The problem in Pakistan is implementation, there are many policies drafted but they were never implemented like in 2007 Trucking Policy was identified as change in the sector but never implemented. Most of the trucks operating on the road are single or double axel trucks. 65-70% of the fleet is single or double axel trucks. According to many studies, single- or double-axle trucks do the most damage to the road since their loads are distributed mostly on the rear axle. The majority of trucks are overloaded, resulting in excessive expenses due to the deterioration of the infrastructure.

Many policy instruments contain wide, vague, and ambiguous intentions, making it difficult to determine whether or not objectives have been met. Several evaluations focus just on the achieved modal shift and ignore the impact of negative externalities. For the development of national transport system, the role and suitability of various modes of transport should be recognized. Every mode has its own role. The railway is designed and suited for long-distance transport. In resource scarce countries, the private sector should be encouraged under a guided policy framework. Inadequate planning and corruption are among the causes responsible for the failure of Pakistan to establish an efficient transportation ecosystem. The role of the private sector, lack of capacity among public transport organizations, negligence in the development of high-capacity public transport, and failure to utilize existing land use patterns for the development of dependable and efficient public transport have been identified as essential factors for the development of an efficient transport system for the nation. Governance, capacity-building including investment, and urban planning are crucial for the national development of Pakistan in order to offer appropriate, efficient, and effective public transportation.

3. Methodology

The aim is to identify the factors influencing mode choice decision of the firms and identify reforms areas for railways freight business. The literature finds significant studies regarding factors influencing mode choice decision in developed countries but none of the study has been conducted for Pakistan. This study fulfills the gap using a mixed methodology.

3.1 Qualitative Methodology

Face to face interviews were conducted from different firms to identify factors influencing mode choice behavior following (Danielis et al., 2005). This will provide a comprehensive understanding of the firm's background in relation to the mode selection. An interview guide was prepared accordingly. In-depth interviews are open ended and unstructured interviews, which are conducted to unearthing respondents' feelings, emotional state, and perceptions about a specific social phenomenon or study topic. The leading benefit of in-depth interviews is that they provide an opportunity of face-to-face or direct interaction between interrogators and respondents. Additionally, it reduces non-response rates as well as goes deeper in research problem. The interview was preferred as focus group involves the simultaneous presence of a group of participants. In context of the research this is too burdensome to achieve as interview will consist of managers with strict agenda and time restrictions. (Bryman, 2016)

Thematic analysis is the method used to analyze the transcribed interviews. Thematic analysis is a method for detecting, interpreting, and reporting patterns (themes) within data that is frequently used in qualitative research (Braun & Clarke, 2006). In thematic analysis, themes are the primary unit of analysis; they are thought to capture something noteworthy about the data in relation to the research question, and they indicate some level of structured response or meaning within the data set (Braun & Clarke, 2006). Inductive thematic analysis is the method most applicable to the research context. Because it begins with the research question rather than a strong epistemological theoretical lens, inductive thematic analysis is simple to incorporate into the pragmatic paradigm followed by research design, which is why it is utilized. Second, due to the absence of such coding frameworks, it was chosen to begin coding themes from scratch as opposed to reusing thematic coding from previous investigations. Third, thematic analysis is adaptive to the requirements of the investigation (Braun & Clarke, 2006).

Coding is the vital instrument for doing theme analysis, which requires categorizing data segments with short names that simultaneously explain and account for each data point (Charmaz, 2006). In other words, it involves adding tags or labelling key areas to transcribed interview content. Each interview was classified separately, and for each interview, a summary of key insights and intriguing details was compiled. The second phase of coding involves organizing and classifying the codes. This resulted in the establishment of themes, including both interview-specific and data-wide themes. During this phase, various themes were recoded, and the interaction between codes and themes was investigated.

3.1.1 Locale

The targeted area for the survey is I-9 Industrial Estate Islamabad near Potohar metro station and Rawat Industrial Estate Rawalpindi. It was established in 1963. About eight different types of industries dominate these areas which include Steel and re-rolling mills, marble cutting and polishing, flour mills, pharmaceutical, galvanizing and metal working and engineering industries. Steel and re-rolling mills are largest in size among others. The data was collected from different manufacturing firms in the targeted area through interviews as the firms are the main stakeholders in freight transportation. And for efficient freight transportation and better freight and logistic policy it is importation to involve the main stakeholders.

3.1.2 Sampling

This study adopted convenient sampling technique. The convenient sampling technique is a type of nonprobability sampling in which samples/unit of data collection are approached by the researcher on the basis of convenience (Edgar & Manz, 2017). The people/sample/unit of data collection were sampled who were easily accessible. Due to constraints and the resistance from the respondents the researcher adopted convenient sampling technique.

Another important element of data collection is deciding the sample size. Professor Keith Townsend by citing various sources states that a fundamental element of "sample size is the depth of data rather than the frequencies", therefore respondents need to be well engaged to properly represent the subject matter of the study (Townsend, 2013). According to Cresswell (2007) for heterogeneous population interview-based qualitative studies need 25 to 30 sample size, while according to Sandelowski (1995), for qualitative studies that involve homogenous

population, the interviews of 10 participants would be sufficient. Likewise, Lincoln and Guba (1985, p. 235) recommend 12 to 20 participants in interview-based studies. Furthermore, Marshall, Cardon, Poddar, & Fontenot (2013), recommend 15 to 30 interviews will be enough for single qualitative case studies. Hence, keeping these views into consideration this study has collected data from 40 respondents to ensure that our sample size surpasses the aforementioned thumb rule of sample size to guarantee the reliability of the research. The data was collected from managers of different firms at the targeted area. As managers is responsible for controlling or administering the firm. Most of the firms are in medium size category (number of employees).

3.2.1 Quantitative Methodology

Primary cross-sectional data was used to identify factors influencing mode choice behavior from different industrial freight shippers in Rawalpindi and Islamabad. PR and trucks are substitutes (Khan and Khan, 2020). So, the study will only focus on railways and trucks. The dependent variable is the mode of transport, which is either rail or truck.

Table 3: Variable Description

Variable	Definition	
Mode	Mode of transportation used for freight shipping	Dependent Variable
Reliability	It is defined as the time delivery and quality of service provided by the transportation agencies	Independent Variable
Cost	The rate charged for transporting the shipment	Independent variable
Loss and damage	The probability of loss and damage to the shipment while transporting it.	Independent variable
Ease of Access	It is defined how easily the transport mode is available	Independent variable
Origin and destination	It means from where the shipment originated and where it is delivered	Independent variable

Models in which the response, or regressand, variable is neither quantitative nor interval-scaled are referred to be qualitative response regression models. The simplest qualitative response regression model is the binary model with a yes/no or presence/absence type regressand. The linear probability model (LPM) is the simplest possible binary regression model, in which the binary response variable is regressed on the relevant explanatory variables (Gujarati et al., 2012). Probit model is more popular than the logit model since it is often assumed that the errors are normally distributed. Since both probit and logit model rely on nonlinear parameters, Maximum likelihood Estimation (MLE) is used to estimate the models (Van Oordt, 2015). Probit model

will be used for the estimation since the dependent variable is binary variable. Here our dependent variable is binary, that it has two outcomes which are 0 and 1. For train the value assigned is 1 and for truck 0. For probit model we are interested in in the response probability written

$$P(y = 1|x_1, x_2 \ldots \ldots x_k) = P(y = 1|X) \ldots. \text{Eq.5.1}$$

If we take X as all independent variables. Written in functional form together with parameter this is

$$P(y = 1|X) = G(\beta_0 + \beta_1 x_1 + \cdots \beta_k x_k) = G(\beta_0 + x\beta) \ldots. \text{Eq.5.2}$$

where $P(y = 1|X)$ means the probability that an event occurs given the value(s) of the X, or explanatory, variable(s).

Maximum likelihood Estimation (MLE) is based on the distribution of y given x and is therefore important for the estimation of the models (Van Oordt, 2015). Maximum likelihood estimation (MLE) is a method of estimating the parameters of an assumed probability distribution, given some observed data. This is achieved by maximizing a likelihood function so that, under the assumed statistical model, the observed data is most probable

The general form of the model is below:

$$Probit\ (Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots. + \beta_n X_n + \mu \ldots. \text{Eq.5.3}$$

Here Y is the dependent variable which is the mode choice between truck and rail, β represent the parameter and X represents the explanatory variables.

4. Results and Discussion

Thematic analysis showed the freight shipper's decision is influenced by certain factors, opting for a specific transport mode for their freight shipment. Reliability is one of the most significant factors affecting mode choice behavior as many of the respondents mention the particular factor. Reliability here means delivery time and the quality of service provided by different transporting agencies. Transit time means the time it would take from shipper location to the receiver. Danielis et al. (2005) found reliability as one of the important factors in mode choice decision. They further emphasized that successful modal shift policies should focus on the quality aspects of the mode to be promoted. As in modern day business firms rely highly on delivery time to be in the competition. Many of the respondent stated that. "*Sales are highly dependent on the timelines of the shipment. If we do not deliver the product on time, we might loss competition in the market*". The reason firm more emphasized on the delivery time is that if they do not meet the sales timing, they might end up losing the product, like if the delivery got late for a 1 day or 2 days they are in trouble, because it can incur loss on the firm. Some of the respondents stated that "*Customer satisfaction is an important thing. If our shipment did not reach on time, it can make our customer unhappy*".

Due to late shipment firm also lose their customers and these customers go to their competitor which is a loss to the firm. The shipment delay can also have significant far-reaching impact on the receiver. Also, it affects the firms' day to day operations. A respondent said that they need raw material daily for production so if their shipment (raw material) gets late, either they have to

buy it locally or stop production. Some of the respondents further explained that *if our raw material gets late then no production activity take place, so we have to pay the labor from our pocket which leads to abrupt increase in the cost.*

The quality of service provided by the trucks is better than the railways. One of the main the feature is door to door service. Perhaps the most significant benefit associated with truck freight is the ability to ship a product directly to the consumer's front door. According to the respondents' trucks are in good state than the freight trains. If the decision has been made to transport something, it is fair to assume that one of the basic requirements of the transport is that it should deliver the goods in a proper way. It is difficult to imagine any situation in which a transport buyer would request low transport quality (Flodén et al., 2017). One other thing is the frequency of service, trucks are available all-day night while railways do not have a proper schedule of trains.

The response to the question why most of the firms are using Trucks than Railways? One of the respondents said: *"If I have to bring it though railways then I will have to send trucks to railways station and then again load it on the trucks. Our material is very heavy, and for that machinery will be required and then I will have to send machinery over there to load it again, so it makes the same cost. So instead of this why don't I load trucks, there are no equipment's for loading and unloading at railways station".* Cost is the primary factor in freight shipper and forwarder mode selection demonstrates their price sensitivity in transport service procurement. Even when examining the type of commodities, pricing is the most important element in mode selection Zeybek (2019).

For time critical shipment, to ensure the timely delivery the firm will opt for expensive option. If firms are consistent and reliable it creates a good image of the firm and they can charge extra for their product which can help in reducing their cost. While if there is flexibility in delivery time than firm can opt for less expensive mode.

The freight rate is among the top two determinants of mode selection (Khan and Khan, 2020). It is important to note, however, that freight rate is never the sole determinant of mode selection, as it is typically connected with other variables, notably reliability. If the cheapest mode option reduces product quality or other operating criteria below the minimum required by the organization, that mode will not be chosen. According to freight shippers the cost-effective mode will be chosen. The policy should be designed in such a way that is efficient in its operation and fair in determining prices, where gains of the efficient operations are equitably distributed among shippers and carriers. Businesses go through risk management process to avoid loss and damages to the business. It is one of the influencing factors in mode choice behavior. As for firms' safety of shipment is their utmost priority. According to (Danielis & Marcucci, 2007) probability of loss and damage is significant in all their models and is one of the most affecting attribute in mode choice decision.

According to the respondents, one of the reason many respondents opt to use trucks is that they carefully load and unload the shipment having proper loading and unloading equipment. Firms do not compromise on the quality of their product as they charge customer for the quality of product they provide and in case of any damage to product the quality of product is sacrificed. Some of the respondents stated that "*Each time we use Railways for delivering our product,*

sometime it gets stolen or damaged because they do not properly load and unload it. They do not care about our product".

During the delivery of shipment anything can happen like accident or shipment getting stolen etc. As firms cannot let their product get destroyed so to avoid the losses, they insure their product and sign contract with the transporting agencies. It helps in minimizing the risk to the product and then the transporting agency have to carefully deliver it to the destination. While investigating about who shall be liable in case of any damages, firm or freight company? The respondents said that "*In case of any damage to the product during delivery freight company is responsible for that as before the departure of the delivery we check everything*". It is one of the reasons why freight shippers prefer truck over railways that they are responsible for damages. The problem with the railways is that firm cannot claim for the damages, so to avoid this risk firm opt for the trucks. The freight forwarding companies stated that they have a proper SOPs for insurance. As shippers are more concerned about the security of their shipment but in the policy such things are not even discussed that how to mitigate the risk to shipment.

Accessibility to a particular transport mode also influence the decision of freight shippers. Transport mode which is easily accessible can influence the decision of the firm. In both the transport modes Truck and Train, Truck is easily accessible that's why most of the firms choose truck over train. It also saves some time for the firms. A respondent said that the procedure of booking the truck is easy and simple. Moschovou and Giannopoulos (2012) rated ease of access to mode (simplicity of procedure) as an influential factor. Some of the respondent stated that *"Trucks are easily available; we book trucks through call and can call them anytime while for train we have to wait for the scheduled timing and trains are never on time and also nowadays very few freight trains are running"*. Ease of access not only means how easily they are available but also how often they are available. And because of this reason road transport is dominating the freight sector as the frequency of service is high. Respondent said that for them the frequency of services is important so that the flow of shipment is continues either its raw material or the final product. Respondents showed concern about the train which have proper schedule timing of freight train but are never on time, truck do not have proper schedule also yet they are available all-day night. For PR to compete with trucks in freight business and to increase their share they need to make sure they are easily accessible and also increase the frequency of their services and have a proper schedule of trains so that firms can have a proper balance mode available.

One of the important things in mode choice decision of the firms is the origin (from where the product comes) and destination (where the product goes). Most of the firms have customers within the city for that truck is the most suitable mode. Respondents stated that "*We are doing steel business, pipe and iron. These are construction base businesses and it is mostly in those areas where we don't need trains so we use truck*" Another respondent said that *"The reason is that the city from where our raw material comes and where our product is delivered is on Grand Trunk (GT) road where only trucks can go train do not have access over there"* Not every area has access to railroad tracks, so rail transport almost always requires other forms of transportation to move products. Rail transportation is often combined with truck freight for efficient delivery. Intermodal transport solutions have relatively low external costs (Hanssen & Mathisen, 2011). According to (Forkenbrock, 2001), the external cost per tonne-kilometer of an intermodal train is only 28% of that of a standard freight vehicle. Because intermodal freight transit uses less energy than road freight transport (Woodburn et al., 2007), it is consider as a

significant contributor to achieving a sustainable transport sector. Therefore, officials at all levels have encouraged intermodal freight transport (Macharis et al., 2011). The estimates of the Probit model are shown in table 4.

Table 4: Probit Estimates

Dependent Variable: Mode

Variable	Coefficients	Std.Error	Prob	Marginal Effects
Cost	-2.23**	0.95	0.02	-0.89
Ease_of_Accees	2.11**	0.65	0.00	0.84
Loss_and_Damage	-0.39	0.86	0.65	-0.16
Origin_and_Dis	-1.47**	0.71	0.03	-0.59
Reliability	1.94**	0.88	0.02	0.77
C	0.51	1.33	0.69	0.20
R-Squared	0.67			
LR Statistic	27.40	Prob (LR statistic)	0.00	

*** 1% level of significance, ** 5% level of significance, *10% level of significance

The negative coefficients of the cost, loss and damage suggest that increase in these variables will decrease the chances that rail is chosen. The variable cost is negatively and statistically significant at 5%. The marginal effect of cost (-0.89) suggest that 1-unit increase in cost would reduce the probability of choosing rail by 89 percentage points. This is because increase in the price or cost of anything would lead to decrease in the demand of that particular commodity or mode. This figure is in range with other studies, (Fridstrom & Madslien, 2001) they report and estimate -2.21, whereas (Patterson et al., 2007) al report coefficient -4.140. Ease of access is positively and statistically significant at 5% level of significance. The marginal effect (0.84) suggests that an increase in 1 unit in ease of access would result in increasing the probability of choosing rail by 84 percentage points. Any mode which is easily accessible and have easy and simple procedure will be chosen. It also shows that availability of truck would also help in increasing the chance that truck is chosen. Reliability is positively and statistically significant. The marginal effect (0.77) shows a strong effect on transportation mode. The result suggests that if reliability is increased by 1 unit, the probability of choosing train would increase by 77 percentage points. The reason firms want on time delivery to be in the competition, timely delivery is most important for businesses. This result is also similar to the study of (Patterson et al., 2007). The loss and damage (-0.16) indicates that 1-unit increase in the loss and damages would result in reducing the probability of choosing train by 16 percentage points. This reason is businesses want to reduce the risk of loss, and they don't compromise on the quality of their product, if the risk of loss and damages increase to their product by a particular mode so they will not opt for that mode. The result are in range with other study by (Patterson et al., 2007) report coefficient (-0.396). Origin and destination variable is statistically significant at 5% level of significance. The marginal effect (-0.59) shows that one-unit increase would lead to decrease in the probability of choosing train by 59 percentage points. Overall, the model is fit with R-square 0.67 which means that 67% of the dependent variable is explained by the independent variables.

Several countries are making substantial investments to revitalize their railways sector or to develop master plans that priorities rail freight infrastructure. India has also made significant investments in freight rail infrastructure, including 3,400 kilometers of exclusive freight-only lines (the Eastern and Western Dedicated Freight Corridors), which will eventually form a core Golden Quadrilateral of freight-only railways connecting the major cities of New Delhi, Kolkata, Chennai, and Mumbai. According to an employee of PR "*The reason people do not conduct business with railways is because our train speed is very low and in business timely delivery is very important, infrastructure is obsolete due to which some of the tracks are closed.*" Proper freight corridors need to be constructed. Railways needs to prioritize freight over passenger as freight is more profitable. Per unit revenue of freight is higher than passenger. Many of the respondent showed concerns about the quality of services provided by the Pakistan Railway, they expressed that they have used railways in the past but due to low-quality services provided to them, they are not using railways anymore for their freight transportation.

Successful railways have taken diverse approaches to the challenge, but their focus has been on customer orientation, with decisions influenced by variables such as customer willingness to pay, commodity type, and logistics characteristics. For any railway to regain modal share customer orientation should be the priority. *"Railway need to be a customer-oriented organization if they want to expand their business because for any business if customer is satisfied the business will thrive, they need to provide quality services to the customer*". According to (Aritua, 2019), if railway want to increase their share in freight their first priority should be customer and provision of quality services to them. Many examples of the successful reforms in railways can be seen in countries like Germany and United States. The prime reason behind the successful revitalization of railways was the customer centric approach.

Despite its importance, PR is far behind in adoption of latest technologies. Adopting new technologies would not only help in stopping accidents but would also bring local and foreign investment. Some respondents said the they need to trace their shipment to inform their customer about it, forwarding companies were more concerned about it. Respondents stated that: "*They need to have a proper online system. For example, if we have to track our shipment, like where is our shipment, security of the shipment is very important. They need to develop a software for tracking and tracing. The problem with railways is you don't know where your shipment is and if you want to know about so you have no idea whom to call*". Encourage and facilitate Track and Trace technologies by all parties involved in the logistics industry, this includes the public and the private sector. Promote Electronic and Mobile Payments, to reduce the risk and inefficiency of using cash for the transactions. Automation is expected to address the leakages which have been the major reason behind the decline in the volume of PR freight in 2020-21 (Anwar, 2022).

At the end of the interview respondent were asked about their preferences by categorizing distance into different categories. Respondent were asked what mode the choose for their day-to-day operation in relation to distance criteria. Freight shippers were asked about their preferences by categorizing distance into four different categories: less than 200 km, 200-600 km, 600-1000 km, more than 1000 km. This categorization of the distance was adopted from (Moschovou & Giannopoulos, 2010). For distance less than 200 km as expected almost all the respondents (100%) use trucks as such type of distance favor the truck mode. One of the best things about the particular mode is their door-to-door service. As all the firm interviewed were manufacturer firm so the goods transported were mainly raw material or final product. For distance 200-600 km the

percentage of respondents uses trucks is lower than the previous case but the percentage is still quite high (94%) while the remaining 6% used other mode that is train. Majority of the transported good were industrial product. One of the reasons using this mode by many respondents is they can easily load and unload the product. For distance 600-1000 km the percentage of respondents using the trucks is surprisingly high (85%) as such type of distance suits train but due to the weakness of the transport system in Pakistan train is the most least used form of transport in the range of 600 km or greater, although it's this type of distance has greater potential for the rail transport. For distance more than 1000 km some of the respondents had no transport to report. Those who reported most of them used trucks as according to most of the respondents the use of trucks is mainly due to the timely delivery.

4.1   Freight shipper were asked about their preferences of mode choice if both truck and train have same cost and haul time.

Figure 2: Freight Shipper mode choice preferences for same Shipping Cost and Haul Time
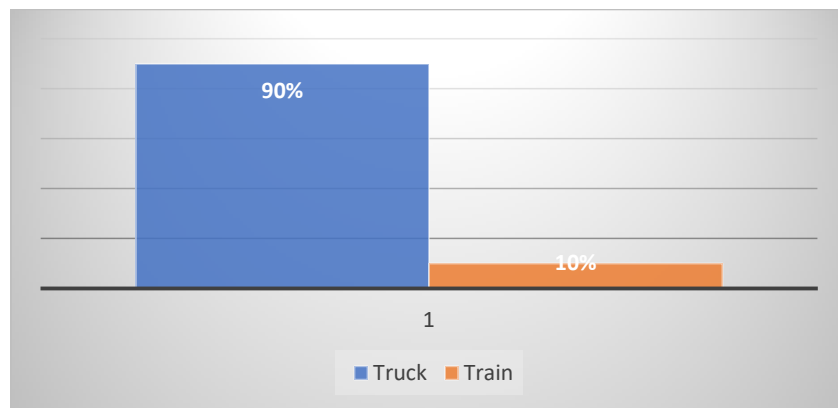

About 90% of the respondents choose to use truck and the remaining 10% choose train if there is no difference in shipping cost and haul time between truck and train. The result proved that truck is the preferred mode of freight transportation as it is very convenient as easy for loading and unloading goods and their door-to-door service.

4.2   Freight Shipper's Mode Choice Preference for the Different Shipping Cost and Haul Time.

 In the industrial area freight shipper were investigated of mode choice by changing (higher and lower) shipping cost and haul time
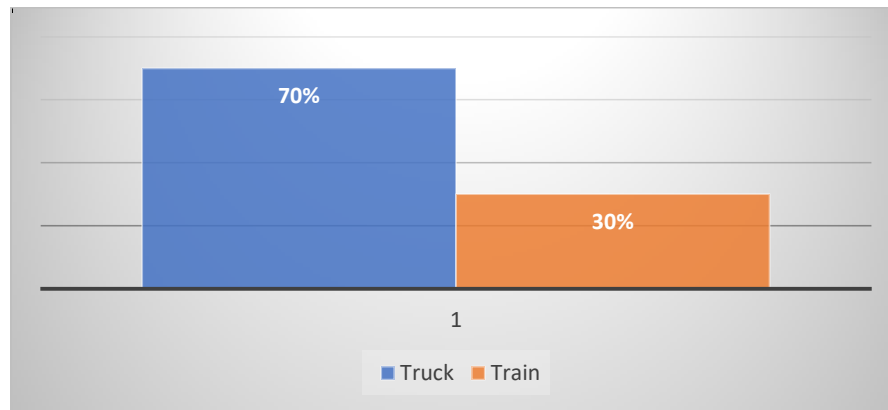
Figure 3: Freight Shipper mode choice preferences for different Shipping Cost and Haul Time

If the shipping cost of trucks is higher and the haul time is one day longer than the train 70% choose, they might use the truck while the remaining 30% opted for the train. The reason people choosing truck over train is if the cheapest mode will decrease the quality of the product or other standards, they will not choose that mode.

5. Conclusion

The mechanism for choosing the mode of transportation (mode choice) for a certain mode of transportation is critical to comprehending transportation behavior and affecting modal split. Several studies have been conducted over the last few decades to better understand the freight shippers' mode and carrier choice behavior, (Cullinane & Toy, 2000) revealed many of critical characteristics, including cost, transit quality, and reliability. The themes constructed from the interviews for the first objective are Reliability, Cost, Ease of Access, Probability of Loss and Damage and Origin and Destination.

Reliability is one the significant factor influencing mode choice behavior identified by the respondents. Reliability here means delivery time and the quality of service provided by different transporting agencies. The reason is firms' sales are highly dependent on the timeliness of the shipment, if they do not deliver on time, they lose competition in the market. (Danielis et al., 2005) report the same result. The cost is one of the top two influencers of mode choice. It is important to note, however, that freight rate is never the sole determinant of mode selection, as it is typically connected with other variables, notably reliability. If the cheapest mode option reduces product quality or other operating criteria below the minimum set by the organization, that mode will not be chosen. Ease of access, the more easily the transportation mode is available the more chances it has to be chosen. The frequency of their services also matters. Probability of loss and damage, the firm wants to minimize the risk for that if there is probability of loss and damage in any mode to their product the firm will not choose that mode. While for choosing a mode they keep that in mind, so it's one of the influencing factors in mode choice decision. Origin and destination is identified by the respondents as influencing factor. Because the decision depends from where the product originates and where it ends. If a transportation mode has access over there it will be chosen.

For Railways to regain rail freight modal share, PR should emerge as a customer-oriented organization. Looking at the current state of Pakistan Railways Open Access Policy (OAP) can

help the railways to manage it wear and tear requirements. The freight market analysis reveals that PR has the potential of 58 daily freight trains, which it is not managing. It is equivalent to the loss of PKR 5 million per day. Reverting to OAP and unleashing the economic activity can have a ripple effect on the PR and economy (Anwar, 2021). Also providing quality services to the customers can help expand the business. As for every organization customer needs to be their priority. Updating technology can help railways revival in freight business as identified by the respondents. Like tracking and tracing technology so that customer can locate their shipment. Also updating signaling system can help in reducing the accidents. Thus for PR to increase the share in freight transportation, it will require more than just improvement in the carrier attributes - the PR needs to change its reputation.

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