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Factors Influencing Commuter Mode Shift Behavior in the Greater Jakarta (Jabodetabek) Area

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ABSTRACT: Greater Jakarta's traffic congestion, especially during rush hours, is worsening due to the high volume of commuters from surrounding areas (Bogor, Depok, Tangerang, Bekasi – Jabodetabek). Roads are packed with both public and private vehicles, including ride-sourcing options, contributing to increased air pollution from fossil fuel emissions. Encouraging commuters to shift to mass public transportation—such as KRL/Commuter Line, MRT, LRT, and buses—is one of the key strategies to improve the air quality. However, research on the factors influencing this shift in Jabodetabek area remains limited. To address this gap, this study tried to apply the push-pull-mooring (PPM) framework to explore factors influencing commuters' transport choices and preferences. Using data obtained from 301 respondents that reside in Jabodetabek area, the study identified how different elements affect the shift from private vehicles to public transport and ride-sourcing. The data analysis results show rail-based modes (KRL/Commuter Line/MRT/LRT) are most preferred, followed by two-wheeled and four-wheeled ride-sourcing; and buses are the least favoured. The multiple regression analysis identified the external factors, customer-perceived quality of buses, and pull factors positively affect the commuter's interest to take public transportation and ride-sourcing services. External factors, like infrastructure and accessibility, also the quality perceived by customers about buses were also identified to enhance the possibility to leave personal vehicles. However, the quality perceived by customers about rail-based public transits (such as KRL/Commuter Line/MRT/LRT) was not identified to influence the commuter's interest to take public transportation. These findings indicate a more complex relationship between the perceived quality of the rail-based mass public transportation and the commuter's willingness to shift to public transportation and ride-sourcing options.

KEYWORDS: Commuters; mode shift, push-pull-mooring framework, transport choice, influencing factors, perceived quality

1. INTRODUCTION

Traffic conditions in Jabodetabek are increasingly worrying, especially during morning and evening rush hours. These congestions are mainly caused by commuters traveling from various areas such as Bogor, Tangerang, Depok, and Bekasi (known as Jabodetabek). At peak times, roads at Jabodetabek's area are heavily congested, particularly with private vehicles such as cars and motorbikes. This contributes to poor air quality, highlighting the need to encourage commuters to shift to mass public transportation across the Jabodetabek region as a key strategy to reduce air pollution. This paper adopted the push-pull-mooring framework in developing the tools for conducting survey on commuters in Jabodetabek area to identify the factors influencing commuters' choice of mass public transportation and to determine their preferred mode of mass transit. The framework adoption was performed by referring to Wang et.al (2020). The push-pull-mooring framework was expected to provide a more comprehensive approach to analyze the commuters' willingness to shift to public transportation.

Several studies in the past have explored the factors influencing commuters' willingness to shift to public transportation. Some have highlighted the importance of socio-demographic characteristics, such as income, occupation, gender, and residence duration, on traveling mode decisions (Irawan et al., 2019). Various factors such as the workers characteristics, lifestyle, traveling type, and commuters perceived value of different transport modes, in term of service quality, that influence the traveling mode decision including traveling convenience, transport mode reliability, traveling cost, and environmental concerns of the commuters also revealed in many studies. The study results show the needs for strategy to motivate commuters to shift away from private car usage and use the public transportation more often (Wang et al., 2020; Pradonoputro & Kozo, 2021). By referring to the previous studies, this research utilized the push-pull-mooring framework in developing the measurement tools to understand how these factors influence the individuals' willingness to shift to public transportation. By gaining a comprehensive understanding of the push and pull factors, as well as the mooring forces that keep individuals with their current transportation choices, this study aims to provide valuable insights for policymakers and urban planners (Wang et al., 2020).

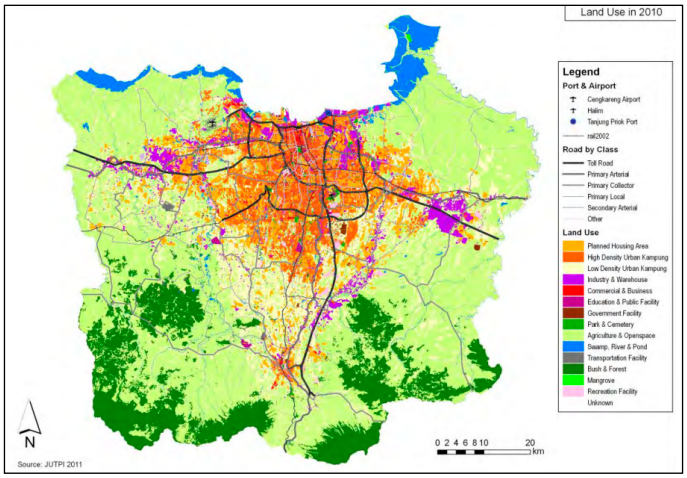

Figure 1. Map of JABODETABEK Area (Japan International Cooperation Agency (JICA), 2012)

The Greater Jakarta area, as shown in Figure 1 and commonly referred to as JABODETABEK, encompasses Jakarta,

Bogor, Depok, Tangerang, and Bekasi. It is Indonesia's largest and most densely populated urban area, with over 30 million residents, and serves as the country's political, economic, and cultural center. Rapid urbanization and population growth have led to major transportation issues, such as traffic congestion, air pollution, and poor public transport infrastructure (Susetyarto, 2020). Solving these problems is key to achieving sustainable development and improving residents' quality of life (Pradonoputro & Kozo, 2021). The area's diverse transport system, combining public and private modes, offers a rich context to study commuter behavior and mode choice. In 2010, 59 million trips were made daily in Greater Jakarta, making it a leading CO_2 emitter globally. Despite a target of 30% public transport usage by 2030, usage was only 6.7% in 2019 (Pradonoputro & Kozo, 2021).

The Jabodetabek region offers a wide array of public transportation options, including the Electric Rail Train (KRL, from the Indonesian abbreviation *Kereta Rel Listrik*) or Commuter Line, Mass Rapid Transit (MRT), Light Rail Transit (LRT), TransJakarta Bus Rapid Transit (BRT), and ride-hailing services such as GoCar, GrabCar, Gojek, and GrabBike. Mass public transportation refers to high-capacity systems designed for efficient urban and suburban mobility, including buses, commuter rail, and subways. The term mass transit is often used interchangeably, encompassing both road- and rail-based systems. The MRT operates as a high-speed, high-frequency urban rail system on exclusive tracks, while KRL, Indonesia's electric commuter rail, shares tracks with other rail services and serves longer, suburban routes. TransJakarta, also known as the Busway, is the region's primary BRT system, operating across 13 corridors. It provides affordable, accessible transport but still faces service quality concerns, particularly where buses leave dedicated lanes. Higher-income commuters often cite reliability and comfort as key issues and call for better system integration to support seamless multimodal travel (Pandyaswargo et al., 2025). Motorcycle taxis, or ojek, have long served as a quick, affordable transport mode. Their evolution into app-based services like Gojek and GrabBike has enabled real-time booking and removed fare negotiations (Belgiawan et al., 2022). These platforms now also offer four-wheeled options like GoCar and GrabCar, providing flexible alternatives and helping to address transport gaps in the city (Pandyaswargo et al., 2025).

2. LITERATURE REVIEW

This literature review explores the theoretical and empirical foundations relevant to understanding commuters' willingness to shift from private transportation to public transit and ride-sourcing services. Utilizing the Push–Pull–Mooring (PPM) framework, the review examines the drivers of change (push factors), the appealing attributes of alternative options (pull factors), and the personal or contextual moderators "moor" individuals to their current mode of transportation (mooring factors). Furthermore, the review discusses the integration of ride-sourcing services with public transportation, emphasizing the importance of seamless intermodal connectivity in encouraging and maintaining a modal transition.

2.1 Push-Pull-Mooring Framework for Evaluating Commuters' Willingness to Shift to Public Transportation and Ride-Sourcing

The **Push-Pull-Mooring (PPM) framework**, introduced by Finnveden in 1999, is widely used in migration and behavioral switching studies. It explains individuals' willingness to switch behaviors—including transportation modes—by considering push, pull, and mooring factors. Push factors are negative aspects of the current mode (e.g., traffic congestion, high parking costs, pollution) that drive people to seek alternatives. Pull factors are positive features of the alternative (e.g., convenience, lower cost, eco-friendliness) that attract users. Mooring factors are personal or contextual barriers (e.g., poor access to transit, rigid schedules, habits) that prevent switching (Wang et al., 2020). Originally rooted in migration studies, the PPM model is now widely applied in transportation research and consumer behavior, such as understanding the shift to green transportation or eco-friendly products (Bansal et al., 2005). By identifying specific push, pull, and mooring factors, researchers can better understand what drives or hinders commuters' shift from private cars to public transportation (Wang et al., 2020).

The push-pull-mooring concept has been adopted in various studies to investigate the willingness to shift to public transportation of workers who commute to work on daily basis. However, some of the studies focused only on certain factors. For instance, a study in a heavy populated city center utilized this framework to identify the factors influencing individuals' willingness to take public transportation as a primary mode of commuting to workplace (Beirão & Cabral, 2007; Pradonoputro & Kozo, 2021). The research results revealed that while pull factors such as accessibility and cost-effectiveness encouraged commuters to consider public transportation, the mooring forces associated with individual car ownership and traveling habits were significant challenges in motivating a shift (Beirão & Cabral, 2007; Pradonoputro & Kozo, 2021; Qian et al., 2021). In a comparative study across multiple urban neighborhoods, the push-pull-mooring framework was used to measure residents' interest to adopt public transportation as their main commuting mode. The study revealed a various relationship of push factors, such as concerns about environmental sustainability and traffic jam, and pull factors like enhanced connectivity and affordability of the public transportation. However, the influence of mooring forces, rooted in dependency on personal vehicles, proved to be an obstacle in shifting commuter behavior towards sustainable transportation choices. While the push-pull-mooring framework has provided valuable insights into commuters' willingness to shift to public transportation, it is important to consider the limitations of this approach. Critics of the push-pull-mooring framework argue that it may oversimplify the complexities of individual decision-making in transportation choices (Wang et al., 2020). However, continuing research that leverages the push-pull-mooring framework for identifying the commuter's interest to take non-personal transportation in different place, like Jabodetabek area in Indonesia, could be beneficial in gaining more insights into commuters' motivation for transition to public transportation.

The Push-Pull-Mooring framework offers a unique and up-to-date approach to understand the commuters' willingness to leave their personal vehicle and take public transportation as their main transportation choice. This framework combines elements from various existing theories to provide a more holistic understanding of the multifaceted factors that influence commuters' interest in taking public transport. The framework encompasses three key components: push factors, pull factors, and mooring factors (Scott et al., 2016; Wang et al., 2020; Pradonoputro & Kozo, 2021). By elaborating the interactions among these factors, transportation planners can develop personalized strategies and policies to effectively encourage and facilitate the transition to public transportation which lead to optimum utilization of transportation facility, air pollution decrement, and traffic jam reduction.

2.2 The push factors of commuter's willingness to Shift to Public Transportation and Ride-Sourcing

Push factors "push" individuals away from their current mode of transportation, which are private cars and motorbikes, and considering more of using the public transportation. Push

factors may include increasing traffic jam, rising fuel prices, and environmental concerns. By understanding these factors, a city transportation facility planner can gain insight into the challenges and limitations of commuters' current transportation choices, providing an opportunity to address them and empower a shift to public transportation. It is important to keep exploring and comprehending the various push factors highlighted in past studies to guide the creation of specific interventions and policies that encourage the use of public transportation (Scott et al., 2016; Wang et al., 2020; Pradonoputro & Kozo, 2021).

Identifying and addressing push factors enables urban planners and policymakers to promote sustainable transportation choices and encourages people to shift from private cars to public transportation. Previous studies have identified a number of strategies that have been proven to motivate people to support environmentally friendly laws regarding transportation options like addressing emission standards and limitations (Pradonoputro & Kozo, 2021).

2.3 The Pull Factors for Commuters' Willingness to Shift to Public Transportation and Ride-Sourcing

Pull factors are attractive features or incentives that 'pull' individual commuters toward using public transportation These may include the public transport infrastructure quality, reliable and convenient services, cost-effectiveness, and environmental advantages. By identifying these pull factors, transportation planners will know better about how to promote public transportation as an appealing and more reasonable alternative to private means of transportation (Scott et al., 2016; Wang et al., 2020; Pradonoputro & Kozo, 2021).

Studies have identified several factors that influence commuters to choose public transit as their primary mode of transportation. Inter-connectivity of public transit networks, including mass rapid transit (MRT), light rail, and bus, is one of the significant pull factors, which have been supported in some studies in some urban and metropolitan regions, that influence commuters to take public transportation. The accessibility and simplicity in reaching various destination via well-connected public transit system is very important for the commuters. Reasonable fare is also an important factor that influences commuters' decision on transportation mode. Studies identified that affordable fare and cost-effective transit options significantly influence people's decision to use public transportation. The affordability of public transit services not only enables a wide range of individuals to commute economically but also moderates the financial barriers associated with private vehicle ownership (Wang et al., 2020). Environmental concern is another pull factor. The case studies in several countries have found awareness of carbon emissions reduction, eco-friendly travel alternatives, and sustainable urban development as influential factors in commuters' transportation choices. Reducing private car usage and promoting travelling with public transit have also been proven to minimize the negative impact of transportation on the environmental sustainability (Pradonoputro & Kozo, 2021).

2.4 Mooring Factors Influencing Commuters to Shift to Public Transportation and Ride-Sourcing

Mooring factors represent the stabilizing forces that "moor" individuals to their current mode of transportation. These factors may include individual habits, perceived convenience, emotional attachment to private vehicles, and accessibility concerns. Understanding these mooring factors is important for designing strategies and interventions to anticipate the barriers that prevent commuters from considering a shift to public transportation (Scott et al., 2016; Wang et al., 2020; Pradonoputro & Kozo, 2021).

Mooring factors refer to the deep-rooted influences and attachments that anchor a person to specific modes of transportation and influence their commuting behaviors and preferences. One of the significant mooring factors is the established culture of car ownership and usage. In many urban and suburban settings, private vehicle ownership has been widely accepted as a societal norm, symbolizing independence, convenience, and status. Initiatives to promote public transportation should aim to challenge conventional ideas linked to owning a car and emphasize the advantages of adopting alternative commuting methods (Cho-Yam, 2010; Wang et al., 2020).

Another factor that "moors" commuters' transportation decisions from using the public transportation is the perceived comfort and flexibility in using the private vehicles. To address this factor, focus on improving the comfort, convenience, and efficiency of public transportation is necessary (Scott et al., 2016; Qian et al., 2021). Initiatives to enhance the punctuality, frequency, and connectivity of public transit services are some alternatives features of public transportation that also important in encouraging a shift towards sustainable transportation. Promoting the societal benefits of reducing individual car usage can also contribute to shifting perceptions regarding the reliability of public transportation (Scott et al., 2016; Wang et al., 2020).

2.5 The Integration of Ride-Sourcing with Public Transportation

Integrating ride-sourcing with public transportation has a major benefit - it improves first and last-mile connectivity. This means that ride-sourcing services can help connect residential areas to public transit hubs, making it easier for commuters to access the public transportation network. For people in areas with limited or inconsistent public transit, ride-sourcing offers a dependable alternative that broadens their commuting choices. Incorporating new tech and digital platforms to combine ride-sourcing and public transportation can make commuting easier for everyone. With mobile apps and digital tools, commuters can get real-time info, plan trips using different types of transport, and switch between ride-sourcing and public transit smoothly for a better commuting experience. This dependable alternative is especially beneficial in areas with limited public transit. The integration of ride-sourcing and public transportation can provide real-time information, smooth trip planning, and improved accessibility. Collaboration between ride-sourcing companies and public transportation agencies is crucial for successful integration. Ride-Sourcing can help reduce the dependence on private vehicle ownership, alleviate traffic congestion, and contribute to environmental sustainability by reducing carbon emissions (Irawan et al., 2019).

Taking both motor-bike-based and car-based ride-sourcing services offer several benefits (Irawan et al., 2019). Car-based ride-sourcing services give a variety of benefits that accommodate different commuting needs. For instance, car-based ride-sourcing offers a more spacious and comfortable travel experience, making it suitable for longer journeys or when traveling with a group. Moreover, car-based ride-sourcing services can accommodate commuters with specific mobility requirements or those carrying bulky goods (Wang & Yang, 2019; Rizki et al., 2021). Both motorcycle-based and car-based ride-sourcing services provide convenience, flexibility, and efficiency in traveling from one place to another (Irawan et al., 2019).

By referring to previous studies, utilizing the Push-Pull-Mooring framework can reveal to a more comprehensive understanding in identifying the factors that influence commuters' willingness to shift to public transportation in Jabodetabek area. The results of the study are expected to

be a solid reference for the transportation planners, policymakers, and urban development stakeholders in developing strategies to encourage sustainable and efficient transportation choices which is aligned with the various needs and preferences of commuters. The Push-Pull-Mooring framework serves as a valuable tool for evaluating and understanding the complex dynamics underlying commuters' mode choice behavior (Qian et al., 2021). To build on this theoretical foundation, the next section outlines the methodology used to examine these factors empirically.

3. RESEARCH METHODOLOGY

Building on insights from previous studies, this research seeks to empirically examine the factors influencing commuters' willingness to shift from private vehicles to public transportation and ride-sourcing services in the Jabodetabek region. To achieve this, a structured questionnaire was developed and distributed it by online to approximately 500 residents of Jabodetabek area. The analysis on the collected data was conducted to reveal the effective strategy to encourage the commuters to take the transportation mode that support environmentally sustainable commuting choice, reduce congestion and air pollutions, while enhance travel cost efficiency. To address this gap and apply the Push–Pull–Mooring framework within the Jabodetabek region, this study adopts a structured research approach to empirically assess the factors shaping commuter behavior.

In order to meet this research objective, following steps were conducted in this study:

1. The research model is designed to analyze factors influencing commuters' willingness to switch from private vehicles to public transportation and ride-sourcing, capturing complex dynamics underlying mode choice behavior.
2. A structured questionnaire was developed to understand commuters' preferences, concerns, and decision-making processes regarding transportation mode choice. The measures in the questionnaire adopted push factors, pull factors, and mooring factors.
3. Collecting data that related to commuter's travel modes such as car, motorcycle, public transportation, etc. Gathering relevant measures such as distance, travel time, cost, traffic conditions, and personal preferences will be very useful in building the research models.
4. Data Preprocessing: this stage handled missing values, eliminate duplicates, and encode category variables to clean up and preprocess the gathered data. By doing this step, the format of the data is guaranteed to be appropriate for further data analysis.
5. Descriptive Analysis: analyzing the frequency and percentage of the responses to describe the respondent's demography and the work travel mode.
6. Multiple Regression Analysis: this stage involves examining the influence of four independent variables - external factors, customer perceived quality of bus services, customer perceived quality of train services, and the other pull factors - on the dependent variable which was identified as commuters' willingness to switch from private vehicles to public transportation and ride-sourcing. The results of the analysis provide empirical justification for the research model developed in the initial stage, offering insights into the relative strength and significance of each factor in shaping commuter mode shift behavior.
7. Results interpretation: interpreting the results obtained in the previous stage and developing insights into the factors that drive the work travel mode choice in Jabodetabek area. This analysis will be used for urban planners and policymakers in transportation planning and infrastructure development.

4. RESEARCH MODEL AND HYPOTHESES

Building upon the theoretical insights and empirical findings discussed in the previous section, this study proposes a research model based on the Push–Pull–Mooring (PPM) framework to identify the factors influencing commuters' willingness to shift to public transportation and ride-sourcing services. The following section outlines the conceptual model and develops the hypotheses derived from previous studies.

4.1 Research Framework and Measures

The framework was constructed for developing the questionnaire for identifying the influencing factor of Commuters' Willingness to Shift from Private Vehicles to Public Transportation and Ride-Sourcing. The framework was built by adopting the dimensions in push-pull-mooring concept (Wang et al., 2020) and referring to previous studies (Abou-Zeid & Ben-Akiva, 2012; Beirão & Cabral, 2007; Belgiawan et al., 2022; Pradonoputro & Kozo, 2021; Scott et al., 2016; Irawan et al., 2019).

4.1.1 Push Factors or External Factors

The first set of factors used in the framework for identifying the factors influencing the commuters' willingness to shift from private vehicles to public transportation and ride-sourcing is the push factor. In this study, the push factor is developed by adopting the external factors. Commuters' perceptions of public transportation's reliability, such as the availability of routes, interarrival, and punctuality, can significantly impact personal choice in taking transportation mode. As additional attributes to service quality, personal characteristics, such as age, income, and occupation, can also act as push factors (Rosnaeni & Buchori, 2017). For example, older commuters or those with higher incomes may be preferred to use private vehicles due to their perceived convenience and social status. (Taylor & Fink, 2013).

The push factors examined in this study included individual perceptions and habits towards public transportation, such as its perceived convenience, comfort, the regulation of the government, the travelling mode choice, and the situation happen in the area such as mass demonstration, floods or special traffic jam.

4.1.2 Pull Factors

The pull factors are about the attractiveness and advantages of the alternative transportation options. This factor includes the reasonable fare of public transportation and ride-sourcing services, relatively compared to the cost of private vehicle ownership and operation. In addition, the flexibility and accessibility of ride-sourcing, such as the ability to request a ride on-demand and the availability of pick-up and drop-off locations, make these services more appealing to the commuters (Borhan et al., 2017; Rizki et al., 2021). Another important pull factor is the quality and accessibility of public transportation infrastructure. The interconnectivity of public transportation networks, with a reliable service, can significantly increase the attractiveness of these modes. Furthermore, the comfort, safety, and cleanliness of public transportation vehicles in considered to be attractive for the commuters to shift from private vehicles (Beirão & Cabral, 2007; Wang et al., 2020). Environmental concerns, such as the desire to reduce carbon emissions and contribute to sustainable transportation, can be a significant influencing factor for commuters (Menghwar et al., 2021; Taylor & Fink, 2013).

The pull factors examined in this study focus on the perceived qualities of the transportation mode, such as affordability, cost-effectiveness, flexibility, and accessibility. The study also examines how commuters' decision in transportation choice might be influenced by the accessibility, quality, and availability of transportation infrastructure (Wan et al., 2009;

Bi & Romão, 2021). The pull factors in this paper also include payment system, number of transits, and security.

4.1.3 Decision on using Public Transportation and Ride-Sourcing

Measuring the interest of the respondents in using the public transportation and the ride-sourcing transportation mode was performed in order to identify the respondent willingness to shift to non-private vehicle. These measures were carefully selected by considering as the consequences of on the push and the pull factors, to enable this study to gain a more comprehensive understanding of the complex linkages between commuter choices, transportation systems, and the overall well-being of people and the communities (Wang et al., 2020). By understanding the relative importance and interrelations of these various factors, the policymakers and transportation planners will be able to develop better strategies to promote the use of public transportation and ride-sourcing service, eventually contributing to more sustainable and equitable mobility solutions (Beirão & Cabral, 2007).

After a very careful discussion and observation, the dimensions and the measurement framework are as can be seen in Table 1, while the research model is as described in Figure 2.

	Measures	Reference
Push	External Factors	(Wang et al., 2020)
Pull	Customer Perceived Quality on Bus	(Irawan et al., 2019)
	Customer Perceived Quality on Train	
	Other Pull Factors	
Consequences	Frequency/interest of using Public Transportation in the Future	(Wang et al., 2020)

Table 1. Dimensions in the Measurement Framework

The utilization of public transportation and ride-sourcing services is influenced by a complex interplay of push, pull, and mooring factors. Previous research has examined how mooring factors—like social norms and environmental concerns—affect commuters' choice of mode of transportation. However, in this paper, the adapted factors are more the push factors and the pull factors. The mooring factors are not explicitly included in this paper because in a certain condition, the "negative" pull factors can also be seen as a barrier which work in the same sense with mooring.

4.2 Research Model

Research model in this paper, as can be seen in Figure 2, was developed based on the literature review, to describe the construction of the influencing factors and the consequences, and to facilitate the hypothesis testing.

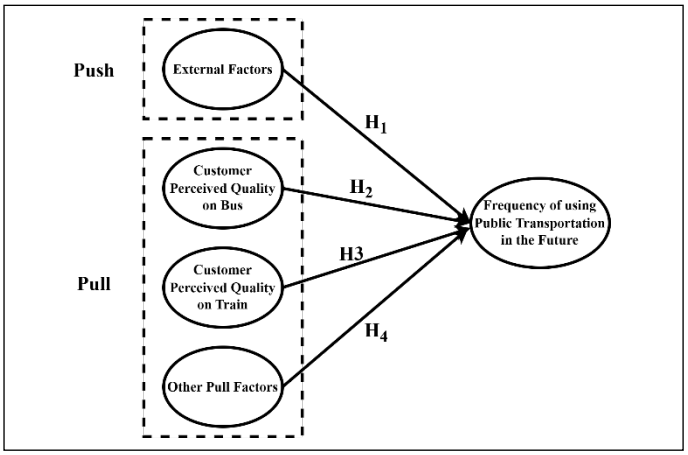

Figure 2. Research Framework

Hypothesis H_1. External Factors positively affects Frequency of Respondent in taking Public Transportation

Hypothesis H_2. Customer Perceived Quality on Bus positively affects Frequency of Respondent in taking Public Transportation

Hypothesis H_3. Customer Perceived Quality on Train/Rail-based Transportation positively affects Frequency of Respondent in taking Public Transportation

Hypothesis H_4. Pull Factors positively affects Frequency of Respondent in taking Public Transportation

These multidimensional push and pull factors were referred in this study in providing a comprehensive understanding of the complex dynamics that shape commuters' willingness to shift from private vehicles to more sustainable transportation options, such as public transportation and ride-sourcing service (Borhan et al., 2017; Menghwar et al., 2021; Rodriguez-Deniz & Villani, 2022; Taylor & Fink, 2013).

5. DATA COLLECTION AND ANALYSIS

This chapter outlines the process and results of the empirical investigation. Starts with an overview of data collection and the sampling approach. The subsequent subsection presents the research sample demographic to contextualize the respondent profile. A reliability test was performed using Cronbach's alpha and the Keiser-Meyer-Olkin (KMO) measure to ensure the validity and reliability of the measurement instrument. A descriptive analysis was conducted to examine the respondent's perception and preferences toward various modes of transportation. Eventually, a multiple regression analysis was conducted to evaluate the proposed hypothesis and to identify the influential factors that drive the transportation modal shifting behavior.

5.1 Data Collection

The data collection was conducted by e-questionnaire distribution. The questionnaire was developed by referring to the framework depicted in Figure 2. The measures used a Likert-type scale with items 1 - 6 was used (where 1 = Strongly Disagree, 2 = Disagree, 3 = Slightly disagree, 4 = Slightly Agree, 5 = Agree and 6 = Strongly Agree) in this study. The survey in this study was conducted over a period spanning from May to August 2023, which a total of 301 valid responses were collected. The participants were residents of the Jakarta, Bogor, Depok, Tangerang, and Bekasi areas, known as JABODETABEK. This region, which encompasses the greater Jakarta metropolitan area, was specifically targeted to understand commuting patterns and preferences due to its high population density and diverse transportation needs. Statistical analysis was performed to obtain insight from the collected data. Initially, descriptive analysis was employed to profile the demography of the respondents. Subsequently, reliability analysis was conducted to ensure the measurement consistency.

5.2 Demography of the Research Sample

The distributions of respondents by different demographic categories based on the survey data includes **Gender, Age Group, Residence Area, Occupation and Monthly Income**. The demography of the research sample will be elaborated more details in following.

There is a mix of male and female respondents, with a higher number of female respondents. The majority of the respondents were female, constituting 56.8% of the sample, while males represented 41.2%, and 2% preferred not to disclose their gender, as can be seen in Table 2.

	Frequency	Percent (%)
Male	124	41.2%
Female	171	56.8%
Prefer not to say	6	2.0%
Total	301	100.0%

Table 2. Distribution of respondents by Gender

The respondents are distributed across various age groups was as follows: over 35 years (35.2%), 17-20 years (6.6%), 21-25 years (42.9%), 26-30 years (9.6%), and 31-35 years (5.6%). Most respondents fall within the "21-25" and ">35" age groups as can be seen in Table 3.

	Frequency	Percent (%)
> 35	106	35.2%
17 - 20	20	6.6%
21 - 25	129	42.9%
26 - 30	29	9.6%
31 - 35	17	5.6%
Total	301	100.0%

Table 3. Distribution of respondents by Age

Geographical distribution of the respondents was as follows: Jakarta (38.2%), Tangerang area (34.9%), Bekasi (9.0%), Bogor area (8.0%), Depok (6.6%), and other areas within Jabodetabek (3.3%) as depicted in Table 4. From the distribution, the respondents are primarily from Jakarta and Tangerang.

	Frequency	Percent (%)
Jakarta	115	38.2%
Tangerang (area)	105	34.9%
Bekasi	27	9.0%
Bogor (area)	24	8.0%
Depok	20	6.6%
Jabodetabek - Other	10	3.3%
Total	301	100.0%

Table 4. Distribution of respondents by Residence Area

	Frequency	Percent (%)
Students	118	39.20%
Private Company	94	31.20%
Lecturer/Faculty Member	26	8.60%
Entrepreneur	23	7.60%
Housewives	23	7.60%
Government	6	2.00%
Retire	3	1.00%
BUMN Worker	2	0.70%
Government Special Employment	1	0.30%
Humanitarian Worker	1	0.30%
Insurance Business	1	0.30%
Research Assistant	1	0.30%
Intern	1	0.30%
Part-timer employee	1	0.30%
Total	301	100.0%

Table 5. Distribution of respondents by Professions

The respondents have a variety of professions. The occupational distribution was primarily composed of students (39.20%) and private company employees (31.20%), followed by lecturers or faculty members (8.60%), entrepreneurs (7.60%), and housewives (7.60%). The occupations of the rest of the respondents included government employees, retirees, BUMN (state-owned enterprise) workers, government special employment, humanitarian workers, insurance business professionals, research assistants, interns, and part-time employees. The most common professions among respondents are students and employees from private companies as can be seen in Table 5.

The respondents' monthly income ranges in various brackets. Income distribution among the respondents was categorized as follows: less than IDR 3,000,000 (29.2%), IDR 3,000,000 to IDR 7,999,000 (29.9%), IDR 8,000,000 to IDR 12,999,000 (16.3%), and more than IDR 13,000,000 (22.6%). Additionally, 0.7% of respondents chose to keep their income confidential, 0.3% were retired, and 1.0% reported no income. The most common monthly income of among respondents is IDR 3.000.000 - IDR 7.999.000 as can be seen in Table 6. As of April 18, 2025, the exchange rate for 1 US Dollar (USD) to Indonesian Rupiah (IDR) is approximately 16,879 IDR, according to Wise.

	Frequency	Percent (%)
< IDR 3.000.000	88	29.2%
IDR 3.000.000 - IDR 7.999.000	90	29.9%
IDR 8.000.000 - IDR 12.999.000	49	16.3%
> IDR 13.000.000	68	22.6%
Confidential	2	0.7%
Retirement	1	0.3%
None	3	1.0%
Total	301	100.0%

Table 6. Distribution of respondents by Monthly Income

5.3 Reliability Test of the Instrument

The suitability of the data for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, while the reliability of the instrument was evaluated through the estimated values of Cronbach's alpha. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is a statistic used to evaluate the appropriateness of conducting factor analysis on a dataset. It ranges from 0 to 1, with values closer to 1 indicating that the dataset is more suitable for factor analysis, as it suggests that the partial correlations among the variables are small, and the common factors are likely to account for a substantial amount of the variance in the data (Pallant, 2020). The KMO measure obtained by using SPSS software and the outputs are as can be seen in Table 7.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.900
Bartlett's Test of Sphericity	Approx. Chi-Square	6801.101
	df	703
	Sig.	<0.001

Table 7. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity

The research uses the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity to assess the suitability of the dataset for factor analysis, which

aims to identify commuters' willingness to shift to public transportation and ride-sourcing services. A KMO score of 0.9 demonstrates outstanding sample adequacy, indicating strong interrelationships among variables, while a significance value from Bartlett's Test below 0.001 confirms that the data is highly appropriate for factor analysis due to sufficient correlations among the variables.

For the next analysis, Cronbach's alpha was utilized to measure the internal consistency and reliability of the research instrument, ensuring the questionnaire's ability to yield consistent results. A Cronbach's alpha coefficient of 0.70 or higher is deemed acceptable, while values over 0.80 indicate good reliability, confirming that the instrument is robust for research purposes. Cronbach's alpha reliability method was used to assess the internal consistency and reliability of the research instrument, ensuring that it yields consistent results across various items. Cronbach alpha is an index of reliability that may be thought of as the mean of all possible split-half co-efficient corrected by Spearman-Brown formula (Agbo, 2010). The Cronbach's alpha coefficient provides valuable information about the quality and consistency of the measurement instrument used in the research study (Greco et al., 2017)

The KMO and Bartlett's Test results, combined with the reliability assessment through Cronbach's alpha, was used to validate that the data and instruments used in this research are highly suitable for structure detection and analysis.

	Measures	Cronbach Alpha
Push	External Factors	0.752
Pull	Customer Perceived Quality on Bus	0.902
	Customer Perceived Quality on Train	0.919
	Other Pull Factors	0.859
Consequences	Frequency/interest of using Public Transportation in the Future	0.787

Table 8. Instrument Reliability Test Results

The internal consistency of instruments measuring factors influencing commuters' transportation preferences was evaluated using Cronbach's alpha, a key statistic for assessing scale reliability. The analysis reveals that external factors, such as cost, convenience, and accessibility, are consistently interpreted by respondents. Specifically, the quality of bus services scored a Cronbach's alpha of 0.902, and train services scored even higher at 0.919, both indicating excellent internal consistency and reflecting consistent perceptions among commuters regarding these services. Other pull factors, such as route availability, service frequency, and safety, also exhibited strong reliability, suggesting they are robust measures of factors attracting commuters to public transportation.

Additionally, the decision to use non-private transportation in the future achieved a Cronbach's alpha of 0.787, indicating that the survey items effectively capture consistent responses about future transportation choices. These high reliability scores highlight the dependable nature of the survey instruments, reinforcing their suitability for predicting commuter behavior and informing strategies to improve public transportation services. Overall, the study offers critical insights into the factors that shape public transportation preferences, supporting efforts to encourage a shift away from private vehicle use.

5.4 Descriptive Analysis of the Respondent Preferences

This subchapter elaborates a descriptive analysis of the measures, including External Factors, Customer Perceived Quality on Buses, Customer Perceived Quality on Trains, Pull Factors, and commuters' decision on using Non-private Transportation, encompassing both public transportation and ride-sourcing service. The value of Minimum, Maximum, Mean, Median and standard deviation of the primary data can be seen in Table 9.

N	Minimum	Maximum	Mean	Median	Std. Deviation
External Factors	1.00	6.00	4.16	4.25	1.03
Customer Perceived Quality on Bus	1.20	6.00	4.09	4.20	0.85
Customer Perceived Quality on Train	1.20	6.00	4.56	4.70	0.83
Pull Factors	1.00	6.00	4.69	4.75	0.85
Decision on using Non-private Transportation (public transportation and ride-sourcing)	1.00	6.00	3.46	3.43	1.08

Table 9. Minimum, Maximum, Mean, and Standard Deviation

The study's descriptive analysis reveals that commuters generally have positive perceptions of public transportation, particularly train services and factors that make these services attractive (pull factors). Train services received more favourable ratings than bus services, with respondents showing broad agreement on their quality. Pull factors, such as incentives and convenience, were perceived positively, suggesting they have strong potential to encourage the use of public transportation. However, the decision to use non-private transportation is more complex, showing a lower mean score and greater variability among respondents. This suggests that while public transport is viewed favourably, there is hesitancy or barriers affecting the actual commitment to use it. The study highlights the need for modified strategies to address specific concerns, such as improving bus services to match the quality of train services, maintaining high train standards, and leveraging pull factors to enhance the appeal of public transportation. Addressing perceived barriers, including convenience, safety, and cost, could significantly impact commuters' willingness to shift to non-private transportation. Strategic improvements and targeted communication efforts could help increase the adoption of public transportation and ride-sourcing services. The median values from the survey reveal that most respondents acknowledge external factors—such as traffic congestion, fuel prices, and environmental concerns—as influential in shaping their transportation choices. Public transportation is perceived positively, with train services viewed more favourably than buses, likely due to better comfort, reliability, or efficiency. Respondents also show a strong willingness to shift from private vehicles to public transport or ride-sourcing services. However, despite positive attitudes and motivation, practical barriers may still prevent commuters from fully transitioning to non-private transportation options.

5.4.1 Personal Vehicle Ownership

A descriptive analysis of the current private vehicles owned by the respondents was elaborated by categorizing their ownership into cars, motorbikes, a combination of motorbikes and cars, none, and other. Most of the respondents have cars as their personal vehicle, followed by motorbikes. The details of the analysis can be seen in Table 10.

	Frequency	Percent (%)
Cars	132	43.85%
Motorbike	94	31.23%
Motorbike and Cars	49	16.28%
None	23	7.64%
Other	3	1.00%
Total	301	100.0%

Table 10. Distribution of Respondents by Personal Vehicle Ownership

The survey data revealed diverse personal vehicle ownership patterns among the respondents, highlighting varied preferences and accessibility across different modes of private transportation. The majority of respondents own cars, with 43.85% owning cars as their primary mode of personal transportation. Motorbikes followed closely behind, with 31.23% owning them due to their cost-effectiveness, manoeuvrability, and convenience in urban areas. Approximately 16% own both motorbikes and cars, indicating a versatile approach to transportation. A smaller segment, 7.64%, does not own any personal vehicle, possibly due to environmental or health concerns or economic constraints. Eventually, 1% own other types of vehicles, such as vans, or non-traditional motorized vehicles, reflecting niche needs or specific occupational uses. The data describes a comprehensive view of personal vehicle ownership, with a predominant inclination towards cars and motorbikes, underlining their essential role in fulfilling daily transportation needs in the surveyed areas.

5.4.2 Preferred Public Transportation and Ride-Sourcing

The survey data provide a detailed breakdown of the transportation modes preferred by the respondents in the JABODETABEK area. The details of the analysis can be seen in Table 11.

Transportation	Frequency	Percentage
Rail Based (KRL/Commuter Line/MRT/ LRT)	122	40.53%
Motor-bike Taxi (ride-sourcing)	83	27.57%
Car-based taxi (ride-sourcing)	57	18.94%
Bus (public transportation)	37	12.29%
MRT, Bus and Motor-bike taxi	1	0.33%
All options	1	0.33%
Grand Total	301	

Table 11. Distribution of Preferred Types of Public Transportation Among Respondents

The descriptive analysis of the data collected in the survey reveals that rail-based transportation is the most popular mode among commuters, with 40.53% of respondents preferring it due to its efficiency and convenience in densely populated urban areas. Ride-Sourcing services, particularly motorbike taxis, follow with 27.57% usage, favoured for their ability to navigate traffic quickly. Car-based taxis, accessed through ride-sourcing apps, are used by 18.94% of respondents, valued for comfort and privacy despite being less economical than public transit. Bus services, though vital, account for only 12.29% of use, likely due to perceived issues with quality, route availability, and efficiency. The study also notes that only 0.33% of participants use a combination of different transportation modes, indicating that most commuters prefer to rely on one or two primary options. These insights highlight the varied preferences in the JABODETABEK area, with a strong leaning toward rail and ride-sourcing services, emphasizing the evolving dynamics of urban transportation to meet the needs of a growing metropolitan population.

5.5 Hypothesis Testing with Multiple Regression Analysis

Multiple regression analysis was conducted to test the hypotheses and derive insights from the dataset, specifically was used to predict the outcome variable—frequency of using public transportation in the future—based on four predictors: Pull Factors, Customer Perceived Quality on Bus, Customer Perceived Quality on Train, and External Factors. Although the dependent variable was initially measured using a Likert scale, it was transformed into a composite score by aggregating multiple items, allowing it to be treated as an approximately continuous variable. This approach is commonly accepted in behavioral and social sciences, particularly when the aggregated Likert data exhibits appropriate distribution properties. Consequently, multiple linear regression was chosen for its interpretability, simplicity, and ability to effectively estimate the strength of predictor relationships.

The Multiple regression analysis (R square data) results presented in Table 12, regression coefficients are detailed in Table 13, and the results of the variance analysis (ANOVA) are shown in Table 14.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.598[a]	0.358	0.349	0.87198

Table 12. Multiple Regression Analysis (R square data).

As can be seen in Table 12, the analysis indicates a moderate positive correlation between the predictors and the outcome, with an R value of 0.598. The model's R Square value of 0.358 indicates that approximately 35.8% of the variance in the dependent variable—commuters' willingness to shift to public transportation or ride-sourcing services—is explained by the model. However, a significant portion of the variance (64.2%) remains unexplained, implying that other factors not included in the model may also influence commuters' decisions. The adjusted R Square of 0.349 indicates that adding more variables to the model may not significantly enhance the model's performance. The Standard Error of the Estimate (SEE) of 0.87198 reflects the average prediction error and indicates that, on average, the model's predictions deviate from actual values by approximately 0.87 units. While this

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.151	0.335		0.452	0.652
External Factors	0.467	0.062	0.447	7.479	<.001
Customer Perceived Quality on Bus	0.388	0.083	0.303	4.680	<.001
Customer Perceived Quality on Train	-0.129	0.088	-0.099	-1.469	0.143
Pull Factors	0.053	0.077	0.042	0.690	0.491

Table 13. Regression Coefficients

suggests a reasonable level of accuracy, it also highlights opportunities for improving model precision.

While the model offers useful insights into factors influencing commuters' willingness to shift to non-private transportation, further research is needed to identify additional predictors and refine the model for more comprehensive decision-making.

A multiple regression analysis was conducted by using SPSS, and the results are as can be seen in Table 13.

Referring to the regression coefficients in Table 13, the regression equation is formulated as shown in eq.1:

$$(1) \quad \hat{y} = 0.151 + 0.467\, x_1 + 0.388\, x_2 - 0.129\, x_3 + 0.053\, x_4$$

where: x_1 = External Factors, x_2 = Customer Perceived Quality on Bus, x_3 = Customer Perceived Quality on Train, x_4 = Pull Factors

In this model, $\hat{y}$ represents the predicted value of commuters' willingness to shift from using their personal vehicle to public transportation and ride-sourcing. The regression model provides insights into how different factors influence respondents interest to use public transportation and ride-sourcing service, and their willingness to shift from using their personal vehicle. The analysis supports Hypotheses H_1, and H_2, indicating that the external factors and the customer-perceived quality on buses positively and significantly influence the willingness to shift to public transportation or ride-sourcing service. External factors have the strongest positive and significant effect with coefficient = 0.467 and $p<0.01$, highlighting that improvements in external conditions, such as government regulation and traffic situation, significantly increase the use of public transit. Similarly, customer-perceived quality on buses has a positive and significant effect with coefficient = 0.388 and $p<0.01$, reinforcing the importance of enhancing bus services to encourage more frequent use. The analysis does not support Hypothesis H_3, as the coefficient for customer-perceived quality on trains is negative (coefficient = -0.129) and statistically insignificant ($p=0.143$). This indicates that perceived improvements in train service quality are not significantly associated with an increased interest in using public transport. The analysis does not support Hypothesis H_4 either, as the pull factors have a relatively minor positive and insignificant effect with coefficient = 0.053 and $p=0.491$. This result is insufficient to draw a meaningful conclusion regarding the contribution of elements such as promotions or incentives in encouraging public transport usage. This counterintuitive finding implies a more complex relationship between train quality perception and public transportation frequency, possibly due to factors like competition with other transport modes or varying preferences among respondents. Overall, the results highlight the importance of external factors and bus service quality in promoting public transport usage while suggesting that simply improving train quality and the pull factors may not lead to increased usage without addressing other underlying factors.

	Sum of Squares	df	Mean Square	F	Sig.
Regression	125.443	4	31.361	41.245	<,001[b]
Residual	225.064	296	0.760		
Total	350.507	300			

Table 14. Analysis of Variance-ANOVA

The ANOVA table as can be seen in Table 14 indicates that the regression model is statistically significant, with a very high F-statistic (41,245.0) and a p-value less than 0.001. This suggests that the set of independent variables (External Factors, Customer Perceived Quality on Bus, Customer Perceived Quality on Train, and Pull Factors) collectively have a significant impact on the dependent variable. The model accounts for a substantial portion of the total variation in the dependent variable, as indicated by the regression sum of squares (125,443). However, there is still a considerable amount of unexplained variability, as shown by the residual sum of squares (225,064). This suggests that while the model is effective, other factors not included in the model may also influence the outcome.

The occupational diversity of respondents strengthens the robustness of the study's findings. A large portion of the sample comprised students (39.20%) and private sector employees (31.20%), suggesting the results may primarily reflect the commuting preferences of younger, potentially more cost-sensitive and flexible individuals. The inclusion of academics, entrepreneurs, housewives, and a smaller group of government employees, interns, and part-time workers introduces perspectives from both formal and informal employment sectors. This diversity supports the generalizability of the results while emphasizing the relevance of life stage, job flexibility, and commuting needs in interpreting how service quality and external factors influence public transport preferences. Given this composition, future research should consider examining whether transportation preferences and frequency of use differ significantly across occupational groups, particularly between students and full-time professionals.

6. CONCLUSION AND RECOMMENDATION

The study reveals that respondent—mainly female, aged 21–25 and over 35, and residing in Jakarta and Tangerang—generally hold positive commuter's perceptions of public transportation, particularly related to train services. Rail-based modes (KRL/Commuter Line/MRT/LRT) were the most preferred, followed by motorbike ride-sourcing services. Multiple regression analysis confirmed that external factors and Customer Perceived Quality on Bus significantly influenced commuter behavior, whereas Customer Perceived Quality on Train showed a negative relationship with frequency of public transportation usage — indicating satisfaction alone may not translate to higher usage, possibly due to contextual or situational constraints. In the mean while the **other pull factors** (e.g., efficiency and convenience) have a insignificant effect.

Based on these findings, the following recommendations are proposed:

- **Prioritize External Factors**: Since external factors have the strongest positive effect on the willingness to use public transportation, focus should be placed on improvement on government regulation including the incentive program to push the commuter's choice on public transit and ride-sourcing service. This includes expanding and maintaining road networks, optimizing transit routes, and ensuring safe, accessible stations. However, the external factors such as traffic jam, floods, mass demonstration which were identified to have strong influence on the respondent choice on travel mode, need to be overcame even though it probably will reduce the commuter's interest to use public transit but for sure it can improve the traffic. Policymakers should consider macro-level interventions addressing external factors like "odd-even" policy.
- **Enhance Bus Services Quality**: Improving bus reliability, frequency, comfort, and route coverage—along with better integration with rail-based modes—can significantly increase appeal and reduce reliance on private vehicles.

- **Address Barriers to Train Use**: Despite high satisfaction ratings, train usage remains limited. Policymakers should investigate and address issues such as overcrowding, safety concerns, ticketing ease, and last-mile connectivity. Improving the overall travel experience, including the integration with other transit options, such as bus and ride-sourcing service, could encourage more people to choose trains for their daily commute.
- **Targeted Communication and Real-Time Info**: Since the study reveals varying preferences and perceptions, targeted communication strategies can address specific commuter concerns, educate the public on the benefits of public transportation, and showcase recent improvements. Providing accurate, real-time information through mobile apps and platforms can also improve the perceived convenience and reliability of public transit options.
- **Develop Integrated Multi-Modal Systems**: With a small portion of commuters using a combination of different transport modes, there is an opportunity to create a seamless multi-modal transport network. Improving integration between buses, trains, and ride-sourcing services can provide commuters with flexible and efficient options, potentially increasing their interest to shift away from private vehicles.
- **Reconsider Incentives Program**: the analysis does not show that pull factors such as incentives and convenience to have an effect on commuter decision-making. Incentive programs, such as discounted fares, loyalty programs, or employer-sponsored transit passes, are not proven to significantly influence commuter mode shifting. Similarly, environmental consciousness does not appear to be a significant determinant in commuters' decisions to change their mode of transport to public transit.

For the future research it is recommended to identify additional predictors or refine existing ones, such as incorporating variables related to commuter demographics, alternative transportation options, or specific policy interventions. However, it should be aware that perceived quality factor alone may not drive the frequency of the commuters in taking public transportation. A more comprehensive study is needed to understand and improve public transportation utilization. A holistic approach considering accessibility, pricing, and convenience may be necessary. The models also emphasize the need for a broader perspective, considering a wider range of factors. A continuous data collection will be useful to address the variability in commuter preferences. By performing gathering data and feedback continuously, the policymakers will be able to monitor the effectiveness of implemented measures and implement the policies as needed. Continuous monitoring on commuters' behaviour on transportation choice is very useful in understanding the changing needs and concerns of commuters can guide ongoing improvements and targeted investments in public transport infrastructure.

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