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Satisfaction and Determinants of the Decision to Switch from Private Vehicles to Commuter Trains in Merak–Rangkasbitung

M. O. Mahendra [1*], M. Djuneydi [2]

[1*,2]*Civil Engineering Department, Faculty of Engineering, Serang Raya University, Banten, Indonesia*

Email: [1*]*muhammadoka81@gmail.com*, [2]*mochammad.djuneydi17@gmail.com*

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ABSTRACT

Urban population growth has had an impact on traffic congestion. Although public infrastructure is available, public preference for private vehicles remains high. This occurs on the Merak-Rangkasbitung route which is served by the train. The gap between service availability and user preferences indicates the need to study mode selection behavior and the factors that influence it. This study aims to analyze motorcycle and car users' tendency to shift their transportation modes from private vehicles to the train service on the Merak-Rangkasbitung route. A quantitative approach was carried out using a questionnaire survey method on 300 respondents using a dual-stratum sampling technique. The analysis used the Importance Performance Analysis (IPA), Customer Satisfaction Index (CSI), and Chi-Square test. The IPA results showed a service suitability value of 86.57%, while CSI showed a satisfaction level of 72.86% (satisfied category). The Chi-Square test results identified that the factors influencing the transportation mode choice differed between segments. For motorcycle users, it was influenced by age, car ownership, and reason for travel, while car users were influenced by occupation, travel costs, reasons and purposes of travel. These findings emphasize the importance of a policy approach based on user segmentation and strengthening integration between modes to improve the effectiveness of train services. With an adaptive service strategy and targeted incentive policies, the transformation towards sustainable urban mobility can be realized.

1. Introduction

The exponential growth of urban population has created complex challenges in managing transportation systems, especially in developing countries [1]. The increasing number of private vehicles is one of the main contributors to traffic congestion, greenhouse gas emissions, and urban environmental burdens [2]. This condition not only reduces mobility efficiency but also affects the quality of life of the community at large. The imbalance

between road capacity and vehicle volume is a significant problem that hinders the sustainability of the transportation system [3]. To answer this problem, public transportation can be a solution to overcome this problem. The high level of private vehicle use exacerbates the urban transportation problem in Indonesia [4]. One of the routes with significant daily mobility density is the Merak-Rangkasbitung route. Although this route has been served by trains, public dependence on private vehicles remains high. This reflects the still low competitiveness of public modes regarding accessibility, comfort, and competitive travel time. From the perspective of transportation planning and infrastructure policy, this condition shows a gap between the provision of public services and the real needs of the user community. Therefore, a contextual study is needed that looks at the technical aspects of service provision and considers user behavior and socio-economic factors that influence the transportation mode choice.

The Indonesian government has initiated various programs to improve the affordability and convenience of public transportation services to encourage a shift from private vehicles [5], [6]. Among them is developing a train network across the Jabodetabek and Banten regions, including the Merak-Rangkasbitung route. The development of an electronic ticket system and expansion of network coverage have been carried out but have not yet shown optimal results. Many users still maintain private modes because public services are considered unable to meet their daily travel needs efficiently, both in terms of travel time, comfort, and safety. The success of a shift in modes depends not only on the availability of infrastructure but also on the ability of the public transportation system to meet user expectations. Thus, a shift in modes strategy must be based on a comprehensive understanding of user preferences, including evaluating service attributes that are considered important in the decision-making process to switch modes.

Several previous studies have examined the determinants of transportation mode choice behavior in an urban context. These studies generally highlight the influence of demographic factors such as age, income, and vehicle ownership on the decision to switch modes [7]–[10]. In addition, public transportation service attributes such as punctuality, fare, safety, and comfort are also often used as primary variables in evaluating the attractiveness of public modes [11]–[14]. The most widely used approaches rely on logistic regression, discriminant models, and structural equation modeling (SEM) to map the relationships between user behavior variables [15]. On the other hand, studies that utilize Importance Performance Analysis (IPA) and Customer Satisfaction Index (CSI) are starting to develop,

especially in assessing user perceptions of the quality of public transportation services more comprehensively [16]. However, most previous studies tend to be general and have not explicitly differentiated user characteristics based on the mode of private vehicle used, such as motorbikes and cars. This segmentation is very relevant in suburban areas such as the Merak-Rangkasbitung route, where users from both groups have different backgrounds, mobility needs, and perceptions of public modes [17], [18]. In addition, a region-based approach that considers spatial conditions and perceptions of train services on the route is still rarely discussed. Therefore, research that combines user segmentation based on the type of private vehicle on the Merak-Rangkasbitung route is needed to produce accurate and applicable policy recommendations.

This study aims to analyze the tendency of motorcycle and car users to shift their transportation mode from private vehicles to train services across Merak-Rangkasbitung. The IPA and CSI approaches are used to determine the level of suitability and satisfaction of train services. In addition, the factors that influence private vehicle users' tendency to switch modes to rail-based public transportation are identified. The results of this study will provide an empirical basis for understanding the heterogeneity of transportation mode user behavior, as well as producing recommendations in formulating strategies for improving train services so as to create a more efficient, inclusive, and sustainable urban mobility system transformation.

2. Research Method

This study uses a quantitative approach with descriptive and explanatory methods. The research location is focused on the Merak-Rangkasbitung train line, including private vehicle user areas around the station. The study began with preparing a questionnaire containing observation variables, followed by a validity and reliability test of the instrument to ensure data accuracy. Furthermore, data were collected through a field survey of respondents. The data obtained were analyzed using descriptive statistics, Importance Performance Analysis (IPA), Customer Satisfaction Index (CSI), and the Chi-Square test to determine the relationship between the variables studied. The results of the analysis were then interpreted to formulate policy implications and strategic recommendations for the development of public transportation services.

2.1 Sample and Population

The population in this study includes all users of transportation modes on the Merak-Rangkasbitung route. The number of samples is determined based on data on the volume of train passengers on the route in 2023. Referring to the Slovin formula, a minimum sample size

of 100 respondents was obtained, representing the population adequately. Using the dual-stratum sampling technique, questionnaires were distributed to three target groups of 100 respondents each for local train users of Merak-Rangkasbitung, motorcycle users, and private car users.

2.2 Data Collection Technique

The survey was conducted using a structured questionnaire instrument. The questionnaire was designed to explore information related to respondent characteristics, vehicle ownership, level of satisfaction, expectations of train services, willingness to switch from private to public transportation, and indicators of variables that influence the decision to choose a mode of transportation. The measurement instrument utilized a five-point Likert scale. Before being distributed, the questionnaire had gone through a validity and reliability test process to ensure the reliability of data measurement.

2.3 Data Analysis Techniques

Descriptive statistical analysis describes the basic characteristics of the respondents' data obtained through the survey. This analysis includes frequency distribution and percentages on demographic variables such as gender, age, and occupation. This approach aims to provide an initial understanding of the profile of respondents who are the object of the study, as well as a basis for further interpretation in the analysis. This data is also useful in identifying general trends and specific patterns that emerge from groups of private vehicle users and train users on the Merak-Rangkasbitung route.

Importance Performance Analysis (IPA) is used to evaluate the suitability between the level of expectation and perception of user performance towards various attributes of train services. Each attribute is assessed based on two main dimensions: level of importance and level of actual performance, which are measured using a Likert scale. The results of the IPA analysis are then mapped into a four-quadrant Cartesian diagram, which groups attribute based on the priority of high-priority actions, maintain performance, low priority, and redundant attributes. This analysis provides a basis for developing a focused and evidence-based service improvement strategy. The Customer Satisfaction Index (CSI) measures the overall level of user satisfaction towards the Merak–Rangkasbitung train service. The CSI value is then classified into satisfaction categories based on the index range, such as very satisfied, satisfied, quite satisfied, and dissatisfied.

The chi-squared test is used as an analysis method to examine the relationship between independent and dependent variables in the context of willingness to switch modes of

transportation. The independent variables analyzed include demographic characteristics (such as age and occupation), vehicle ownership (two-wheeled and four-wheeled), reasons and purposes of travel, and travel costs. The analysis was conducted separately for two groups of respondents, motorcycle and private car users, to identify specific determinants in each group. The Chi-Square test results can show a statistically significant relationship between respondent characteristics and mode preferences, so it can be used as a basis for formulating segmentative and contextual transportation policies.

3. Results and Discussions

3.1   Respondent Characteristics and User Profile of Transportation Modes

Figure 1 shows that the gender composition is dominated by males (60%), while females are 40%. Regarding age, most respondents are in the young and productive age category, namely 19-30 years (66%), followed by 31-45 years (24%), and only 10% are under 18 years old. No respondents were found to be over 55 years old. Meanwhile, based on occupation, most respondents came from students (49%), followed by entrepreneurs (17%), private employees (13%), civil servants (PNS)/BUMN (10%), housewives (6%), and others (5%).
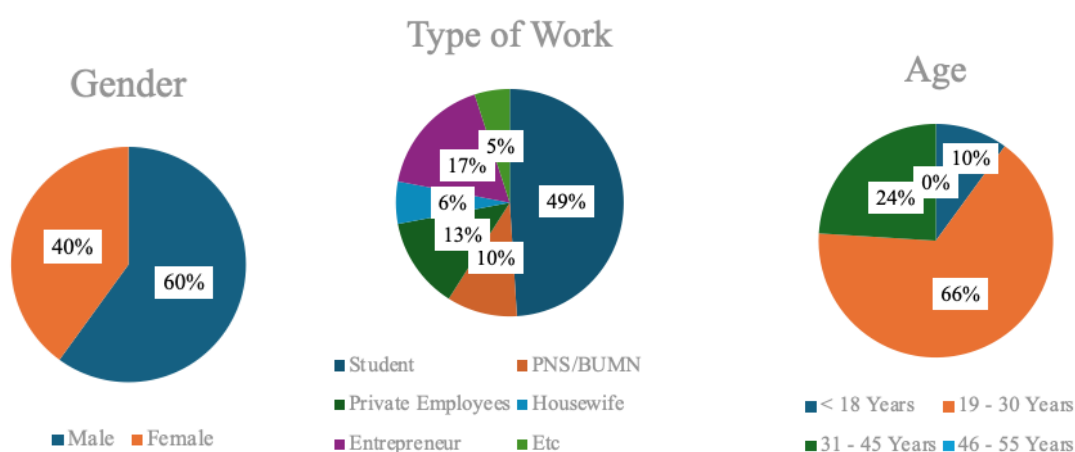
Source: Author Research Results (2024).

Figure 1. Gender, Occupation, and Age of Respondents

Gender distribution shows that men have higher mobility when using private vehicles on this route, both for work and other activities. This indicates that the policy of changing modes needs to consider the factors of comfort and time efficiency which are often the main considerations for male users [19], [20]. The users of transportation modes dominated by 19-

30 years indicate that this age segment is critical to target in promoting and improving train services. The group of students and college students as dominant users of private vehicles shows a dependence on flexible modes in time and distance. The potential for changing modes is very high if the train can provide competitive services in terms of travel time, affordable fares, and station accessibility.

3.2　　Level of Satisfaction and Expectations for Commuter Line Services

Based on the results of the IPA calculation, the suitability value was 86.57%, which is included in the fairly satisfactory category. This value reflects that the Local Train service has generally approached user expectations, although several attributes still require special attention. Several attributes are the main priority to be improved such as ease of getting tickets (Online) through KAI Access, fast completion of ticket purchase transactions, suitability of ticket prices with services, ease of getting information about available seats and departure schedules, security of personal data, availability of health facilities for emergency handling, availability of security facilities to prevent criminal acts, friendly officers and employees, availability of facilities for breastfeeding mothers and wheelchair passengers as well as comfort and cleanliness of toilets. In addition, the results of the CSI value showed a figure of 72.86%, which is in the range of 66-80%, which is included in the satisfied category. The results of the IPA and CSI analysis simultaneously showed that although, in aggregate, passengers were satisfied with the Local Train service, several aspects of the service needed improvement to achieve optimal public service standards.

This study supports the findings of previous studies, which state that supporting facilities at stations and trains are the main determinants of the image of public transportation services [21]. In addition, the success of train services is not only determined by schedules and fares, but also by the quality of officer interactions and the condition of facilities and infrastructure [22]. Therefore, improving the quality of comprehensive services must be carried out integratively, covering digital systems, physical facilities, and user interaction experiences to increase satisfaction and attract more users to switch to public transportation modes.

3.3　　Potential for Modal Shift

Based on **Figure 2a**, it is known that as many as 67% of motorcycle users stated that they are willing to switch to train mode, while 33% stated that they are not willing. Meanwhile, **Figure 2b** shows that 75% of private car users stated they are willing to switch to train mode, with the remaining 25% rejecting the change.
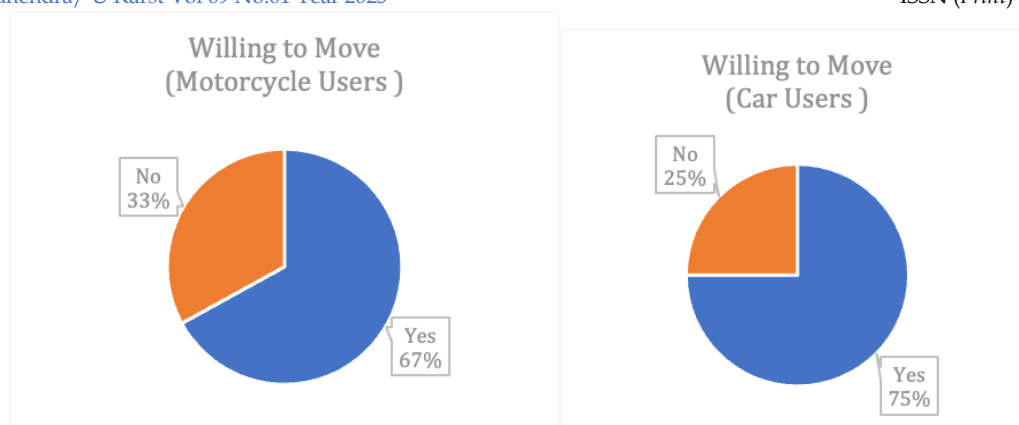
Source: Author Research Results (2024).

Figure 2. Willing to Switch to Commuter Line (a) Motorcycle Users; (b) Car Users.

These data show that in general, there is quite a large potential to encourage mode shifting from private vehicles to the Merak–Rangkasbitung Commuter Line. The fairly high percentage of willingness to switch, especially from car users (75%), shows that people are considering public transportation an efficient alternative, especially in the context of rising fuel costs, traffic congestion, and parking density. However, motorcycle users have a slightly lower level of willingness (67%). This can be attributed to the perception of higher flexibility in using motorcycles, especially in reaching areas with limited public transportation access (first and last-mile issues) [23]. In addition, motorcycle users generally come from economic segments that are more sensitive to cost and time, so their decision-making is more influenced by tariff efficiency and ease of access.

This finding is relevant to previous literature, that user characteristics and regional context greatly influence the success of mode shift [24], [25]. The Merak-Rangkasbitung region, which still faces challenges in intermodal connectivity and supporting infrastructure, is a factor that needs to be improved to optimize the realization of the mode shift. The high willingness to switch modes provides a positive signal for policy development. With the right strategy, the potential for this mode shift can be realized to support more sustainable urban mobility.

3.4 Factors Influencing Mode Selection Behavior

The choice of transportation mode results from a complex interaction between various individual factors, economic factors, and trip characteristics. This complexity encourages understanding the factors influencing users' willingness to change travel modes.

3.4.1 Motorcycle Users

The Chi-Square test results in **Table 1** show that three variables significantly influence motorcyclists' decisions to switch to train: age, ownership of four-wheeled vehicles,

and reasons for travelling. This finding reflects that preferences for switching modes are not entirely homogeneous but rather highly contextual and tied to users' demographic characteristics and utilitarian motivations.

Table 1. Chi Square Test Results (Motorcycle Users)

Independent Variable	Chi Square	Significance	Significant (✓) or Not (x)
Gender	1.980	0.159	X
Age	12.309	0.006	✓
Occupation	4.645	0.461	X
Income	7.613	0.667	X
4 Wheel Ownership	8.410	0.015	✓
2 Wheel Ownership	4.545	0.103	X
Travel Purpose	1.918	0.751	X
Cargo	5.401	0.751	X
Frequency	7.272	0.064	X
Travel	7.930	0.094	X
Reason for Travel	8.271	0.041	✓
Travel Cost	2.212	0.331	X

Source: Author Research Results (2024).

Age influences the tendency of mode choice, where young individuals (19–30 years old) are more dominant in choosing motorbikes. This is due to the flexibility offered by motorbikes for daily mobility, especially in areas with limited access to public transportation. Young age is also generally associated with high physical adaptation and tolerance for uncomfortable travel conditions. In addition, older ages tend to choose public transportation for comfort reasons compared to motorbikes [26]. Ownership of a four-wheeled vehicle has also been shown to influence mode choice. This indicates that ownership of transportation assets plays a significant role in the mode choice process (modal ownership-based mode choice) [27], [28]. Someone who does not have other mode choices tends to maintain the most accessible and economical mode. Travel reasons also influence mode choice behavior. Someone who travels for work or educational reasons is more likely to use a motorbike because this mode offers punctuality and the ability to navigate traffic jams. Meanwhile, the train transportation mode can be an option if the trip is made over a long distance [29].

3.4.2 Car Users

Based on the chi-squared test results shown in **Table 2**, four variables significantly influence the choice of transportation mode by private car users, namely occupation, travel purpose, reason for travelling, and travel costs.

Table 2. Chi-square Test Results (Car Users)

Independent Variable	Chi Square	Significance	Significant (✓) or Not (x)
Gender	14.185	0.165	X
Age	41.427	0.080	X
Occupation	123.650	0.001	✓
Income	41.236	0.083	X
4 Wheel Ownership	30.313	0.450	X
2 Wheel Ownership	22.330	0.323	X
Travel Purpose	60.272	0.021	✓
Cargo	18.143	0.578	X
Frequency	22.291	0.325	X
Travel	54.323	0.065	X
Reason for Travel	91.864	0.001	✓
Travel Cost	89.825	0.001	✓

Source: Author Research Results (2024).

Individuals' professional background will influence mode choice decisions. Car users with permanent jobs or high professional status tend to maintain car mode due to convenience, social prestige, and time flexibility. This finding suggests an opportunity to encourage mode shifting, especially if public transportation, such as trains, can provide the same value of convenience, privacy, and flexibility as premium class upgrades or trains with work facilities. However, travel costs have also been shown to influence mode choice. Although car users are generally associated with high purchasing power, sensitivity to fixed costs influences mode preference. Operational costs such as fuel, tolls, and parking are often a comparison factor in switching to public modes [30]–[32].

Mode selection is also greatly influenced by the purpose of the trip. Routine and functional trips such as to work can be a reason for choosing a car because it is considered to offer time reliability and route flexibility. However, in conditions of high congestion and limited parking, this preference can shift if alternative modes show comparability regarding travel time and accessibility. In addition, the reason or motive for the trip is one of the cognitive determinants that influences mode selection behavior. Car users who travel for work, urgency, or professionalism will be more likely to choose a mode that provides control over travel time and safety. Conversely, if the purpose of the trip is not routine, such as a business trip out of town, it will affect mode selection [33]. This reinforces the understanding that not all car users have homogeneous motivations, and public transportation policies must target segmentation based on travel motives.

3.5   Policy Implications and Strategic Recommendations

This study emphasizes the need for a contextual and segment-based approach in designing strategies for managing and developing public transportation modes, especially the Merak-Rangkasbitung train. The government and transportation operators need to develop policies that directly target the obstacles the community faces in accessing and choosing public transportation modes. Based on the research findings, the public transportation system is required to be able to compete not only in terms of fares but also in terms of accessibility, comfort, travel time, and service integration. One strategic step that can be implemented is strengthening inter-mode connectivity by providing integrated feeder transportation. This intervention will address the challenge of access to and from train stations, especially for users who have so far relied on private vehicles due to the limited reach of public transportation.

In addition, train services can be optimized to be more responsive to the needs of users from various social backgrounds and travel motives. For professional workers, the development of train services with supporting facilities such as work cabins. For students and lower-middle-income communities, the provision of fare subsidy programs, periodic subscriptions, and community-based or institutional collective discount promotions can increase the attractiveness of trains as the main mode. This segmentation-based policy can be combined with a promotional strategy that is not only informative but also educational, prioritizing the rational and social benefits of switching to public transportation. In addition, fiscal support is needed in the form of incentives for public mode users, both in the form of direct subsidies and additional cost cuts, such as parking around the station. This kind of intervention creates a balancing effect on the operational costs of private vehicles and shows the state's support for the sustainable transportation agenda. With a policy direction that focuses on improving service quality, integration between modes, user segmentation, and targeted economic incentives, the shift from private vehicles to trains is increasingly massive, encouraging the transformation of a more efficient, inclusive, and sustainable urban mobility system.

4. Conclusion

This study reveals that the potential for switching from private vehicles to the Merak–Rangkasbitung commuter line is quite high, especially among private car users. The level of user satisfaction with the commuter line service is in the satisfied category, although

several service attributes still require strategic improvement, especially in terms of accessibility, comfort, and safety. Findings from the Importance Performance Analysis (IPA) and Customer Satisfaction Index (CSI) emphasize the importance of improving services based on user preferences to encourage wider adoption of public transportation modes. The Chi-Square test results show that demographic and travel factors significantly influence users' tendency to switch modes, but these determinants differ between user segments. For motorcycle users, age and vehicle ownership are the main determinants, while for car users, occupation, purpose, costs, and reason for travel are more dominant. These findings emphasize the need for a segment-based transportation policy approach contextual to user characteristics. The results of this study provide a strong basis for formulating a strategy for improving train services that are more integrated, adaptive, and responsive to user needs. Policy implications include developing intermodal systems, improving the quality of services based on target groups, and fiscal incentives to encourage sustainable mobility. This will encourage the transformation of urban mobility systems to be more efficient, inclusive, and sustainable.

5. Acknowledgement

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Satisfaction and Determinants of the Decision to Swtich from Private Vehicle to Commuter Trains in Merak – Rangkasbitung

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