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Study on Transportation Mode Choice Among Full-Time Students in Jakarta

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Abstrak

Mahasiswa sebagai kelompok demografis signifikan di lingkungan perkotaan memainkan peran penting dalam aktivitas perjalanan sehari-hari. Memahami pola pergerakan dan preferensi moda transportasi mereka sangat penting untuk mendukung perencanaan kota yang lebih berkelanjutan dan efisien. Penelitian ini bertujuan untuk mengevaluasi preferensi moda transportasi mahasiswa menggunakan Analytical Hierarchy Process (AHP), sebuah pendekatan Multi-Criteria Decision-Making (MCDM), dengan perangkat lunak Expert Choice.
Data diperoleh melalui kuesioner terhadap 119 mahasiswa penuh waktu. Analisis mempertimbangkan empat kriteria utama: biaya (C1), fleksibilitas (C2), keandalan (C3), dan kenyamanan (C4), pada tiga moda transportasi: kendaraan pribadi (M1), angkutan umum (M2), dan transportasi berbasis online (M3). Hasil menunjukkan bahwa mayoritas mahasiswa (64,2%) lebih memilih kendaraan pribadi, dengan biaya sebagai kriteria paling berpengaruh (60,9%), diikuti oleh fleksibilitas (20,8%), keandalan (10,7%), dan kenyamanan sebagai kriteria dengan pengaruh terendah (7,6%). Penelitian ini memberikan wawasan penting bagi pembuat kebijakan untuk merancang sistem transportasi perkotaan yang lebih responsif terhadap kebutuhan mahasiswa.

Kata kunci: pemilihan moda; transportasi mahasiswa; mobilitas mahasiswa; metode AHP

Abstract

University students, as a significant demographic group in urban environments, play a crucial role in daily commuting activities. Understanding their travel patterns and transportation mode preferences is essential for promoting sustainable and efficient urban planning. This study aimed to evaluate students' transportation mode preferences using the Analytical Hierarchy Process (AHP), a Multi-Criteria Decision-Making (MCDM) method, processed through Expert Choice software.
Data were collected via questionnaires distributed to 119 full-time students. The analysis considered four main criteria: cost (C1), flexibility (C2), reliability (C3), and comfort (C4), across three transportation modes: private vehicles (M1), public transport (M2), and online-based transportation (M3). Results indicate that the majority of students (64.2%) prefer private vehicles, with cost being the most influential criterion (60.9%), followed by flexibility (20.8%), reliability (10.7%), and comfort, which was the least influential criterion (7.6%). This study provides valuable insights for policymakers to design urban transportation systems that better address the needs of university students.

Keywords: *mode choice; student transportation; student mobility; AHP method*

INTRODUCTION

Students represent a segment of society whose movement patterns are particularly interesting to study. Their need to move between multiple locations in a single day, combined with financial limitations, creates unique characteristics. The number of students in a city is typically large, making them a significant trip generator. Therefore, they deserve attention from researchers to understand how they move and the modes of transportation they choose in various situations. Understanding this group of people provides a broader picture of how a city can develop transportation policies to accommodate their needs. This is important because unmet needs could threaten the urban layout and traffic flow.

Students can be categorized into two groups: the first consists of those who are fully financially supported by their parents, the government, or other institutions and therefore do not need to work to meet their needs. The second group comprises students who also work, either part-time or full-time. The latter group typically works before deciding to continue their education. When comparing these two groups, significant differences emerge, particularly in the mobility patterns and transportation preferences of single students versus those who are married. Even if they are married, their characteristics differ from those of other married individuals who are not students.

Additional expenses for assignments, exams, and basic tuition costs will temporarily alter their lifestyle and transportation preferences. Although for

single students, changes in transportation preferences may only be temporary until they complete their studies, the large number of students year after year, with new students replacing those who graduate, means their patterns and preferences as a group remain consistent. Therefore, this research period will include two studies focusing on student travel preferences, whether they are solely students or also working students.

Today, each person is faced with various alternatives to choose from, including when deciding on transportation. When selecting a mode of transport, it is assumed that decisions are made based on the alternative that provides the greatest satisfaction, known in transportation as utility theory. Nicholson & Snyder (2007) define utility as the satisfaction one gains from engaging in economic activities. The basic assumption in the selection process is that decision-making is considered to exhibit "rational behavior" and implies that the decision-maker aims to "maximize" utility.

A person's socio-demographic factors influence their ability, which ultimately affects their choice of transportation mode, although the characteristics of the journey also play a role. Previous studies have extensively examined how socio-demographic factors influence an individual's choice of transportation mode. In several studies, socio-economic and demographic indicators such as age, gender, marital status, and income are the most commonly used variables to estimate the transportation mode choice behavior of commuter workers (Irjayanti et al., 2021).

Older adults tend to use cars more than public transportation (Buehler, 2011) . In India, individuals in the 20–30 age group are more likely to use two-wheelers than buses, while older age groups tend to use cars more than buses. In Beijing, China, the 30–40 age group predominantly uses cars (Ashalatha et al., 2013) (Jiang et al., 2014). Students and individuals over 65 in Spain prefer to use trains and buses (Arbués et al., 2016). A study in Honolulu found that older adults are more likely to use public transportation (Lucas et al., 2007). Elderly people in Germany and the U.S. exhibit different behaviors. Older adults in Germany tend to use public transportation, while those in the U.S. use cars (Buehler, 2011). Meanwhile, in Indonesia, as individuals age, they are more likely to use public transportation, buses, and trains (Setyodhono, 2017).

Widyaningsih and Dermawan (2018) found that the average distance traveled from one place to another significantly influences the mode choice of travelers. In their study of working students, it was found that when the travel distance is between 5–15 km, and the travel time exceeds 30 minutes, respondents prefer to use private vehicles. In contrast to Widyaningsih and Dermawan, using logistic regression, Irjayanti et al. (2021) identified factors influencing commuters' choice of transportation mode for work, finding that with increasing age, travel time, and commuting distance, commuters are less likely to use private vehicles (Widyaningsih & Dermawan, 2018).

There are few researchers who have studied the transportation preferences of students, so this research aims to explore this research gap to gain a deeper understanding of students' transportation preferences. Based on the background presented, the problem that can be formulated is: what factors influence students' decisions in choosing a mode of transportation?

METHODOLOGY

The data in this study were analyzed using the Analytic Hierarchy Process (AHP). AHP is an effective method for ranking alternatives when decision-making criteria vary significantly. In the 1970s, Saaty developed a powerful and useful tool for managing the qualitative and quantitative multi-criteria elements involved in decision-making by prioritizing several alternatives while considering multiple criteria. This method allows decision-makers to structure the problem into a hierarchy or an integrated series of levels, then input numerical values to represent human perceptions in making comparisons. These values are then systematically processed to produce logical priorities (Saaty, 1987). AHP is often used to solve problems related to alternative selection, priority setting, policy selection, optimization, and performance measurement. The formulas for calculating the Consistency Index (CI) and the consistency ratio can be found in formulas (1) and (2).

$$\text{Consistency Index (CI)} = (\lambda maks - n)/(n-1) \quad (1)$$

$$\text{Consistency Ratio (CR)} = CI/IR \quad (2)$$

Where:
λmax = the largest eigenvalue in the matrix
n = the number of attributes.

To achieve the established objectives, the study followed the process outlined below:

1. Development of the questionnaire
2. Interviews with participants
3. Application of the AHP method, which includes:
    a) Defining the problem: Determining the objectives, criteria, and alternatives
    b) Creating a hierarchical structure of the objectives. Evaluating the criteria and alternatives. Criteria and alternatives are assessed through pairwise comparisons. While a scale of 1 to 9 is generally preferred for expressing opinions, this study used a scale of 1 to 5 to minimize respondent confusion.

c) Creating a pairwise comparison matrix (Pairwise Comparison Matrix, PCM). To calculate the consistency of the pairwise comparison matrix, a consistency ratio (CR) is needed. According to Saaty's calculations using 500 samples, if numerical "judgments" are randomly selected from a scale of 1/9, 1/8, ..., 1, 2, …, 9, the average consistency for matrices of different sizes can be obtained.
d) Measuring consistency. In decision-making, it's important to know how good the consistency is, as decisions based on low consistency judgments are undesirable.

4. Analysis
5. Conclusion and recommendations

RESULT AND DISCUSSION

The respondents in this study, referred to as participants in the Expert Choice software, are full-time students who are not employed, either part-time or full-time. As shown in the Table 1, the gender distribution of respondents is nearly balanced, with a female-to-male ratio of 46:54. The majority of respondents, 61%, commute from their parents' homes to campus, while only 9% of students live within a distance of less than 1 km. Those living within a 1 km radius are students who rent accommodation near the campus.

64% of respondents come from the Faculty of Engineering (engineering programs), while the remaining 36% are from the Faculty of Psychology, the Faculty of Design and Creative Arts (FDSK), and the Faculty of Economics and Business (FEB). The majority of respondents, 70%, have a motorcycle specifically for their daily use, 20% own a car, 3% own both a motorcycle and a car, and 7% have a bicycle. Students who use bicycles for their daily activities are those living near the campus.

Table 1. Respondent's Characteristics

Characteristics	Percentage (%)
Gender:	
Female	46
Male	54
Distance from home to campus:	
< 1 km	9
1 - 3 km	13
3 - 6 km	17
> 6 km	61
Field of study:	
Social	36
Engineering/Science	64
Vehicle ownership for daily use:	
Motorcycle	70
Car	20
Motorcycle and car	3
Bicycle	7

Source: data

In this study, the selection of transportation modes of full-time students is established as the goal, with four criteria: cost, flexibility, reliability, and comfort, and three alternative modes: private vehicles, public transportation, and online transportation. Figure 1 shows the hierarchical structure of this study, from the goal, four (4) criteria, and three (3) alternatives, with the same alternatives for each criterion. This diagram was created using Expert Choice software after defining the goal, criteria, and alternatives.

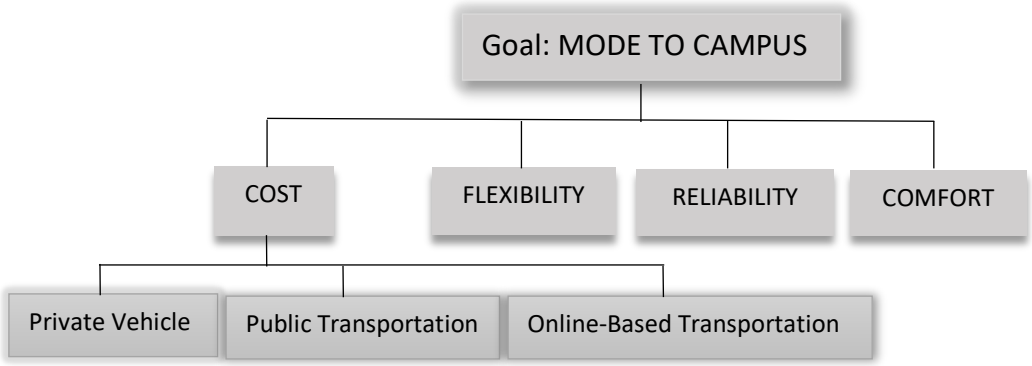

Figure 1. Hierarchical Structure Output from Expert Choice

The selection of cost as a criterion is important because full-time students do not yet have an income and are financially dependent on their parents or scholarship providers, making cost an important factor in most of their life choices. Flexibility is also crucial in this study, as students often need to move between multiple locations. Reliability, meaning the mode is always available when needed, and comfort also significantly influence transportation choice theories. The impact of these four criteria will be discussed in the following paragraphs.

Figure 2 shows the output from the Expert Choice software after the responses from all participants were entered. In this study, 20 responses (out of 119 valid data points) were not used due to high inconsistency levels. Although some inconsistency is inevitable, as it is difficult to achieve 100% consistency in responses, in AHP studies, an inconsistency ratio of less than 10% is recommended (Saaty, 1987). Figure 2 shows that the overall inconsistency among all respondents is 0.07.

Fig 2 also shows that private vehicles are the most chosen mode by respondents, with 64.2% selecting them. The next most popular choice is online transportation, with 25.6%, and public transportation is the least chosen at 10.2%. The large gap of 54% between private vehicles and public transportation may be due to the majority of respondents owning a private motorcycle for daily mobility.

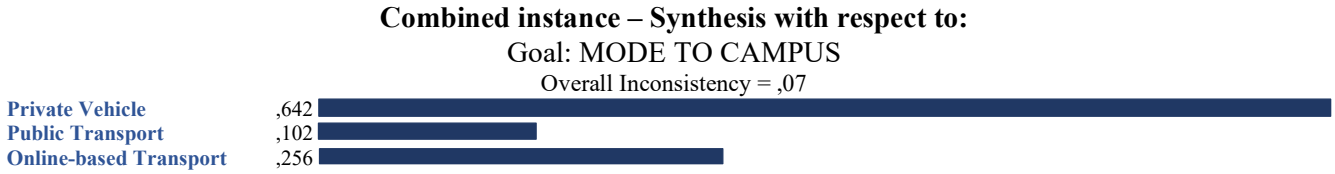

Figure 2. Output Synthesis of Participant Responses

Figure 3 illustrates the sensitivity levels of the factors examined in this study, highlighting private vehicles as the most preferred option, with cost being the most influential factor. For a clearer view of the sensitivity percentages, refer to Figure 4.

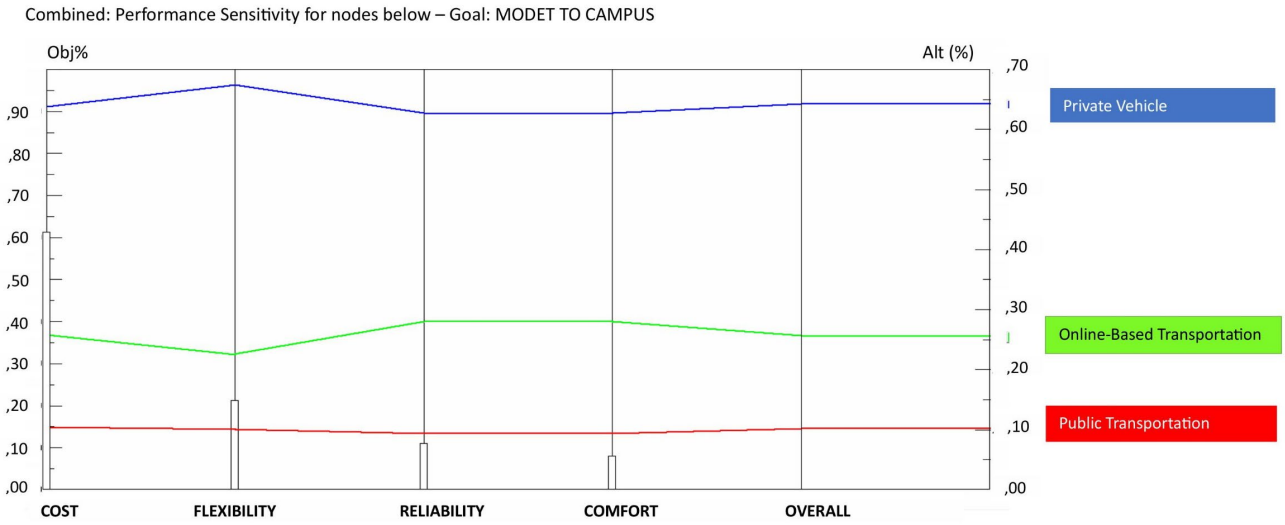

Figure 3. Sensitivity output between criterion

Private vehicles are preferred by 64.2%, followed by online transportation in second place, and public transportation in last place. The most sensitive factor is cost, with a sensitivity level of 60.9%, followed by flexibility at 20.8%, reliability at 10.7%, and comfort with the lowest sensitivity level at just 7.6%.

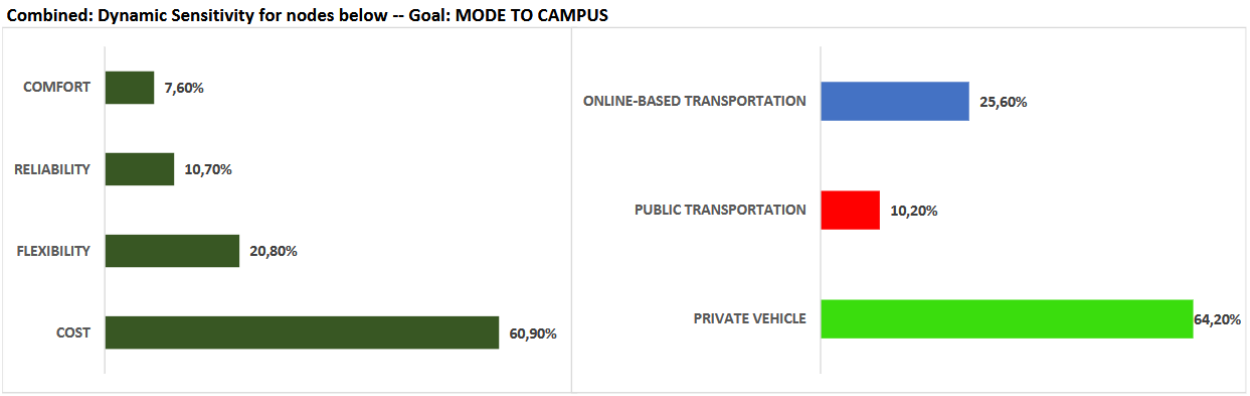

Figure 4. Sensitivity Percentage for Each Criterion

Figure 5 shows a comparison between private vehicles and public transportation, revealing that private vehicles are preferred over public transportation mainly due to cost, followed by flexibility, reliability, and comfort. The cost factor dominates more than half of the flexibility factor.

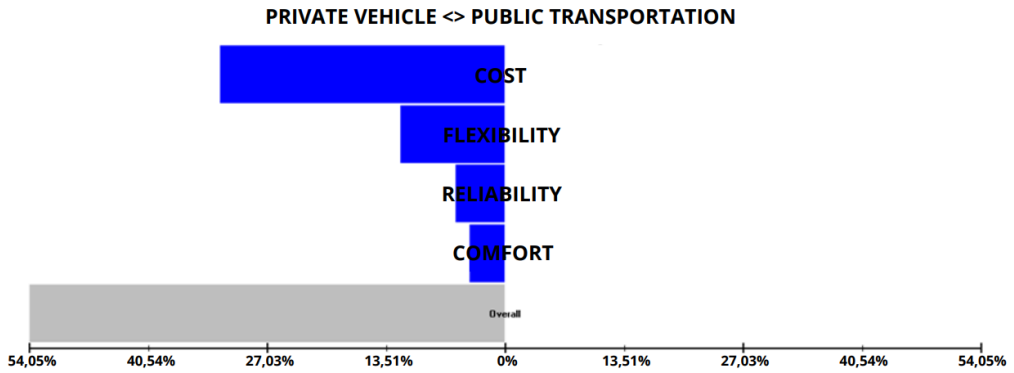

Figure 5. Sensitivity Comparison Between Private Vehicles and Public Transportation

Furthermore, compared to online transportation, private vehicles are also preferred due to cost, although the gap between cost and flexibility is not as large as in the case of private vehicles versus public transportation.

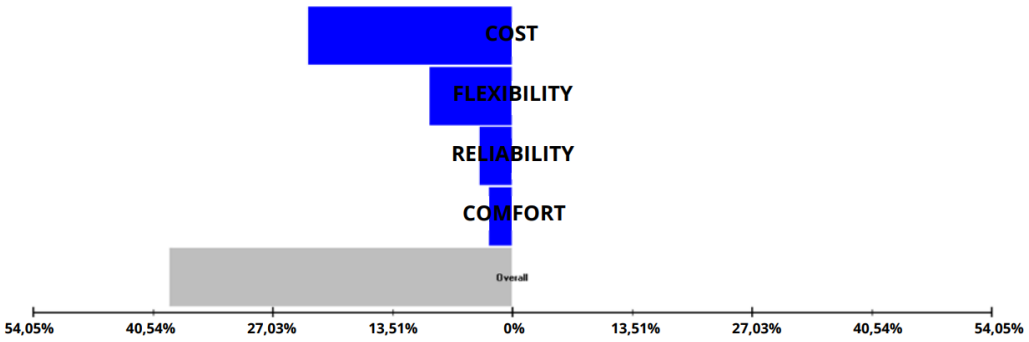

Figure 6. Sensitivity Comparison Between Private Vehicles and Online Transportation

This study confirms that, for full-time students, cost is a highly sensitive factor. The private vehicles owned by participants are perceived to better meet their needs in terms of cost and flexibility. Meanwhile, reliability and comfort are less critical in their transportation mode choices. Reliability is considered less important than cost and flexibility, as the reliability of transportation is already inherent in the private vehicles they own. While flexibility and reliability are important factors, they rank lower in sensitivity compared to cost. However, these factors still influence the decision-making process, with students favoring transportation modes that offer greater flexibility and reliability in their daily routines. Based on this study, to increase the use of public transportation, the cost factor should be made more attractive to full-time students.

Consistent with the findings in this study, Agrawal, Blumenberg, et al. (2011) in their article "Getting Around When You're Just Getting By: The Travel Behavior and Transportation Expenditures of Low-Income Adults" also found that cost is an important factor in transportation decisions for low-income individuals. They strategically manage limited resources, often prioritizing affordability over convenience or comfort when choosing a transportation mode. This is especially true for students, who must balance tight budgets with their need for reliable transportation options (Agrawal et al., 2011).

Several studies have highlighted how transportation costs significantly influence mode choice among low-income populations, including students. For instance, a study from Temple University emphasizes that transportation costs often represent a significant portion of the budget for low-income students, sometimes exceeding the cost of books and nearly equaling food expenses. This financial burden can limit students' options to more affordable, though less comfortable or reliable, transportation modes such as public buses or shared rides (Clay & Valentine, 2021)

Additionally, the findings from Clay and Valentine (2021) in "Impact of Transportation Supports on Students' Academic Outcomes" reveal that inadequate and costly transportation options can directly impact students' ability to complete their education. This issue is particularly prevalent among students, whose budgets are largely allocated to transportation.

As noted in "A Hidden Cost of Inadequate Transportation — Students Don't Finish College" by Via Transportation 2022, some colleges and universities have taken steps to help alleviate the transportation burden on students. For example, Portland State University in Oregon and American University in Washington, D.C., have collaborated with local transit agencies to secure discounted unlimited transit passes for buses or subways. Community colleges like Chattanooga State in Tennessee have used federal pandemic relief funds to offer free bus rides to all students and college employees until August 2022 (Via Transportation, 2022).

Georgia Military College and Wiregrass Georgia Technical College, both in Valdosta, Georgia, have partnered with local authorities to provide their students with access to a new form of mobility: on-demand microtransit. These colleges have purchased passcodes to offer their students free, on-demand rides via the Valdosta On-Demand app. Students can book rides according to their own schedules, to any destination within a certain area, all through a mobile app or by calling a dedicated phone line. Students only need to walk 1-2 minutes to reach a pickup point, making this transit mode very convenient for those who do not live within the service area of fixed-route transit.

These findings suggest that reducing transportation costs and increasing accessibility can play a crucial role in supporting students' educational success. For public transportation to be more competitive, these factors, especially cost, need to be addressed. The findings highlight the need for transportation policies that consider the financial constraints of students. Reducing the cost of public transportation and enhancing its flexibility and reliability could encourage greater use among students. Examples from other universities show that collaborations with local transit agencies and innovative mobility solutions like on-demand microtransit can effectively support students' transportation needs and academic success.

CONCLUSSION

1. The study confirms that cost is the most critical factor in transportation mode selection among full-time students. This sensitivity to cost is primarily attributed to their financial dependence on parents or scholarship providers, making affordability a key concern when selecting a transportation mode.
2. Comfort ranks as the least influential factor in students' transportation mode choices. This suggests that students are willing to compromise on comfort if it means lower costs or greater flexibility and reliability.
3. The majority of respondents favor private vehicles, specifically motorcycles, for their daily commutes. This preference is driven by the lower costs associated with owning and using private vehicles compared to other

transportation options, such as public transportation or online-based transport services.

4. Public transportation is the least chosen mode, indicating a significant gap in attractiveness compared to private vehicles. This gap is primarily due to cost concerns, but also reflects issues related to flexibility and reliability.
5. Future research could focus on integrating sustainability considerations into students' transportation preferences by exploring the potential adoption of shared mobility services and electric vehicles (Liu et al., 2023; Amekudzi-Kennedy et al., 2022). Additionally, longitudinal studies investigating how shifts in socio-economic factors and advancements in transport technology influence mode preferences would provide valuable insights (Jou & Chen, 2021).

REFERENCE

Agrawal, A. W., Blumenberg, E. A., Abel, S., Pierce, G., & Darrah, C. N. (2011). *Getting around when you're just getting by: The travel behavior and transportation expenditures of low-income adults.*

Amekudzi-Kennedy, A., Faghih-Imani, A., & Lord, D. (2022). Electric vehicle adoption and its implications for urban mobility. *Journal of Transport Geography, 104,* 102527.

Arbués, P., Baños, J. F., Mayor, M., & Suárez, P. (2016). Determinants of ground transport modal choice in long-distance trips in Spain. *Transportation Research Part A: Policy and Practice, 84,* 131–143. https://doi.org/10.1016/j.tra.2015.06.010

Ashalatha, R., Manju, V. S., & Baby, Z. A. (2013). Mode choice behavior of commuters in Thiruvananthapuram city. *Journal of Transportation Engineering, 139(5),* 494–502. https://doi.org/10.1061/(ASCE)TE.1943-5436.0000533

Buehler, R. (2011). Determinants of transport mode choice: A comparison of Germany and the USA. *Journal of Transport Geography, 19(4),* 644–657. https://doi.org/10.1016/j.jtrangeo.2010.07.005

Clay, J. R., & Valentine, J. L. (2021). Impact of transportation supports on students' academic outcomes: A quasi-experimental study of the U-Pass at Rio Hondo College.

Irjayanti, A. D., Sari, D. W., & Rosida, I. (2021). Perilaku pemilihan moda transportasi pekerja komuter: Studi kasus Jabodetabek. *Jurnal Ekonomi dan Pembangunan Indonesia, 21(2),* 125–147. Available at: https://scholarhub.ui.ac.id/jepi/vol21/iss2/1

Jiang, K., Zhang, N., & Feng, Z. (2014). A binary logit model for commute mode choice: A case study of Hefei. *14th COTA International Conference of Transportation Professionals,* 3029–3040.

Jou, R.-C., & Chen, H. (2021). Investigating the determinants of transportation mode shift over time: A longitudinal study. *Transportation Research Part A: Policy and Practice, 145,* 182–194.

Liu, Y., Wang, J., & Cheng, Y. (2023). Examining the adoption of shared mobility services in urban areas: A multi-modal approach. *Transportation Research Part D: Transport and Environment, 114,* 103537.

Lucas, T. Y. I., Archilla, A. R., & Papacostas, C. S. (2007). Mode choice behavior of elderly travelers in Honolulu, Hawaii. *Transportation Research Record, 2013(1),* 71–79. https://doi.org/10.3141/2013-10

Saaty, R. W. (1987). The analytic hierarchy process—what it is and how it is used. *Mathematical Modelling, 9(3),* 161–176. https://doi.org/10.1016/0270-0255(87)90473-8

Setyodhono, S. (2017). Faktor yang mempengaruhi pekerja komuter di Jabodetabek menggunakan moda transportasi utama. *Warta Penelitian Perhubungan, 29(1),* 21. https://doi.org/10.25104/warlit.v29i1.326

Via Transportation. (2022, April 13). A hidden cost of inadequate transportation — students don't finish college.

Widyaningsih, N., & Dermawan, W. B. (2018). Characteristics of traveling using a private car of employee class in Mercu Buana University, Jakarta. *American Journal of Engineering Research (AJER, 7,* 327–331.