# COMMUTER'S TRAVEL PATTERN IN JAKARTA METROPOLITAN URBAN AREA

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## ABSTRACT

There is an emerging need for Indonesia, especially Jakarta, to investigate commuter travel behavior, concentrating on analyzing passenger characteristics in transit-oriented station areas. This research attempts to fulfill this need by looking at how passenger travel behavior differs between public transportation and private vehicles when traveling to station nodes. This study employed socio-demographic analysis to explain the choices between these modal relationships comprehensively. The findings present descriptive input by providing a socio-demographic summary of electric train passengers' modes of getting to stations for various routine and non-routine destinations. The crosstab method is a tool for analyzing the relationship between socio-demographic factors and passenger travel behavior. Education, age, and income strongly correlate with all travel behavior factors. Meanwhile, gender is only related to the purpose of travel, the frequency of travel using electric trains, and the mode of getting to the station. Vehicle ownership is only related to the frequency of travel and the mode used.

# 雅加達大都會區通勤者旅運行為之研究

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關鍵詞：通勤者、社會人口統計、出行行為。

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摘　要

隨著印尼都市化程度不斷提升，雅加達大都會區通勤者之旅運行為研究需求日漸迫切，尤其需要深入探討在以大眾運輸為核心 (Transit-oriented) 之車站周邊地區，通勤者的特性及其交通模式選擇的影響因素。本研究針對通勤者前往車站時所採取的大眾運輸工具以及私人車輛之行為差異進行比較，並透過社會人口統計因素 (Socio-demographic factors) 的分析，完整闡明影響其交通模式選擇之關鍵因素。研究結果以描述性方式呈現電聯車 (Electric train) 乘客在前往車站途中，針對日常及非日常旅次所選擇之交通模式的社會人口背景特徵。本研究採用交叉分析法 (Crosstab) 檢視社會人口因素與旅運行為之間的關聯性，結果發現教育程度、年齡與收入皆明顯影響所有的旅運行為；性別則僅影響旅運目的、電聯車搭乘頻率及抵達車站之交通方式，而車輛持有狀況僅與搭乘頻率和前往車站所選擇之交通模式呈現顯著相關。研究成果可作為規劃與優化以車站為核心之大眾運輸系統的重要參考依據。

# 1.　INTRODUCTION

Urbanization poses serious challenges to cities worldwide, but mobility remains dominant.　Mobility is an important element of modern life; undoubtedly, humans cannot participate in economy, social and cultural events, or any other activities without travel [1].　Population growth has been a serious concern in several Southeast Asian cities; Indonesia is experiencing population growth and urbanization of 57% [2].　This trend raises a new character in city movement, which has become an important component in urban transportation, further growing the economy and density in a city through the use of private vehicles [3,4].

Jakarta has a population of 30 million people [5], making it the second-largest megacity after Tokyo.　Jakarta has five administrative cities; compared to the five, the city of Jakarta has experienced rapid growth in land use changes, such as the development of new cities and industrial areas in recent years [6].　Commute travel occupies an important position in people's daily transportation activities.　Based on the 2019 Jabodetabek Commuter Survey, commuters make up 11% of the total population, with various trips to several rural areas to reach different activities in the city center and around Jakarta. Private vehicles dominate the mode share in passenger trips, which is reflected in 72% of trips [7], while public transportation only accounts for less than 10% of trips.　The city's traffic condition can affect this case.　Traffic jams are closely related to rapid urbanization and sub-urbanization [8].

Several studies have explored this phenomenon, and many cities have tried to innovate by creating a new ecosystem in urban movement.　The proposed innovation is enabling micro-mobility toward decent public transportation and sustainable land use [9-11].　Balancing those two aspects can foster positive travel patterns by reducing the use of private vehicles, traffic jams, and pollution and increasing the passengers' modal movement in transit station areas [12].　The rail-based transit area is one of the government's efforts to reduce private vehicles on long-distance commute trips [13].　Rail-based transit areas have several advantages: stable speed, ample passenger capacity, and on-time services.　These advantages attract urban passengers, providing many choices in using urban transportation modes, which is beneficial for reducing car dependency as a daily means of transportation [14-16].　Many studies have investigated rapid transit or transit-oriented development and commuter travel behavior patterns.　Several studies found a positive relationship between rail-based public transportation and transit areas [17,18].　Therefore, it is necessary to understand travel behavior patterns in transit station areas for routine activities (such as work, school, or college) and non-routine activities (recreation and social) as input values for existing mobility patterns in transit station areas.

Several studies have analyzed societal travel behavior [1,19-22].　However, this becomes a complex issue when focusing on developing countries [23].　As a developing country undergoing rapid urban growth, Indonesia faces distinct mobility challenges compared to developed countries.　Its capital, Jakarta, is one of the largest megacities in the world, and as its population grows, infrastructure development frequently falls behind.　Therefore, it is critical to analyze travel behavior in transitional urban contexts as it can offer insights for other developing countries.　Due to differences in the socio-demographic characteristics of passengers, this case is different from that of developed countries.　As mentioned, in Indonesia, especially Jakarta, it is necessary to conduct research focusing on people's travel behavior and analyzing passenger characteristics in station areas.　Understanding commuters' travel behavior is vital because it reflects how they respond to transportation systems, socio-economic pressures, and urban forms.　In rapidly developing regions, such insights help in transport planning, policy design, and infrastructure investments aligned with commuter needs and sustainability goals.

Commuters who travel short distances are more likely to choose active travel [24,25], thereby raising the average daily routine trip [26].　Mass public transportation attracts more commuters when it offers subsidized fares, ample seat availability, and on-time service [27].　A data-based study found that public transport fares are among the most influential factors determining mode choice in people's trips in 46 cities worldwide.　In recent years, the emergence of app-based ride-hailing services has not only significantly replaced traditional modes of travel [28], but it has also led to an increase in travel frequency among certain income groups [29].　The purpose of travel can also influence mode choice [30].　This research examines the relationship between passenger travel behavior

and their mode choice by looking at how the latter differs between public transportation and private vehicles when traveling to station nodes. This study employed socio-demographic analysis to explain the choices between these modal relationships comprehensively. SITRAMP and JUTPI studies show that the Greater Jakarta area records over 30 million daily passenger trips, indicating extreme transport pressure [31]. However, few studies have explored how socio-demographic factors shape commuter behavior in the context of station area typologies. This research fills this gap by analyzing commuter responses using quantitative methods across the Jakarta Kota–Bogor corridor. This research tries to examine the relationship between travel characteristics and socio-demographics with additional passenger vehicle ownership to determine commuter travel patterns in the central transit area of the Electric Railway Station on the Jakarta Kota-Bogor line, Indonesia. This study contributes to existing literature by offering a detailed analysis of socio-demographic influences on commuter behavior in a Southeast Asian megacity. Unlike previous studies that generalize travel behavior, this study highlights differentiated mode choice, frequency, and travel purposes by demographic profile, including gender, age, education, and income, in a TOD setting. This study's findings contribute to targeted policy and infrastructure design for better last-mile connectivity and mode integration. However, previous studies have not sufficiently examined the influence of socio-demographic factors on commuter travel behavior within the specific context of transit station areas, particularly in relation to differentiated mode choice, trip frequency, and travel purposes. Most existing literature tends to adopt a generalized approach, lacking detailed segmentation based on demographic attributes such as age, gender, education, income, and vehicle ownership. This study addresses that gap by offering a comprehensive, data-driven analysis of how these variables shape commuter patterns in a high-demand commuter rail corridor. The novelty of this research lies in its integration of socio-demographic dimensions with access mode behavior to transit stations, providing valuable empirical insights for improving transportation planning and policy interventions within transit-oriented development frameworks.

## 2.    METHODOLOGY

This study collected the data from questionnaire surveys distributed to KRL passengers at twenty-four stations on the Jakarta Kota-Bogor route, as seen in Fig. 1. The researchers surveyed over four months, from March 2023 to July 2023. The sample for this study resulted in 1085 respondents, but only 932 respondents were valid because this study only used fully completed questionnaire surveys. The raw data then went through the coding stage with the help of frequency analysis to assess the relationship between demographic travel characteristics and the mode used to get to the KRL transit station. Thereafter, the researchers entered and checked the data using cross-tabulation; this study used a cross-tabulation test to find evidence of a relationship between socio-demographic factors (gender, age, income, education, vehicle

ownership) and travel characteristic factors (trip destination, distance between origins, and mode used). In addition, this study presents the data in quantitative and qualitative (narrative) forms. This study used chi-square analysis to detect significant relationships between two variables. This method is adopted from previous studies on the effects of demographic characteristics on passenger mode choices with chi-square significance < 0,5 [32].

## 3.    RESULTS AND DISCUSSION

Socio-demographic factors such as age and income significantly influence travel patterns, shaping the mode of transportation, frequency of trips, and overall mobility. Understanding these influences is crucial for transportation planning, policy development, and ensuring fair access to mobility options. The result explores how age and income affect travel behavior by combining insights from various studies and providing results from relevant research. Quantitative descriptive research uses primary data as the main source. This data contains comprehensive information relating to the socio-demographic. The Jakarta Kota-Bogor Commuter Line Station is 54 kilometers long, spread across Jakarta-Bogor. This study focuses on socio-demographic factors with travel behavior (travel purpose, destination to station, trip frequency, and mode choice). Based on gender in traveling, women occupy the highest position with economic travel destinations of 316 people, or 53.9%, followed by men at 46.1%. Total trips by gender were 387 for men and 545 for women. Table 1 shows the differences between men and women regarding travel purposes (economic, social, educational, recreational, and cultural). Women traveled the most with various travel destinations, a new phenomenon from previous research [4,21,23]. The fact that electric trains on all lines have special carriages for women, one of the aims of which is to accommodate the large number of women who travel, further proves this phenomenon. Based on the Pearson chi-square significance, the results in Table 1 are 0.0. These results show a close relationship between gender and travel purposes. However, gender and distance to the station have no relationship because the Pearson chi-square significance is 0.462. The travel frequency factor based on gender is that women often travel 5 times a week at 51.4% and choose online transportation as the preferred mode using online transportation at 73.9%. This result proves previous research that women consider comfort more when traveling. Tables 2 and 3 explain the crosstab of the relationship between gender and travel frequency and gender with travel mode.

Table 1    Crosstab gender and travel purpose

| Gender | Travel Purpose | | | | | Total |
|---|---|---|---|---|---|---|
| | Economic | Social | Education | Recreation | Culture | |
| Male | 270 | 6 | 79 | 31 | 1 | 387 |
| Female | 316 | 32 | 32 | 70 | 1 | 545 |
| Total | 586 | 38 | 205 | 101 | 2 | 932 |

Source: processed with SPSS 26. 2022

Table 2　Crosstab gender and trip frequency

| Gender | Trip Frequency | | | | | Total |
|---|---|---|---|---|---|---|
| | Very rarely | Rarely | Sometimes | Often | Always | |
| Male | 25 | 26 | 97 | 159 | 80 | 387 |
| Female | 45 | 49 | 171 | 168 | 112 | 545 |
| Total | 70 | 75 | 268 | 327 | 192 | 932 |

Source: processed with SPSS 26. 2022

Table 3　Crosstab gender and mode choice

| Gender | Mode Choice | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | Walking | Jaklingko | Private | BRT | Public | Online | |
| Male | 45 | 2 | 243 | 13 | 30 | 54 | 387 |
| Female | 68 | 1 | 257 | 14 | 52 | 153 | 545 |
| Total | 113 | 3 | 500 | 27 | 82 | 207 | 932 |

Source: processed with SPSS 26. 2022

The Pearson chi-square significance analysis between gender and trip frequency is 0.015. Meanwhile, the Pearson chi-square significance between gender and mode choice is 0.000. This value shows that gender, trip frequency, and mode choice factors correlate well with passenger travel patterns. Table 4 shows the crosstab results of age and travel behavior variables. The Pearson chi-square value of age against the distance to the station is 0.008. Sequentially, age and travel frequency have a Pearson chi-square value of 0.000. In addition, age on the mode choice used when traveling to the station has a Pearson chi-square value of 0.006. Tables 5 to 7 present the results of the age factor on travel behavior factors. The results of the analysis show that age strongly correlates with travel behavior at the electric train station.

Table 4　Crosstab age and travel purpose

| Age | Travel Purpose | | | | | Total |
|---|---|---|---|---|---|---|
| | Economic | Social | Education | Recreation | Culture | |
| < 18 | 1 | 1 | 19 | 7 | 0 | 28 |
| 18-24 | 189 | 22 | 179 | 64 | 0 | 454 |
| 25-34 | 259 | 6 | 6 | 15 | 0 | 286 |
| 35-44 | 77 | 1 | 0 | 6 | 0 | 84 |
| 45-54 | 48 | 3 | 1 | 8 | 2 | 62 |
| > 54 | 12 | 5 | 0 | 1 | 0 | 18 |
| Total | 586 | 38 | 205 | 101 | 2 | 932 |

Source: processed with SPSS 26. 2022

Table 5　Crosstab age and destination to station

| Age | Destination to Station | | | | | Total |
|---|---|---|---|---|---|---|
| | Very Near | Near | Enough | Far | Very Far | |
| < 18 | 1 | 5 | 4 | 7 | 11 | 28 |
| 18-24 | 7 | 45 | 156 | 131 | 115 | 454 |
| 25-34 | 3 | 32 | 106 | 78 | 67 | 286 |
| 35-44 | 1 | 6 | 30 | 24 | 23 | 84 |
| 45-54 | 6 | 6 | 16 | 16 | 18 | 62 |
| > 54 | 0 | 0 | 9 | 7 | 2 | 18 |
| Total | 18 | 94 | 321 | 263 | 236 | 932 |

Source: processed with SPSS 26. 2022

Table 6　Crosstab age and trip frequency

| Age | Trip Frequency | | | | | Total |
|---|---|---|---|---|---|---|
| | Very rarely | Rarely | Sometimes | Often | Always | |
| < 18 | 3 | 0 | 8 | 10 | 7 | 28 |
| 18-24 | 48 | 41 | 173 | 127 | 65 | 454 |
| 25-34 | 7 | 25 | 46 | 135 | 73 | 286 |
| 35-44 | 1 | 6 | 16 | 34 | 27 | 84 |
| 45-54 | 10 | 3 | 15 | 15 | 19 | 62 |
| > 54 | 1 | 0 | 10 | 6 | 1 | 18 |
| Total | 70 | 75 | 268 | 327 | 192 | 932 |

Source: processed with SPSS 26. 2022

Table 7　Crosstab age and mode choice

| Age | Mode Choice | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | Walking | Jaklingko | Private | BRT | Public | Online | |
| < 18 | 6 | 0 | 15 | 1 | 1 | 5 | 28 |
| 18-24 | 57 | 3 | 246 | 19 | 27 | 102 | 454 |
| 25-34 | 30 | 0 | 147 | 4 | 31 | 74 | 286 |
| 35-44 | 9 | 0 | 48 | 2 | 7 | 18 | 84 |
| 45-54 | 10 | 0 | 34 | 0 | 10 | 8 | 62 |
| > 54 | 1 | 0 | 10 | 1 | 6 | 0 | 18 |
| Total | 113 | 3 | 500 | 27 | 82 | 207 | 932 |

Source: processed with SPSS 26. 2022

Age is another significant factor influencing travel behavior. Different age groups display different travel patterns, with younger individuals often showing preferences for more flexible and convenient transportation options. For example, a study on generational travel patterns in the United States revealed that millennials had lower daily vehicle miles traveled (VMT) than older generations, suggesting a shift towards more sustainable or shared transportation options [33]. In contrast, older adults in the United States tended to rely on private vehicles, with built environment characteristics influencing their mode choice [34]. In rural Nigeria, older adults were more likely to use non-motorized transport, such as walking or cycling, while younger individuals might prefer motorized options if available [35]. Similarly, age also influenced walking behavior in Shah Alam City, Malaysia, with older individuals engaging less in utilitarian walking but more in recreational walking [36].

The productive age group in the 18 ~ 24 range traveled the most at 48.7%, with 189 economic destinations and 179 educational goals. Meanwhile, only those aged 45 ~ 54 travel for cultural purposes, and only 1.9% of those aged over 54 years travel by electric train for economic and social purposes. Older people also prefer medium-distance travel, with 2.8%, and a relatively frequent frequency of 3.7%, using private vehicles when traveling to the electric train station. Socio-demographic factors such as education and the nature of travel do not strongly correlate. In contrast to age based on the Pearson chi-square value, education and distance have no relationship because the significant value is 0.100. Tables 8 to 10 explain the results of the relationship between education and travel purpose, trip frequency, and choice of mode to get to the station.

Table 8    Crosstab education and travel purpose

| Education | Travel Purpose | | | | | Total |
|---|---|---|---|---|---|---|
| | Economic | Social | Education | Recreation | Culture | |
| SD | 2 | 3 | 1 | 1 | 0 | 7 |
| SMP | 8 | 1 | 7 | 4 | 0 | 20 |
| SMA | 181 | 24 | 152 | 66 | 1 | 424 |
| D3 | 19 | 0 | 1 | 1 | 0 | 21 |
| S1 | 322 | 8 | 40 | 27 | 1 | 398 |
| S2 | 51 | 2 | 4 | 2 | 0 | 59 |
| S3 | 3 | 0 | 0 | 0 | 0 | 3 |
| Total | 586 | 38 | 205 | 101 | 2 | 932 |

Source: processed with SPSS 26. 2022

Table 9    Crosstab education and trip frequency

| Education | Trip Frequency | | | | | Total |
|---|---|---|---|---|---|---|
| | Very rarely | Rarely | Sometimes | Often | Always | |
| SD | 0 | 1 | 4 | 1 | 1 | 7 |
| SMP | 4 | 0 | 5 | 4 | 7 | 20 |
| SMA | 40 | 33 | 143 | 130 | 78 | 424 |
| D3 | 2 | 1 | 5 | 6 | 7 | 21 |
| S1 | 19 | 37 | 98 | 156 | 88 | 398 |
| S2 | 5 | 3 | 12 | 28 | 11 | 59 |
| S3 | 0 | 0 | 1 | 2 | 0 | 3 |
| Total | 70 | 75 | 268 | 327 | 192 | 932 |

Source: processed with SPSS 26. 2022

Table 10    Crosstab education and mode choice

| Education | Mode Choice | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | Walking | Jaklingko | Private | BRT | Public | Online | |
| SD | 4 | 0 | 0 | 0 | 3 | 0 | 7 |
| SMP | 5 | 0 | 8 | 0 | 3 | 4 | 20 |
| SMA | 66 | 2 | 220 | 11 | 37 | 88 | 424 |
| D3 | 0 | 0 | 16 | 2 | 1 | 2 | 21 |
| S1 | 37 | 1 | 215 | 13 | 34 | 98 | 398 |
| S2 | 0 | 0 | 40 | 1 | 4 | 14 | 59 |
| S3 | 1 | 0 | 1 | 0 | 0 | 1 | 3 |
| Total | 113 | 3 | 500 | 27 | 82 | 207 | 932 |

Source: processed with SPSS 26. 2022

Education correlates strongly with travel purposes. As many as 54.9% of those with undergraduate education traveled for economic purposes, while only 0.3% of those with elementary school education traveled for economic or work purposes. Only high school and undergraduate level students travel for cultural purposes. The frequency of travel at the high school level is the most frequent at 45.5%, followed by the undergraduate level at 42.7%. This result aligns with high school and undergraduate levels, which vary in transportation mode choices to the station using electric trains. Private vehicles occupy the most frequently used mode of transportation from origin to station at all levels of education at 53.64%. In addition, online transportation is the second most used at 22.21% at all levels. The third choice is walking to the station, at 12.12%, dominated by high school and undergraduate levels. The relationship between educational factors and travel destinations has a Pearson chi-square value of 0.00, the same value between educational factors and the mode choice of transportation. The difference between education and travel frequency is a Pearson chi-square value of 0.017.

Based on the result, commuters' travel patterns correlated closely with socio-demographic factors such as income level, age, gender, occupation, household size, and education. These factors influence the choice of transportation mode, travel duration, travel distance, trip frequency, and other mobility aspect. For instance, income level significantly determines whether individuals rely on public transportation or private vehicles. Research by [37] highlights that higher-income commuters prefer private vehicles due to their flexibility and comfort. In contrast, lower-income groups are more likely to use public transportation due to the fares. Similarly, found that age influences travel behavior [4]. Young commuters are more open to multimodal transportation and active mobility (walking, cycling), while older commuters prioritize convenience and safety, often resulting in shorter and more direct trips. Gender also plays a crucial role, as studies indicate that women tend to have more complex trip chaining (*e.g.,* combining work, childcare, and shopping trips) than men, who typically have more direct commuting patterns [38]. In addition, occupation affects travel frequency and mode choice; blue-collar workers often have fixed work schedules that align with peak-hour public transport demand. At the same time, white-collar professionals have more flexible travel patterns and a higher likelihood of remote work or staggered commuting hours [39]. A case study on the Jakarta Kota-Bogor commuter rail corridor further supports these findings, revealing distinct travel patterns based on socio-economic backgrounds [40,41]. These correlations suggest that socio-demographic factors should be central to transit planning, as different groups have varying needs and constraints.

Understanding the influence of socio-demographic factors on travel patterns is essential for developing equitable transportation policies. For instance, improving public transportation accessibility and affordability can help reduce the mobility disadvantages lower-income groups face. The study recommended enhancing public transportation in Jakarta to ensure sustainability and flexibility [42]. Similarly, in Amman, improving the safety and efficiency of public transportation could address the mobility needs of low-income residents [1]. Socio-demographic factors like age, gender, and education significantly influence travel patterns, shaping the choice of transportation mode, trip frequency, and overall mobility. Understanding these influences is crucial for developing equitable transportation policies and improving mobility options for all groups. Policymakers can create more inclusive and sustainable transportation systems by addressing the unique needs of different socio-demographic groups. Future research should continue exploring the complex interactions between socio-demographic factors and travel behavior, particularly in rapidly changing urban environments. A study in Shizuoka, Japan, demonstrated that integrating smart card data and advanced analytics can provide deeper insights into travel pattern variability. The impact of global events, such as the COVID-19 pandemic, on travel behavior among different socio-demographic groups requires further investigation.

# 4. CONCLUSIONS

The novelty of this study lies in its empirical focus on how socio-demographics shape commuter travel choices in Jakarta's TOD corridor. It bridges a gap in the literature by integrating mode access patterns with station typologies, providing actionable insights for transit planning in megacities of the Global South. The study on commuters' travel patterns in the Jakarta Kota-Bogor commuter rail corridor demonstrates a strong correlation between socio-demographic factors and commuting behavior. Key factors such as income, age, gender, education, and vehicle ownership significantly influence the choice of transportation mode, travel frequency, and travel purpose. Findings reveal that women tend to travel more frequently than men, often preferring online transportation for first- and last-mile connectivity, while younger commuters (18 ~ 24 years old) dominate both economic and educational travel purposes. Moreover, education level impacts travel patterns, as individuals with higher education levels are more likely to travel for work. In contrast, high school and undergraduate-level individuals reveal different travel purposes.

The study also emphasizes the strong relationship between commuters' distance to transit stations and their travel mode choices, with those living further away relying more on private vehicles and online transportation. Additionally, vehicle ownership also affects commuting behavior, influencing the frequency of rail travel and mode selection for reaching transit nodes. The crosstab analysis and chi-square test confirm that socio-demographic characteristics are crucial in shaping urban mobility. These insights highlight the importance of transit-oriented development (TOD) strategies in improving accessibility and reducing dependence on private vehicles. By enhancing multimodal integration, improving last-mile connectivity, and considering socio-demographic differences in transit planning, urban policymakers can create a more efficient, sustainable, and inclusive commuter system in Jakarta.

# DATA AVAILABILITY STATEMENT

The data sets produced in this study can be obtained from the corresponding author upon a reasonable request.

# AUTHOR CONTRIBUTIONS

CS was responsible for proposing ideas, conducting formal analysis, and drafting, reviewing, and editing the manuscript. CS and YB contributed to conceptualization, writing, supervision of methods, and manuscript review. MJ and I were involved in conceptualization, methodology, validation, and manuscript review. All authors have read and approved the final version of the manuscript.

# DATA AVAILABILITY

The data sets produced in this study can be requested from the corresponding author under reasonable conditions.

# CONFLICT OF INTEREST

The authors confirm that there are no conflicts of interest.

# REFERENCES

1. Shbeeb, L., "How do the socio-economic indicators influence the Travel Behaviour Pattern? Case Study Amman-Jordan." *Journal of Applied Engineering Science*, Vol. 21, No. 1, pp. 6-28 (2023).

2. World Bank, "12 World Bank World Urbanization Prospect," The 18 Rev. World Bank (2018).

3. Sidek, M. F. J., Bakri, F. A., Hamsa, A. A. K., Othman, N. N. A. N., Noor, N. M., and Ibrahim, M., "Socio-economic and travel characteristics of transit users at Transit-Oriented Development (TOD) Stations," *Transportation Research Procedia*, Vol. 48, No. 2019, pp. 1931-1955 (2020). https://doi.org/10.1016/j.trpro.2020.08.225

4. Benita, F., "Exploring non-mandatory travel behavior in Jakarta City: Travel time, trip frequency, and socio-demographic influences," *Transportation Research Interdisciplinary Perspectives*, Vol. 21, p. 100896 (2023). https://doi.org/10.1016/j.trip.2023.100896

5. Martinez, R. and Masron, I. N., "Jakarta: A city of cities," *Cities*, Vol. 106 (2020). https://doi.org/10.1016/j.cities.2020.102868

6. Rukmana, D., "Rapid urbanization and the need for sustainable transportation policies in Jakarta," *In IOP Conference Series: Earth and Environmental Science* (2018).

7. Purwoko, B. A., Chotib, and Yola, L., "Willingness to modal shift from private to public transportation in Jakarta Metropolitan Area," *Planning Malaysia*, Vol. 20, No. 2, pp. 22-34 (2022).

8. Roberts, M., Sander, F. G., and Tiwari, S., "Time to ACT: Realizing indonesia's urban potential," *World Bank Publications* (2019). https://elibrary.worldbank.org/doi/pdf/10.1596/978-1-4648-1389-4

9. Emberger, Guenter, Paul Pfaffenbichler, Sittha Jaensirisak, and Paul Timms, "Ideal' decision-making processes for transport planning: A comparison between europe and south east Asia," *Transport Policy*, Vol. 15, No. 6, pp. 341-

349 (2008).

10. Loo, L. Y. L., Corcoran, J., Mateo-Babiano, D., and Zahnow, R., "Transport mode choice in south east Asia: Investigating the relationship between transport users' perception and travel Behaviour in Johor Bahru, Malaysia," *Journal of Transport Geography*, Vol. 46, pp. 99-111 (2015). http://dx.doi.org/10.1016/j.jtrangeo.2015.06.011

11. Lee, S., Lee, J., Hiemstra-van Mastrigt, S., and Kim, E., "What cities have is how people travel: Conceptualizing a data-mining-driven modal split framework," *Cities*, Vol. 131, p. 103902 (2022). https://doi.org/10.1016/j.cities.2022.103902

12. Kumar, P., Ravi Sekhar, C., and Parida, M., "Identification of neighborhood typology for potential transit-oriented development," *Transportation Research Part D: Transport and Environment*, Vol. 78, p. 102186 (2020). https://doi.org/10.1016/j.trd.2019.11.015

13. Loo, B. P. Y., Chen, C., and Chan, E. T. H., "Rail-based transit-oriented development: Lessons from New York City and Hong Kong," *Landscape and Urban Planning*, Vol. 97, No. 3, pp. 202-212 (2010). http://dx.doi.org/10.1016/j.landurbplan.2010.06.002

14. Litman, T., "Impacts of rail transit on the performance of a transportation system," *Transportation Research Record Rec*, Vol. 1930, No. 1, pp. 23-29 (2005).

15. Southworth, M., "Designing the walkable city," *Journal of Urban Planning and Development*, Vol. 131, pp. 246-257 (2005).

16. Barton, H. and Grant, M., "Urban planning for healthy cities a review of the progress of the European healthy cities Programme," *Journal of Urban Health*, Vol. 90, SUPPL 1, pp. 129-141 (2013).

17. Lund, H., "Reasons for living in transit-oriented development, and associated transit use," *Journal of the American Planning Association*, Vol. 3, No. 72, pp. 357-366 (2006).

18. Renne, J., "Transit-Oriented development and ports: A national analysis in the United States," *Journal of Transport and Land Use*, Vol. 11, No. 1, pp. 297-304 (2018).

19. Astuti, D. W., Barus, L. S., Achjar, N., and Martell-Flores H., "Travel behavior of commuter line passenger to station in Depok City," *IOP Conference Series: Materials Science and Engineering*, Vol. 673, No. 1 (2019).

20. Jiang, H. and Ren, X., "Model of passenger behavior choice under flight delay based on dynamic reference point," *Journal of Air Transport Management*, Vol. 75, pp. 51-60 (2019). https://doi.org/10.1016/j.jairtraman.2018.11.008

21. Basbas, S., Papagiannakis, A., Baraklianos, I., Nikiforiadis, A., and Campisi, T., "Does gender matter in daily urban mobility? Exploring travel perceptions, attitudes, and Behaviours," *International Journal of Transport Development and Integration*, Vol. 7, No. 2, pp. 67-75 (2023).

22. Marzi, I., "Adolescents' travel behavior in Germany: Investigating transport mode choice considering destination, travel distance, and urbanization," *Journal of Transport Geography*, Vol. 112, p. 103694 (2023). https://doi.org/10.1016/j.jtrangeo.2023.103694

23. Ma, J., Mitchell, G., and Heppenstall, A., "Daily travel behaviour in Beijing, China: An analysis of workers' trip chains, and the role of socio-demographics and urban form," *Habitat International*, Vol. 43, pp. 263-273 (2014).

http://dx.doi.org/10.1016/j.habitatint.2014.04.008

24. Mouratidis, K., "Built environment and leisure satisfaction: The role of commute time, social interaction, and active travel," *Journal of Transport Geography*, Vol. 80, p. 102491 (2019). https://doi.org/10.1016/j.jtrangeo.2019.102491

25. Neves, A., and Brand, C., "Assessing the potential for carbon emissions savings from replacing short car trips with walking and cycling using a mixed GPS-travel diary approach," *Transportation Research Part A: Policy and Practice*, Vol. 123, pp. 130-146 (2019). https://doi.org/10.1016/j.tra.2018.08.022

26. Dharmowijoyo, D. B. E., Susilo, Y. O., and Karlström, A., "Relationships among discretionary activity duration, its travel time spent and activity space indices in the Jakarta Metropolitan Area, Indonesia," *Journal of Transport Geography*, Vol. 54, pp. 148-160 (2016). http://dx.doi.org/10.1016/j.jtrangeo.2016.05.012

27. Gaduh, A., Gračner, T., and Rothenberg, A. D., "Life in the slow lane: Unintended consequences of public transit in Jakarta," *Journal of Urban Economics*, Vol. 128 (2022).

28. Shi, K., Shao, R., De Vos, J., Cheng, L., and Witlox, F., "The influence of ride-hailing on travel frequency and mode choice," *Transportation Research Part D: Transport and Environment*, Vol. 101, p. 103125 (2021). https://doi.org/10.1016/j.trd.2021.103125

29. Gehrke, S. R., Felix, A., and Reardon, T. G., "Substitution of ride-hailing services for more sustainable travel options in the Greater Boston Region," *Transportation Research Record*, Vol. 2673, No. 1, pp. 438-446 (2019).

30. Lanzini, P. and Khan, S. A., "Shedding light on the psychological and behavioral determinants of travel mode choice: A meta-analysis," *Transportation Research Part F: Traffic Psychology and Behaviour*, Vol. 48, pp. 13-27 (2017). http://dx.doi.org/10.1016/j.trf.2017.04.020

31. JUTPI, "JABODETABEK urban transportation policy integration," *Jakarta Urban Transportation Policy* (2019).

32. Sovacool, B. K., Kester, J., Noel, L., and De Rubens, G. Z., "The demographics of decarbonizing transport: The influence of gender, education, occupation, age, and household size on electric mobility preferences in the Nordic region," *Global Environmental Change*, Vol. 52, pp. 86-100 (2018). https://doi.org/10.1016/j.gloenvcha.2018.06.008

33. Zhang, M. and Li, Y., "Generational travel patterns in the United States: New insights from eight national travel surveys," *Transportation Research Part A: Policy and Practice*, Vol. 156, pp. 1-13 (2022). https://doi.org/10.1016/j.tra.2021.12.002

34. Ozbilen, B., Akar, G., White, K., Dabelko-Schoeny, H., and Cao, Q., "Analysing the travel behaviour of older adults: What are the determinants of sustainable mobility?" *Ageing and Society*, pp. 1-29 (2022).

35. Aderibigbe, O. O. and Gumbo, T., "Influence of socio-economic attributes on travel behaviour in the rural areas of nigeria: Towards a sustainable rural planning and development," *Urban, Planning and Transport Research*, Vol. 10, No. 1, pp. 181-199 (2022). https://doi.org/10.1080/21650020.2022.2072946

36. Talmizi, N. M., Ali, N. E. H., and Mokhtar, S., "The Effect of Socio-Demographic Attributes on Walking Behaviour of Residents in Shah Alam City, Malaysia." Planning Malaysia, Vol. 20, No. 2, pp. 260-271 (2022).

37. Lidbe, A., Adanu, E. K., Penmetsa, P., and Jones, S., "Changes in the travel patterns of older americans with medical conditions: A comparison of 2001 and 2017 NHTS data," *Transportation Research Interdisciplinary Perspectives*, Vol. 11, p. 100463 (2021). https://doi.org/10.1016/j.trip.2021.100463

38. Chen, E., Stathopoulos, A., and Nie, Y. M., "Transfer station choice in a multimodal transit system: An empirical study," *Transportation Research Part A: Policy and Practice*, Vol. 165, pp. 337-355 (2022). https://doi.org/10.1016/j.tra.2022.09.014

39. Koyilerian, S. P. and Anjaneyulu, M. V. L. R., "Influence of socio-demographic characteristics on activity travel behaviour of commuters in a medium sized city in India," *International Journal for Traffic and Transport Engineering*, Vol. 11, No. 4, pp. 629-639 (2021).

40. Sugiyanto, G., Yanto, Wibowo, A., Tauladan, T., and Damantoro, T., "Demand modeling for taxi and ride-hailing transport services (RTS)," *Civil Engineering Journal (Iran)*, Vol. 9, No. 5, pp. 1039-1058 (2023).

41. Sugiyanto, G., Yanto, Wibowo, A., and Astoto, T. W., "Service quality of transit and demand-supply forecasting for ride-hailing in the Jakarta Greater Area, Indonesia," *Journal of Engineering Research (Kuwait)*, Vol. 11, No. 2, pp. 187-199 (2023).

42. Aritenang, A., "Examining socio-economic inequality among commuters: The case of the Jakarta Metropolitan Area," *Urban Planning*, Vol. 7. No. 3, pp. 172-184 (2022).