

ASSESSING COMMUTER PERCEPTIONS FOR LAST-MILE POLICY PROPOSALS: FACTS FROM GONDANGDIA STATION, JAKARTA

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Sherly Nandya Putri*, Ova Candra Dewi, Jati
Pratomo

*Interdisciplinary Department of Urban and Regional
Planning, Universitas Indonesia, Depok, Indonesia*

Abstract. Jakarta's high dependency on motorized transport and insufficient last-mile connectivity hinder sustainable mobility. This study aims to assess commuter responses to policy interventions promoting a shift from motorized to non-motorized transport for last-mile trips at Gondangdia Station. Applying the Theory of Planned Behavior (TPB), the methodology operationalized three policy scenarios (low, medium, and high cost) derived from literature and stakeholder interviews, evaluated via questionnaires from 272 commuters. Results reveal that last-mile trips are dominated by ride-hailing services (50.37%). Perceived behavioral control contributed most strongly to intention (0.80–0.85). Although the high-cost scenario yielded the highest intention score (0.80), its marginal difference from the medium and low-cost scenarios (0.77) indicates that scaling up intervention costs alone is insufficient. Consequently, last-mile policies should prioritize practical improvements in infrastructure, safety, and accessibility.

Keywords: Last-Mile Travel; Mode Shift; Non-Motorized Transport; Policy Intervention; Theory of Planned Behavior (TPB)

[Judul: ANALISIS PERSEPSI KOMUTER TERHADAP USULAN KEBIJAKAN PERJALANAN TAHAP AKHIR: STUDI KASUS DI STASIUN GONDANGDIA, JAKARTA]. *Tingginya ketergantungan masyarakat Jakarta terhadap transportasi bermotor serta belum memadainya konektivitas perjalanan tahap akhir (last mile) menjadi hambatan dalam mewujudkan mobilitas berkelanjutan. Penelitian ini bertujuan untuk menganalisis respons komuter terhadap intervensi kebijakan yang mendorong peralihan dari transportasi bermotor ke transportasi tidak bermotor untuk perjalanan tahap akhir di Stasiun Gondangdia. Dengan menggunakan Theory of Planned Behavior (TPB), penelitian ini mengoperasionalkan tiga skenario kebijakan berdasarkan tingkat biaya, yaitu rendah, sedang, dan tinggi, yang dirumuskan berdasarkan kajian literatur dan wawancara dengan pemangku kepentingan. Ketiga skenario tersebut dievaluasi melalui kuesioner yang melibatkan 272 komuter. Hasil penelitian menunjukkan bahwa perjalanan tahap akhir didominasi oleh penggunaan layanan transportasi berbasis aplikasi (ride-hailing), dengan proporsi sebesar 50,37%. Kontrol perilaku yang dipersepsikan (perceived behavioral control) merupakan faktor yang memiliki pengaruh paling kuat terhadap niat berperilaku, dengan koefisien sebesar 0,80–0,85. Meskipun skenario berbiaya tinggi menghasilkan skor niat tertinggi, yaitu 0,80, perbedaannya relatif kecil dibandingkan dengan skenario berbiaya sedang dan rendah, yang masing-masing menghasilkan skor sebesar 0,77. Temuan ini mengindikasikan bahwa peningkatan biaya intervensi saja belum tentu cukup untuk mendorong peningkatan niat beralih moda. Oleh karena itu, kebijakan perjalanan tahap akhir perlu memprioritaskan peningkatan kualitas infrastruktur, keselamatan, dan aksesibilitas guna mendukung peralihan menuju transportasi tidak bermotor.*

Kata Kunci: Perjalanan Tahap Akhir; Peralihan Moda; Transportasi Tidak Bermotor; Intervensi Kebijakan; Theory of Planned Behavior (TPB)

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1. INTRODUCTION

Jakarta significant urban mobility challenges due to its high dependence on private vehicles and declining air quality. The transportation sector contributes the largest share of greenhouse gas emissions at 46% (Dinas Lingkungan Hidup Provinsi DKI Jakarta, 2024), with motorcycles being the dominant contributor, generating the highest emissions per capita at 3.17 mg PM/km and 0.15 kgCO₂/km (WRI Indonesia, 2019). In addition, approximately 4.4 million commuters from the Bodetabek area travel into Jakarta daily, with 79% relying on private vehicles, while only 19.5% use public transport and 1.4% use active modes (BPS, 2023). Limited feeder services have resulted in suboptimal accessibility to and from public transport hubs, particularly for last-mile connectivity. As a result, commuters heavily depend on motorized modes, especially ride-hailing services even for short-distance trips. While the share of public transportation in Jakarta continues to grow, motorcycle-based ride-hailing remains dominant, accounting for 26.8% of total users. Although the Jakarta government has developed active mobility infrastructure, including 214.62 km of sidewalks and 316.7 km of bicycle lanes integrated with public transport nodes (ITDP, 2023a, 2023b), the use of bicycles as last mile mode is still limited and trend in cycling numbers has actually decreased over the last two years (Sunandar & Tia, 2020). This is even though last-mile trips are relatively short, averaging only 4.5 km (ITDP, 2023b) and could potentially be served by Non-Motorized Transport (NMT). This highlights the urgency of promoting more sustainable and low-emission transport solutions, particularly through the enhancement of non-motorized transport (NMT) in last-mile connectivity.

The concept of low-emission urban transport is closely aligned with the principles of sustainable transportation as outlined in SDG 11.2 (United Nations, 2026), which emphasizes the provision of safe, affordable, and sustainable transport systems. In this context, efforts toward transport decarbonization focus on reducing greenhouse gas emissions through strategies such as the Avoid–Shift–Improve (ASI) approach. Among these, the *Shift* strategy highlights the importance of

transitioning from private motorized vehicles to public transport and active mobility (GIZ-SUTP, 2019). This transition is recognized as a key pathway toward supporting broader low-emission transport systems.

In practice, this shift is operationalized through the integration of public transport and active mobility within a continuous mobility chain commonly referred to as walk–transit and bike–transit systems (Kager et al., 2016). In this context, active mobility functions as a feeder to mass transit systems (Ewing & Cervero, 2001), particularly within first-mile and last-mile trips. Walking is generally suitable for distances of up to 500 meters (ITDP, 2024), while cycling can serve distances of 3–5 km, and micromobility for distances greater than 5 km (Kittelson et al., 2003). In this study, non-motorized transport modes for first mile and last-mile trips are limited to walking and conventional cycling, reflecting their relevance within the context of urban commuter behavior.

Previous studies on last-mile travel behavior in Jakarta have consistently identified key determinants of mode choice, including travel distance, cost, convenience, and integration (Risdiyanto et al., 2019), highlight that online motorcycle taxis dominate as feeder modes due to their flexibility and accessibility. Other studies emphasize that non-motorized modes such as walking and cycling remain less preferred, despite relatively short travel distances, due to inadequate infrastructure quality, safety concerns, and limited supporting facilities (Risdiyanto et al., 2019). This is further supported by findings that users tend to shift to motorized modes when walking distances

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*Email: sherlynandya96@gmail.com

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exceed tolerable thresholds or when pedestrian and cycling environments are not supportive (Purba & Widiyastuti, 2024). Most studies primarily focus on existing travel patterns, mode preferences, and service quality, without explicitly examining how users respond to specific policy interventions aimed at encouraging a shift toward non-motorized transport (NMT). There remains limited empirical understanding of how such interventions influence commuters' behavioral intentions to shift, as the effectiveness of sustainable transport policies depends not only on infrastructure provision but also on users' behavioral responses to these interventions.

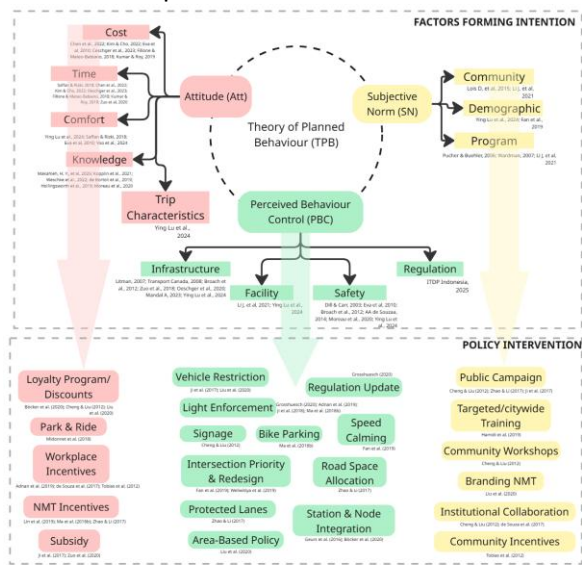


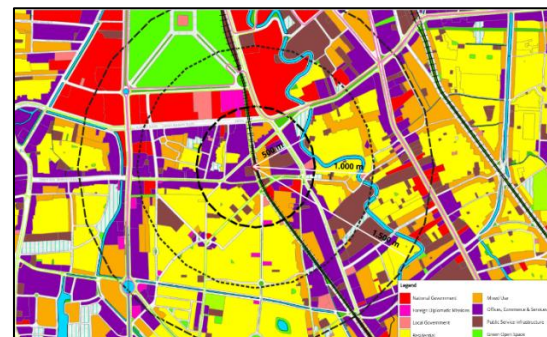
Figure 1. TPB Factors and Policy Interventions for Last-Mile Mode Shift

Source: Developed by the authors based on literature synthesis, 2026

To address this gap, this study adopts the Theory of Planned Behavior (Ajzen, 1991, 2002, 2011; Donald et al., 2014; Si et al., 2020) as a conceptual framework to examine how attitudes, subjective norms, and perceived behavioral control influence commuters' willingness to shift toward walking and cycling for last-mile trips. By integrating behavioral perspectives with intervention-based scenarios, this study seeks to understand how policy measures are perceived by users and how these perceptions shape behavioral intention. Based on this approach, a conceptual framework is developed through a synthesis of previous studies on travel behavior, non-motorized transport and policy interventions. These studies

identify key determinants which are then mapped into the behavioral constructs of the Theory of Planned Behavior (TPB): attitude, subjective norms, and perceived behavioral control, and linked to corresponding intervention strategies as illustrated in Figure 1.

This study aims to assess commuter perceptions toward policy interventions designed to promote non-motorized transport (NMT) in last-mile travel and to examine how these perceptions influence their intention to shift from motorized modes. It further explores how travel characteristics and behavioral factors shape commuter responses within the context of Gondangdia Station. The study hypothesizes that attitude, subjective norms, and perceived behavioral control positively influence commuters' intention to shift to non-motorized transport, perceived behavioral control has a stronger influence on behavioral intention compared to attitude and subjective norms; and policy interventions that enhance perceived accessibility, safety, and convenience are more likely to increase commuters' intention to adopt NMT.



(a)



(b)

Figure 2. (a) Land Use; (b) Public Transportation Services and Bicycle Lanes Around Gondangdia Station

The study is conducted in the Gondangdia Station area, Central Jakarta, due to its strategic urban context. The area represents a highly suitable case for analyzing last-mile connectivity as it is characterized by a strategic location with diverse land use as shown in Figure 2 (a), and the availability of multiple public transport services and non-motorized transport (NMT) infrastructure, as shown in Figure 2 (b). It also became the location of a planned bike-sharing pilot project. Additionally, the area is served by various public transport modes and supported by existing bicycle lanes within a 500–1.500 meter radius, making it an ideal setting to assess the potential integration between public transport and non-motorized modes in last-mile travel in an urban context characterized by mixed land use and high travel demand.

2. METHODS

This study employed a mixed-method approach combining qualitative and quantitative analysis to

comprehensively address the research objectives as illustrated in Figure 3.

2.1 Policy Scenario Development

In the initial stage, a literature review and expert interviews were conducted to identify and formulate relevant policy proposals related to last-mile connectivity and non-motorized transport (NMT). The experts involved in this study consisted of representatives from the Jakarta Transportation Agency, a non-governmental organization in sustainable mobility (ITDP Indonesia), and the cycling community Bike to Work (B2W) Indonesia, providing practical and policy insights. These proposals, categorized into different cost scenarios (low cost, middle cost, and high cost), were systematically structured according to three key behavioral dimensions: attitude, subjective norm, and perceived behavioral control adapted from the Theory of Planned Behavior (Ajzen, 2002). The detailed formulation of each scenario is presented in Table 1.

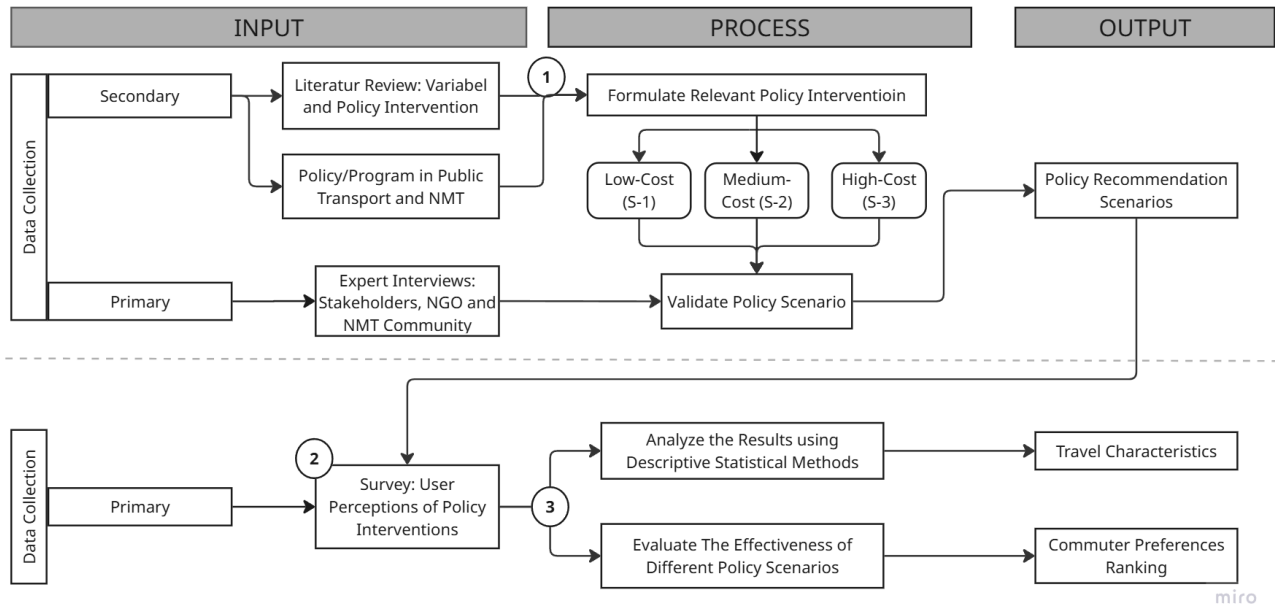


Figure 3. Framework of Methodology

Table 1. Policy Proposals Scenarios Based on Literature Review and Expert Interviews

Behavioral Aspect	Low-Cost (S1)	Medium-Cost (S2)	High-Cost (S3)
Attitude (Att)	Travel rewards (points/tickets) for walking and cycling	30% fare subsidy for walking and bike-share users	50% fare subsidy for walking and bike-share users
Subjective Norm (SN)	Public campaigns and awareness programs on NMT	Workshops and educational programs on NMT usage	Community-based incentive programs for NMT adoption
Perceived Behavioral Control (PBC)	Enforcement of regulations on pedestrian and cycling facilities	Cycling priority at intersections and traffic calming measures	Provision of protected bicycle lanes

Source: Author's elaboration based on literature review and expert interviews, 2026

2.2 Data Collection and Survey Design

In the subsequent stage, a questionnaire survey was administered to assess commuter responses to various policy proposals for mode shift. The population of this study consists of public transport users who perform last-mile trips to and from transit stations within the study area. The sample size was determined using the Slovin formula using equation (1) based on an estimated daily passenger volume of 22.993 users/day and a margin of error of 10% resulting in a minimum sample of 268 respondents which was achieved in this study.

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

The survey collected data on socio-demographic characteristics, travel patterns, last-mile distance, current mode choice, and preferences for shifting from motorized to non-motorized transport. Preferences were measured using a six-point Likert scale to avoid a neutral midpoint and encourage more definitive responses. This approach is supported by Leung (2011), who found that even-numbered Likert scales can improve response differentiation and reduce central tendency bias, and is also commonly applied in transportation studies to capture user preferences. The survey employed an accidental sampling technique, where respondents were selected based on their availability at Gondangdia Station, ensuring that participants were actual last-mile users.

Prior to index construction, instrument validity and internal consistency reliability were verified using JASP software. Construct validity was evaluated via Pearson's product-moment correlation (r), where all measurement items yielded correlation values exceeding the critical table value (r calculated $> r$ table=0.119, $\alpha = 0.05$), confirming item validity. Internal consistency reliability was confirmed using Cronbach's Alpha (α), achieving an overall instrument reliability score of $\alpha = 0.884$ (with sub-construct scores of $\alpha_{Att} = 0.812$, $\alpha_{SN} = 0.795$, and $\alpha_{PBC} = 0.856$), well above the standard threshold of 0.70.

2.3 Data Analysis

Data collection measured commuters' Stated Intention (on a 6-point Likert scale, where 1 = strongly unwilling and 6 = strongly willing) to shift to non-motorized transport in response to specific policy interventions representing TPB dimensions (Attitude-oriented, Subjective Norm-oriented, and Perceived Behavioural Control-oriented interventions) across three scenarios (S1, S2, and S3). To empirically prove whether variations in policy interventions lead to statistically significant differences in commuters' shift intention (rather than relying solely on descriptive means), non-parametric paired-samples tests (Wilcoxon Signed-Rank Test) were executed ($p < 0.05$).

In this study, Stated Intention (I_{stated}) is operationally defined as commuters' self-reported willingness and behavioral readiness to adopt non-motorized transport (walking or cycling) under hypothetical policy scenarios, measured on a normalized index scale (0.00 – 1.00). Conversely, **Actual Shift** (B_{actual}) refers to observable, real-world mode choice behavior under existing baseline conditions, benchmarked against station intercept counts and observational field surveys.

In the final stage, the data were analysed using descriptive statistical methods, including frequency distribution, percentage analysis, and preference ranking to identify the most preferred policy proposals. The results were then interpreted to evaluate the effectiveness of different policy scenarios in influencing commuter willingness to shift modes toward non-motorized transport in last-mile travel. Each aspect was first normalized to a 0–1 using min–max scaling approach (Patro & Sahu, 2015) on equation (2), where $X_{\min} = 1$ and $X_{\max} = 6$, corresponding to the boundaries of the 6-point Likert scale. A normalized index score of 0.00 represents complete unwillingness/unfavorable perception, while 1.00 represents maximum agreement. The resulting normalized scores were categorized into three intention tiers: Low (0.00 – 0.33), Moderate (0.34 – 0.66), and High (0.67 – 1.00). Indicators within each TPB construct were aggregated using equal-weighted arithmetic averaging, followed by composite scenario scoring using weighted linear combination. The overall intention score for each policy scenario was computed to assess the comparative effectiveness of cost interventions in influencing mode shift intention.

$$x' = \frac{x - x_{\min}}{x_{\max} - x_{\min}} \quad (2)$$

In addition, a composite intention score was calculated based on the Theory of Planned Behavior (TPB) framework by combining attitude (Att), subjective norm (SN), and perceived behavioral control (PBC) using a weighted sum approach (Ajzen, 2011) Using equation (3), attitude, subjective norm, and perceived behavioural control were assigned relative weights of 0.35, 0.25, and 0.40 as identified in prior empirical standard meta-analytic findings of the Theory of Planned Behavior

in active transport studies. (Ajzen, 2011; Armitage & Conner, 2001).

$$Intention(t) = w_A \cdot Att(t) + w_{SN} \cdot SN(t) + w_{PBC} \cdot PBC(t) \quad (3)$$

These empirical meta-analyses demonstrate that physical capability and structural safety (PBC) exert a significantly stronger behavioral influence on active mode choice than normative pressures (SN). Furthermore, this weighting distribution aligns with our empirical survey data, where commuters' shift intentions exhibited the highest statistical sensitivity toward Perceived Behavioral Control interventions.

3. RESULTS & DISCUSSION

3.1 User Characteristics

The results indicate that the majority of respondents travel for work purposes (89.93%), reflecting the importance of reliable last-mile connectivity to support daily commuting. The remaining trips are distributed across several other purposes, including religious activities, recreation, education (school), and other minor purposes, although each represents only a small proportion of total trips. This distribution also reflects the mixed-use land use characteristics of the Gondangdia area, where residential, commercial, educational, and public facilities coexist within proximity, generating diverse but relatively smaller-scale trip purposes beyond commuting. In terms of user characteristics, the sample shows a relatively balanced gender distribution, with 53% male and 47% female respondents. Meanwhile, the age distribution is dominated by the productive age group, particularly users aged 25–34 years (35%) and 35–44 years (32%), followed by those aged 45–54 years (23%). Younger (18–24 years) and older age groups (>55 years) constitute a smaller share of users. This indicates that transit usage at Gondangdia Station is largely driven by working-age individuals with regular mobility needs.

3.2 Travel Characteristics

The average last-mile travel distance is 2.1 km, indicating that most trips fall within the short-to-medium range where non-motorized and feeder-based modes should be viable. However, this distance exceeds the comfortable walking threshold

for many users, limiting walking as a feasible option for a significant portion of commuters. This is consistent with the observed mode choice distribution, where motorcycle use dominates (50.37%), followed by walking (33.09%) and feeder bus services (13.60%), while cycling remains negligible (1.47%) despite being well-suited for typical last-mile distances (1–3 km).

As shown in Table 2, the distribution of distance ranges aligns with the functional role of each mode: walking for short distances, feeder services for medium distances, and motorcycles for longer trips; however, the persistently low share of cycling within the 1–3 km range highlights an underutilization of a mode that is spatially and operationally appropriate for last-mile travel. This condition implies that distance alone does not determine mode choice; rather, mode selection appears to be influenced by users' perceived feasibility in adopting alternative

perceived as a safe or socially acceptable mode, even among populations that are physically capable of adopting it. In contrast, the reliance on motorcycles among the 25–34 age group reflects a stronger preference for speed and convenience, reinforcing the role of lifestyle and time sensitivity in mode choice decisions.

3.3 User Perception of Policy Scenarios

Statistical verification through the Wilcoxon Signed-Rank Test confirms that commuters' willingness/intention to shift varies significantly depending on the specific intervention package (Table X). Moving from Low-Cost (S1) to Medium-Cost (S2) interventions does not yield statistically significant increases in intention across Attitude ($p=0.129$), Subjective Norms ($p=0.683$), or PBC ($p=0.203$). In contrast, escalating to High-Cost (S3) interventions generates a statistically significant

Table 2. Existing Mode Choice, Travel Distance, and Age Characteristics at Gondangdia Station

No	Mode-Choice	Frequency	Percentage (%)	Distance Range	Average Distance	Age Group
1	Motorcycle	137	50.37	>3 km	2.4 km	25-34 year
2	Walking	90	33.09	500 m - 1 km	1.7 km	35-44 year
3	Feeder Bus	37	13.60	1 - 3 km	1.9 km	25-34 year
4	Cycling	4	1.47	500 m - 1 km	1.6 km	35-44 year
5	Car	4	1.47	> 3 km	3 km	35-44 year

modes. Interestingly, the average walking distance reaches 1.7 km, which is only slightly lower than the feeder bus average of 1.9 km. This relatively small gap suggests that a portion of feeder bus users could theoretically shift to walking, particularly for trips within the lower bound of the 1–3 km range. The persistence of feeder usage despite comparable distances indicates the presence of non-distance barriers, such as perceived travel time, physical effort, thermal comfort, or pedestrian infrastructure quality. Furthermore, the age distribution reveals that non-motorized transport users are not dominated by younger groups; instead, walking is more prevalent among the 35–44 age group, while cycling remains minimal across all age categories. This pattern suggests that cycling is not yet

surge in shift intention, particularly for PBC-oriented infrastructure ($z=-3.420, p<0.001$) and Attitude-oriented fare subsidies ($z=-2.527, p=0.006$). This statistical proof confirms that minor programmatic tweaks fail to alter travel intention, whereas comprehensive physical support under S3 significantly unlocks commuters' willingness to shift to active modes.

To evaluate the effectiveness of different policy scenarios in influencing commuter willingness to shift modes toward non-motorized transport in last-mile travel, this analysis specifically focuses on respondents who currently use motorized transport modes, as they represent the primary target group

for mode shift. Based on a Likert scale assessment, responses were grouped into agreement levels using a top-3 box approach (scores 4–6) to represent willingness to shift. The results show that 89% of respondents expressed willingness to shift under the proposed policy scenarios, while only 11% remained unwilling. A more detailed distribution of Motorized User perceptions across policy scenarios and behavioural dimensions is illustrated in Figure 4.

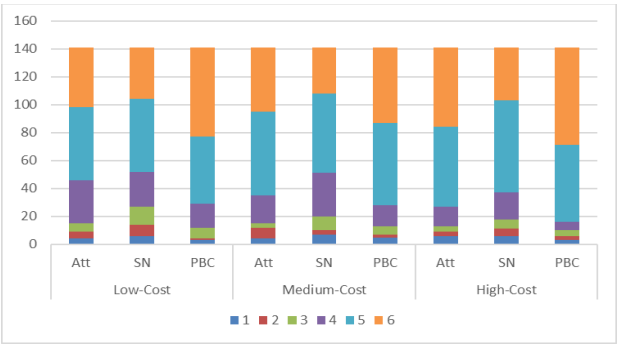


Figure 4. Distribution of Motorized Users' Agreement Levels toward Policy Proposals
Source: Author's survey, 2026

Further analysis of user perceptions toward policy interventions shows that all scenarios receive consistently high evaluations, indicating strong overall support for last-mile mode shift policies. High-cost interventions perform best across all constructs, with the highest scores in attitude (Att = 5.01; normalized = 0.803), subjective norms (SN = 4.76; normalized = 0.752), and perceived behavioral control (PBC = 5.25; normalized = 0.850). Medium-cost interventions show slightly lower values (Att =

4.86; SN = 4.61; PBC = 5.01), followed by low-cost interventions (Att = 4.78; SN = 4.56; PBC = 5.11). Despite this, across all scenarios, perceived behavioral control remains relatively comparable to or slightly higher than attitude and subjective norms, particularly in the high-cost scenario. This suggests that while users perceive interventions positively, improvements in infrastructure and system support (reflected in high-cost scenarios) play a stronger role in enhancing users' perceived ability to adopt non-motorized transport practice in the context of last-mile travel for commuters.

As illustrated in Figure 5, the pattern is consistent across scenarios, where all variables show an increasing trend from low- to high-cost interventions, with the most notable improvement observed in perceived behavioral control (PBC). In the low-cost scenario, the scores for attitude, subjective norms, and PBC are 0.771, 0.745, and 0.835, respectively. These values increase slightly under the medium-cost scenario to 0.783 (Att), 0.763 (SN), and 0.842 (PBC), and further improve in the high-cost scenario to 0.803 (Att), 0.752 (SN), and 0.850 (PBC). The composite intention analysis also indicates a consistently high level of behavioral intention across all scenarios, with scores of 0.771 for both low- and medium-cost interventions, and a slightly higher value of 0.809 under the high-cost scenario. These results suggest that policy proposals are generally well-received by users and contribute to strengthening key behavioral constructs associated with the adoption of non-motorized transport.

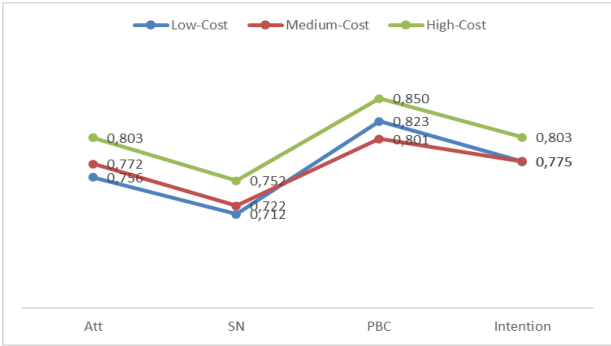


Figure 5. Comparison of Behavioral Factors across Policy Scenarios
Source: Author's survey, 2026

Table 3. Wilcoxon Signed-Rank Test Results Across Policy Scenarios (p-value)

No	TPB Dimension	S1 vs S2	S2 vs S3	S3 vs S1
1	Motorcycle	0.129	0.006*	0.001*
2	Walking	0.683	0.023*	0.930
3	Feeder Bus	0.203	0.001*	0.061

Source: Processed by the author using JASP, 2026

*Statistically significant at $p < 0.05$ level.

Across all scenarios, perceived behavioral control remains the highest among the TPB components, indicating that commuters' intention to shift is strongly associated with their perceived ability to adopt alternative modes. While improvements in intervention scale are associated with incremental increases in perception scores, the relatively close range of intention values suggests that behavioral intention is not solely determined by the magnitude of intervention, but also by how users perceive the feasibility of adopting non-motorized transport in practice.

A critical finding emerges from disaggregating the policy scenario comparisons using the Wilcoxon Signed-Rank Test (Table 3). Moving from the Low-Cost (S1) to Medium-Cost (S2) scenario does not produce statistically significant improvements across Attitude ($p = 0.129$) or Perceived Behavioral Control ($p = 0.203$). However, escalating to the High-Cost (S3) scenario yields a highly significant surge in shift intention.

Importantly, this high intention score in S3 is not primarily driven by financial incentives (Attitude: $p = 0.006$), but rather by physical infrastructure interventions under Perceived Behavioral Control ($z = -3.420, p < 0.001$). While fare subsidies in S3 improve user attitude, the inclusion of physically protected bicycle lanes and intersection traffic calming significantly reduces perceived safety risks, which acts as the true catalyst for mode shift. This statistically proves that commuters prioritize physical protection and dedicated space over monetary discounts when deciding to shift to non-

motorized transport (Bhattarai et al., 2025). This is in line with the study in Dalian City, China and Malaysia where the commuters in this city perceived a higher level of safety in their trip (Bhattarai et al., 2025; Kalhor et al., 2021).

A substantial gap exists between commuters' stated intention (88.9% willingness under supportive scenarios; composite index = 0.771 – 0.809) and actual behavioral realization (1.47% existing cycling share). Observational field audits around Gondangdia Station explain why stated willingness fails to automatically translate into actual mode shift:

1. **Infrastructure Discontinuity:** Dedicated bicycle lanes terminate abruptly at major arterial intersections (e.g., Jalan Kebon Sirih and Jalan Wahid Hasyim), forcing cyclists into direct conflict with heavy motorized traffic (Huang & Wu, 2005).
2. **Pedestrian Space Obstructions:** Sidewalks within a 500-meter radius are frequently obstructed by street vendors, informal motorcycle parking, and utility infrastructure, severely degrading walking comfort (ITDP, 2023b; Yoon et al., 2025).
3. **Microclimate & Parking Security Constraints:** High ambient heat, lack of natural tree canopy shading, and the absence of secure, sheltered bicycle parking at Gondangdia Station concourses increase perceived physical effort and risk of theft.

These physical observations validate why interventions focusing on Perceived Behavioral Control (PBC)—such as protected bike lanes and

intersection redesign—are mandatory to bridge the intention–behavior gap.

Overall, these findings highlight that commuter responses to policy proposals are closely linked to perceived enabling conditions. This reinforces the importance of addressing factors related to accessibility, safety, and convenience in order to support the adoption of non-motorized transport in last-mile travel. Moreover, it suggests that the effectiveness of policy measures may not solely depend on their scale or cost, but also on how well they improve users' perceived feasibility and reduce practical barriers in everyday last-mile travel contexts.

4. CONCLUSION

This study aims to assess commuter perceptions toward policy interventions designed to promote non-motorized transport (NMT) in last-mile travel and to examine how these perceptions influence their intention to shift from motorized modes. The findings reveal that most last-mile trips fall within a distance range that is theoretically suitable for non-motorized transport, yet travel behavior continues to be dominated by motorized modes, reflecting a persistent gap between spatial feasibility, stated willingness to shift, and actual mode choice. This suggests that distance alone is insufficient to drive behavioral change, as commuters' decisions are more strongly shaped by their perceived ability to use alternative modes under real-world conditions, particularly in terms of safety, convenience, and accessibility. An important insight from this study is that some trips currently served by motorized modes may fall within a potentially walkable range, indicating an opportunity for modal shift if appropriate conditions are provided. In line with this, the analysis of user perceptions shows a generally strong willingness to shift to non-motorized transport under the proposed policy scenarios, reflecting a high level of acceptance toward last-mile interventions. Nevertheless, this willingness does not automatically translate into actual behavior, highlighting the critical role of enabling factors in bridging the intention–behavior gap. From a behavioral perspective, perceived

behavioral control (PBC) emerges as the most influential factor shaping commuters' intention to adopt NMT, outweighing the influence of attitudes and subjective norms. This implies that policy efforts should prioritize improving users' perceived and actual ability to use non-motorized modes. These findings underscore the importance of providing safe, continuous, and accessible infrastructure, supported by integrated and context-sensitive policy measures, to effectively encourage a shift toward more sustainable last-mile travel behavior.

From a policy perspective, these results emphasize the importance of strengthening enabling conditions that directly support user capability, particularly through targeted and user-centered interventions. Interventions focusing on improving infrastructure quality, safety, and last-mile connectivity are therefore critical in facilitating the transition toward more sustainable travel behavior. Complementary measures that are scalable and context-sensitive can further support these efforts, particularly when aligned with local travel patterns and user needs, but their effectiveness ultimately depends on how well they enhance users' perceived control over travel choices. However, this study is limited by its reliance on stated preference data, which captures behavioral intention rather than actual travel outcomes. Moreover, the current analysis does not quantify the extent to which these intentions translate into real-world mode shift. Future research is therefore needed to integrate behavioral insights with simulation-based approaches to better estimate the magnitude and evolution of mode shift over time, as well as to assess the systemic impacts of policy interventions within the broader urban transport context. Such approaches would provide a more comprehensive and empirically grounded understanding of how intention can be effectively translated into sustained behavioral change over time.

5. REFERENCES

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.

- doi:[https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Ajzen, I. (2002). Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior. *Journal of Applied Social Psychology*, 32(4), 665-683. doi:<https://doi.org/10.1111/j.1559-1816.2002.tb00236.x>
- Ajzen, I. (2011). The theory of planned behaviour: Reactions and reflections. *Psychology & Health*, 26(9), 1113-1127. doi:10.1080/08870446.2011.613995
- Bhattarai, K., Zhao, S., Bachir Diop, E. I., Zhang, D., & Joshi, M. (2025). Investigating work commuters mode choice behavior in Dalian city during pandemic: a hybrid choice model approach. *Transportation Planning and Technology*, 48(5), 1047-1069. doi:10.1080/03081060.2024.2410317
- BPS. (2023). Statistik-komuter-jabodetabek-hasil-survei-komuter-jabodetabek-2023. from Badan Pusat Statistik <https://www.bps.go.id/assets/publication/2024/03/28/33b6bef825944e576e7ea3ba/statistik-komuter-jabodetabek-hasil-survei-komuter-jabodetabek-2023.html>
- Dinas Lingkungan Hidup Provinsi DKI Jakarta. (2024). Publikasi_data_20250710031121. from Dinas Lingkungan Hidup Provinsi DKI Jakarta <https://dev.dinaslhdkj.id>
- Donald, I. J., Cooper, S. R., & Conchie, S. M. (2014). An extended theory of planned behaviour model of the psychological factors affecting commuters' transport mode use. *Journal of Environmental Psychology*, 40, 39-48. doi:<https://doi.org/10.1016/j.jenvp.2014.03.003>
- Ewing, R., & Cervero, R. (2001). Travel and the Built Environment: A Synthesis. *Transportation Research Record*, 1780(1), 87-114. doi:10.3141/1780-10
- GIZ-SUTP. (2019). *Sustainable Urban Transport: Avoid-Shift-Improve (A-S-I)*: GIZ-SUTP.
- Huang, L., & Wu, J. (2005). A Study on Cyclist Behavior at Signalized Intersections. *IEEE Transactions on Intelligent Transportation Systems*, 5, 293-299. doi:10.1109/TITS.2004.837812
- ITDP. (2023a). Catatan-Teknis-Keberlanjutan-Jalur-Sepeda-Jakarta. from ITDP <https://itdp-indonesia.org/wp-content/uploads/2023/11/Catatan-Teknis-Keberlanjutan-Jalur-Sepeda-Jakarta.pdf>
- ITDP. (2023b). Peta Jalan Pengembangan Infrastruktur Pejalan Kaki dan Pesepeda DKI Jakarta 2023 – 2027. from ITDP <https://itdp-indonesia.org/publication/peta-jalan-pengembangan-infrastruktur-pejalan-kaki-dan-pesepeda-dki-jakarta-2023-2027/>
- ITDP. (2024). ITDP's Cycling Cities. <https://cyclingcities.itdp.org/>
- Kager, R., Bertolini, L., & Te Brömmelstroet, M. (2016). Characterisation of and reflections on the synergy of bicycles and public transport. *Transportation Research Part A: Policy and Practice*, 85, 208-219. doi:<https://doi.org/10.1016/j.tra.2016.01.015>
- Kalhor, M., Au Yong, H. N., & Ramendran Spr, C. (2021). Understanding the Factors Affecting Pro-Environment Behavior for City Rail Transport Usage: Territories' Empirical Evidence—Malaysia. *Sustainability*, 13(22), 12483. Retrieved from doi:10.3390/su132212483
- Kittelson, Associates, Administration, U. S. F. T., Program, T. C. R., & Corporation, T. D. (2003). *Transit capacity and quality of service manual* (Vol. 42): Transportation Research Board.
- Leung, S.-O. (2011). A Comparison of Psychometric Properties and Normality in 4-, 5-, 6-, and 11-Point Likert Scales. *Journal of Social Service Research*, 37(4), 412-421. doi:10.1080/01488376.2011.580697
- Purba, G., & Widiyastuti, D. (2024). *First mile and last mile analysis using users' perceived quality of Jakarta Mass Rapid Transit (MRT Jakarta) North-South Corridor Phase 1*. Paper presented at the IOP Conference Series: Earth and Environmental Science.
- Risdiyanto, A. M., Irawan, M. Z., Biddinika, M. K., & Alfred, J. (2019). *Importance Performance Analysis Of Online Motorcycle Taxi Services: Indonesian Passenger Perspective*. Paper presented at the Proceedings of the 2nd International Conference on Applied Science, Engineering and Social Sciences - ICASESS;

- ISBN 978-989-758-452-7, SciTePress, pages 79-85. DOI: 10.5220/0009878600790085.
- Si, H., Shi, J.-g., Tang, D., Wu, G., & Lan, J. (2020). Understanding intention and behavior toward sustainable usage of bike sharing by extending the theory of planned behavior. *Resources, Conservation and Recycling*, 152, 104513. doi:<https://doi.org/10.1016/j.resconrec.2019.104513>
- Sunandar, A., & Tia, R. W. (2020). *Analysis of Bicycle Path Infrastructure in Jakarta to Improve Cycling Comfort*. Paper presented at the Journal of World Conference (JWC).
- United Nations. (2026). The 17 Goals. from United Nations https://sdgs.un.org/sites/default/files/2021-10/Transportation%20Report%202021_FullReport_Digital.pdf
- WRI Indonesia. (2019). Menghitung Jejak Karbon Pribadi Dapat Mendukung Aksi Iklim. Retrieved from <https://wri-indonesia.org/id/wawasan/menghitung-jejak-karbon-pribadi-dapat-mendukung-aksi-iklim>
- Yoon, T., Choi, M., & Lee, S. (2025). Pedestrian Perceived Risk of Construction Obstructions and Barriers Identified via Image Segmentation. *Applied Sciences*, 15(10), 5261. Retrieved from doi:10.3390/app15105261