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Posted Date: 2 July 2025

doi: 10.20944/preprints202507.0177.v1

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Willingness to Pay for Active Mobility Infrastructure in a Thai University

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Abstract

This research examines road users' willingness to pay for enhanced active mobility infrastructure at King Mongkut's Institute of Technology Ladkrabang (KMITL), a suburban university campus in Bangkok, Thailand. The study addresses the need for sustainable transportation solutions in middle-income urban environments by analyzing factors that influence walking and cycling adoption among university community members. The research employed a comprehensive mixed-methods framework combining qualitative SWOT analysis, a stated preference survey of 400 participants, and binary logistic regression modeling. The analysis revealed that specific infrastructure improvements significantly increase the likelihood of active mobility adoption. Rest areas demonstrated the strongest positive association (OR=1.820, p=0.034), followed by CCTV security systems (OR=1.726, p=0.060), protective barriers separating pedestrians and cyclists from motorcycles (OR=1.608, p=0.086), and improved public transport connectivity (OR=2.192, p=0.005). Demographic analysis uncovered notable resistance patterns, with male participants (OR=0.512, p=0.096) and higher-income individuals (OR=0.114, p=0.004) showing reduced willingness to transition from motorized transportation. These findings reflect broader cultural preferences and socioeconomic factors that influence mobility choices in the Thai context. Using the Contingent Valuation Method, the study quantified potential behavioral changes, projecting an 8-16 minute daily increase in active mobility engagement. This enhancement would generate measurable health benefits for individuals and environmental improvements for the broader community. The research contributes valuable insights to the limited body of active mobility literature from Southeast Asian suburban contexts, where car and motorcycle dependency remains dominant. The findings emphasize that safety infrastructure and seamless connectivity are fundamental prerequisites for successful active mobility programs. The study's methodological approach, combining economic valuation through contingent valuation with statistical modeling via logistic regression, provides a replicable framework for similar investigations.

Keywords: active mobility; willingness to pay; sustainable transport; university campus; Thailand; logistic regression

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1. Introduction

Active Mobility (AM)—referring to human-powered transportation modes such as walking and cycling—has become a core focus in the transition toward sustainable, equitable, and liveable urban environments. Globally, efforts to promote AM have been driven by goals to reduce air pollution and greenhouse gas emissions, improve public health outcomes, and increase access to urban services (Pucher & Buehler, 2008; WHO, 2021). Countries such as the Netherlands, Japan, and Singapore exemplify integrated policies promoting active travel by combining investments in infrastructure with supportive land-use planning, enforcement, and behavioural change campaigns (Song et al., 2013; Easton & Ferrari, 2015).

In developing regions, however, including Southeast Asia, research on AM remains comparatively sparse. Thailand, as a rapidly urbanizing middle-income country, faces increasing environmental and health challenges due to motorization and urban sprawl. Active mobility presents an opportunity to address these challenges, yet empirical studies evaluating the economic benefits and the public's willingness to pay (WTP) for AM improvements remain limited. This study seeks to contribute to filling this gap by assessing WTP for AM-related infrastructure enhancements in a suburban context, specifically at King Mongkut's Institute of Technology Ladkrabang (KMITL), Bangkok, Thailand. University campuses are particularly relevant testbeds for such studies because of their diverse populations and potential for AM adoption (Bordagaray et al., 2015).

Despite isolated efforts to promote walking and cycling infrastructure in Thailand (e.g., bicycle lane initiatives around Rattanakosin Island and Lad Phrao Road), these projects have been largely piecemeal, lacking comprehensive assessment of user preferences, behavioural responses, and economic justifications (Meesit et al., 2023). Prior research on AM at KMITL highlights that while the built environment enables basic pedestrian and cycling activity, significant gaps in safety, accessibility, and continuity deter wider adoption (Meesit et al., 2023).

This study addresses three critical research questions: What is the public's willingness to pay (WTP) for selected AM improvement measures in a suburban Thai university context? How do demographic and travel behavior characteristics influence WTP for AM measures? And What are the potential behavioral shifts (in walking/cycling duration) that could result from implementing these measures? By using the Contingent Valuation Method (CVM) and binary logistic regression models, this study provides evidence-based insights to support decision-making by local governments, campus authorities, and transportation planners in Thailand and similar contexts. The analysis builds upon the concept of weak complementarity between neighbourhood characteristics and walking behaviour (Saelens & Handy, 2008; Wilson et al., 2012). This theoretical approach posits that as pedestrian environments improve, individuals derive greater utility from walking, making them more willing to support investments in related public goods. Furthermore, it applies the Health Economic Assessment Tool (HEAT) developed by the WHO to frame the health co-benefits of AM in monetary terms (Rabl & Nazelle, 2012). KMITL represents a valuable case study for AM research in Thailand due to its suburban setting, relatively large population of daily commuters, and existing yet underutilized walking and cycling infrastructure. Moreover, as Thailand aspires to develop sustainable urban transport solutions under the National Strategy on Environmentally Sustainable Transport, university campuses like KMITL serve as microcosms for testing integrated AM interventions.

2. Literature Review

The promotion of Active Mobility (AM)—primarily walking and cycling—has gained substantial global traction as part of efforts to reduce greenhouse gas emissions, improve urban liveability, and promote public health (Pucher & Buehler, 2008; WHO, 2021). Numerous international studies have demonstrated that improving walking and cycling infrastructure not only facilitates non-motorized transport but also generates substantial health and environmental benefits (Sælensminde, 2004; Wang et al., 2004).

2.1. Active Mobility Promotion Measures

Extensive research has explored measures for enhancing AM adoption. These include infrastructure improvements, such as wider sidewalks, dedicated bicycle lanes, improved crossings, and lighting (Ibeas et al., 2011; Methorst et al., 2010); behavioral interventions through campaigns and educational programs (Clark, 2017; Easton & Ferrari, 2015); safety measures, including the installation of CCTV, motorcycle barriers, and pedestrian prioritization at intersections (Sansanee

Sangsila, 2012; Pucher & Buehler, 2010); integrated multimodal planning, ensuring seamless connections between walking, cycling, and public transit (Song et al., 2013; Koh & Wong, 2013).

While these measures are widely studied in high-income contexts, Southeast Asian urban environments face unique challenges related to informal transport, tropical climates, and rapid motorization (Pongphonrat et al., 2015; Boon-or & Limpasenee, 2020). In Thailand, few comprehensive evaluations have been conducted on how infrastructure quality affects willingness to engage in active travel, especially in suburban or university environments.

2.2. Economic Appraisal of Active Mobility

Quantifying the economic benefits of AM has become increasingly important in guiding infrastructure investment decisions. The Contingent Valuation Method (CVM) and Choice Modelling (CM) are among the most commonly used methods for assigning monetary value to non-market benefits, such as improved safety or health gains associated with AM (Bateman et al., 2002). Studies using CVM and CM internationally have shown robust benefits. For example, Sælensminde (2004) found that the benefits of walking and cycling infrastructure in Norwegian cities far exceeded costs, with benefit-cost ratios ranging between 2.9 and 14.0. Wang et al. (2004) identified a benefit-cost ratio of 2.94 for combined pedestrian and cycling infrastructure in U.S. communities. Bejranonda & Attanandana (2015) evaluated WTP for bicycle lane maintenance in Bangkok, revealing that factors such as education, income, and environmental attitudes significantly influence WTP. WHO's HEAT model provides a standard for estimating health-related economic benefits of walking and cycling infrastructure (Rabl & Nazelle, 2012). This tool uses values of statistical life to monetize reductions in mortality risk due to increased physical activity.

Despite growing interest, Thai research on economic valuation of AM remains underdeveloped. Prior works such as Benjasiri (2015) on Bangkok skywalk projects highlight positive WTP for improved pedestrian access, but these remain largely confined to central city areas. Additionally, past studies have focused more on walking than on cycling, despite both being critical components of AM strategies.

2.3. Research Gaps

Notably, the literature reveals three main gaps that this study aims to address: Geographic Gap: Most Thai studies focus on dense urban cores. Suburban contexts, like that of KMITL, remain under-examined despite their potential for AM development. Cycling Underrepresentation: Prior Thai WTP studies disproportionately focus on walking-related infrastructure, leaving bicycle infrastructure and integrated AM systems relatively neglected. Policy Relevance in Middle-Income Settings: While health and environmental benefits are documented, few studies have provided actionable economic valuations that local policymakers in middle-income countries like Thailand can use to justify AM investments.

This study contributes to filling these gaps by estimating WTP for multiple AM improvement measures—including both walking and cycling elements—within a suburban campus in Thailand, using robust econometric analysis. The findings are expected to support policy formulation aligned with Thailand's National Strategy on Environmentally Sustainable Transport.

2.4. Justification for Using Contingent Valuation Method (CVM)

Given that many benefits of active mobility infrastructure—such as improved safety, environmental quality, and health outcomes—are non-market public goods, the Contingent Valuation Method (CVM) is a particularly suitable approach for eliciting individuals' willingness to pay (WTP) for such improvements (Bateman et al., 2002; Hanemann, 1994). CVM has been widely applied in transport economics to assess user preferences for hypothetical infrastructure improvements that lack direct market prices (Bejranonda & Attanandana, 2015; Sælensminde, 2004).

 doi:10.20944/preprints202507.0177.v1

Moreover, CVM is advantageous for this study for three reasons. Firstly, relevance to Public Goods: AM infrastructure, especially in suburban educational environments like KMITL, exhibits non-excludable and non-rival characteristics typical of public goods. CVM enables capturing users' valuation of these improvements in monetary terms. Secondly, suitability for Policy Decision-Making: Economic valuations derived from CVM help translate qualitative preferences into quantifiable metrics, supporting cost-benefit analysis (CBA) frameworks for public-sector investments in Thailand and other middle-income countries. Lastly, precedent in Similar Contexts: Previous Thai WTP studies have successfully employed CVM for evaluating pedestrian infrastructure in urban cores (e.g., Benjasiri, 2015), yet suburban contexts remain underexplored. Applying CVM in this study extends its utility to suburban environments, providing valuable inputs for Thailand's National Strategy on Environmentally Sustainable Transport. To minimize potential bias often associated with CVM (e.g., hypothetical bias), the study employed a double-bounded dichotomous choice format in the survey instrument, following best-practice recommendations for enhancing precision (Bateman et al., 2002; Hanemann, 1994).

3. Methodology

3.1. Study Area Justification

This study was conducted at King Mongkut's Institute of Technology Ladkrabang (KMITL) and its surrounding neighbourhoods, representing a suburban university campus within Bangkok, Thailand. Suburban campuses like KMITL provide a valuable context for evaluating Active Mobility (AM) promotion due to their diverse populations of daily commuters—including students, staff, and local residents—and the typical gaps in pedestrian and cycling infrastructure.

KMITL was specifically selected as a representative microcosm of Thailand's broader urban mobility challenges, particularly in middle-income countries experiencing rapid urbanization and increasing reliance on motorized transport. Despite the campus's compact and walkable layout, 44% of users still rely on motorcycles, reflecting the country's strong motorization trend (Boon-or & Limpasenee, 2020). Additionally, 73% of users live within a 3 km radius, making the setting highly suitable for targeted AM interventions. This context aligns with international trends in campus-based AM research (Cervero et al., 2009), offering a scalable model for promoting sustainable transport behaviours in suburban and educational environments across Thailand.

3.2. Research Design

A mixed-methods approach was adopted to identify key AM measures and estimate the public's willingness to pay (WTP) for them. This design comprised three sequential stages:

3.2.1. Measure Selection Process

To ensure the relevance of measures selected for economic appraisal, the study combined qualitative and quantitative stages: Qualitative Phase: SWOT analyses of walking and cycling at KMITL were conducted using 24 in-depth interviews with students, staff, and local road users (Meesit et al., 2023). This provided rich contextual understanding of AM barriers and priorities. Pilot Survey: A pilot survey with 36 participants was conducted to test the WTP survey instrument. Respondents evaluated six AM-related measures identified from the qualitative stage including development of public transport connections, architectural improvements to pedestrian and bicycle paths, installation of resting areas, enhancements to pedestrian crossings, motorcycle barriers on sidewalks, and security improvements (e.g., lighting, CCTV)

Results from the pilot indicated that three measures emerged as highest-priority interventions based on initial WTP values and qualitative feedback: Development of public transport systems integrated with AM (to improve multimodal connectivity, especially where walkable/bikeable trips alone may be impractical in suburban settings); Architectural improvements of footpaths and bicycle lanes; and A combined package of public transport connectivity with enhanced security features.

Note that while public transport itself is not strictly AM, it functions as a complementary mode by supporting "first-mile/last-mile" walking and cycling trips (Pucher & Buehler, 2010; WHO HEAT Guidance, 2021).

3.2.2. Survey Instrument

The final survey employed a double-bounded dichotomous choice format using the Contingent Valuation Method (CVM). Respondents were asked whether they would be willing to pay a stated amount for each measure; based on their answer, they were presented with a higher or lower follow-up bid to estimate their maximum WTP. This approach is widely recommended in environmental and transport valuation studies to reduce bias and increase estimate precision (Bateman et al., 2002). The Contingent Valuation Method (CVM) is a survey-based economic technique used to determine individuals' WTP for non-market goods by presenting respondents with hypothetical scenarios. In this study, each scenario described specific AM infrastructure improvements, and participants were asked whether they would pay a proposed amount for their implementation.

A **double-bounded dichotomous choice** format was used to enhance precision and reduce starting point bias. Respondents were first given an initial bid amount and asked for a yes/no response. Depending on their answer, they were subsequently presented with a **higher or lower follow-up bid** to approximate their maximum WTP (Bateman et al., 2002; Hanemann, 1994).

The underlying utility framework assumes that a respondent will accept a bid **B** if their perceived utility of the improved AM infrastructure with payment exceeds that of the status quo:

$$U(\text{Improvement with Payment}) \geq U(\text{Status Quo without Payment}) \quad (1)$$

The probability of accepting a given bid amount can be modeled as:

$$P(Yes) = 1 / (1 + \exp(-(\alpha + \beta B + \gamma X))) \quad (2)$$

Where:

- **P(Yes)** = Probability of a respondent accepting the bid
- **α** = Constant term
- **β** = Coefficient of the bid amount (expected to be negative)
- **B** = Bid amount presented to respondent
- **γ** = Vector of coefficients for explanatory variables
- **X** = Vector of respondent characteristics (e.g., income, gender, travel behavior)

By analyzing the responses using **binary logistic regression**, the study estimates how **bid amounts** and **respondent characteristics** influence the likelihood of WTP.

3.2.3. Sampling

Given a total study population of approximately 27,357 individuals (including 24,909 students and 2,448 staff at KMITL as of 2020), a sample size of 400 respondents was calculated using Yamane's formula (1967) with a 5% margin of error. The sample was stratified to ensure representation across key groups: students, academic staff, non-academic employees, and local business operators.

3.2.4. Questionnaire Design

The questionnaire comprised two sections: (1) demographic and travel behaviour questions (e.g., gender, income, travel mode), and (2) AM factor questions (e.g., infrastructure preferences, safety measures). An initial list of 50 AM measures was derived from the qualitative findings, literature review (e.g., Methorst et al., 2010), and Thai AM studies (Pongphonrat et al., 2015). A pilot survey (n=36) tested question clarity and relevance, leading to the selection of 44 measures (Table 1) based on respondent feedback and expert consultation (urban planners, transport engineers). The pilot sample size, while small, aligns with CVM pilot studies (Hanemann, 1994), and its limitations are addressed in Section 6.

3.2.5. Measure Selection

The 44 measures (Table 1) were categorized into five domains: physical infrastructure (e.g., separated lanes), safety/security (e.g., CCTV), amenities (e.g., rest areas), promotion (e.g., media campaigns), and policy (e.g., public transport integration). Measures like public transport connections were included as complementary to AM, enhancing first/last-mile accessibility (Pucher & Buehler, 2008). The selection process ensured alignment with SWOT findings (e.g., addressing "motorcycle threats" with protective barriers) and global AM best practices.

Table 1. Selected AM measures for quantitative survey.

Domain	Measure	Description	Source
Physical Infrastructure	Separate	Separation of pedestrian and bicycle lanes	SWOT, Pucher & Buehler (2008)
	Architecture	Beautiful architectural design (e.g., landmarks)	Qualitative interviews
	Roof	Pedestrian covered walkways	UddC (2015)
Safety/Security	Motor Protection	Barriers to prevent motorcycles on sidewalks	SWOT, Pongphonrat et al. (2015)
	CCTV	CCTV in high-risk areas	Qualitative interviews
	Safe Crossing	Clear crossings with safety technology	Sansanee Sangsila (2012)
Amenities	Rest Area	Rest areas along paths	SWOT, Methorst et al. (2010)
	Water Station	Drinking water points	Qualitative interviews
	Bicycle Parking	Sufficient bicycle parking	Bordagaray et al. (2015)
Promotion	Promote	Offline/online media campaigns	Qualitative interviews
	Application	AM information apps	Literature review
Policy	Public Tran	Public transport integration	Pucher & Buehler (2008)
	Service Centre	Violation notification centres	Qualitative interviews

3.3. Econometric Analysis

To analyse the factors influencing WTP, binary logistic regression models were employed for each measure. This statistical method estimates the likelihood of a respondent being willing to pay (WTP = 1) versus not willing to pay (WTP = 0), based on a set of independent explanatory variables:

$$\text{logit}(P) = \ln(P/(1-P)) = \beta_0 + \beta_1 X_1 + \cdots + \beta_n X_n \quad (3)$$

Where:

- P = probability of WTP for a given measure
- X_n = independent variables (e.g., gender, age, income, distance to campus, travel habits, motivation for AM)
- β_n = estimated coefficients interpreted as odds ratios (Exp(B))

The independent variables were derived from the quantitative questionnaire and included demographic, socioeconomic, and travel-behaviour characteristics (Table 2). A preliminary correlation analysis was conducted to check for multicollinearity among variables. The models were selected based on Nagelkerke R Square values for explanatory strength and statistical significance of individual variables at 90%, 95%, and 99% confidence levels.

Table 2. SWOT analysis for walking.

Strength	Weakness	Opportunity	Threat
Exercise benefits	Hot weather	Prevent motorcycle encroachment	Improper motorcycle behaviour
Cost savings	Long travel times	Smoother road surfaces	Bad road surfaces
Enjoy surroundings	Insufficient sidewalk width	Adequate lighting	Waterlogging
			Insufficient lighting

3.4. Social Benefit Estimation

To evaluate the overall social benefits of AM promotion, the aggregate WTP of survey respondents was scaled to the study population to estimate potential annual benefits. These were compared with cost estimates for implementing each measure to calculate key economic indicators including Benefit-Cost Ratio (B/C), Net Present Value (NPV), and Economic Internal Rate of Return (EIRR) Sensitivity analysis was conducted to assess the robustness of economic viability under varying assumptions of: Proportion of population benefiting, Operation and maintenance (O&M) costs, and Discount rate.

4. Results and Discussion

4.1. Qualitative Findings: SWOT Analysis

The SWOT analysis (Tables 2 and 3) revealed key strengths, weaknesses, opportunities, and threats for walking and cycling at KMITL. Walking's strengths included exercise benefits and cost savings, but weaknesses such as hot weather and long travel times were prominent. Cycling was valued for convenience but hindered by unsafe shared lanes and inadequate bicycle lights. Opportunities for both modes included improved infrastructure (e.g., separated lanes, lighting), while threats such as motorcycle encroachment and poor road surfaces persisted.

Table 3. SWOT analysis for cycling.

Strength	Weakness	Opportunity	Threat
Exercise benefits	Skirt-wearing challenges	Prevent motorcycle encroachment	Improper motorcycle behaviour
Faster than walking	Small headlight/taillight	Bicycle-sharing system	Poor road sharing
	Inadequate bicycle lanes	Improved bicycle lanes	

4.2. Quantitative Findings: Respondent Characteristics

The survey (n=400) captured a diverse sample: 53% male, 83% under 26 years, 80% students, and 40% with incomes <10,000 THB (~$303 USD, 1 USD = 33 THB in 2021). Most lived within 3 km of KMITL (73%), with 44% using motorcycles and 32% walking as primary modes. Travel costs were

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low (58% spent ≤20 THB daily), and 84% expressed willingness to switch to AM if infrastructure improved (Table 4).

Table 4. Descriptive statistics.

Variable	N	Mean	SD	Min	Max	Median
SECTION 1: DEMOGRAPHIC QUESTIONS						
Gender (0=Male, 1=Female)	400	0.53	0.5	0	1	1
Age	400	23.6	7.53	17	70	21
Marital Status	400	1.14	0.46	1	4	1
Education Level	400	3.86	0.62	1	5	4
Career	400	1.39	0.91	1	5	1
Income	400	2.03	1.16	1	5	2
Bicycle Ownership	400	0.34	0.47	0	1	0
Distance to University (km)	400	7.47	10.1	0	80	2
Travel Cost	400	45.9	66.5	0	500	20
Frequent Mode of Transport	400	2.55	1.2	1	5	3
Daily Distance for Walking or Cycling	400	2.02	1.01	1	4	2
Factors Influencing Transport Choice	400	4.23	1.81	1	7	4
Intention to Switch to Active Mobility	400	0.84	0.37	0	1	1
SECTION 2: ACTIVE MOBILITY FACTOR QUESTIONS						
Separation of Pedestrian and Bicycle Lanes	400	3.91	1.16	1	5	4
Planting Around the Pedestrian and Bicycle Lanes	400	3.59	1.07	1	5	4
Architectural Design	400	3.65	1.09	1	5	4
Protection Against Motorcycle Incursions	400	3.91	1.17	1	5	4
CCTV for Security	400	4.02	1.06	1	5	4
Security Checkpoints	400	3.69	1.11	1	5	4
Emergency Communication Devices	400	3.67	1.12	1	5	4
Safe Crossings and Intersections	400	4.04	1.08	1	5	4
Covered Walkways for Pedestrians	400	3.88	11.7	1	5	4
Sufficient Lighting at the Pedestrian and Bicycle Lanes at Night	400	4.09	1.1	1	5	4
Sufficient and Suitable Bins	400	3.85	1.1	1	5	4
Road Signs and Maps for Pedestrian and Bicycle Lane	400	3.77	1.12	1	5	4
Outdoor Workout Equipment	400	3.27	1.11	1	5	3
Rest Areas	400	3.73	1.07	1	5	4
Sufficient Bicycle Parking	400	3.74	1.14	1	5	4

A Service Point for Borrowing and Returning Bicycles Within the Institution's Area	400	3.62	1.08	1	5	4
Shower Spot and Lockers	400	3.26	1.13	1	5	3
Drinking Water Service Points	400	3.58	1.07	1	5	4
The Connection Point between Other Public Transport and Pedestrian or Bicycle Lanes	400	3.73	1.06	1	5	4
Pedestrian and Bicycle Lanes are Interconnected to Cover the Area	400	3.84	1.05	1	5	4
Promotion Through Offline and Online Media	400	3.48	1.08	1	5	4
Cleaning and Maintenance of Sidewalks and Bicycle Paths	400	3.94	1.1	1	5	4
Notification of Violation of the Use of Pedestrian and Bicycle Lane	400	3.81	1.05	1	5	4
Using the Area Around the Pedestrian and Bicycle Lanes to Organize Activities	400	3.38	1.05	1	5	3
Application to Provide Information and News About Walking and Cycling	400	3.46	1.09	1	5	4
Policy to Promote Walking or Bicycle by Giving Prizes or Charitable Donations	400	3.40	1.13	1	5	3
Pedestrian and Bicycle Photography or Video Contests	400	3.26	1.15	1	5	3
Walk or Bicycle Day Activities	400	3.32	1.23	1	5	3
Educating and Organizing Training on Safety Use of Pedestrian and Bicycle Lanes	400	3.49	1.08	1	5	4
Encouraging to Travel by Public Transport	400	3.74	1.01	1	5	4
Participation of Students or Staff in Presenting the Design of the Pedestrian or Bicycle Lanes Within the Institute	400	3.57	1.05	1	5	4
Determining Policies on Improving and Building Pedestrian on Campus	400	3.83	1.09	1	5	4

Figure 1 shows the motivation for the change in walking or cycling behavior of the sample. It was found that the respondents focused on two main issues including 31% of traffic safety, followed by good health at 30%. The least effect of motivation that the sample group responded on behavior change was the promotion campaign from the public and private sector accounted for only 5%. From these results it could be concluded that having health promotion policies and safe infrastructures may be the keys to making people to change travel behavior to AM mode.

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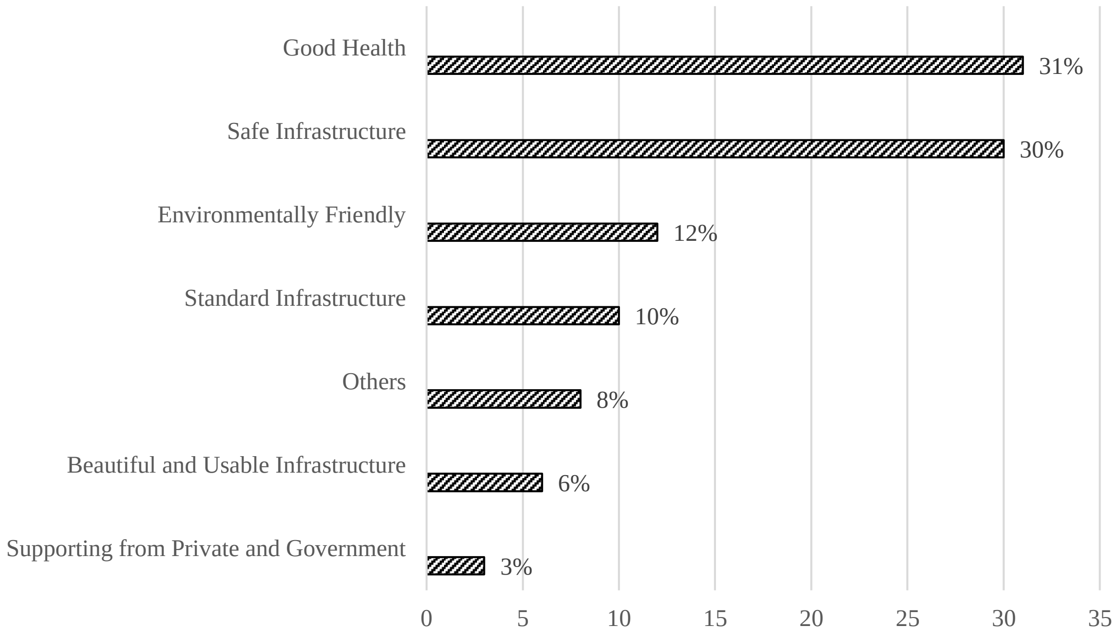

Figure 1. What factors will persuade your transport preference to walking or cycling?

4.3. Binary Logistic Regression Results

In this study, a binary logistic regression model was used to determine the factors that influence the change in transportation modes to active mobility (AM). The quantitative questionnaire used in this study yielded 44 variables that were used to construct the Binary Logistic Model. Among these variables, FutureTravBeh was the model dependent variable used to predict future travel behavior. It had two values: 1 (changed) and 0 (unchanged), while the other 43 variables were independent variables in the model. These variables included ratio variables such as age and travel expenses, dichotomous variables such as sex and having a bicycle, and polytomous variables such as occupation and travel style. The values of these variables were defined in the form of codes, and the definitions of each variable are shown in Table 5. The polynomial variables in the form of category variables were given default values, which were used as reference values and compared to other values in the model.

Table 5. the definitions of each variable.

Variable	**Definition**
Gen	Gender (0= male, 1= female)
Age	Age (year)
Status	Status (1= single, 2= married, 3= divorce, 4= others)
Edu	Education level (1= primary, 2=secondary, 3= diploma, 4= bachelor, 5= upper bachelor)
Career	Career (1= student, 2= staff, 3= lecturer, 4= merchant/personal business)
Income	Income (1= <10,000, 2= 10,000-15,000, 3= 15,001-20,000, 4= 20,001-25,000, 5=>25,000
Bicycle	The bicycle occupancy (yes: 1, no: 0)
Distance	In a typical day, what is the distance between your accommodation and university? (km)

TraCost	Travel cost (1= 0, 2= <20 bath, 3= <50 bath, 4= <150 bath, 5= >150 bath)
TraMode	Frequent mode of transport (1=walk, 2= bicycle, 3= motorcycle, 4= car, 5= others)
ActDistance	In a typical day, how many kilometers do you spend for walking or cycling? (1= <1 km, 2= 1-2 km, 3= 2-3 km, 4= >3 km
FutureTravBeh	If there is a development in walking and cycling infrastructure, are you going to switch the mode of transport to walking and cycling (0= yes, 1= no)
Separate	Separation of pedestrian and bicycle lanes (1=least significant, 2=less significant, 3=moderate significant, 4=significant, 5=very significant)
Tree	Planting around the pedestrian and bicycle lanes (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Architecture	Architectural design that looks beautiful, such as having a landmark, etc. (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
MotorProtection	Protection to prevent motorcycles from running on the sidewalk (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
CCTV	CCTV for security in risk areas (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
CheckPoint	Checkpoints for security guards (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
EmerPhone	A device for contacting the staff in case of an emergency (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
SafeCrossing	Clear crossing, clear intersection and technology is used to increase security (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Roof	Pedestrian covered walkways (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Light	Sufficient lighting at the pedestrian and bicycle lanes at night (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
TrashCan	Sufficient and suitable bins (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Sign	Road signs and maps for pedestrian and bicycle lane (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)

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WorkoutEquipment	Outdoor workout equipment (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
RestArea	Rest areas (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
BicycleParking	Sufficient bicycle parking (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
BicycleRental	A service point for borrowing and returning bicycles within the institution's area (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
ShowerSpot	Shower spot and lockers (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
WaterStation	Drinking water service points (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
ConnectPubTran	The connection point between other public transport and pedestrian or bicycle lanes (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
NetworkConnection	Pedestrian and bicycle lanes are interconnected to cover the area (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Promote	Promotion through offline and online media (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Cleaning	Cleaning and Maintenance of sidewalks and bicycle paths (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
ServiceCentre	Notification of violation of the use of pedestrian and bicycle lane (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
OtherActivities	Using the area around the pedestrian and bicycle lanes to organize activities (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Application	Application to provide information and news about walking and cycling (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Charity	Policy to promote walking or bicycle by giving prizes or charitable donations (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)

PhotoCompet	Pedestrian and bicycle photography or video contests (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
WalkBday	Walk or Bicycle Day activities (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
EduWB	Educating and organizing training on safety use of pedestrian and bicycle lanes (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
PublicTran	EncouragING to travel by public transport (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Cooperate	Participation of students or staff in presenting the design of the pedestrian or bicycle lanes within the institute (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
OrgPolicy	Determining policies on improving and building pedestrian on campus (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)

The binary logistic regression model assessed factors influencing AM adoption, with a Nagelkerke R^2 of 0.505 ($p<0.05$), indicating a good fit (Table 6). The model accurately predicted 88.3% of cases (95.2% for non-switchers, 53% for switchers), suggesting robust explanatory power.

Table 6. Model suitability test results.

-2 Log Likelihood	Cox & Snell R^2	Nagelkerke R^2
216.385	0.299	0.505

Significant variables (Table 7) included demographic, travel behaviour, and infrastructure factors. Key findings are:

- Demographics: Males were less likely to switch to AM (OR=0.512, p=0.096), possibly due to cultural preferences for motorized transport. Higher-income groups (15,001–20,000 THB) were 88.6% less likely to switch (OR=0.114, p=0.004) compared to the <10,000 THB reference group.
- Travel Behaviour: Higher daily travel costs increased AM likelihood slightly (OR=1.008, p=0.044). Motorcycle (OR=0.171, p=0.002) and car users (OR=0.136, p=0.004) were significantly less likely to switch compared to walkers/cyclists.
- Infrastructure: Beautiful architectural design (OR=1.695, p=0.045), rest areas (OR=1.820, p=0.034), CCTV (OR=1.726, p=0.060), protective barriers (OR=1.608, p=0.086), and safe crossings (OR=1.650, p=0.056) increased AM likelihood. Public transport integration was highly influential (OR=2.192, p=0.005).
- Promotion: Media campaigns (OR=0.576, p=0.039) and AM apps (OR=0.583, p=0.038) negatively affected AM adoption, suggesting infrastructure priorities over promotion.

Table 7. Binary logistic regression results.

Variable	**B**	**S.E.**	**Wald**	**Sig.**	**OR(Exp(B))**
Gen	-0.669	0.402	2.764	0.096*	0.512

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Age	-0.014	0.028	0.268	0.605	0.986
Edu (1)	0.127	1.936	0.004	0.948	1.136
Edu (2)	-0.486	1.938	0.063	0.802	0.615
Edu (3)	0.765	1.858	0.169	0.681	2.148
Edu (4)	1.786	2.022	0.780	0.377	5.966
Income (1)	0.400	0.487	0.675	0.411	1.492
Income (2)	-1.215	0.672	3.270	0.071*	0.297
Income (3)	-2.174	0.752	8.363	0.004***	0.114
Income (4)	-1.426	0.937	2.316	0.128	0.240
Bicycle	0.666	0.450	2.188	0.139	1.947
Distance	0.023	0.030	0.582	0.445	1.023
TraCost	0.008	0.004	4.044	0.044**	1.008
TraMode (1)	0.310	1.430	0.047	0.829	1.363
TraMode (2)	-1.768	0.561	9.917	0.002***	0.171
TraMode (3)	-1.995	0.699	8.138	0.004***	0.136
ActDistance (1)	0.203	0.474	0.183	0.669	1.224
ActDistance (2)	-0.425	0.607	0.491	0.484	0.654
ActDistance (3)	-0.539	0.649	0.688	0.407	0.584
Separate	0.150	0.273	0.302	0.583	1.162
Tree	-0.456	0.279	2.677	0.102	0.634
Architecture	0.528	0.263	4.013	0.045**	1.695
MotorProtection	0.475	0.277	2.952	0.086*	1.608
CCTV	0.546	0.290	3.545	0.060*	1.726
CheckPoint	-0.297	0.260	1.305	0.253	0.743
EmerPhone	-0.249	0.258	0.932	0.334	0.779
SafeCrossing	0.501	0.261	3.667	0.056*	1.650
Roof	-0.410	0.295	1.933	0.164	0.663
TrashCan	-0.340	0.281	1.460	0.227	0.712
Sign	0.111	0.251	0.193	0.660	1.117
WorkoutEquipment	-0.103	0.259	0.157	0.692	0.902
RestArea	0.599	0.282	4.500	0.034**	1.820
BicycleParking	-0.057	0.252	0.052	0.820	0.944
BicycleRental	0.256	0.284	0.813	0.367	1.291
ShowerSpot	-0.372	0.286	1.697	0.193	0.689
WaterStation	-0.419	0.306	1.878	0.171	0.658
ConnectPubTran	-0.061	0.321	0.037	0.848	0.940
Promote	-0.552	0.267	4.271	0.039**	0.576

Cleaning	0.253	0.275	0.846	0.358	1.288
ServiceCentre	0.558	0.292	3.660	0.056*	1.747
OtherActivities	0.269	0.245	1.197	0.274	1.308
Application	-0.540	0.260	4.303	0.038**	0.583
Charity	0.132	0.244	0.292	0.589	1.141
PhotoCompet	0.315	0.251	1.570	0.210	1.370
WalkBday	-0.325	0.246	1.734	0.188	0.723
EduWB	0.306	0.245	1.556	0.212	1.358
PublicTran	0.785	0.279	7.923	0.005***	2.192
Cooperate	-0.317	0.264	1.449	0.229	0.728
OrgPolicy	-0.034	0.280	0.015	0.904	0.967
Constant	-2.165	2.414	0.805	0.370	0.115

Note: * = $p<0.10$, ** = $p<0.05$, *** = $p<0.01$.

The model suggests infrastructure improvements could increase daily AM duration by 8–16 minutes per person, based on respondent willingness to switch (84%) and typical AM distances (1–2 km, 35%). While modest, this aligns with health benefits from short AM bouts (Clark & Stigell, 2017). For example, rest areas (OR=1.820) address hot weather fatigue (SWOT weakness), potentially encouraging longer walking/cycling trips.

The findings align with global AM research emphasizing infrastructure's role in behaviour change (Pucher & Buehler, 2008). Safety measures like CCTV and protective barriers address Thai-specific concerns about motorcycle encroachment (Pongphonrat et al., 2015), while rest areas cater to climatic challenges (UddC, 2015). The negative effect of media campaigns contrasts with studies advocating promotion (Bordagaray et al., 2015), suggesting infrastructure should precede promotion in Thailand.

Males' lower AM likelihood (OR=0.512) may reflect cultural preferences for motorized transport as status symbols in Thailand (Boon-or & Limpasenee, 2020). This warrants targeted campaigns to normalize AM among males, drawing on successful European strategies (Pucher & Buehler, 2008).

5. Conclusion

This study investigated road users' attitudes toward active mobility (AM) at King Mongkut's Institute of Technology Ladkrabang (KMITL), a suburban university in Bangkok, Thailand, to identify factors influencing the adoption of walking and cycling. Employing a mixed-methods approach grounded in the Theory of Planned Behaviour (TPB), including qualitative SWOT analysis, a stated preference survey (n=400), and binary logistic regression, the study provides robust empirical insights into context-specific AM preferences in Thailand.

The findings reveal that infrastructure improvements, safety measures, and amenities significantly drive AM adoption. Rest areas (OR=1.820, p=0.034), CCTV (OR=1.726, p=0.060), protective barriers against motorcycles (OR=1.608, p=0.086), and public transport integration (OR=2.192, p=0.005) emerged as critical facilitators, addressing local barriers such as hot weather and unsafe sidewalks. Demographic factors also shaped AM adoption: males (OR=0.512, p=0.096) and higher-income groups were less likely to switch to AM, reflecting cultural preferences for motorized transport. Promotional efforts alone were insufficient, with media campaigns (OR=0.576, p=0.039) and AM apps (OR=0.583, p=0.038) reducing adoption, highlighting the need to prioritize infrastructure first.

These findings contribute to filling a key geographic gap in global AM literature by providing new evidence from a Southeast Asian middle-income context. The study demonstrates that suburban

 doi:10.20944/preprints202507.0177.v1

university campuses are promising testbeds for AM promotion and offers a scalable model for similar settings across Thailand.

Policy Recommendations

- Infrastructure First: Invest in rest areas, CCTV, and protective barriers before launching promotional campaigns.
- Integrate Public Transport: Strengthen first/last-mile connections with trams or bike-sharing.
- Targeted Campaigns: Tailor campaigns to address gender and cultural attitudes, particularly focusing on normalizing AM among males.
- Pilot and Scale: Test interventions at KMITL with pre/post evaluation and expand to other Thai campuses.

6. Limitations and Future Research

While the small pilot survey may limit generalizability, triangulation with qualitative findings supports the reliability of selected measures. Future research should employ larger samples, longitudinal designs, and explore psychological and cultural factors in greater depth, potentially incorporating behavioural models such as the Transtheoretical Model.

In conclusion, targeted infrastructure investments, combined with integrated transport planning and context-specific behavioural strategies, can significantly advance AM adoption in Thailand, contributing meaningfully to both national sustainability goals and global efforts to promote healthier, more liveable cities.

Author Contributions*:* Conceptualization, P.C. and R.M.; methodology, P.C.; validation, R.M., S.S. and P.C.; formal analysis, R.M. and S.S.; investigation, S.P.; resources, S.P.; data curation, S.P.; writing—original draft preparation, R.M. and S.S.; writing—review and editing, P.C. and M.H.; supervision, P.C.; project administration, S.A.; funding acquisition, R.M. All authors have read and agreed to the published version of the manuscript.

Funding: This work is funded by the WHO-Royal Thai Government (RTG) Country Cooperation Strategy (CCS) 2017-2021 on road safety.

Acknowledgements: This work is supported by the WHO-Royal Thai Government (RTG) Country Cooperation Strategy (CCS) 2017-2021 on road safety.

Conflicts of Interest: The authors declare no conflict of interest.

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