

Determinants of Sustainable Biking as an Alternative Mode of Transport in Ibadan, Nigerian

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Abstract

Rapid urbanization in Nigeria has intensified traffic congestion, environmental degradation, and public health concerns, and economic loss, highlighting the need for sustainable mobility alternatives. Existing research focuses on psychological determinants separately from the environmental, and on the physical and infrastructural determinant within which travel behaviour occurs. Consequently, there is a need for empirical study that integrates all variables for better understanding of the impact on adoption of cycling. This study investigates the determinants of cycling behaviour in Ibadan using an integrated framework based on the Theory of Planned Behavior (TPB) and the Ecological Model of Active Transportation. A convergent mixed-methods design was employed, involving questionnaire surveys administered to 150 urban commuters and semi-structured interviews conducted with 7 commuters, transport planners, and cycling advocates. Quantitative data were analysed using descriptive statistics, multiple linear regression, and binary logistic regression, while qualitative data were examined through thematic analysis. The results indicate that TPB constructs significantly predict cycling intention ($R^2 = 0.41$), with perceived behavioural control emerging as the strongest predictor ($\beta = 0.48$, $p < 0.001$). However, actual cycling behaviour was influenced primarily by contextual factors. Perceived infrastructure safety significantly increased the likelihood of regular cycling ($OR = 4.20$, $p < 0.001$), whereas private car ownership substantially reduced participation ($OR = 0.20$, $p = 0.001$). Qualitative findings further revealed concerns regarding inadequate cycling infrastructure, destination security, and the potential of electric bicycles to overcome physical and environmental constraints.. The study concludes that cycling adoption in Ibadan is shaped more by infrastructural, institutional, and policy conditions than by individual intentions, stressing the need for integrated transport interventions.

Keywords: Sustainable urban mobility; active transportation; cycling behaviour; Biking, Planned Behavior; Ibadan; Nigeria.

1.0. Introduction

As cities continue to grow across the twenty-first century, transit mobility has become central to socioeconomic development, particularly in Nigeria and other sub-Saharan African countries where urban transport systems remain characterized by a preference for private vehicle use and a strong reliance on informal paratransit services such as okadas (commercial motorcycles), kekes (tricycles), and minibuses (Afenyo & Adjei, 2022). This auto-centric trajectory has locked cities into an unsustainable cycle marked by severe traffic gridlock that drains urban productivity, worsening vehicular emissions that compromise public health, and an increasingly sedentary urban population prone to cardiovascular and other non-communicable diseases (Oyeyemi et al., 2019).

In response to these challenges, contemporary urban planning increasingly emphasizes active transportation, particularly walking and cycling, as viable alternatives to motorized travel. These modes offer space-efficient, zero-emission, and health-promoting alternatives to motorized gridlock. While global cities like Amsterdam, Copenhagen, Bogotá, and Seville demonstrate that targeted municipal policies and infrastructure investments can elevate cycling from a recreational pastime to a mainstream transit choice (Pucher and Buehler, 2021), Nigerian cities have yet to see any significant adoption of active transport.

The barriers to non-motorized transit in Nigeria are structurally deeply embedded. Decades of urban road design have ignored non-motorized transport components along high-density corridors, leaving the few who attempt to walk or cycle highly exposed to severe safety risks and fatal collisions with aggressive motorized traffic (Ogendi et al., 2023). Compounding this infrastructure deficit, recent macroeconomic shocks—notably the abrupt removal of fuel subsidies—have caused transport fares to skyrocket, plunging average commuters into deeper economic vulnerability and underscoring the urgent need for affordable, self-sustaining transit options (Opiyo and Adebayo, 2024).

However, designing effective interventions requires a clearer understanding of the behavioral, cultural, and environmental variables that dictate whether a commuter will choose a bicycle over a motorized alternative. This empirical study moves away from reductive, single-variable assumptions to analyze the multifaceted determinants driving or inhibiting bicycle adoption within Ibadan—a sprawling, high-density metropolitan hub in southwestern Nigeria that typifies the contemporary sub-Saharan urban crisis.

1.1 Justification for the study

The rationale for this study stems from important gaps in the existing body of knowledge on cycling and sustainable urban mobility. Although previous studies have extensively documented the environmental, health, and economic benefits associated with cycling (de Hartog et al., 2010), as well as the influence of individual behavioural factors on cycling decisions (Heinen et al., 2010), the literature remains largely fragmented in its treatment of the determinants of cycling behaviour. Existing research has often examined psychological factors, such as attitudes, intentions, and perceived behavioural control, independently of the broader environmental and institutional contexts within which travel decisions occur. Conversely, studies focusing on infrastructure and urban design have frequently emphasized the role of the built environment while giving less attention to the cognitive and social processes that shape individual mobility choices.

As a result, there remains limited empirical evidence on how psychological, social, institutional, and environmental factors interact to influence cycling behaviour. Addressing this gap is essential for developing a more comprehensive understanding of the mechanisms underlying cycling adoption and sustained participation (Winters et al., 2010).

A further limitation of the literature is its strong concentration in Northern European countries, where cycling has long been supported by established cycling cultures, extensive infrastructure networks, and favourable policy environments. The transferability of findings from these contexts to cities in developing countries is often uncertain due to marked differences in socioeconomic conditions, transport systems, urban form, and cultural attitudes toward cycling. Consequently, there is a need for context-specific evidence from rapidly urbanizing cities where cycling infrastructure remains limited and motorized transport continues to dominate urban mobility.

This study seeks to address these gaps by adopting an integrated analytical framework that simultaneously considers individual, social, institutional, and environmental influences on cycling behaviour. By doing so, it contributes to a more nuanced understanding of active transportation in developing urban contexts and provides evidence to support the formulation of effective and contextually appropriate mobility policies.

1.2 Research Questions

This study seeks to examine the factors influencing the adoption and sustained use of cycling as a mode of urban transport in Nigeria. Specifically, it addresses the following research questions:

1. How do individual psychological factors, including attitudes, subjective norms, and perceived behavioural control, influence commuters' intentions to adopt cycling for urban travel?
2. What is the effect of the built environment, particularly cycling infrastructure and traffic safety conditions, on the adoption of cycling as a transport mode?
3. How do socio-demographic characteristics and institutional factors facilitate or constrain the use of cycling for daily commuting?

1.3 Aim and Objectives

The aim of this study is to investigate the individual, environmental, socio-demographic, and institutional factors that influence the adoption and continued use of cycling as a sustainable mode of urban transport in Nigerian cities.

To achieve this aim, the following objectives were set:

1. To examine the influence of individual psychological factors, including attitudes, subjective norms, and perceived behavioural control, on commuters' intentions to cycle.
2. To assess the effect of cycling infrastructure and perceived traffic safety on the actual use of bicycles for urban commuting.
3. To evaluate the roles of socio-demographic characteristics, particularly income and household vehicle ownership, in shaping cycling behaviour.
4. To examine the extent to which institutional factors, including workplace support measures and transport-related policies, encourage or hinder the adoption of cycling for daily travel.

1.4 Study Area

Ibadan North Local Government Area (LGA) was selected as the study area for this research. Ibadan North LGA is a prominent administrative and municipal entity located within the Ibadan Metropolis of Oyo State, South-Western Nigeria (Durowoju, 2022). It stands out as a highly cosmopolitan hub within the larger municipal configuration of Ibadan (Alabi et al., 2024; Durowoju, 2022).

Geographically, the local government area is defined by its strategic spatial coordinates (Figure 3). The Ibadan North LGA lies approximately between latitudes 7°23'N and 7°29'N of the Equator, and longitudes 3°53'E and 3°59'E of the Greenwich Meridian (Adebola, 2005; Durowoju, 2022; Olawuyi & Adeoye, 2018). The administrative headquarters of Oyo State, the State Secretariat complex situated in the Agodi area, falls within this local government boundary at specific coordinates of 7°24'35"N and 3°54'28"E (Olawuyi & Adeoye, 2018).

In terms of its boundaries and territorial extent, Ibadan North LGA covers a significant land mass area estimated at approximately 145.58km square (Durowoju, 2022). It shares contiguous political and spatial boundaries with five other local governments, making it a critical transit corridor for non-motorized and informal transport modes. In the North side, it is bounded by Akinyele Local Government Area (Durowoju, 2022), in the West by Ido Local Government Area and Ibadan North-West Local Government Area (Durowoju, 2022), in the East by Lagelu, Egbeda, and Ibadan

North-East Local Government Areas (Durowoju, 2022), and in the South it connects into the core municipal patterns of Ibadan South-East Local Government Area. Regarding the demographic and Socio-Economic profile of Ibadan North LGA, the National Population Commission (NPC) 2006 census data, the population of Ibadan North LGA was recorded at 306,795 residents (Adebola, 2005). Projections based on urban growth metrics updated the population of this specific local government to approximately 432,900 people (Durowoju, 2022). This high population density generates significant intra-city traffic volumes, elevating the demand for sustainable and flexible modal alternatives such as active biking.

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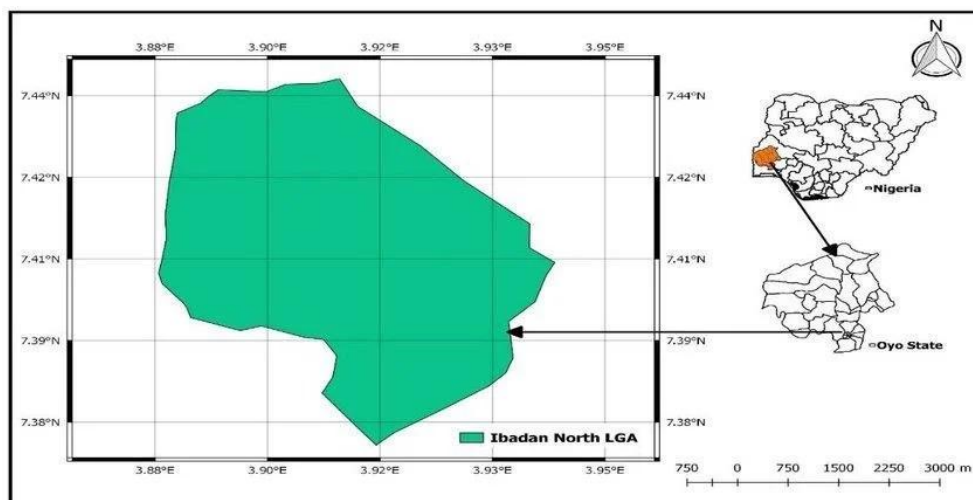


Fig 1: Ibadan North Local Government Areas

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Economically, the study area plays host to major institutional, institutional-residential, and commercial nerve centers. Notably, the premier University of Ibadan (UI), the Bodija Market and the highly active Bodija Plank Market (Ugege, 2015), a dense network of formal public sector institutions, housing a substantial portion of the state's civil service workforce (Olawuyi & Adeoye, 2018).

2.0 Literature Review and Conceptual Framework

This section presents literature review and conceptual framework. The review covers Determinants of Utilitarian Cycling, Environmental and Infrastructural Determinants, Socio-Economic and Institutional Determinants, and Intrapersonal and Psychological Determinants.

2.1 Literature Review

2.1.1 Determinants of Utilitarian Cycling

The factors influencing utilitarian cycling are multidimensional and can be broadly grouped into three interrelated domains: environmental and infrastructural conditions, socio-economic and institutional influences, and intrapersonal psychological factors. Contemporary research suggests that cycling behaviour emerges from the interaction of individual motivations, social contexts, and the physical environments in which travel occurs.

2.1.2 *Environmental and Infrastructural Determinants*

The built environment remains one of the most influential determinants of cycling participation. Studies consistently demonstrate that the availability of connected, continuous, and protected cycling infrastructure significantly increases cycling uptake by improving both actual and perceived safety among users (de Jong et al., 2023; Timmons et al., 2024). In contrast, environments where cyclists are required to share high-speed roadways with motorized vehicles often discourage cycling due to heightened exposure to traffic-related risks and stress (Haug et al., 2023). Prati et al.,(2022) and Battiston et al.,(2023) further point that perceptions of cycling safety vary across demographic groups, with women generally reporting greater concerns about road safety, driver behaviour, and the quality of cycling infrastructure than men.

Urban form characteristics also influence cycling behaviour. According to (de Jong et al., 2023; Schlosser et al., 2023), mixed land-use developments, compact neighbourhoods, and higher residential densities tend to shorten travel distances, thereby making cycling a more practical and attractive transport option for daily activities. Moreover, although physical constraints such as steep terrain and adverse weather conditions can discourage cycling, evidence suggests that their effects can be mitigated through high-quality infrastructure design and technological innovations such as electric bicycles (Timmons et al., 2024).

2.1.3 *Socio-Economic and Institutional Determinants*

Socio-economic characteristics also shape cycling participation. Previous studies, such as Martínez et al., (2023) and Battiston et al., (2023) have identified significant variations in cycling behaviour across gender, age, income, and educational groups, reflecting broader social and cultural inequalities in access to active mobility opportunities (Martínez et al., 2023; Battiston et al., 2023). Additionally, Martínez et al., (2023) posit that in many developing countries, cycling remains more common among younger individuals and lower-income populations, partly because it provides an affordable alternative to motorized transport.

Vehicle ownership represents another important determinant. According to Timmons et al., (2024), the acquisition of private automobiles is frequently associated with reduced dependence on active transport modes, reinforcing long-term travel habits centred on motorized mobility.

Research also indicates that, beyond individual socio-economic factors, institutional support plays a crucial role in promoting cycling. Government investments in cycling networks, traffic-calming measures, and active transport policies contribute to creating supportive environments that encourage cycling adoption (Timmons et al., 2024; Lonardi et al., 2024). At the organizational level, workplace initiatives such as secure bicycle parking facilities, changing rooms, shower facilities, and cycling incentive programmes have been shown to encourage employees to adopt cycling as a regular commuting mode (Behavioural Interventions Review, 2024).

2.1.4 *Intrapersonal and Psychological Determinants*

Individual attitudes and psychological factors are equally important in explaining cycling behaviour. The Theory of Planned Behavior (TPB) remains one of the most widely applied frameworks for understanding active travel decisions. According to this theory, cycling intentions are influenced by three key constructs: attitudes toward cycling, subjective norms, and perceived behavioural control (Machavarapu et al., 2023).

Expanding on these three keys, Machavarapu et al., (2023) posits that positive attitudes toward cycling—such as beliefs regarding health benefits, environmental sustainability, and financial savings—have been found to increase individuals' willingness to cycle. Similarly, supportive social norms from family members, friends, and colleagues can strengthen intentions to engage in active travel. Perceived behavioural control, which reflects an individual's confidence in their cycling abilities and capacity to overcome travel barriers, has also been consistently associated with higher levels of cycling participation.

However, Timmons et al., (2024) is of the opinion that behavioural intentions do not always translate into action. Established habits of private car use or dependence on public and paratransit systems often create behavioural inertia that limits the adoption of cycling even when favourable attitudes exist. Alluding to this, Haug et al., 2023; Prati et al., (2022) points that emotional factors such as fear of traffic collisions, anxiety arising from hostile road environments, and concerns about physical discomfort can reduce perceived behavioural control and discourage cycling participation.

Overall, current evidence indicates that utilitarian cycling is shaped by the combined influence of supportive infrastructure, favourable socio-institutional conditions, and positive psychological dispositions. Sustainable increases in cycling participation are therefore most likely to occur when interventions simultaneously address these environmental, social, and individual dimensions

2.2 Conceptual Framework

This study is anchored on the integration of the Theory of Planned Behavior (TPB) and the Ecological Model of Active Transportation. The combination of these complementary perspectives provides a comprehensive framework for understanding the complex factors influencing utilitarian cycling behaviour. While the TPB explains the cognitive processes underlying individual travel decisions, the ecological perspective broadens the analysis by incorporating environmental, social, organizational, and policy-related influences that shape active mobility choices.

The Theory of Planned Behavior, developed by Icek Ajzen (1991), posits that behaviour is primarily determined by behavioural intention, which is influenced by three constructs: attitude toward the behaviour, subjective norms, and perceived behavioural control. Attitude reflects an individual's positive or negative evaluation of performing a behaviour; subjective norms refer to perceived social expectations from significant others; and perceived behavioural control represents an individual's perception of their capability to perform the behaviour despite potential constraints (Ajzen, 1991). Within the context of cycling, favourable attitudes regarding health, environmental sustainability, and economic savings, together with supportive social norms and high levels of perceived competence, have been associated with stronger intentions to cycle and greater likelihood of cycling participation (Yang-Wallentin et al., 2022; Machavarapu et al., 2023).

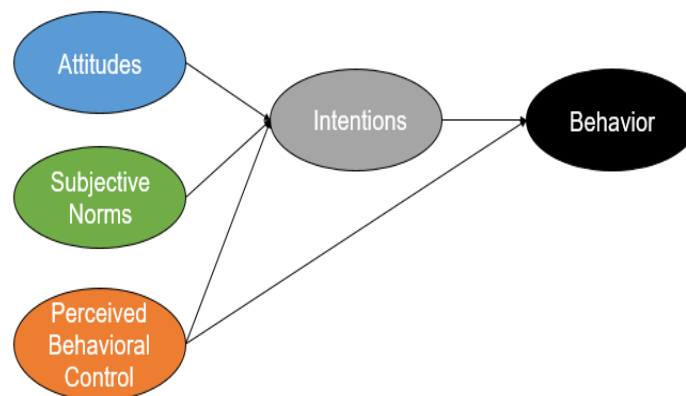


Fig.1 Theory of Planned Behavior (TPB)

Although the TPB has demonstrated considerable explanatory power in predicting travel behaviour, it has been criticized for placing greater emphasis on individual cognition while providing limited consideration of contextual factors that may facilitate or hinder behavioural outcomes (Panter et al., 2021). Consequently, behavioural intentions may not always translate into actual cycling behaviour where environmental and institutional conditions are unfavourable.

In response to this limitation, the present study incorporates the Ecological Model of Active Transportation, which conceptualizes travel behaviour as the outcome of interactions among multiple levels of influence (Sallis et al., 2006; Sallis et al., 2016). The ecological perspective recognizes that individual decisions are embedded within broader social, organizational, physical, and policy environments. At the intrapersonal level, factors such as attitudes, beliefs, knowledge, physical ability, and health status influence cycling behaviour. The interpersonal level encompasses social support, family influences, peer networks, and prevailing community norms. At the institutional level, organizational arrangements such as workplace policies, provision of bicycle parking facilities, shower amenities, and incentive programmes may encourage or discourage cycling. The community level focuses on characteristics of the built environment, including cycling infrastructure, street connectivity, land-use patterns, traffic conditions, and perceptions of safety. Finally, the policy level considers government regulations, transport planning strategies, investment priorities, and legislative measures that shape opportunities for active transportation (Sallis et al., 2006; Götschi et al., 2024).

The integration of the TPB and the Ecological Model provides a holistic framework for examining utilitarian cycling behaviour. The framework assumes that cycling behaviour is influenced by behavioural intentions derived from individual attitudes, subjective norms, and perceived behavioural control, while the translation of these intentions into actual behaviour is conditioned by social, environmental, organizational, and policy contexts. Accordingly, individuals with strong intentions to cycle may be discouraged by unsafe road conditions, inadequate cycling infrastructure, or unsupportive workplace environments. Conversely, favourable institutional arrangements and supportive built environments may facilitate cycling adoption even among individuals with relatively weak initial intentions. This integrated perspective is particularly relevant for understanding cycling behaviour in rapidly urbanizing cities, where individual

preferences interact continuously with structural and environmental conditions to shape mobility choices.

In order to establish a comprehensive analytical model capable of capturing both internal psychological conditions and external physical boundaries, this study adopted an integrated conceptual framework combining the Theory of Planned Behavior (TPB) and the Ecological Model of Active Transportation.

As illustrated below (Figure 3) above, the framework conceptualizes behavior as the dynamic outcome of nested layers of influence:

- Intrapersonal: Internal attitudes, self-efficacy, and physical cycling skills (directly corresponding to the core cognitive variables of the TPB).
- Interpersonal: Peer networks, familial safety anxieties, and localized cultural mobility stigmas.
- Communit/Institutional: Micro-organizational rules, employer support, and corporate commuting facilities.
- Built Environment: Macro urban form, infrastructure network connectivity, lane separation, and physical traffic safety levels.
- Public Policy: Comprehensive transport budgets, national highway design standards, and municipal non-motorized transport master plans.

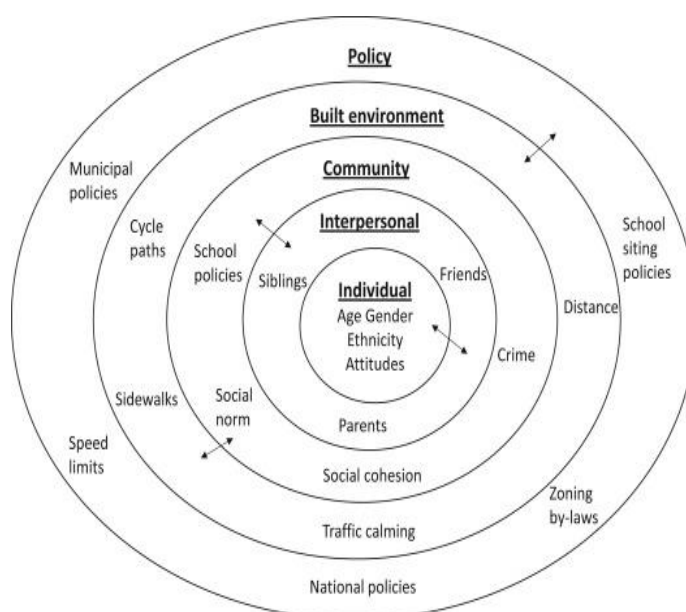


Fig. 3: Ecological Model of Active Transportation.

By synthesizing these two paradigms, our conceptual model posits that while internal cognitive constructs dictate an individual's *intention* to cycle, the physical transition to *actual behavior* is strictly enabled or constrained by the external environmental and institutional layers of the Ecological Model. This integrated view provides a direct explanation for the "attitude-behavior

gap"—acknowledging that highly motivated individuals with strong pro-environmental intent will ultimately fail to cycle if forced to navigate unsafe infrastructure or unsupportive workplace environments.

3.0 Methodology

This section presents the research design and method of data collection from the respondents in the study area, the type of instrument to be used for data collection, the type of data analysis to be carried out.

3.1 Sampling frame, Sampling size and data Collected Procedure

This study adopted a mixed-method design and used a cross-sectional survey to obtain data from respondents residing in Ibadan North Local Government Area of Oyo State. The selection of Ibadan North LGA is due to its demographic configuration that is highly diverse, combining high-income residential zones, civil servant quarters, vibrant student communities, and dense informal commercial clusters. This socio-economic heterogeneity makes it an ideal canvas to measure how varied user demographics act as determinants for adopting sustainable biking. Due to financial constraints and consideration for fast data collection, a sample frame of 150 respondents (at a 95% confidence level,) from a sample frame of 306,795 residents were randomly administered with structured questionnaire on influence of individual psychological factors (including attitudes, subjective norms, and perceived behavioural control) on commuters' intentions to cycle, the effect of cycling infrastructure and perceived traffic safety on the actual use of bicycles for urban commuting, roles of socio-demographic characteristics (income and household vehicle ownership), in shaping cycling behaviour, and the extent to which institutional factors (workplace support measures and transport-related policies) encourage or hinder the adoption of cycling for daily travel. Quantitative data were collected from 7 key informant. The interviews explored participants' perceptions of cycling, motivations for cycling adoption or avoidance, infrastructural challenges, safety concerns, institutional support mechanisms, and policy-related issues. Secondary data are obtained from multiple sources to provide contextual information and support the interpretation of primary data findings. These sources include:

- Municipal transportation plans, mobility strategies, and cycling policy documents;
- Traffic volume and bicycle count records obtained from relevant transport agencies;
- Population census and household travel survey data;
- Reports published by national and international transportation organizations;
- Peer-reviewed journal articles and scholarly publications relating to cycling behaviour, active transportation, and sustainable urban mobility.

3.2 Data Analysis

Quantitative data obtained from the questionnaire survey are coded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 29 and were subsequently analysed using both Descriptive, such as frequencies, percentages, means, and standard deviations, and inferential statistics (Multiple linear regression analysis is used to assess the influence of attitudes, subjective norms, and perceived behavioural control on respondents' intentions to cycle. Binary logistic regression analysis) while thematic analysis was applied to quantitative data. The resulting

themes were subsequently organized according to the dimensions of the Ecological Model of Active Transportation utilitarian cycling within the study area.

3.3 Ethical Considerations

Ethical principles governing data collect in research were strictly observed throughout the study. Participation was voluntary, and informed consent was obtained from all respondents prior to data collection. Participants were assured of anonymity, confidentiality, and the right to withdraw from the study at any stage without penalty. Data were securely stored and used exclusively for academic purposes in accordance with established research ethics guidelines.

4.0 Results and Findings

The section provides detailed analysis of result and interpretation.

4.1 Socio-economic profile of Respondents

The demographic profile of the survey sample (N= 150) as shown in Table 1, exhibits a balanced gender distribution, comprising 52.0% (78) male and 48.0% (72) female respondents, which minimizes demographic polarization and ensures subsequent mobility preference analyses remain unskewed by gender-specific biases (Table 1). To establish a robust measure of central tendency and mitigate the impact of outliers, the cohort's age is captured via a median of 34 years, representing a young-adult to middle-aged demographic nucleus that directly corresponds with the economically active, commuting segment of the local population.

These baseline characteristics provide a representative foundation for evaluating broader modal choices, which currently reveal a stark divide in transit profiles: a distinct majority of respondents (60.0%, 90) own at least one functional motor vehicle, whereas a substantial car-less minority (40.0%, 60) relies heavily on alternative networks like walking, micro-mobility, and public transportation.

This structural reliance on alternative transit is further nuanced by a pronounced polarization in active transportation data; only 24.7% (37) of participants engage in regular utilitarian cycling (defined as cycling three or more times per week for functional purposes like commuting or errands), while the vast majority (75.3%, 113) remain intermittent or non-cyclists. This marked deficit in utility cycling—particularly when contrasted with the 40% of the population lacking private vehicles—strongly suggests that systemic and environmental barriers, such as fragmented cycling infrastructure, acute safety concerns, extended commuting distances, or persistent social stigmas, continue to restrict wider adoption.

Table 1: Socio-demographic profile of the study participants (N=150).

| Socio-Demographic Variable | Category | Frequency | Percentage (%) |
|----------------------------|----------------------|-----------|----------------|
| Gender | Male | 78 | 52.0% |
| | Female | 72 | 48.0% |
| Age Distribution | Median Age: 34 Years | — | — |

| Socio-Demographic Variable | Category | Frequency | Percentage (%) |
|------------------------------|--|-----------|----------------|
| Car Ownership Status | Owens at least one functional car | 90 | 60.0% |
| | Does not own a private car | 60 | 40.0% |
| Utilitarian Cycling Behavior | Cycles ≥ 3 times/week for utility | 37 | 24.7% |
| | Intermittent or Non-Cyclist | 113 | 75.3% |

Table 2 presents the descriptive statistics for the three core composite scales, each evaluated on a 5-point Likert scale (1 to 5). The Attitudinal Value of Cycling (Health/Eco) construct, comprised of 4 items, yielded the highest level of endorsement among respondents ($M = 4.20$, $SD = 0.65$), suggesting a robust valuation of the health and environmental benefits associated with cycling. In contrast, the Perceived Behavioral Control (Traffic Safety) scale, which comprised 3 items, reflected a moderate baseline evaluation ($M = 2.80$) yet exhibited the greatest dispersion in responses ($SD = 0.89$), highlighting substantial variance in participants' perceived agency regarding navigating traffic. Finally, the Perceptions of Infrastructure Quality construct, consisting of 5 items, received the lowest systematic evaluation across the sample ($M = 1.95$, $SD = 0.72$). Synthesizing these descriptive indices, the data indicate that while participants maintain highly favorable intrinsic attitudes toward cycling, their perceived behavioral control remains constrained by traffic safety apprehensions, and their assessments of local infrastructure quality are profoundly critical.

Table 2: Descriptive statistics of core composite scales.

| Composite Construct Measure | Number of Items | Mean (1–5) | Standard Deviation (SD) |
|---|-----------------|------------|-------------------------|
| Attitudinal Value of Cycling (Health/Eco) | 4 | 4.20 | 0.65 |
| Perceived Behavioral Control (Traffic Safety) | 3 | 2.80 | 0.89 |
| Perceptions of Infrastructure Quality | 5 | 1.95 | 0.72 |

4.2 Inferential Statistics

The results of the multiple regression analysis presented in Table 3 indicate that the Theory of Planned Behavior (TPB) constructs collectively explained 41.0% of the variance in respondents' behavioural intention to engage in cycling ($R^2 = 0.410$), suggesting a substantial level of explanatory power. Among the predictors, perceived behavioural control emerged as the strongest determinant of cycling intention ($\beta = 0.48$, $t = 5.82$, $p < .001$), indicating that individuals who perceived themselves as capable of cycling and overcoming potential barriers were significantly more likely to express an intention to cycle.

Attitude toward biking was also found to be a significant positive predictor of behavioural intention ($\beta = 0.31$, $t = 3.21$, $p = .002$), implying that respondents who held favourable evaluations of cycling, particularly in relation to its health, environmental, and economic benefits, exhibited

stronger intentions to adopt cycling as a mode of transport.

Subjective norms, although the weakest predictor among the TPB variables, remained statistically significant ($\beta = 0.15$, $t = 2.08$, $p = .040$), suggesting that social influences, including approval and encouragement from family members, friends, and significant others, contributed positively to individuals' intentions to cycle.

Overall, the findings demonstrate that behavioural intention to cycle is primarily shaped by an individual's perceived ability to engage in cycling, followed by personal attitudes and, to a lesser extent, social pressures. These results provide empirical support for the applicability of the Theory of Planned Behavior in explaining cycling intentions and highlight the importance of enhancing cyclists' confidence, promoting positive perceptions of cycling, and fostering supportive social environments to encourage greater uptake of active transportation.

Table 3: Multiple regression predicting behavioral intention to bike ($R^2=0.410$).

| Predictor TPB Construct | Standardized Coefficient (β) | t-value | Significance (p) |
|------------------------------------|--------------------------------------|---------|------------------|
| Perceived Behavioral Control (PBC) | 0.48 | 5.82 | < .001 |
| Attitude Toward Biking | 0.31 | 3.21 | .002 |
| Subjective Norms | 0.15 | 2.08 | .040 |

4.2.1 Predicting Actual Utilitarian Biking Behavior (Binary Logistic Regression)

The logistic regression results (Table 4) identify the factors that significantly predict regular cycling behaviour among respondents. The findings indicate that perceptions of infrastructure safety constituted the strongest positive predictor of regular cycling participation (OR = 4.20, 95% CI = 2.15–8.21, $p < .001$). This suggests that individuals who perceived cycling infrastructure as safe and supportive were more than four times as likely to engage in regular cycling compared with those who held less favourable perceptions.

Workplace support measures, including the provision of dedicated bicycle parking facilities and cycling-related incentives, also exerted a significant positive influence on cycling behaviour (OR = 2.10, 95% CI = 1.12–3.95, $p = .030$), indicating that respondents with access to such institutional support were approximately twice as likely to cycle regularly. Another predictor, Perceived behavioural control remained a significant predictor of actual cycling behaviour (OR = 1.80, 95% CI = 1.08–2.98, $p = .020$), demonstrating that individuals who felt confident in their ability to cycle and overcome potential barriers were more likely to translate their intentions into consistent cycling practice. Conversely, private car ownership emerged as a strong negative determinant (OR = 0.20, 95% CI = 0.06–0.62, $p = .001$), suggesting that vehicle owners were substantially less likely to engage in regular cycling than non-car owners.

In contrast, attitude toward biking did not exhibit a statistically significant effect on actual cycling behaviour (OR = 1.05, 95% CI = 0.85–1.30, $p = .680$), indicating that positive perceptions of cycling alone were insufficient to predict sustained participation when other behavioural, environmental, and institutional factors were taken into account. Collectively, these findings underscore the dominant role of structural and contextual factors in shaping regular cycling behaviour and suggest that while favourable attitudes may contribute to behavioural intentions, actual cycling participation is more strongly influenced by safe infrastructure, supportive

workplace environments, individual self-efficacy, and reduced dependence on private automobiles.

To isolate the critical factors overriding the transition from behavioral intention to routine execution, a binary logistic regression model was constructed to predict whether a respondent functions as a regular utilitarian cyclist. The comprehensive logistic model demonstrated high statistical significance ($\chi^2(8)=58.3, p<.001$), yielding strong explanatory precision.

Table 4: *Logistic regression model predicting actual regular cycling behavior.*

| Independent Predictor Variable | Odds (OR) | Ratio 95% Confidence Interval (CI) | Significance (p) |
|--|------------------|---|-------------------------|
| Perception of Infrastructure Safety | 4.20 | [2.15, 8.21] | < .001 |
| Workplace Incentives & Dedicated Parking | 2.10 | [1.12, 3.95] | .030 |
| Perceived Behavioral Control (PBC) | 1.80 | [1.08, 2.98] | .020 |
| Private Car Ownership | 0.20 | [0.06, 0.62] | .001 |
| Attitude Toward Biking | 1.05 | [0.85, 1.30] | .680 |

4.2.2 Qualitative Themes from In-Depth Interviews

The qualitative component of the study provided deeper insights into the perceptions, experiences, and contextual realities shaping cycling behaviour among urban commuters in Ibadan. Thematic analysis of the fifteen in-depth interviews identified five interrelated themes that correspond to various levels of the Socio-Ecological Model, highlighting the complex interplay of individual, social, environmental, institutional, and technological factors influencing cycling adoption.

4.2.2.1 Psychological Barriers to Cycling

Participants consistently emphasized the psychological demands associated with cycling as a mode of daily transportation. Many respondents perceived cycling within the urban traffic environment of Ibadan as inherently risky, particularly along major arterial roads characterized by high traffic volumes and limited traffic control measures. Although regular cyclists reported positive experiences associated with personal autonomy, health benefits, and environmental consciousness, non-cyclists overwhelmingly identified fear of collisions with motorized vehicles as the primary deterrent to cycling adoption. As one participant noted:

“I want to cycle for my health, but truth be told, you need serious guts to face the Micra drivers and tippers in this city. It feels like a suicide mission when there are no lanes.”

This finding underscores the significance of perceived traffic danger as a psychological constraint on cycling behaviour and suggests that safety concerns remain a major impediment to the widespread adoption of active mobility in the study area.

4.2.2.2 Inadequate and Fragmented Cycling Infrastructure

A prominent theme emerging from the interviews was the inadequacy and discontinuity of cycling infrastructure within the city. Participants acknowledged the existence of isolated sections of relatively safe cycling space; however, these facilities were often disconnected from one another and failed to provide continuous route coverage. Consequently, cyclists were frequently compelled to merge into heavily trafficked roadways, thereby increasing their exposure to road hazards. One respondent explained:

“We have a few safe islands of bike space, but there is no safe way to swim between them. You are suddenly dropped directly into aggressive traffic.”

The findings suggest that the effectiveness of cycling infrastructure is dependent not only on its availability but also on its connectivity and integration within the broader urban transport network. Fragmented infrastructure may therefore limit the utility and attractiveness of cycling as a viable commuting option.

4.2.2.3 Socio-Cultural and Familial Influences

The interviews further revealed that social norms, cultural perceptions, and family expectations significantly influence cycling behaviour, particularly among female commuters. Female participants reported experiencing discouragement from family members who perceived cycling as unsafe and socially undesirable. In several instances, cycling was associated with economic hardship rather than being recognized as a legitimate or sustainable transportation choice. One female academic observed:

“My family practically begged me to stop cycling to work. My mother kept saying it's either too dangerous because of the trucks, or people will think things are financially bad with us.”

These accounts demonstrate the extent to which socio-cultural attitudes and familial influences shape mobility decisions. The findings further suggest that efforts to promote cycling may require broader cultural reorientation and public awareness campaigns aimed at addressing prevailing stereotypes and misconceptions.

4.2.2.4 Absence of Secure End-of-Trip Facilities

Beyond concerns relating to road safety and infrastructure, respondents identified the lack of secure bicycle parking facilities as a critical institutional barrier. Many participants expressed apprehension regarding bicycle theft at workplaces, commercial centres, and other destinations. The absence of secure storage infrastructure was perceived as a significant disincentive to cycling and a major obstacle to modal shift. According to one transport advocate:

“Even if I survive the traffic from Bodija to Mokola, where do I lock my bike? Leaving it outside means it will disappear before closing hours.”

This finding highlights the importance of considering end-of-trip facilities within broader cycling promotion strategies. Investment in secure bicycle parking and related support infrastructure may be essential for enhancing commuter confidence and encouraging greater cycling uptake.

4.2.2.5 *Electric Bicycles as an Enabling Technology*

Participants identified electric bicycles (e-bikes) as a potentially transformative innovation capable of addressing several barriers to cycling within the urban context of Ibadan. Respondents noted that e-bikes could reduce the physical demands associated with traversing the city's undulating terrain, mitigate fatigue arising from high temperatures and humidity, and facilitate longer commuting distances. A municipal planner remarked:

“Ibadan is built on hills, which naturally deters people. The e-bike changes the entire equation because it flattens those ridges and means you don't arrive at the office completely drenched in sweat.”

The findings indicate that e-bikes have considerable potential to broaden participation in active mobility by making cycling more accessible, convenient, and attractive to a wider segment of the urban population.

Overall, the qualitative findings demonstrate that cycling behaviour in Ibadan is shaped by a complex interaction of psychological perceptions, infrastructural conditions, socio-cultural influences, institutional support mechanisms, and technological innovations. These factors collectively influence individuals' willingness and ability to adopt cycling as a regular mode of transportation. Consequently, policies aimed at promoting cycling must adopt a holistic and integrated approach that addresses both physical infrastructure deficiencies and the broader social and institutional contexts within which mobility decisions are made.

5.0 Discussion of Findings

This study examined the determinants of sustainable biking as an alternative mode of transportation in Ibadan by integrating insights from the Theory of Planned Behaviour (TPB) and the Socio-Ecological Model. The findings reveal that cycling behaviour is shaped by a complex interaction of psychological, infrastructural, institutional, and socio-cultural factors. While respondents generally expressed favourable attitudes toward cycling, actual participation was constrained primarily by environmental and structural barriers. These findings reinforce the growing consensus that cycling adoption depends not only on individual motivation but also on the extent to which the urban environment supports active mobility (Pucher & Buehler, 2021; Gössling, 2020).

The socio-economic profile of respondents revealed a relatively young and economically active population, with a median age of 34 years. Despite the fact that 40% of respondents did not own a private vehicle, only 24.7% reported engaging in regular utilitarian cycling. This disparity suggests that the absence of private car ownership does not automatically translate into cycling adoption. Similar observations have been reported in several developing-country contexts where inadequate infrastructure, safety concerns, and weak institutional support discourage cycling even among populations with limited access to motorized transport (Salon & Gulyani, 2019; Mogaji, 2020). The finding indicates that transport choices are influenced by more than economic necessity

and that cycling must be perceived as both safe and socially acceptable before it can become a viable mobility alternative.

The descriptive statistics further revealed an important contradiction. Respondents demonstrated highly positive attitudes toward the health and environmental benefits of cycling, yet simultaneously expressed low levels of confidence regarding traffic safety and extremely poor evaluations of cycling infrastructure. This pattern reflects what transport scholars describe as the “attitude–behaviour gap,” whereby favourable perceptions of sustainable transport modes fail to translate into actual behavioural change because of contextual constraints (Lanzini & Khan, 2021; Kroesen & Chorus, 2018). Similar findings have been documented in studies of active transportation across both developed and developing countries, where supportive attitudes alone were found to be insufficient in the absence of safe and accessible infrastructure (Fishman, 2022).

The multiple regression results provide strong empirical support for the Theory of Planned Behaviour. Perceived behavioural control emerged as the strongest predictor of cycling intention, followed by attitudes toward cycling and subjective norms. This finding is consistent with Ajzen’s (1991) proposition that individuals are more likely to form behavioural intentions when they believe they possess the ability and resources required to perform the behaviour successfully. Previous studies have similarly identified perceived behavioural control as one of the most influential determinants of cycling intention because it captures individuals’ confidence in overcoming barriers such as traffic conditions, road safety concerns, and travel distances (Heinen et al., 2010; Ton et al., 2019). The significance of attitude toward cycling further suggests that respondents recognize the personal and societal benefits associated with active transportation, while the positive effect of subjective norms indicates that encouragement from family members, peers, and social networks contributes to favourable cycling intentions. Comparable relationships have been reported in studies conducted in Europe, Asia, and Africa, where social support was found to strengthen active transportation intentions (Félix et al., 2024; Kroesen & Chorus, 2018).

While psychological factors explained behavioural intentions, the logistic regression analysis revealed that actual cycling behaviour was determined predominantly by structural and environmental conditions. Perceptions of infrastructure safety emerged as the strongest predictor of regular cycling participation, with respondents who perceived the cycling environment as safe being more than four times more likely to cycle regularly. This finding aligns with extensive international evidence demonstrating that safety remains the most critical determinant of cycling behaviour (Aldred et al., 2019; Winters et al., 2020). Heinen et al. (2010) similarly concluded that infrastructure quality and perceived safety exert stronger influences on cycling participation than most socio-demographic variables. In the African context, Mogaji and Uzundu (2022) found that concerns regarding road safety and exposure to motorized traffic were among the principal barriers preventing cycling adoption. The present findings therefore reinforce the argument that investments in dedicated cycling infrastructure and traffic-calming measures are prerequisites for increasing cycling participation in Nigerian cities.

The importance of workplace support further demonstrates the influence of institutional factors on travel behaviour. Respondents with access to workplace incentives and dedicated bicycle parking were significantly more likely to cycle regularly. This finding corroborates previous studies showing that end-of-trip facilities such as secure bicycle parking, showers, and changing rooms substantially increase active commuting rates (Heinen et al., 2019; Buehler et al., 2021). The qualitative findings strengthen this conclusion, as participants repeatedly identified fears of bicycle theft and the absence of secure parking facilities as major deterrents. These results suggest

that cycling promotion strategies should extend beyond road infrastructure to include supportive institutional arrangements at workplaces, educational institutions, and commercial centres.

Private car ownership was found to be a strong negative predictor of regular cycling behaviour. Respondents who owned private vehicles were substantially less likely to cycle regularly than those without access to a car. This finding is consistent with research demonstrating that automobile ownership reinforces car-dependent lifestyles and reduces the likelihood of adopting active transportation modes (Handy et al., 2022; Pucher & Buehler, 2021). Car ownership not only provides greater mobility flexibility but also reflects broader social and cultural preferences associated with convenience, status, and comfort. Consequently, efforts to promote cycling may be less effective if implemented in isolation from broader transport demand management measures aimed at reducing automobile dependence.

A particularly significant finding of the study is the non-significant relationship between positive attitudes toward cycling and actual cycling behaviour. Although respondents generally recognized the benefits of cycling, attitudes did not significantly predict regular participation once infrastructural, institutional, and behavioural-control factors were considered. This finding provides strong evidence of the attitude-behaviour gap identified in contemporary mobility research (Lanzini & Khan, 2021). Similar conclusions have been reached by Fishman (2022), who observed that positive perceptions of cycling often fail to translate into action where environmental barriers remain unresolved. The implication is that awareness campaigns alone are unlikely to generate substantial increases in cycling participation unless accompanied by tangible improvements in infrastructure and safety.

The qualitative findings provide important contextual explanations for these quantitative relationships. Participants consistently described cycling in Ibadan as psychologically demanding because of fears associated with high traffic volumes, aggressive driving behaviour, and the absence of protected cycling lanes. These concerns mirror findings from studies conducted in rapidly motorizing cities, where perceptions of danger frequently discourage active transportation regardless of personal attitudes toward cycling (Gössling, 2020; Winters et al., 2020). The interviews also revealed widespread dissatisfaction with the fragmented nature of existing cycling infrastructure. Participants noted that isolated sections of relatively safe cycling space often fail to form continuous networks, thereby exposing cyclists to dangerous traffic conditions. This observation supports previous research indicating that connectivity and continuity are as important as infrastructure availability in encouraging cycling uptake (Pucher & Buehler, 2021).

Socio-cultural influences emerged as another important barrier, particularly among female participants. Interviewees reported that family members often perceived cycling as unsafe or associated it with economic hardship. These perceptions reflect broader societal attitudes that continue to influence transportation choices in many developing countries. Similar findings have been reported in studies examining gender and active mobility, which found that women are generally more sensitive to safety concerns and social perceptions than men (Aderibigbe, 2025; Mogaji & Uzundu, 2022). Addressing such barriers may therefore require not only infrastructure investments but also public education campaigns capable of reframing cycling as a legitimate, healthy, and socially desirable transportation option.

Finally, the identification of electric bicycles (e-bikes) as a potential enabling technology presents important opportunities for sustainable mobility in Ibadan. Participants perceived e-bikes as capable of reducing the physical effort associated with navigating the city's undulating topography

and coping with high temperatures. International evidence increasingly suggests that e-bikes can expand cycling participation by making active transportation accessible to older adults, longer-distance commuters, and individuals with lower physical fitness levels (Fishman & Cherry, 2016; Ling et al., 2023). Given Ibadan's hilly terrain and dispersed urban structure, e-bikes may offer a practical pathway for increasing cycling uptake while supporting broader sustainability and climate objectives.

Overall, the findings demonstrate that sustainable cycling adoption in Ibadan is influenced less by awareness of cycling benefits and more by the presence of supportive environmental and institutional conditions. The results therefore support integrated approaches to active mobility planning that combine infrastructure development, workplace support, behavioural interventions, cultural reorientation, and technological innovation. Such an approach is essential if cycling is to become a viable and sustainable component of urban transportation in Nigerian cities.

6.0 Recommendations

Based on the findings, the following recommendations are proposed:

1. **Develop Safe and Connected Cycling Infrastructure:** Urban authorities should invest in dedicated, continuous, and well-maintained cycling lanes to improve safety and encourage cycling participation.
2. **Enhance Road Safety Measures:** Traffic regulations should be strengthened and public awareness campaigns implemented to promote safer interactions between motorists and cyclists.
3. **Provide Workplace Cycling Support:** Employers and institutions should provide secure bicycle parking, changing facilities, and incentive programmes to encourage active commuting.
4. **Mainstream Cycling in Urban Planning:** Cycling infrastructure should be integrated into transport and land-use planning to ensure accessibility and connectivity across urban areas.
5. **Address Socio-Cultural Barriers:** Public education and advocacy campaigns are needed to improve perceptions of cycling and encourage wider social acceptance, particularly among underrepresented groups.
6. **Promote Electric Bicycle Adoption:** Policies that support the use of e-bikes can help overcome barriers related to distance, terrain, and physical effort, thereby expanding cycling participation.

7.0 Conclusion

This study examined the determinants of sustainable biking as an alternative mode of transport in Ibadan. The findings indicate that while residents generally hold positive attitudes toward cycling, actual participation is influenced more strongly by infrastructural, institutional, and behavioural factors. Perceived infrastructure safety emerged as the most important predictor of regular cycling, followed by workplace support and perceived behavioural control, whereas private car ownership reduced the likelihood of cycling.

The qualitative findings further revealed that safety concerns, inadequate cycling infrastructure, socio-cultural perceptions, and limited institutional support remain major barriers to cycling adoption. Overall, the study demonstrates that increasing cycling participation requires more

than awareness of its benefits; it necessitates supportive environments that enhance safety, accessibility, and convenience. Consequently, integrated investments in cycling infrastructure, supportive policies, and behavioural interventions are essential for promoting sustainable urban mobility in Ibadan and other Nigerian cities.

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