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**Sustainable Transportation Choices and Household Budgets: Exploring the Effects of Travel Conditions, Alternative Access, and Infrastructure Quality on Household Transportation Expenditures in Hermosa, Bataan, and Malolos, Bulacan**



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## **Sustainable Transportation Choices and Household Budgets: Exploring the Effects of Travel Conditions, Alternative Access, and Infrastructure Quality on Household Transportation Expenditures in Hermosa, Bataan, and Malolos, Bulacan**

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### **ABSTRACT**

**Purpose:** This study aims to investigate the relationship between travel conditions, access to transportation alternatives, and the quality of transportation infrastructure on household transportation expenditures in Hermosa, Bataan, and Malolos, Bulacan, Philippines.

**Methodology:** This study employed a quantitative research design to investigate the relationship between household transportation expenditures and factors like travel conditions, access to transportation alternatives, and infrastructure quality. Data was collected through a structured survey administered to 384 households in Hermosa, Bataan, and Malolos, Bulacan. The survey instrument, validated through a pilot test, utilized a 4-point Likert scale to assess respondent perceptions. Data analysis involved descriptive statistics and multiple linear regression.

**Findings:** The findings revealed that among the variables, QTI significantly and positively influenced HTE ( $B = 0.338$ ,  $p < 0.001$ ), indicating that poorer infrastructure quality contributes to higher transportation costs. This relationship highlights how deficiencies in road conditions, public transport facilities, and pedestrian infrastructure increase household financial burdens. However, travel conditions and access to transportation alternatives were not statistically significant predictors of HTE ( $p = 0.366$  and  $p = 0.152$ , respectively).

**Unique Contribution to Theory, Policy and Practice:** This study emphasizes the critical role of transportation infrastructure quality (QTI) in shaping household transportation costs. Findings support theories like Consumer Choice and Planned Behavior, highlighting the significance of structural factors. To promote sustainable urban development, policymakers must invest in road maintenance, expand public transit, and enhance pedestrian/cycling infrastructure. This ensures equitable access to affordable transport and addresses socioeconomic disparities. Urban planners should prioritize infrastructure upgrades that improve connectivity and reduce travel inefficiencies, while incentivizing sustainable modes like electric vehicles and bike-sharing.

**Keywords:** *Household Transportation Expenditures (HTE), Sustainable Transportation, Travel Conditions (TC), Transportation Alternatives, Infrastructure Quality, Household Budgets*

## 1.0 INTRODUCTION

Transportation has always been a cornerstone of human civilization, facilitating the movement of people, goods, and services across time and space. From the early days of animal-drawn carts to the modern-day advent of cars, buses, and airplanes, transportation has undergone profound transformations that have revolutionized not only how we move but also how societies function. Its role extends far beyond simply enabling mobility; transportation serves as the lifeblood of economic growth, trade, and communication, all of which are essential to the establishment and maintenance of thriving societies (Bhasin, 2020). The development of transportation systems has long been viewed as a key driver of social, cultural, and economic advancement. However, the contemporary challenges facing transportation systems, especially in developing nations, present significant barriers to achieving sustainability and addressing pressing socio-economic and environmental issues.

In many developing countries, such as the Philippines, transportation systems are increasingly recognized as inadequate and unsustainable, with numerous structural and operational deficiencies that hinder their ability to support economic development and environmental goals. Liyanage et al. (2017) emphasize the need for comprehensive action to address these shortcomings, particularly as countries like the Philippines grapple with growing populations, urbanization, and mounting environmental concerns. Sustainable transportation, in this context, emerges as a vital solution, offering the potential to not only reduce environmental impacts but also improve economic productivity, social equity, and quality of life (Velazquez et al., 2015). The concept of sustainable transportation is broad, encompassing various modes of transportation—ranging from private vehicles to public transit and non-motorized modes such as cycling—and stressing the importance of effective infrastructure and system planning (Liyanage et al., 2017). Yet, achieving sustainability remains a challenge, as the infrastructure required to support such a system is often lacking or poorly developed, particularly in rural and underserved areas (Secretary-General's Global Sustainable Transport Conference-Summary Report, 2016).

A significant aspect of this challenge lies in the relationship between transportation choices and household budgets, especially in developing countries where transportation costs constitute a significant portion of household expenditures. Anowar et al. (2017) argue that understanding how transportation choices influence household spending is crucial for informing effective transportation policy. As transportation becomes an increasingly important expenditure, its impact on household budgets is compounded by factors such as travel conditions, access to transportation alternatives, and the quality of transportation infrastructure. These elements contribute to variations in transportation costs across different geographical regions and socio-economic groups. The issue of how households in both urban and rural settings allocate resources toward transportation is an important aspect of achieving sustainable and equitable transportation outcomes (Bak & Szczecińska, 2018). Households in rural areas, for instance, are often burdened

by limited transportation options, while urban residents face challenges related to congestion, pollution, and high travel costs.

In the Philippines, disparities between urban and rural areas are stark, with rural communities such as Hermosa, Bataan, and parts of Malolos, Bulacan, facing unique challenges related to transportation access and infrastructure quality. Urban centers like Malolos are heavily affected by congestion, air pollution, and increasing transportation costs, while rural areas such as Hermosa experience fewer transportation options, longer travel times, and higher costs associated with fewer transport choices. Both areas are part of the complex landscape of the Philippine transportation system, where infrastructure quality and availability greatly influence transportation expenses for households. On the other hand, urban areas like Metro Manila, with their burgeoning car ownership rates, suffer from congested roads, resulting in increased travel time and fuel consumption, contributing to higher household transportation expenditures (Manila, 2024).

Transportation costs are particularly significant in countries like the Philippines, where households are already burdened by the high cost of basic necessities. According to Mendoza (2022), approximately fifty percent of Filipino households' income is spent on utilities, transportation, and food, underscoring the financial strain transportation expenditures place on households. As these expenses continue to rise, they disproportionately affect low-income and rural households, making it difficult to meet essential needs like healthcare, education, and nutrition. Understanding the dynamics of household transportation expenditures is crucial for devising policies that address these financial pressures while promoting sustainability in the sector.

Sustainable transportation, which aims to reduce environmental impact, enhance economic productivity, and promote social equity, is particularly vital for developing nations, where the combination of poor infrastructure, high costs, and limited access to eco-friendly alternatives hinders progress toward sustainability. The role of transportation infrastructure in these challenges is significant, as inadequate roads, limited public transportation options, and poorly maintained facilities contribute to higher transportation costs for households, making it essential to investigate how these factors influence household spending on transportation (Perez et al., 2021). By focusing on areas like Hermosa and Malolos, this study explores the effects of travel conditions, access to transportation alternatives, and the quality of transportation infrastructure on household transportation expenditures, offering valuable insights into how these factors intersect to shape transportation choices and their financial implications.

This research adopts a quantitative approach, utilizing multiple linear regression to examine the relationship between household transportation expenditures (the dependent variable) and three key independent variables: travel conditions, access to transportation alternatives, and transportation infrastructure quality. The study is set in Hermosa, Bataan, and Malolos, Bulacan, and aims to explore how different transportation factors affect household expenditures in both rural and urban contexts. By using validated questionnaires and employing rigorous statistical techniques, the

study seeks to provide reliable insights into the factors influencing transportation costs. The results will offer valuable recommendations for policymakers, urban planners, and transportation authorities, helping them design more equitable, affordable, and sustainable transportation systems. These systems are critical in reducing the financial burden on households while promoting broader socio-economic development goals.

## **2.0 LITERATURE REVIEW**

### **Travel Conditions and Household Transportation Expenditures**

Studies have consistently highlighted the significant influence of travel conditions, such as travel frequency, distance, and time, on household transportation expenditures. Numerous studies demonstrate a positive relationship between poorer travel conditions and higher household transportation costs. For instance, Travassos et al. (2021) found that young adult-headed households, which often experience higher mobility needs, tend to spend more on transportation compared to elderly-headed households. Similarly, Mattson (2020) indicated that longer travel distances and durations, common in rural areas with limited transportation options, are associated with increased transportation expenses. Feng & Wang (2024) reinforced this by showing that variations in travel frequency, distance, and time are directly related to changes in reported transportation expenditures.

Moreover, studies by Ghosh et al. (2023) and Sugiarto et al. (2014) have corroborated these findings, emphasizing that households facing longer travel distances and durations incur higher transportation costs. Guerra et al. (2018) observed a complex relationship in Greater Buenos Aires, where factors such as job accessibility and distance to downtown significantly influenced transportation expenditures. This pattern was also evident in the Monterrey Metropolitan Area, where Moreno et al. (2022) found that increased trip frequency and longer travel distances were associated with higher household transportation expenditures. Jing et al. (2018) and Zolnik et al. (2019) similarly identified travel conditions as critical determinants of transportation costs.

Conversely, improved travel conditions, such as better accessibility to public transportation and reduced travel distances, are associated with lower household transportation costs. Ogryzek et al. (2020) found that enhanced travel conditions, such as increased accessibility to public transportation, could lower household transportation expenses. Anthony (2023) echoed this, emphasizing the role of efficient services, urban planning, and public transportation accessibility in shaping travel conditions and reducing travel time and costs for households. Further supporting this, Leichenko & Taylor (2024) discussed how the development of cycling infrastructure can influence travel conditions, thereby impacting household transportation expenditures. Elassy et al. (2024) highlighted the role of Intelligent Transportation Systems (ITS) in improving travel conditions by enhancing traffic flow and reducing congestion, potentially leading to household cost savings.

Sustainability considerations are integral to this discussion. Studies by Di Martino et al. (2024) and Euler et al. (2024) emphasized the importance of optimizing transportation networks and considering both technical and economic factors in sustainable transportation solutions. Promoting multimodality and integrating electric mobility assets can help manage travel conditions by reducing traffic congestion and travel time, thus lowering household transportation costs (Anthony, 2023). Additionally, Lättman et al. (2018) noted that perceptions of accessibility significantly influence transportation choices and expenditure patterns, suggesting that improved travel conditions can enhance perceived accessibility and support sustainable transportation behaviors. Overall, the literature underscores a clear positive relationship between poorer travel conditions and higher household transportation expenditures while highlighting the potential for improved travel conditions to reduce these costs. Integrating sustainability measures, such as enhanced public transportation and cycling infrastructure, further supports reducing household transportation expenditures and promoting sustainable transportation choices.

### **Access to Transportation Alternatives and Household Transportation Expenditures**

The relationship between access to transportation alternatives and household transportation expenditures exhibits both negative and positive aspects, as evidenced by various studies in the literature. Several studies highlight the benefits of access to sustainable transportation options. Travassos et al. (2021) said that access to transportation alternatives significantly influences household spending, particularly in elderly-headed households, emphasizing the importance of analyzing demand elasticities and socioeconomic factors in consumption behavior. Diverse transportation options are essential for reducing transportation expenses and enhancing financial stability and mobility in these households. Moreover, Waqas et al. (2018) and Singh et al. (2020) highlight the positive correlation between awareness of alternative modes of transportation and the willingness to adopt them. For example, Shuttle, a private transportation service, has been shown to be the most sustainable choice, leading to reduced congestion and fewer accidents (Singh et al., 2020). Ventura (2023), also highlights low greenhouse gas emissions and electric or alternative fuel cars as one of sustainable alternative options, which increases accessibility to greener modes of transportation for cutting emissions and boosting energy efficiency. Pendall et al. (2015) further emphasize the importance of access to automobiles in facilitating employment among subsidized housing recipients, leading to better economic outcomes. Additionally, neighborhoods with access to sustainable transportation options are better equipped to cope with disruptive events like gas price increases, contributing to greater resilience, particularly in low-income suburban areas (Bronson & Marshall, 2014). Chik et al. (2017) underscore the significant contribution of the transportation sector to environmental harm and advocate for shifting towards eco-friendly options like hybrid or solar cars to mitigate this impact.

However, despite access to alternative modes of transportation, households may still face challenges in reducing transportation expenditures due to constrained resources and limited access in certain areas (Mattioli et al., 2016; Zhou & Zolnik, 2013). Dewitt, Yen, & Burke (2017)

highlight the negative consequences of unaffordable transportation, potentially leading to social isolation and financial strain for households in urban areas. Additionally, Lee (2023) emphasizes the tradeoffs between housing affordability and transportation accessibility, suggesting that households in certain areas may face challenges in reducing transportation expenditures despite access to alternatives. This indicates a potential negative relationship between access to transportation alternatives and household transportation expenditures. Another implication that Haseeb & Mitra (2023) stated, transportation-related social exclusion limits individuals' access to activities due to inadequate transportation options. Addressing the travel needs of those with limited transport opportunities is crucial for enhancing their quality of life and promoting social inclusion. By prioritizing accessible and affordable transportation options, we can mitigate the negative impacts of exclusion and foster greater participation in society. On the other hand, Zolnik et al. (2019) emphasize the importance of improving transportation infrastructure and services to reduce transportation expenditures and address the tradeoffs between housing affordability and transportation accessibility. Furthermore, neighborhoods with higher accessibility tend to have higher transportation expenditures, suggesting a positive correlation between access and spending (Guerra et al., 2018; Dong, 2021). Finally, Sugiarto et al. (2014) highlight the significant differences in transportation expenditure patterns among households with access to transportation alternatives compared to those without such access, indicating the importance of considering access in shaping transportation spending behaviors.

In terms of sustainability, promoting access to alternative transportation modes is essential for reducing environmental pollution, traffic congestion, and reliance on private vehicles (Anthony, 2023). To improve accessibility, sustainable transportation integrates alternative modes of transportation like cycling and public transportation with urban policies aimed at environmental sustainability and economic growth (Pourramazani & Miralles-Garcia, 2022). However, encouraging people to choose sustainable transport remains a challenge, requiring increased awareness efforts (Singh et al., 2020). According to Hamidi & Zhao (2020), Individuals with high environmental awareness tend to utilize public transportation or cycling to promote sustainability. Political agendas also influence decisions, with governments allocating funds based on ideological stances and public demand. Public preferences and factors like personal benefits and political beliefs shape transportation investment priorities (Cattaneo et al., 2018; O'Connell et al., 2018). An example for this is that, people may prioritize investments based on factors like reduced travel time or environmental sustainability. Schneider (2013) emphasizes the importance of understanding mode choice processes and contextual factors in promoting sustainable transportation in communities. Di Martino et al. (2024) stress the importance of enhancing sustainability in local public transportation systems to minimize environmental impact, while Lambotte et al. (2023) highlight the influence of social interactions on individual transportation mode choices. Understanding commuters' perceptions and motivations towards different modes of transport is crucial for promoting sustainable transportation alternatives (Blamah et al., 2021). The

development of access to public transport will increase other alternative options for people and reduce usage of private cars (Hamidi & Zhao, 2020). Overall, while access to transportation alternatives may have positive implications for sustainability, its impact on household transportation expenditures can vary depending on factors such as resource constraints, geographical location, and individual preferences. Therefore, further research is needed to explore the nuanced relationship between access to transportation alternatives and household transportation expenditures.

### **Transportation Infrastructure Quality and Household Transportation Expenditures**

The relationship between access to transportation alternatives and household transportation expenditures exhibits both negative and positive aspects, as evidenced by various studies in the literature. Better transportation infrastructure quality generally leads to increased spending on transportation-related goods and contributes to economic growth. Several studies have demonstrated the positive correlation between household transportation expenditures and transportation infrastructure quality. Wang et al. (2020) showed that transportation infrastructure development positively influences household transportation expenditures by boosting household income. Similarly, Hu et al. (2021) and Wang & Sun (2016) highlighted how infrastructure investments in transportation lead to increased spending on infrastructure-related goods and contribute to rural development in China. Moreover, Wong & Yip (2019) emphasized the positive correlation between household transportation expenditures and transportation infrastructure quality, indicating that improvements in infrastructure could lead to increased transportation costs for households. Mattson (2020) further supported this, stating that areas with better infrastructure experience reduced spending on transportation. Additionally, Ghosh et al. (2023) and Dong (2021) highlighted the significant influence of transportation infrastructure quality on household transportation expenditures.

However, it is important to note that the relationship between transportation infrastructure quality and household transportation expenditures can exhibit negative aspects as well. For instance, Wu-Yuan (2022) highlighted how transportation infrastructure development in rural areas could lead to increased transportation costs for households, particularly among lower social classes. Similarly, Gaus & Link (2020) found that better roads increase household spending on transportation, which may strain household budgets. Waqas et al. (2018) also noted that people may rely more on their own cars due to less confidence in public transportation dependability and safety concerns, leading to higher household transportation expenditures. In terms of sustainability, Mitra (2016) emphasized the importance of good transit service and land use diversity in promoting sustainable urban transportation, indicating that poorly managed transit systems can hinder transportation alternatives. Additionally, Singh et al. (2020) highlighted how urban areas with financial constraints and poorly managed transit systems may negatively impact sustainable transportation choices. Savchenko (2022) revealed that despite investments in road infrastructure, there was no significant increase in transportation activity in Ukraine, suggesting



that infrastructure development alone may not positively impact transportation choices. Feng & Wang (2024) also noted that misreporting in household income and expenditure is correlated with various sociodemographic characteristics, including urban-rural disparities, indicating the need for holistic approaches to address transportation challenges. Bhuiya et al. (2024) also emphasized the importance of considering perceptions of transportation system limitations, such as infrastructure quality, in modeling mode choice behavior. Overall, while access to transportation alternatives can negatively and positively affect household transportation expenditures, improvements in transportation infrastructure quality generally lead to increased spending on transportation-related goods and contribute to economic growth.

## **2.1 Theoretical Review**

### ***Theory of Consumer Choice***

The Theory of Consumer Choice illustrates how consumers manage their consumption within budget constraints and personal preferences (Muro-Rodríguez et al., 2017; Liberto, 2023). This theory helps the researchers understand how households make transportation choices based on their preferences and constraints, which include travel conditions. By comprehending consumer preferences and constraints such as travel conditions, the study can identify ways for sustainable transportation initiatives to align with utility-maximizing behavior. Numerous studies highlight the factors influencing consumers' choices regarding sustainable mobility options (Nogueira et al., 2023; Cao & Yang, 2022). Additionally, internal motivations and identities, such as attitudes and intentions toward sustainable consumption, influence adopting sustainable transportation systems (Negacz, 2021). Abbasi et al. (2021) suggest that consumers' awareness of sustainability issues and environmental impacts, mainly related to their chosen mode of transportation, affects their intentions and the significance placed on sustainable approaches in transportation decision-making.

### ***Theory of Planned Behavior***

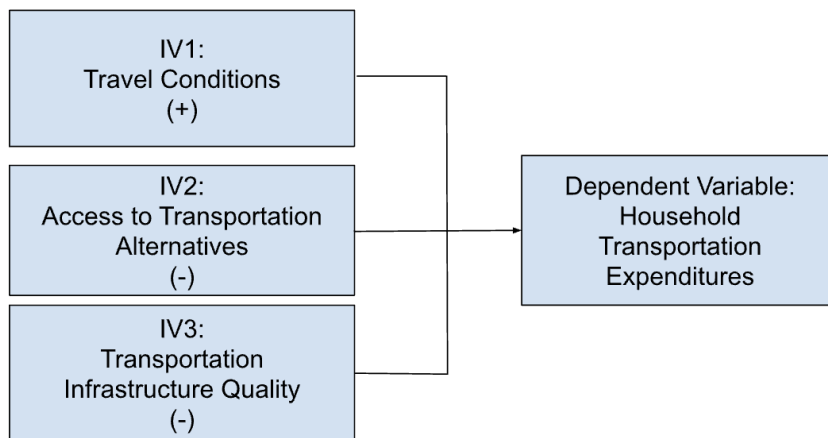
The Theory of Planned Behavior (TPB) is significant in understanding sustainable transportation choices. Past studies emphasize the importance of attitudes, subjective norms, and perceived behavioral control in influencing people's inclinations toward sustainable mobility options such as public transit and hybrid vehicles. Incorporating sustainability goals into decision-making within the TPB framework enables consumers to choose eco-friendly transportation modes (Ong et al., 2023; Sadeghian et al., 2022). The TPB can be applied to understand the behavior of individuals towards transportation infrastructure quality (such as road conditions and the reliability of public transportation), the social influence regarding a person's chosen mode of transportation, and the accessibility of alternative transportation modes. For example, investigating rail transportation patterns in Malaysia using TPB highlights the role of attitudes, subjective norms, and the importance of environmental sustainability in promoting rail system utilization (Kalhor et al., 2021). This theory provides a valuable framework for comprehending and promoting sustainable

transportation preferences by addressing essential psychological and social factors driving individual choices.

### *Synthesis*

This study examines the intricate relationships between the dependent variable, Household Transportation Expenditures, and the identified independent variables: Travel conditions, Access to Transportation Alternatives, and Transportation Infrastructure Quality. The theoretical foundation guiding this investigation comprises two key frameworks: the Theory of Consumer Choice and the Theory of Planned Behavior (TPB). The Theory of Consumer Choice, specifically focusing on the concept of revealed preferences, will help understand how households allocate their finances among different transportation modes. This framework emphasizes the role of cost-benefit analysis in decision-making, considering factors like travel time, comfort, and safety. Furthermore, it emphasizes the significance of awareness regarding sustainability issues and environmental impacts in guiding transportation decision-making processes. The TPB will be used to understand the psychological factors influencing household transportation choices. Attitudes towards different modes of transportation (e.g., public transport, cycling, walking) will be assessed, along with subjective norms (social pressures and expectations) related to transportation choices. Perceived behavioral control will be examined by assessing factors such as perceived ease of access to different transportation modes and perceived barriers to their use.

## 2.2 Conceptual Framework



*Figure 1. Simulacrum*

*Source: Researchers (2024)*

## 2.3 Statement of the Hypothesis

**H1:** Travel Conditions has a positive significant effect with Household Transportation Expenditures.

**H2:** Access to Transportation Alternatives has a negative significant effect with Household Transportation Expenditures.

**H3:** Transportation Infrastructure Quality has a negative significant effect with Household Transportation Expenditures.

### 3.0 MATERIAL AND METHODS

This study employed a quantitative research design to investigate the relationship between household transportation expenditures and several independent variables, including travel conditions (e.g., traffic congestion, travel time, distance to work/school), access to transportation alternatives (e.g., public transport availability, frequency, proximity), and quality of transportation infrastructure. Data were collected through a structured survey administered to a representative sample of 384 households in Hermosa, Bataan, and Malolos, Bulacan. The survey instrument consisted of 38 questions and utilized a 4-point Likert scale to assess respondents' perceptions and attitudes toward various aspects of transportation, including satisfaction with the transportation modes available in their area, perceived safety of transportation infrastructure, and willingness to adopt sustainable transportation options (e.g., walking, cycling, public transport). Data were analyzed using IBM SPSS to identify patterns and relationships between variables through descriptive and inferential statistics. Ethical considerations, such as informed consent and data confidentiality, were upheld throughout the research process.

The study focused on analyzing the influence of travel conditions, access to transportation alternatives, and the quality of transportation infrastructure on household transportation expenditures in relation to sustainable transportation choices among residents of Hermosa, Bataan, with a population of 77,443 (as of 2020), representing a more rural context, and Malolos, Bulacan, with a population of 261,189 (as of 2020), exhibiting more urban characteristics. It was confined to residents within the geographical boundaries of these municipalities. The analysis explored the relationships between travel conditions (e.g., traffic congestion, travel distance), accessibility of alternative transportation modes, and the quality of transportation infrastructure (e.g., road conditions, waiting sheds, and the efficiency of public transportation modes) on household transportation expenditures.

The research instrument, a structured questionnaire, was meticulously developed by the researchers through an extensive review of relevant literature and by analyzing surveys conducted by governments worldwide. The observed capabilities of respondents in answering pilot test questionnaires were carefully considered to enhance the questionnaire's construction. The instrument garnered a Cronbach's alpha value ranging from 0.6 to 0.7 during pilot testing, indicating acceptable internal consistency and reliability (Nunnally & Bernstein, 1994).

A pilot test was conducted on 30 respondents from Hermosa, Bataan, and Malolos, Bulacan, to assess the validity and reliability of the Likert scale survey instrument. This crucial step involved

evaluating face validity (whether questions appeared to measure the intended constructs) and content validity (whether the questions adequately covered all relevant aspects). Necessary revisions were made based on the pilot test findings, such as rephrasing confusing questions and adjusting survey length to enhance respondent engagement. This iterative process improved the survey's quality, ensuring the collection of reliable and valid data for subsequent multiple linear regression analysis.

The questionnaire was structured into five sections. The first section collected demographic information, while the second section focused on the dependent variable: household transportation expenditures. The remaining three sections addressed the independent variables: travel conditions, access to transportation alternatives, and the quality of transportation infrastructure. The questionnaire utilized a 4-point Likert scale to minimize response bias and encourage nuanced opinions by eliminating a neutral midpoint (Kusmaryono & Wijayanti, 2022). By requiring respondents to express a clear preference, this approach reduced the likelihood of neutral responses, potentially leading to more decisive data and stronger relationships between variables. Data collection occurred in various public establishments across the study areas, including salons, transportation terminals, waiting sheds, malls, streets, and restaurants. This multi-site approach ensured a diverse and representative sample, enhancing the generalizability of the findings. The questionnaire was available in both English and Filipino to cater to the linguistic preferences of respondents.

The study employed purposive sampling, selecting respondents based on specific traits, including residency in Hermosa, Bataan, or Malolos, Bulacan, varied household income levels, and the utilization of diverse transportation modes. This targeted approach ensured that the sample accurately represented the transportation behaviors and expenditures of households in both rural and urban contexts. However, several limitations affected the study's findings. Data limitations included potential biases in self-reported data, such as social desirability bias or recall bias, which could impact the accuracy of responses. Sampling biases may have arisen, potentially limiting the generalizability of findings beyond the specific sample of residents included in the study. Methodological limitations included challenges in establishing definitive causal relationships between variables and the potential for limited generalizability of findings to other regions with different socio-economic and demographic characteristics. External factors, such as economic fluctuations, policy changes, or unforeseen events, also influenced the transportation choices of residents and may have impacted the study's outcomes.

The study employed Multiple Linear Regression (MLR) analysis to examine the determinants of Household Transportation Expenditures (HTE). This approach quantified the impact of socio-demographic factors and three independent variables—Travel Conditions (TC), Access to Transportation Alternatives (ATA), and Quality of Transportation Infrastructure (QTI)—on HTE. The theoretical underpinnings of this analysis included socio-demographic influences, such as age, gender, marital status, income, household size, and educational attainment, which were analyzed

using descriptive statistics to contextualize the study's population. The relationships between the dependent variable, HTE, and the independent variables (TC, ATA, and QTI) were assessed through MLR to measure their individual and combined effects on transportation costs. The regression model estimated the magnitude and significance of each independent variable's influence on HTE while also evaluating the explanatory power of the model. MLR was particularly effective in understanding the multidimensional factors driving household transportation expenditures, providing insights into key determinants and guiding future policy and planning decisions. To help identify whether to accept or refute the economic theories and related literature by testing the relationship of the variables, the following econometric model was used:

$$\text{HTE} = \alpha_0 + \alpha_1 (\text{TC}) + \alpha_2 (\text{ATA}) + \alpha_3 (\text{QTI}) + \epsilon$$

Wherein:

HTE = Household Transportation Expenditure

TC = Travel Condition

ATA = Access to Transportation Alternatives

QTI = Quality of Transportation Infrastructure

$\alpha_0$  = Constant term

$\alpha_1, \alpha_2, \dots, \alpha_n$  = Alpha Coefficient

### 3.1 Ethical Consideration

This research was conducted with an emphasis on ethical conduct. Prior to their involvement, all respondents provided informed consent, demonstrating a comprehensive understanding of the study's objectives, methodologies, potential risks, and their inherent right to withdraw from participation at any point. Stringent measures were implemented to safeguard participant confidentiality and anonymity. The study design prioritized the minimization of any potential harm to participants, and their voluntary engagement in the research was strictly upheld. All collected data were meticulously secured and shielded from unauthorized access. The study protocol underwent rigorous ethical scrutiny and received formal approval from an independent ethics committee, ensuring strict adherence to established ethical guidelines.

#### 3.1.1. Respect for Persons

Respect for persons was upheld throughout the study. Researchers provided participants with a comprehensive informed consent document that outlined the study's purpose, procedures, potential risks and benefits, their right to withdraw at any time without penalty, and how their data would be handled. Participant confidentiality was strictly maintained by removing personal identifiers whenever possible. Data were securely stored using restricted access for online surveys and secured containers for physical surveys. Only authorized research personnel had access to the data.

Data were used solely for this research project and were not shared with any other parties or used for any other purposes without explicit participant consent. Where applicable, researchers took specific measures to protect vulnerable populations, such as ensuring appropriate safeguards for individuals with cognitive impairments. If the study involved any deception or potential for psychological discomfort, a debriefing session was conducted to address any concerns and provide accurate information to participants.

### **3.1.2 Integrity**

The paper prioritized unwavering integrity. We adhered to the highest ethical standards by obtaining necessary ethical approvals from relevant institutions (such as Philippine Social Science Council) and ensuring informed consent was obtained from all participants. Data collection and analysis were conducted rigorously using validated methods, while maintaining participant confidentiality and anonymity. We carefully evaluated the potential impacts of this research on the communities and strived to ensure equitable treatment of all participants. By disseminating findings to relevant stakeholders, including policymakers and the public, we aimed to contribute meaningfully to the understanding and promotion of sustainable transportation practices in the Philippines.

### **3.1.3 Confidentiality, Privacy, Anonymity**

Strict measures were implemented to safeguard confidentiality, privacy, and anonymity throughout the research process. Data access was restricted to authorized researchers involved in the analysis. Physical documents were securely stored and handled exclusively by the research team. Informed consent was obtained from all participants prior to data collection, addressing their privacy concerns. Only data relevant to the research objectives were collected, minimizing the intrusion into participants' privacy. Furthermore, all data were de-identified as soon as possible by removing or replacing personal identifiers, ensuring participant anonymity during analysis and in the reporting of research findings.

### **3.1.4. Informed Consent**

Prior to participating in the survey, all respondents received an informed consent document. To streamline the process, researchers provided respondents with a set of concise terms and conditions that summarized key information, including the study's purpose, voluntary participation, the right to withdraw, and data confidentiality. This allowed respondents to quickly assess their willingness to participate. However, researchers also clearly indicated that this was a summary and that the full informed consent document was available upon request. Any respondent who wished to review the complete document was provided with a copy. This approach ensured that participants were aware of their rights and had the opportunity to make an informed decision about their participation, while also streamlining the consent process.

### **3.1.5 Beneficence**

This study prioritized the well-being of the participants and aimed to minimize any potential harm, including psychological and social discomfort. Ethical approval was obtained to ensure adherence to ethical standards. Informed consent was sought from all participants, clearly outlining the study's objectives, procedures, potential risks (e.g., minor discomfort from sensitive questions), and benefits. To safeguard participant privacy, stringent measures were implemented to ensure data security and anonymity throughout the research process. Data was collected, stored, and analyzed using secure methods to prevent unauthorized access. Respondent anonymity was maintained during all stages of data analysis and reporting. Open lines of communication were maintained throughout the study to address any participant inquiries or concerns. The study aimed to generate valuable insights into the impact of sustainable transportation choices on household budgets and the environment. These findings were shared with the involved municipalities to inform the development of cost-saving policies, improve transportation infrastructure, and enhance environmental sustainability. By promoting sustainable transportation practices and improving community well-being, this study aimed to contribute to a more just and equitable society.

### **3.1.6 Social Justice**

This study prioritized social justice by striving for inclusivity in the research process. Purposive sampling was employed to include respondents from diverse backgrounds, considering factors beyond gender, such as age, socioeconomic status, disability status, and the presence of marginalized groups within the communities of Hermosa, Bataan, and Malolos, Bulacan. The study acknowledged the potential negative impacts of public transport construction on some households, particularly those who may have experienced land loss or other disruptions. To address these concerns, the research design included specific questions to assess the impact on affected residents. The analysis carefully considered the potential biases introduced by these impacts, ensuring that the perspectives of all stakeholders were fairly represented. Furthermore, the study examined broader issues of social justice, including procedural justice (were affected residents meaningfully involved in the planning and implementation of the projects?) and distributive justice (were the benefits of the public transport system distributed fairly across all segments of the population?). The study aimed to empower residents by sharing the research findings with policymakers and the broader community to promote equitable and inclusive transportation solutions that benefited all members of society.

### **3.1.7 Cultural and Gender Sensitivity**

To ensure cultural and gender sensitivity, the study offered the survey in both English and Filipino to accommodate diverse language preferences. Survey questions were carefully crafted to be culturally appropriate and respectful, considering local norms and values. Gender sensitivity was explicitly addressed by collecting data on gender identity and expression and analyzing results disaggregated by gender to identify any disparities. To further enhance cultural sensitivity, the research team consulted with community members and cultural experts throughout the research

process. The team also received training on cultural sensitivity and respectful communication. Pilot testing of the survey instruments was conducted, and participant feedback was actively incorporated to refine the research process and ensure it was inclusive and responsive to the unique needs and perspectives of the local communities

### 3.1.8 Protection of Vulnerable Groups

Recognizing the unique vulnerabilities of certain segments of the population, the study prioritized the ethical protection of participants, including people with disabilities, the elderly, individuals with limited mobility, and other marginalized groups. To ensure informed participation, the research team obtained consent from all individuals, providing thorough explanations in both English and Filipino to accommodate diverse language needs. Participants with limited comprehension received careful guidance from researchers to ensure full understanding of the study and their rights. Stringent measures were implemented to safeguard participant confidentiality, including secure data storage and the anonymization of sensitive information. To address concerns regarding income disclosure, respondents who expressed apprehension were explicitly assured that their income data would be held in strict confidence and used solely for the purposes of the research. The research team diligently considered and mitigated potential harms, such as psychological distress or social stigma, that vulnerable participants might experience. By prioritizing the safety, well-being, and dignity of all participants, the study aimed to contribute to a more equitable and inclusive transportation system that addressed the specific needs of vulnerable populations.

## 4.0 FINDINGS

### 4.1. Descriptive Statistics

*Table 1. Descriptive Statistics of the participants*

Characteristics	Category	N	%
Residence	Hermosa, Bataan	185	48.18%
	Malolos, Bulacan	199	51.82%
Gender	Female	158	41.58%
	Male	222	58.42%
Age	18 to 31 years old	208	55.32%
	32 to 45 years old	85	22.61%
	46 to 59 years old	62	16.49%
	Over 60 years old	21	5.59%
Marital Status	Single	225	63.03%



	Married	110	30.81%
	Separated	6	1.68%
	Widowed	3	0.84%
	None of the Choices	13	3.64%
Educational Level	Primary (Elementary School)	17	4.89%
	Secondary School	97	27.87%
	Bachelor's Degree	171	49.14%
	Master's Degree or higher	12	3.45%
	Vocational/Technical Training	51	14.66%
Employment Status	Student	96	27.99%
	Employed Full-Time	119	34.69%
	Employed Part-Time	86	25.07%
	Unemployed	21	6.12%
	Self-employed	17	4.96%
	Retired	4	1.17%
Number of members in the Household	1 to 3	105	29.83%
	4 to 6	201	57.10%
	7 to 9	45	12.78%
	above 10	1	0.28%
Monthly household income level	Below Php 11,000	163	46.18%
	Php 11,001 to Php 80,000	152	43.06%
	Php 80,001 to Php 150,000	21	5.95%
	Php 150,001 and above	17	4.82%

*Source: Researchers (2024)*

**Note:** Descriptive Statistics of the participants (Residence; n=384, Gender; n=380, Age; n=376, Marital Status; n=357, Educational Level; n=348, Employment Status; n=371, Number of members in the household; n=352, Monthly Household Income levels; n=353)

The survey gathered responses from 384 participants across Hermosa, Bataan, and Malolos, Bulacan, reflecting a mix of urban and rural demographics. Of the respondents, 48.18% resided in Hermosa, while 51.82% lived in Malolos, showcasing a relatively balanced representation of the two areas. In terms of gender, males constituted a larger proportion (58.42%) compared to females (41.58%). The age distribution revealed that over half of the respondents (55.32%) fell within the 18–31 age range, followed by 22.61% aged 32–45, 16.49% aged 46–59, and a small percentage (5.59%) aged 60 and above. Regarding marital status, the majority (63.03%) were single, while 30.81% were married, and the rest comprised separated, widowed, or those who selected “none of the choices.”

Educational attainment showed that nearly half of the respondents (49.14%) held a bachelor’s degree, followed by 27.87% who had completed secondary education, and 14.66% who underwent vocational or technical training. Only 3.45% had attained a master’s degree or higher, while 4.89% had completed primary education. Employment data indicated that 34.69% were employed full-time, 27.99% were students, 25.07% were part-time workers, and the remaining participants were unemployed, self-employed, or retired. Household size data highlighted that most respondents (57.10%) lived in households with 4–6 members, while 29.83% resided in smaller households with 1–3 members. A minority had 7–9 members (12.78%), and only 0.28% had over 10 members. Monthly household income levels revealed that 46.18% earned below Php 11,000, 43.06% fell within Php 11,001 to Php 80,000, while higher-income groups earning above Php 80,001 were minimal.

These statistics paint a comprehensive picture of the respondents, showcasing diversity in socioeconomic backgrounds. The data highlights significant rural-urban contrasts, with varying levels of income, household size, and education that may influence transportation expenditures and choices. These variations establish a robust foundation for analyzing the factors affecting household transportation expenditures in the selected locales.

## 4.2. Validity Results

### 4.2.1. Pilot-testing the Research Instrument

Table 2. Reliability Coefficients of Variables from Pilot Testing and Actual Research Data

Variables	Number of items	Deleted Items	Number of Retained Items	Cronbach's Alpha	
				Testing Data with n=30	Actual Research Data with n=384
DV: Household Transportation Expenditures	8	DVQ1, DVQ2	6	.71	.73
IV <sub>1</sub> : Travel conditions	8	IV1Q5	7	.75	.62
IV <sub>2</sub> : Access to Transportation alternatives	12	None	12	.79	.88
IV <sub>3</sub> : Transportation infrastructure Quality	10	None	12	.81	.60

Source: Researchers (2024)

**Note:** A conservative criterion discussed in Kock (2022) states that Cronbach's alpha coefficients should be 0.70 or higher. Nunnally and Bernstein (1994) suggest that a Cronbach's alpha of 0.6 or higher may be acceptable for newly developed scales.

Pilot testing is a critical step in ensuring the validity and reliability of a research instrument. In this study, a pilot test was conducted with 30 respondents from Hermosa, Bataan, and Malolos, Bulacan, to assess the internal consistency and appropriateness of the survey items. The results, as shown in Table 3, demonstrate that the reliability coefficients (Cronbach's Alpha) for the dependent and independent variables met acceptable thresholds, based on the standards outlined by Nunnally and Bernstein (1994). These findings provide confidence that the survey items measure the intended constructs consistently and meaningfully.

The dependent variable, Household Transportation Expenditures (HTE), had eight items initially but retained six after removing two low-performing items (DVQ1 and DVQ2). The Cronbach's Alpha for HTE increased from 0.71 in pilot testing to 0.73 in the actual study, indicating moderate reliability. Among the independent variables, Travel Conditions (TC) initially had eight items, but

one item (IV1Q5) was removed during refinement, resulting in a reliability score of 0.75 during pilot testing and 0.62 in the main study. Although slightly below the ideal threshold, the score remains acceptable for newly developed scales, as suggested by Nunnally and Bernstein (1994).

Access to Transportation Alternatives (ATA) demonstrated high reliability, with no items removed. Its Cronbach's Alpha improved from 0.79 in the pilot to 0.88 in the main study, reflecting strong internal consistency. Similarly, Quality of Transportation Infrastructure (QTI) maintained its ten original items, achieving a reliability score of 0.81 in the pilot and 0.60 in the main study. Although QTI's reliability declined in the full study, this is consistent with findings in transportation research, where respondent interpretations of infrastructure-related items can vary widely due to differing local contexts (Du et al., 2023).

The pilot testing also validated the survey's structure, which incorporated negatively framed questions to reduce response bias, as noted by Blamah et al. (2021). For instance, items such as "I am not satisfied with the condition of roads and highways" were intentionally framed to capture dissatisfaction levels objectively. These methodological choices, coupled with the rigorous refinement process, ensured that the final instrument could reliably assess the relationships between household transportation expenditures, travel conditions, access to alternatives, and infrastructure quality.

#### 4.2.2. Discussion

*Table 3. Regression Results for Household Transportation Expenditure of Respondents*

	<b>Unstandardized Coefficient (B)</b>	<b>Standard Error</b>	<b>Standardized Coefficient (Beta)</b>	<b>t-value</b>	<b>P-value</b>
Constant	1.612	.172		9.394	.000
TC	-.054	.059	-.049	-.906	.366
ATA	.113	.079	.088	1.434	.152
QTI	.338	.059	.318	5.712	.000

*Source: Researchers (2024)*

**Note:**  $F(3, 380) = 18.923, p = .000$ ;  $R\text{-square} = .130$ ,  $Adjusted\ R\text{-square} = .123$ ; Sample size ( $n$ ) = 384

Table 3 presents the results of the multiple linear regression analysis examining the predictors of Household Transportation Expenditure (HTE) based on Travel Condition (TC), Access to Transportation Alternatives (ATA), and Quality of Transportation Infrastructure (QTI). The

overall model was statistically significant,  $F(3, 380) = 18.923$ ,  $p = .000$ , explaining 12.3% of the variance in HTE, as indicated by the adjusted  $R^2$  value.

Among the predictors, QTI emerged as the only statistically significant variable ( $p < .001$ ). The positive coefficient ( $B = 0.338$ ) suggests that households perceiving poorer transportation infrastructure quality tend to incur higher transportation expenditures. This aligns with the hypothesis that deficiencies in infrastructure, such as inadequate road networks and unreliable public transport, increase travel costs.

In contrast, TC and ATA did not significantly predict HTE. The coefficient for TC ( $B = -0.054$ ,  $p = .366$ ) was negative, indicating no meaningful relationship between travel conditions and household transportation expenditures. Similarly, ATA, although positively associated with HTE ( $B = 0.113$ ), lacked statistical significance ( $p = .152$ ). These results suggest that while accessibility to transportation alternatives and perceived travel conditions might influence costs indirectly, their direct impact on HTE is limited in this sample.

Overall, the findings highlight that perceptions of poor transportation infrastructure quality are a significant driver of household transportation expenses. While travel conditions and alternative accessibility were hypothesized to play crucial roles, their lack of statistical significance may warrant further investigation into indirect or contextual factors that could moderate their influence on HTE.

## **5.0 CONCLUSION AND RECOMMENDATIONS**

### **5.1. Summary of Key Findings and Recommendations**

This study explored the determinants of household transportation expenditures (HTE) in Hermosa, Bataan, and Malolos, Bulacan, focusing on travel conditions (TC), access to transportation alternatives (ATA), and quality of transportation infrastructure (QTI). The findings revealed that QTI significantly impacts HTE, with households perceiving poorer infrastructure quality incurring higher costs. This aligns with research by Ghosh et al. (2023), which highlighted the economic burdens caused by inadequate infrastructure. The results underscore the urgent need for infrastructure improvements, including better-maintained roads, expanded public transport networks, and safer pedestrian facilities, as emphasized by Guo et al. (2020).

Contrary to expectations, travel conditions and access to transportation alternatives did not significantly influence HTE. This outcome suggests that their effects may be indirect or moderated by factors such as income, geographic location, or household size, echoing findings by Feng and Wang (2024). While TC and ATA are commonly emphasized in transportation planning (Zolnik et al., 2019), this study's results indicate the need for a more nuanced approach to addressing their role in household transportation expenditures. Policymakers should consider these complexities, particularly in crafting solutions aimed at reducing transportation costs for lower-income households, who often face the greatest financial burden (Mendoza, 2022).

Based on these findings, several recommendations are proposed. First, improving transportation infrastructure should be prioritized to enhance accessibility and reduce travel costs, particularly in underserved areas. Second, policies encouraging multimodal transportation options, such as subsidies for public transit or incentives for bike-sharing programs, may provide long-term benefits by promoting sustainable and cost-effective alternatives (Anthony, 2023). Lastly, future studies should investigate contextual factors influencing TC and ATA, such as the interplay between socio-demographic variables and transportation availability, to develop a more holistic understanding of their impacts on household expenditures (Blamah et al., 2021).

## **5.2. Policy Implications**

The results of this study have significant policy implications for reducing household transportation expenditures and promoting sustainable transportation systems in the Philippines. Investments in transportation infrastructure should address deficiencies in road quality, expand public transit networks, and ensure the safety of transportation facilities. Improved infrastructure can reduce travel costs, enhance connectivity, and provide more equitable access to transportation, especially for rural households. This finding aligns with studies emphasizing the critical role of infrastructure in alleviating financial burdens and fostering economic opportunities (Wang et al., 2020).

In addition to infrastructure improvements, policies promoting sustainable and alternative transportation modes should be implemented. For example, subsidies for public transit users, incentives for electric vehicles, and support for bike-sharing programs can mitigate environmental impacts while reducing household expenses (Anthony, 2023; Blamah et al., 2021). Policymakers should also address the stark disparities between urban and rural areas by ensuring equitable distribution of transportation resources and infrastructure investments, as highlighted by Cross and Nutley (1999). Bridging these gaps will ensure that marginalized communities have access to affordable and efficient transportation.

Finally, public awareness campaigns are essential to encourage behavior shifts toward sustainable transportation options. Highlighting the economic and environmental benefits of alternatives, such as reduced fuel consumption and lower emissions, can drive public adoption of eco-friendly transport (Di Martino et al., 2024). A combined approach that integrates infrastructure improvements, equitable resource allocation, and behavioral interventions will be critical for fostering a more cost-effective and sustainable transportation system in the Philippines. This integrated strategy can align with global sustainability goals while addressing the unique challenges of developing nations like the Philippines.

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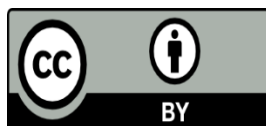
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