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Technological Development and Sustainability of Public Transportation Logistics in Calaca City, Batangas

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Abstract:

This study examines the technological development and sustainability of public transportation logistics in Calaca City, Batangas, focusing on commuter motivations such as accessibility, safety, and quality. Primarily, it assessed the state of public transportation in terms of technological innovation and sustainability and to explore their relationships with commuter motivations. The study also identified the significant differences in perceptions based on demographic and behavioral factors and propose strategies to enhance public transportation logistics. Using a quantitative-descriptive research design, data were collected through a systematic random sampling of 384 respondents aged 18 and above. A survey questionnaire was utilized, validated by experts, and tested for reliability. Statistical tools, including mean, frequency, percentage, Pearson's correlation, Independent T-test and One way ANOVA, Pearson's correlation, Independent T-test and One way ANOVA, were employed to analyze the relationships and differences among variables.

Findings revealed that the majority of respondents were aged 18–25, predominantly female, and primarily students. Motorcycles were the most preferred mode of transport, while walking was least preferred. Respondents generally agreed on the technological advancements and sustainable practices in Calaca City's public transport but noted areas needing improvement, particularly in automated systems like electronic ticketing and the integration of sustainable vehicles. Motivation to use public transportation was driven strongly by accessibility, with respondents emphasizing participation in social and economic activities. Safety was another key motivator, especially at night, while quality was influenced by punctuality and reliability. Significant differences in perceptions were observed based on age, employment status, and preferred transport mode, but not by sex. Strong positive correlations were found between technological development and motivational factors (accessibility, safety, and quality), as well as between sustainable development and these motivations. Then, based on the findings, strategies are proposed to address gaps in Calaca City's public transportation, such as enhancing technological innovation, promoting sustainability initiatives, improving accessibility, strengthening safety measures, and upgrading infrastructure and services.

Keywords — Public Transportation Logistics, Technological Development, Sustainability, Accessibility, Safety, Quality, Calaca City.

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I. INTRODUCTION

Public transportation serves as a vital component in fostering economic growth, social inclusion, and environmental sustainability across urban and rural areas worldwide. As urbanization and technological advancements continue to reshape cities, efficient and sustainable public transportation systems have become critical in addressing the challenges of urban mobility. Globally, governments and urban

planners have focused on integrating technological innovations and sustainable practices into public transportation to improve accessibility, safety, and service quality. Advanced systems, such as real-time tracking, electronic ticketing, and electric vehicles, are not only enhancing commuter experience but also reducing the environmental footprint of transportation networks.

In the Philippines, the need for sustainable and technologically driven public transportation is particularly pressing. Cities like Calaca in Batangas are striving to modernize their transportation logistics to accommodate growing populations and evolving commuter needs. Despite efforts to improve infrastructure and adopt sustainable practices, public transportation in smaller cities often faces challenges such as outdated systems, limited technological integration, and insufficient awareness of sustainability initiatives. These limitations hinder the potential for public transportation to serve as a reliable and sustainable alternative to private vehicles.

II. OBJECTIVES

This objective of the study is to assess the technological development, sustainability and motivation of using public transportation logistics in Calaca City Batangas.

III. RESEARCH DESIGN

To meet this objective, the researcher used the descriptive approach design using quantitative research, in which numerical data were used to obtain information about the variables as its research design.

IV. RESPONDENTS OF THE STUDY

The study involved the 384 respondents aged 18 years old and above who used public transportation in Calaca City, Batangas. To ensure unbiased selection from an unknown population, the researcher employed systematic random sampling, which is particularly effective when the population size is unknown. The recommended sample size is 384, which was followed in this research.

In this study, systematic random sampling began with identifying general survey points, such as terminals or TODAs in barangays, minimart, and churches. Subsequently, at least three sub-survey points were selected within each general survey point. The general and sub-survey points were then randomly chosen. An interval ranging from one to five was determined next. Finally, pre-qualifying questions were used to confirm whether individuals at the selected survey points, based on the chosen interval, were 18 years or older, residents of Calaca City, Batangas, and users of public transportation logistics.

V. DATA GATHERING INSTRUMENTS

The data gathering instrument used to collect data or information about the current technological development, sustainability and its motivation to use public transportation logistics in Calaca City was a survey questionnaire made by the researcher. The draft of the questionnaire was developed based on the researcher's readings, previous studies, professional literature, published and unpublished thesis relevant to the study, and other online publications.

The instrument consists of three (3) parts. The first part deals with the commuters' profiles in terms of age, sex, employment status, and most preferred mode of transport. The second part pertains to a questionnaire with two (2) items regarding public transportation in terms of technological development and sustainability. The last part consists of three (3) items regarding commuters' motivation to use public transportation, particularly accessibility, safety, and quality.

Then, the questionnaire was validated by

the thesis adviser and four panelists, including the chairman, statistician, and industry experts. Upon the questionnaire's approval, the researcher proceeded to carry out the dry run and test its reliability. The pre-survey was conducted in Balayan, Batangas, in cooperation with 30 respondents who were chosen systematically. The tally of the dry run was given to the statistician for the reliability testing, which was measured through Cronbach's Alpha.

The reliability of each variable in the questionnaire is presented in Table 1.

Table I
Reliability

Variables	Number of Items	Cronbach's Alpha	Verbal Interpretation
Technological Development	6	0.731	Acceptable
Sustainable Development	6	0.808	Good
Accessibility	6	0.849	Good
Safety	6	0.733	Acceptable
Quality	7	0.793	Acceptable

The actual survey was conducted in Calaca City, Batangas, using printed questionnaires to collect data for the study. To facilitate the actual survey process, the researcher or hired enumerators who guided the respondents by clarifying any items they found unclear in the questionnaire.

For scoring, a Likert-type 7-point scale was utilized to gather respondents' opinions and knowledge related to the topic, where 7 is the highest and 1 is the lowest, as shown in Table 2.

Table 2
Scoring and Interpretation for Technological Development

Rate	Interval	Interpretation	Verbal Interpretation
7	6.50 – 7.00	Strongly Agree	Highly Developed
6	5.50 – 6.49	Agree	Developed
5	4.50 – 5.49	Slightly Agree	Partially Developed
4	3.50 – 4.49	Neutral	Neutral
3	2.50 – 3.49	Slightly Disagree	Partially Not Developed
2	1.50 – 2.49	Disagree	Less Developed
1	1.00 – 1.49	Strongly Disagree	Not Developed

Table 3
Scoring and Interpretation for Sustainability

Rate	Interval	Interpretation	Verbal Interpretation
7	6.50 – 7.00	Strongly Agree	Highly Sustainable
6	5.50 – 6.49	Agree	Sustainable
5	4.50 – 5.49	Slightly Agree	Partially Sustainable
4	3.50 – 4.49	Neutral	Neutral
3	2.50 – 3.49	Slightly Disagree	Partially Not Sustainable
2	1.50 – 2.49	Disagree	Less Sustainable
1	1.00 – 1.49	Strongly Disagree	Not Sustainable

Table 4
Scoring and Interpretation for Motivations

Rate	Interval	Interpretation	Verbal Interpretation		
			Accessibility	Safety	Quality
7	6.50 – 7.00	Strongly Agree	Highly Accessible	Very Safe	Excellent Quality
6	5.50 – 6.49	Agree	Accessible	Safe	Good Quality
5	4.50 – 5.49	Slightly Agree	Moderately Accessible	Moderately Safe	Satisfactory Quality
4	3.50 – 4.49	Neutral	Neutral	Neutral	Neutral
3	2.50 – 3.49	Slightly Disagree	Slightly Inaccessible	Slightly Unsafe	Substandard Quality
2	1.50 – 2.49	Disagree	Inaccessible	Unsafe	Poor Quality
1	1.00 – 1.49	Strongly Disagree	Highly Inaccessible	Very Unsafe	Very Poor Quality

VI. DATA GATHERING PROCEDURE

The researcher conducted the actual survey in Calaca City, Batangas, wherein the respondents were chosen systematically. In systematic random sampling, the researcher and enumerators identified first the general survey points such as terminal, minimart, and Church. Then, at least three sub-survey points in each general survey point were determined. The sub-survey points for the terminal were Madalunot TODA, Salong TODA and Dacanlao TODA. For minimart, the sub- survey points were Macalindong minimart, Robinsons Easymart, and Alfamart – Poblacion 4. Moreover,

the sub-survey points for church were Archdiocesan Shrine and Parish of St. Raphael the Archangel, Iglesia ni Cristo, and The United Church of Christ in the Philippines.

Next, the general survey point and sub-survey point were randomly selected by the researcher or enumerators. This was followed by picking an interval from one to five. Then, pre-qualifying questions were asked to validate if the people who came in at chosen survey points and by order of the selected interval were 18 years old and above, residing in Calaca City, Batangas, and using the public transportation. There were some people who did not qualify as the respondents for this study. The researcher and enumerators strictly followed the interval until 384 respondents were achieved. The qualified respondents were assisted by the researcher and enumerators in answering the questionnaire.

Upon completion of the actual survey, all gathered information was summed up and tallied, which served as the basis of analysis and interpretation to assess the technological development, sustainability, and motivation in using the public transportation. Lastly, the researcher submitted the tallied data to the statistician to apply the necessary statistical treatment needed for the study.

VII.STATISTICAL TREATMENT OF DATA

To address the research questions, the study utilized various statistical tools to achieve its objectives. Data collection, tabulation, analysis, and interpretation involved descriptive statistics such as mean, frequency, and percentage, alongside inferential methods like Pearson's correlation, Independent T-Test, and One way ANOVA. The mean identified central tendencies in technological development, sustainability, accessibility, safety, and quality, providing an overall trend. Frequency measured the occurrence of categories, while percentages highlighted proportions for easier interpretation and comparison. Pearson's correlation analyzed the relationship between public transportation logistics and motivations for use. The Independent T-Test examined differences in responses based on gender, and One-Way ANOVA assessed variations when respondents were grouped by age, employment status, and mode of transportation. These tools collectively ensured a comprehensive analysis of the data.

VIII. RESULT AND DISCUSSION

This consists of the data of the study which was presented, analyzed, and interpreted by the researcher. The data were derived from the questionnaires issued by the researcher to their respondents.

Table 5
Distribution of Respondents by Age

Age	Frequency	Percentage
18 - 25	123	32.03
26 – 35	74	19.27
36 - 45	92	23.96
46 - 55	50	13.02
56 and above	45	11.72
Total	384	100

The data indicates that individuals aged 18–25 are the most frequent users of public transportation in Calaca City, highlighting their strong dependence on these services for a variety of purposes, including traveling to work, attending educational institutions, and participating in social or recreational activities. This age group's reliance on public transport may stem from its affordability and accessibility, particularly for young individuals who are often students or early-career professionals with limited financial resources. In contrast, the significantly lower usage rates among those aged 56 and above may reflect several factors. Older adults may prefer private vehicles due to the comfort and flexibility they offer, especially if they have achieved financial stability. Additionally, physical challenges or health-related issues often associated with aging could limit their ability to use public transportation. Lifestyle changes, such as retirement, might also reduce their need for regular commuting. These findings underscore the varying transportation needs across age groups, suggesting a need for public

transportation systems to consider these differences to better accommodate all demographics.

Table 6
Distribution of Respondents by Employment Status

Employment Status	Frequency	Percentage
Employed Full-Time	60	15.63
Employed Part-Time	81	21.09
Self-Employed	75	19.53
Unemployed	30	7.81
Retired	31	8.07
Student	105	27.34
Others	2	0.52
Total	**384**	**100**

As stipulated on the table, the largest group of respondents are students, with a frequency of 105, accounting for 27.34% of the total respondents. This is followed by part-time employees, who make up 21.09% (81 individuals). The category with the lowest representation is others, comprising only 2 individuals, which constitutes 0.52% of the sample.

The results highlight the significant presence of students among the respondents, suggesting that this demographic may have a stronger reliance on public transportation in Calaca City. On the contrary, the minimal representation of the "others" category indicates that this group, which likely includes non-traditional employment statuses or miscellaneous classifications, has limited impact on the study. The sizable proportion of part-time employees and self-employed individuals further emphasizes the diverse usage patterns of public transport across employment types.

Table 7
Distribution of Respondents by Most Preferred Mode of Transport

Preferred mode of Transport	Frequency	Percentage
Private Car	96	25.00
Motorcycle	129	33.59
Bicycle	7	1.82
Jeepney	55	14.32
Tricycle	90	23.44
Electric Vehicle	6	1.56
Walking	1	0.26
Total	**384**	**100**

The data indicate that motorcycles are the most preferred mode of transport, with 129 respondents accounting for 33.59% of the total. This is followed by private cars at 25.00% (96 respondents) and tricycles at 23.44% (90 respondents). On the other hand, walking is the least preferred mode of transport, with only one respondent (0.26%). Electric vehicles (1.56%) and bicycles (1.82%) also have a minimal preference among respondents.

The dominance of motorcycles as the preferred mode of transportation highlights their practicality in urban settings like Calaca City. Motorcycles are not only affordable and fuel-efficient but also highly effective for navigating narrow streets and avoiding traffic congestion, which are common challenges in such areas. Private cars and tricycles also emerge as popular choices, largely due to the convenience, comfort, and availability they provide for commuters. In contrast, the relatively low preference for walking points to potential shortcomings in pedestrian-friendly infrastructure, such as safe sidewalks, crosswalks, and well-lit pathways, which discourage walking as a viable option. Similarly, the minimal use of electric vehicles may reflect limited access to charging infrastructure, higher initial costs, or a lack of awareness and incentives to promote sustainable transportation alternatives.

Table 8
Public Transport Logistics Assessment of Technological Development

Technological Development	Mean	Interpretation
1. I know of any technological innovations or upgrades in the public transportation logistics.	6.30	Agree
2. I can assess real-time information regarding public transportation schedules, such as through mobile apps, websites, or electronic boards.	6.38	Agree
3. I can utilize the technological tools in navigating the public transport.	6.26	Agree
4. I notice any automated systems (e.g., electronic ticketing, smart card systems) in Calaca City's public transportation.	5.94	Agree
5. I believe that the implementation of smart traffic management systems would significantly improve public transportation in my hometown.	6.11	Agree
6. I am satisfied with the current level of investment in technological upgrades for public transportation.	6.41	Agree
Composite Mean	**6.46**	**Agree**

The table shows the assessment of technological development in public transport logistics, with a composite mean of 6.46, interpreted as developed. Among the indicators, the highest-rated is satisfaction with the current level of investment in technological upgrades (6.41), closely followed by access to real-time information through apps or electronic boards (6.38). These results suggest that users recognize the efforts in upgrading public transportation technology and value the convenience of accessing accurate, timely information. Conversely, the two lowest-rated

indicators are awareness of automated systems (5.94) and the belief in the potential of smart traffic management systems (6.11). These ratings, while still within the "Developed" range, indicate a relative gap in visible automation and the perceived readiness or implementation of advanced traffic technologies, suggesting areas for further investment and improvement to enhance the system's technological development.

Table 9
Public Transport Logistics Assessment of Sustainability

Sustainable Development	Mean	Interpretation
1. I know the concept of sustainable public transportation.	6.59	Strongly Agree
2. I experienced any sustainable transportation initiatives or programs.	6.59	Strongly Agree
3. I believed that public transportation logistics support the economic growth and social inclusion.	6.61	Strongly Agree
4. I believe that current transportation systems adequately address environmental challenges such as carbon emissions and pollution.	6.36	Agree
5. I will support the integration of sustainable practices such as the use of electric vehicles or zero emission vehicle in the Public Transportation.	6.35	Agree
6. I believe that current public transportation infrastructure is sufficient to support the sustainable urban logistics (e.g., reduced road congestion and efficient freight movement,)	6.41	Agree
Composite Mean	**6.28**	**Agree**

The results indicate a generally positive perception of public transportation sustainability, as reflected by the composite mean of 6.28 interpreted as sustainable. Among the indicators, the highest scores are for "I know the concept of sustainable public transportation" and "I experienced any sustainable transportation initiatives or programs," both with a mean of 6.59, interpreted as highly sustainable. This reflects strong awareness and exposure to sustainability concepts and initiatives, possibly indicating effective advocacy or implementation efforts in public transport systems. Conversely, the two lowest scores, "I believe that current transportation systems adequately address environmental challenges such as carbon emissions and pollution" (6.36) and "I will support the integration of sustainable practices such as the use of electric vehicles or zero-emission vehicles in public transportation" (6.35), are still rated as sustainable. However, these lower scores may reflect perceived gaps in addressing environmental concerns and the actual implementation of sustainable technologies, highlighting areas for improvement in policy and infrastructure development.

Table 10
Motivation in Using the Public Transportation Assessment by Accessibility

Accessibility	Mean	Interpretation
1. I am satisfied with the accessibility of public transportation logistics	6.48	Agree
2. I can easily access the essential services such as healthcare, market using public transportation	6.51	Strongly Agree
3. I believe that current public transportation options allow me to participate fully in social and economic activities	6.61	Strongly Agree
4. I believe that the distance to the nearest public transport stop affect my daily travel decisions	6.51	Strongly Agree
5. I believe that improvements in transportation infrastructure have positively affected regional economic growth	6.57	Strongly Agree
6. As a commuter, I believe that the use of public transport as a sustainable alternative to motorized transportation	6.47	Agree
Composite Mean	**6.54**	**Strongly Agree**

The assessment of motivation in using public transportation based on accessibility reveals a high level of satisfaction among respondents, as indicated by the composite mean of 6.54, which falls within the strongly agree range, interpreted as highly accessible. The two highest-rated items are the belief that current public transportation allows full participation in social and economic activities (6.61) and the positive impact of transportation infrastructure improvements on regional economic growth (6.57). These results suggest a strong perception that public transportation significantly supports both individual engagement and broader economic development. Conversely, the two lowest-rated items, while still within the agree range, include satisfaction with public transportation logistics (6.48) and the belief in public transportation as a sustainable alternative to motorized options (6.47). These slightly lower scores may indicate areas for further optimization, such as enhancing logistics and promoting sustainability to maintain public trust and usability.

Table 11
Motivation in Using the Public Transportation Assessment by Safety

Safety	Mean	Interpretation
1. I feel safe using public transportation in the context of health concerns	6.47	Agree
2. I don't worry about the risk of sexual harassment or other forms of assault while using public transport	6.45	Agree
3. I believe that factors such as overcrowding, poor lightning, lack of surveillance and nighttime travels contribute to safety risk in public transportation	6.39	Agree
4. I feel safe using public transportation at night.	6.53	Strongly Agree
5. I do not encounter or witness traumatic events (e.g., accidents, violence) while using public transportation.	6.32	Agree
6. I believe that safety is important factors when choosing different mode of transportation.	6.45	Agree
Composite Mean	**6.27**	**Agree**

Based on the data, the highest-rated item is "I feel safe using public transportation at night" with a mean of 6.53, interpreted as very safe, suggesting that respondents perceive nighttime public transport as notably secure. The second highest is "I feel safe using public transportation in the context of health concerns" with a mean of 6.47, interpreted as safe, highlighting confidence in health safety measures. On the other hand, the lowest-rated item is "I believe that safety is an important factor when choosing different modes of transportation" with a mean of 6.45, interpreted as safe, indicating a slight underemphasis compared to other aspects of safety concerns. Additionally, "I do not encounter or witness traumatic events (e.g., accidents, violence) while using public transportation" scored a mean of 6.32, also interpreted as safe, reflecting some room for improvement in preventing or mitigating incidents. Overall, while public transportation is generally perceived as safe, safety at night and health-related safety stand out as strengths, whereas occasional traumatic events and prioritizing safety in transport choice warrant attention.

Table 12

Motivation in Using the Public Transportation Assessment by Quality

Quality	Mean	Interpretation
1. I am satisfied with the punctuality of the transportation services	6.47	Agree
2. I am comfortable in using public transportation.	6.37	Agree
3. I am happy to the customer service provided by the public transportation personnels.	6.41	Agree
4. I am contended with the frequency of service, cleanliness, intramodality and service hours of the public transportation logistics.	6.39	Agree
5. I believe that quality of public transportation influences my decision to use it over than private vehicles.	6.41	Agree
6. I much prefer the public transportation of Calaca City to another city / town	6.22	Agree
7. I will recommend the public transportation services.	6.28	Agree
Composite Mean	**6.32**	**Agree**

The results of the assessment reveal that respondents generally perceive the quality of public transportation as good quality based on the verbal interpretation, with an overall composite mean of 6.32, interpreted as agree. The two highest-rated items are satisfaction with the punctuality of transportation services (6.47) and happiness with the customer service provided by public transportation personnel (6.41). These scores highlight the importance of punctuality and customer service in fostering positive perceptions of public transportation. Conversely, the two lowest-rated items are a preference for Calaca City's public transportation compared to other cities (6.22) and willingness to recommend public transportation services (6.28). These lower ratings may indicate areas where public transportation in Calaca City could improve, such as benchmarking against transportation systems in other cities and enhancing service quality to boost user loyalty and advocacy. Overall, the consistent agree interpretation or good quality underscores the service's commendable performance, with opportunities for further enhancements.

Table 13

Relationships of Motivations vs Technological Development

Technological Development VS	Pearson's r	p-value	Decision on H_o	Interpretation
Accessibility	0.794	<0.001	Reject	High Positive Correlation
Safety	0.757	<0.001	Reject	High Positive Correlation
Quality	0.800	<0.001	Reject	High Positive Correlation

The analysis reveals strong positive correlations between technological development and the three motivational factors for using public transport. The highest correlation was observed between technological development and quality (r = 0.800), followed closely by accessibility (r = 0.794), and safety (r = 0.757). All correlations were statistically significant, as indicated by p-values less than 0.001, leading to the rejection of the null hypothesis in each case.

The strong positive correlations suggest that improvements in technological development significantly enhance users' motivation to choose public transport, particularly due to perceived quality, accessibility, and safety. This implies that advanced technological features—such as real-time tracking, comfortable designs, and integrated safety measures—play a critical role in influencing public transport preferences. Quality's slightly stronger correlation may reflect the importance users place on overall experience, reliability, and technological enhancements in public transport services.

Table 14
Relationships of Motivations vs Sustainable Development

Sustainable Development VS	Pearson's r	p-value	Decision on H_o	Interpretation
Accessibility	0.796	<0.001	Reject	High Positive Correlation
Safety	0.801	<0.001	Reject	High Positive Correlation
Quality	0.822	<0.001	Reject	High Positive Correlation

The results show strong positive correlations between sustainable development and the three motivational factors for using public transport. The highest correlation was observed between sustainable development and quality (r = 0.822), followed by safety (r = 0.801), and accessibility (r = 0.796). All correlations are statistically significant, as indicated by p-values less than 0.001, leading to the rejection of the null hypothesis in each case.

These findings suggest that sustainable development significantly influences motivations for public transport use, with the strongest association linked to perceived quality. This may be due to the increasing focus on environmental sustainability in modern transportation systems, which enhances the quality of services through cleaner, more efficient technologies and improved infrastructure. The strong correlations with safety and accessibility further emphasize that sustainable practices, such as reducing environmental hazards and enhancing inclusivity, contribute to a positive user experience, thereby motivating public transport usage.

Table 15
Relationships of Technological Development vs Sustainable Development

	Pearson's r	p-value	Decision on H_o	Interpretation
Technological Development VS Sustainable Development	0.767	<0.001	Reject	High Positive Correlation

The results indicate a strong positive correlation (r = 0.767) between technological development and sustainable development in public transport, with a statistically significant p-value of <0.001. This means that improvements in technological development are closely associated with advancements in sustainable development within the public transport sector. The null hypothesis was rejected, confirming the significance of the observed relationship.

The strong correlation suggests that technological advancements play a crucial role in promoting sustainability in public transport systems. Features such as energy-efficient designs, electric and hybrid vehicles, and smart transportation technologies contribute to reducing environmental impacts and enhancing the sustainability of public transport. The integration of technology not only supports greener operations but also improves the efficiency and quality of services, aligning them with sustainability goals. This synergy highlights the mutual reinforcement between technology and sustainability, with each factor amplifying the other.

IX. PROPOSED OUTPUT

The strategic plan to improve public transportation in Calaca City is a comprehensive designed to address key challenges and enhance the city's transportation system. It aims to modernize public transport through technological innovations, promote sustainability with eco-friendly practices, improve accessibility to encourage widespread adoption, prioritize safety for commuters, and elevate the overall quality of services. By integrating these strategies, the plan seeks to create a reliable, efficient, and sustainable transportation system that meets the needs of Calaca City's residents and visitors while supporting urban development and environmental goals.

Vision Statement

To create a modern, efficient, sustainable, and safe public transportation system that meets the needs of Calaca City's residents and visitors.

Mission Statement

To enhance the public transportation experience in Calaca City through the integration of technology, sustainability, accessibility, safety, and quality improvements, fostering a reliable and eco-friendly urban mobility system.

Key Goals and Strategies

1. **Technological Innovations**

Findings: Lack of automated systems like electronic ticketing and smart cards.

Strategy: Implement and promote automated systems through partnerships, public demonstrations, training, and feedback mechanisms.

Objective: Enhance the visibility, efficiency, and adoption of automated systems.

Key Actions:

- Partner with technology providers to introduce automated ticketing systems.
- Organize public demonstrations and training sessions for commuters.
- Collect feedback to improve system usability and adoption.

Persons Involved: City government, transportation operators, technology providers, community leaders, and commuters.

Expected Outcome: Increased awareness, adoption, and satisfaction with automated systems, leading to a modernized transportation system.

2. Sustainability

Findings: Low public support for sustainable practices like electric vehicles.

Strategy: Launch awareness campaigns, provide incentives, foster partnerships, and implement pilot programs for sustainable transportation.

Objective: Increase public support and adoption of sustainable vehicles, reduce emissions, and promote sustainable urban development.

Key Actions:

- Conduct campaigns to educate the public on the benefits of sustainable transportation.
- Offer incentives for adopting electric or zero-emission vehicles.
- Develop policies to support the integration of sustainable vehicles into the public transportation fleet.

Persons Involved: City government, transportation operators, environmental groups, vehicle manufacturers, and community members.

Expected Outcome: Widespread acceptance and integration of sustainable practices, reduced emissions, and improved air quality.

3. Accessibility

Findings: Low trust and adoption of public transportation as a sustainable alternative.

Strategy: Promote public awareness campaigns and incentives to encourage the use of public transport.

Objective: Increase commuter trust and adoption of public transportation.

Key Actions:

- Launch campaigns highlighting the benefits of public transportation for the environment and economy.
- Provide incentives such as discounted fares for regular users.
- Collaborate with urban planners to ensure public transport routes are convenient and accessible.

Persons Involved: Transportation authorities, urban planners, and city government.

Expected Outcome: Enhanced public transport utilization, reduced reliance on private motorized vehicles, and improved sustainability.

4. Safety

Findings: Safety concerns due to accidents and violence in public transportation.

Strategy: Increase security measures and surveillance on public transportation.

Objective: Minimize traumatic events and enhance passenger safety.

Key Actions:

- Install surveillance cameras in vehicles and stations.
- Increase law enforcement presence on public transport routes.
- Train personnel in handling emergencies and ensuring passenger safety.

Persons Involved: Public transportation authorities, law enforcement, and security personnel.

Expected Outcome: Improved passenger confidence and a safer public transportation experience.

5. Quality

Findings: Preference for public transportation in other cities over Calaca City.

Strategy: Improve quality, reliability, and accessibility through infrastructure upgrades and service enhancements.

Objective: Increase satisfaction and preference for Calaca City's public transportation system.

Key Actions:

- Upgrade infrastructure such as terminals and bus stops.
- Enhance service reliability by adhering to schedules and improving vehicle conditions.
- Ensure accessibility for people with disabilities and other vulnerable groups.

Persons Involved: City government, transportation planners, and service providers.

Expected Outcome: A public transportation system that is user-friendly, efficient, and highly preferred by residents and visitors alike.

Performance Metrics

- Technological Innovations: Percentage increase in the use of automated systems by commuters.
- Sustainability: Reduction in emissions and increase in electric or zero-emission vehicle adoption.
- Accessibility: Growth in public transport ridership and commuter satisfaction ratings.
- Safety: Decrease in reported incidents on public transportation.
- Quality: Improved user satisfaction ratings and positive comparisons with other cities.

Review and Evaluation

- Conduct quarterly reviews to assess progress against goals.
- Use commuter surveys and data analytics to measure performance.
- Adjust strategies as needed based on feedback and evolving needs.

X. CONCLUSION

Based on the significant findings of the study, the researcher drew the following conclusions:

1. The majority of respondents were aged 18–25 years old predominantly female and primarily students. Motorcycles emerged as the most preferred mode of transport, while walking was the least preferred.

2. The assessment of technological development in public transportation indicated overall agreement among respondents on the advancements in technology within the system. Similarly, the sustainability of public transportation logistics reflected the general agreement on the integration of sustainable practices.

3. The assessment of motivation for using public transportation indicates that accessibility reflected that respondents strongly agree public transport facilitates their participation in social and economic activities. Safety showed that respondents generally feel safe using public transportation, particularly at night. Quality highlighted satisfaction with the punctuality of transportation services.

4. Significant differences were observed in perceptions of technological development, sustainability, accessibility, safety, and quality based on age, employment status, and most preferred mode of transport. However, no significant differences were found across these variables based on sex.

5. Significant positive correlations were found between technological development and the motivational factors of accessibility, safety, and quality. Similarly, positive correlations were observed between sustainable development and the motivational factors of accessibility, safety, and quality. Additionally, a significant positive correlation was identified between technological development and sustainable development.

6. In conclusion, the implementation of the proposed strategic plan is crucial for transforming Calaca City's public transportation system into a modern, efficient, and sustainable network that meets the evolving needs of its residents and visitors. By integrating technological innovations, the system will adopt automated solutions that enhance efficiency and user convenience. Emphasizing sustainability will promote eco-friendly practices, reduce emissions, and contribute

to a healthier urban environment. Efforts to improve accessibility will build public trust and encourage the use of public transport as a viable alternative to private vehicles. Strengthening safety measures will ensure a secure and reliable experience for passengers, while investments in quality infrastructure and service upgrades will boost satisfaction and competitiveness with other cities.

XI. RECOMMENDATION

Based on the foregoing findings and conclusions, the following recommendations are hereby presented:

1. Efforts to improve public transportation may focus on introducing automated systems like electronic ticketing and smart cards, especially in areas where passengers are less satisfied.
2. Sustainability practices may be enhanced by promoting and integrating environmentally friendly transport options, such as electric or zero-emission vehicles, alongside awareness campaigns to encourage public support for these initiatives.
3. To increase accessibility, public transportation services may ensure sufficient routes and stops to facilitate easier participation in social and economic activities.
4. Safety measures may be further strengthened, particularly during nighttime operations, through improved lighting, surveillance, and the deployment of security personnel to enhance commuter confidence.
5. To improve quality, public transportation may prioritize being on time, reliable, and competitive with systems in compared to other cities.
6. Future studies related to the results of this study may be conducted

XII. REFERENCES

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