(RESEARCH ARTICLE)

Preparation for smart and modernizing transportation: A qualitative exploration of commuters and operators in science City of Muñoz, Nueva Ecija

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Abstract

The move towards smart and modern transportation systems is crucial to the growth of cities like the Science City of Muñoz, Nueva Ecija. Urban residents increasingly expect convenient, punctual, and technologically advanced means of transportation, especially as cities undergo transformational processes. This study investigates the readiness of Science City of Muñoz for a smart and innovative transport system, focusing on the perspectives of both commuters and transportation providers. This research forms part of a broader planning effort to align the city's transportation system with the needs of modern urban environments and sustainable development.

1. Introduction

1.1. Background and Rationale

The proposed research addresses a significant gap in transportation studies by focusing on the perspectives of commuters and transportation operators regarding smart and modernized transport initiatives in Science City of Muñoz, Nueva Ecija. While global advancements in smart transportation technologies are well-documented, there is limited understanding of how these initiatives are perceived and utilized in smaller urban areas like Muñoz. This research seeks to explore the attitudes, experiences, and expectations of local commuters and operators towards smart transportation solutions. By doing so, the study aims to provide insights that will inform the development and implementation of effective smart transportation strategies tailored to the specific needs and contexts of Science City of Muñoz.

This study aligns with the United Nations Sustainable Development Goals (SDGs), particularly SDG 9 (Industry, Innovation, and Infrastructure), which focuses on developing resilient infrastructure and sustainable industrialization, and SDG 11 (Sustainable Cities and Communities), which aims to make cities inclusive, safe, resilient, and sustainable. The findings of this study will contribute to the city's efforts to enhance transport connectivity, ultimately improving the quality of life in Science City of Muñoz.

As a researcher, my passion for traveling to different places, especially in ASEAN countries, has provided me with firsthand experience of various modes of transportation. This exposure has deepened my understanding of the complexities involved in transportation planning and inspired me to explore how smart transportation solutions can be adapted and implemented in the unique context of Science City of Muñoz. Through this research, I aim to contribute to

the development of a transportation system that meets the needs of the city's residents while promoting sustainable urban growth and preparing the city for the future as a smart city.

1.2. Research Objectives

- Determine the current condition of transportation in Science City of Muñoz to establish a baseline for addressing the research questions.
- Analyze the perception and preparedness of commuters and operators towards smart and modern modes of transport.
- Identify potential considerations and challenges in transitioning to a smart transportation system.
- Explore the feasibility of successfully integrating transport improvements into the city.

2. Methodology

2.1. Research Design

This study employs a qualitative research approach, emphasizing participants' narratives sourced from interviews and Focus Group Discussions (FGDs). The qualitative approach is complemented by quantitative data to gather specific insights into participants' perceptions, views, and experiences. As Science City of Muñoz is rapidly developing, this study aims to assess the city's readiness for smart and modern transport systems from the perspectives of both commuters and operators.

2.2. Participants

The study will use purposive sampling to select participants, ensuring diverse representation across various demographic characteristics, such as age, gender, occupation, and commuting patterns. The participants will include:

- **Regular commuters:** Individuals who rely on public transportation for their daily activities.
- **Transportation operators:** Members of local transport organizations like TODA (Tricycle Operators and Drivers Association) and JODA (Jeepney Operators and Drivers Association).

2.3. Data Collection

- **In-depth Interviews:** One-on-one interviews will be conducted with selected participants to gather detailed insights into their experiences, expectations, and concerns regarding the city's transportation system.
- **Focus Group Discussions (FGDs):** Group discussions will be organized to facilitate a collective exploration of ideas, challenges, and suggestions for improving the transportation system.
- **Observation:** The study will include direct observation of current transportation modes, including waiting sheds, terminal placements, and overall commuter experiences.

2.4. Data Analysis

Data collected will be analyzed using thematic analysis, involving several phases:

- **Familiarization with data:** Reading and re-reading the data to become immersed and intimately familiar with its content.
- **Generating initial codes:** Systematically coding interesting features of the data across the entire dataset.
- **Searching for themes:** Collating codes into potential themes and gathering all data relevant to each theme.
- **Reviewing themes:** Checking if the themes work in relation to the coded extracts and the entire dataset.
- **Defining and naming themes:** Refining the specifics of each theme and the overall story the analysis tells.
- **Producing the report:** The final analysis involves selecting compelling extract examples, conducting a final analysis of selected extracts, and relating the analysis back to the research question and literature.

2.5. Key Areas of Exploration

2.5.1. Current Transportation Landscape

- Understanding existing transportation modes, their efficiency, and challenges.
- Analyzing infrastructure supporting transportation, including waiting sheds, terminals, and road networks.

2.5.2. Commuter Experiences and Expectations

- Examining daily commuter experiences, including travel time, comfort, safety, and cost.
- Gathering commuter perspectives on the need for modern transportation solutions.

2.5.3. Operator Readiness and Challenges

- Assessing the readiness of transport operators to adapt to modernized systems, including technological upgrades and policy changes.
- Identifying barriers that operators face in transitioning to smart transportation.

2.5.4. Smart Transportation Innovations

- Exploring potential smart transportation solutions suitable for the city, such as point-to-point (P2P) bus services, real-time tracking systems, and digital payment options.
- Understanding the role of local government and stakeholders in facilitating these innovations.

2.5.5. Sustainability and Environmental Impact

- Analyzing how smart transportation can contribute to environmental sustainability in the city.
- Exploring the potential reduction of carbon emissions and traffic congestion through modernized transportation.

2.6. Expected Outcomes

dThe research is expected to provide a comprehensive understanding of the preparedness of Science City of Muñoz for smart and modern transportation. It will identify key factors influencing the successful implementation of transportation innovations and highlight the challenges that need to be addressed. The study will also offer recommendations for policymakers, transport operators, and other stakeholders on how to effectively transition to a modernized transportation system that meets the needs of the city's growing population.

3. Results

This chapter presents the findings of the study based on data collected through in-depth interviews, focus group discussions (FGDs), and observations. The analysis is structured around the key areas of exploration outlined in the methodology, including the current transportation landscape, commuter experiences and expectations, operator readiness and challenges, smart transportation innovations, and sustainability. The discussion integrates the findings with existing literature to provide a comprehensive understanding of the readiness of Science City of Muñoz for smart and modern transportation.

3.1. Current Transportation Landscape

3.1.1. Existing Transportation Modes and Infrastructure

The study found that the current transportation system in Science City of Muñoz is predominantly composed of traditional modes of transport such as tricycles, jeepneys, and buses. These modes are widely used by commuters for their daily activities due to their accessibility and affordability. However, the infrastructure supporting these transportation modes, such as waiting sheds and terminals, is often inadequate and poorly maintained.

Participants reported that many of the waiting sheds are in disrepair, offering little protection from the elements, and that terminals are often overcrowded, leading to a disorganized and inefficient system. Road conditions were also cited as a significant issue, with numerous potholes and traffic congestion affecting the overall efficiency of transportation.

3.1.2. Challenges in the Current System

The main challenges identified in the current transportation system include:

Traffic Congestion: Peak hours in the city are characterized by significant traffic jams, particularly around the city center, schools, and public markets. This congestion is exacerbated by the narrow roads and the high volume of vehicles, especially tricycles and jeepneys.

Safety Concerns: Many participants expressed concerns about the safety of the existing transportation modes, citing the lack of road safety measures, insufficient lighting at night, and the aggressive driving behavior of some operators.

Inconsistent Service Quality: There is a noticeable inconsistency in the service quality provided by transportation operators. Factors such as irregular schedules, lack of proper vehicle maintenance, and unprofessional behavior by some drivers were frequently mentioned as sources of dissatisfaction among commuters.

3.2. Commuter Experiences and Expectations

3.2.1. Daily Commuter Experiences

Commuters highlighted several issues they encounter daily, including long wait times, overcrowded vehicles, and discomfort during travel, especially in extreme weather conditions. Despite these challenges, many commuters have become accustomed to these conditions and consider them part of their daily routine.

However, there is a strong desire for improvements. Commuters expressed a preference for more reliable and comfortable transportation options, with particular interest in air-conditioned buses and more organized transport schedules. The majority of respondents indicated that they would be willing to pay higher fares for better services, reflecting a demand for enhanced transportation quality.

3.2.2. Expectations for Modern Transportation Solutions

Commuters showed a keen interest in smart transportation solutions, such as real-time tracking of vehicles, cashless payment systems, and more efficient point-to-point (P2P) services. The younger demographic, in particular, is more receptive to the integration of technology into the transportation system, viewing it as a natural progression towards modernization.

However, there were also concerns about the accessibility of these technologies, particularly among older and less tech-savvy commuters. Some participants feared that the shift towards modern transportation could marginalize those who are less familiar with digital tools.

3.3. Operator Readiness and Challenges

3.3.1. Adaptation to Modernized Systems

Transportation operators expressed a mixed level of readiness for transitioning to smart and modernized systems. While some operators, especially those from organized associations like TODA and JODA, are open to adopting new technologies and improving their services, others are resistant due to the perceived cost and complexity of implementation.

Operators highlighted several challenges in adapting to modernized systems:

Financial Constraints: Many operators are concerned about the financial burden of upgrading their vehicles and integrating new technologies. The cost of new vehicles, maintenance, and the adoption of digital payment systems are seen as significant barriers.

Lack of Training and Awareness: There is a general lack of awareness and training on how to use new technologies effectively. Operators expressed the need for government-led initiatives that provide training and support to help them transition smoothly.

Resistance to Change: Some operators are resistant to change, preferring to stick to traditional methods due to familiarity and a fear of losing control over their operations.

3.3.2. Barriers to Transitioning to Smart Transportation

The study identified several key barriers to transitioning to a smart transportation system:

Infrastructure Deficiency: The existing infrastructure is not well-equipped to support modern transportation systems. Upgrading the infrastructure, including roads, terminals, and communication networks, is essential for the successful implementation of smart transportation.

Regulatory and Policy Challenges: The lack of clear policies and regulations governing the adoption of smart transportation technologies is a significant hurdle. Operators and stakeholders are uncertain about the legal and operational implications of transitioning to modern systems.

3.4. Smart Transportation Innovations

3.4.1. Potential Smart Transportation Solutions

Participants expressed strong support for the introduction of smart transportation solutions that are tailored to the needs of the city. The following innovations were highlighted as having the most potential:

Point-to-Point (P2P) Bus Services: P2P bus services are seen as a viable solution for reducing congestion and providing a more efficient mode of transport. These services would offer direct routes between key locations in the city, reducing travel time and improving convenience for commuters.

Real-Time Tracking Systems: The implementation of real-time tracking systems would allow commuters to monitor the location and arrival times of vehicles, reducing uncertainty and wait times.

Cashless Payment Options: The introduction of digital payment systems would streamline the payment process, making it more convenient for both commuters and operators. However, ensuring widespread accessibility and ease of use is critical for the success of this innovation.

3.4.2. Role of Local Government and Stakeholders

The successful implementation of smart transportation solutions will require strong collaboration between the local government, transportation operators, and other stakeholders. Participants emphasized the need for government-led initiatives to provide financial support, training, and infrastructure development to facilitate the transition.

Moreover, there is a need for clear communication and consultation with all stakeholders to ensure that the proposed changes are understood and accepted. The involvement of the community in the planning and decision-making process is crucial to the success of these initiatives.

3.5. Sustainability and Environmental Impact

3.5.1. Contribution to Environmental Sustainability

The transition to smart transportation is expected to have a positive impact on the environment by reducing carbon emissions and traffic congestion. Participants acknowledged the environmental benefits of modernized transport, particularly the potential for reducing the city's reliance on fossil fuels and minimizing air pollution.

3.5.2. Challenges in Achieving Sustainability

Despite the potential environmental benefits, there are challenges in achieving sustainability through smart transportation. The initial cost of implementing eco-friendly technologies, such as electric vehicles and green infrastructure, is a significant concern. Additionally, ensuring that the transportation system remains affordable and accessible to all residents while promoting sustainability is a delicate balance that needs to be carefully managed.

4. Discussion

The findings of this study reveal a complex landscape of challenges and opportunities in the transition to smart and modern transportation in Science City of Muñoz. While there is a strong desire for improved transportation options among both commuters and operators, the readiness to adopt these changes varies significantly.

The success of smart transportation initiatives will depend on addressing the financial, infrastructural, and regulatory barriers identified in this study. The involvement of local government in providing support and guidance will be crucial in facilitating the transition. Moreover, the adoption of smart transportation solutions must be inclusive, ensuring that all residents, regardless of age or technological proficiency, can benefit from the improvements.

This study contributes to the broader discourse on urban transportation modernization, particularly in the context of smaller cities that are often overlooked in global discussions on smart cities. The insights gained from this research can

inform the development of policies and strategies that are tailored to the unique needs and contexts of Science City of Muñoz, ultimately paving the way for a more efficient, sustainable, and inclusive transportation system.

4.1. Summary of Key Findings

The current transportation system in Science City of Muñoz faces significant challenges, including traffic congestion, safety concerns, and inconsistent service quality.

Commuters are eager for modern transportation solutions, but there are concerns about the accessibility of new technologies.

Transportation operators show varying levels of readiness for modernization, with financial constraints and a lack of training being major barriers.

Smart transportation solutions, such as P2P bus services and real-time tracking, have strong potential but require government support and infrastructure development.

The transition to smart transportation can contribute to environmental sustainability, but achieving this requires careful planning and investment.

5. Conclusions

The study explored the readiness of Science City of Muñoz, Nueva Ecija, for the adoption of smart and modernized transportation systems, focusing on the perspectives of commuters and transportation operators. The research revealed a complex interplay of factors that influence the city's transportation landscape, highlighting both the challenges and opportunities in transitioning to a more efficient, sustainable, and inclusive system.

Key conclusions from the study include:

- Current Transportation Challenges: The existing transportation system in Science City of Muñoz is characterized by significant challenges, including traffic congestion, safety concerns, and inconsistent service quality. These issues are exacerbated by inadequate infrastructure, such as poorly maintained waiting sheds and overcrowded terminals, which hinder the efficiency and reliability of transportation services.
- Commuter Expectations and Readiness for Change: Commuters in Science City of Muñoz exhibit a strong desire for improvements in transportation, particularly in terms of reliability, comfort, and convenience. There is a clear interest in modern transportation solutions, such as air-conditioned buses, real-time tracking systems, and digital payment options. However, concerns about the accessibility and usability of new technologies, especially among older and less tech-savvy commuters, must be addressed to ensure inclusivity.
- Operator Readiness and Barriers: Transportation operators show varying levels of readiness for transitioning to smart and modernized systems. While some are open to adopting new technologies, others face significant barriers, including financial constraints, lack of training, and resistance to change. The success of smart transportation initiatives will depend on overcoming these barriers through targeted support and capacity-building efforts.
- Potential for Smart Transportation Innovations: Smart transportation solutions, such as Point-to-Point (P2P) bus services, real-time tracking, and cashless payment systems, have strong potential to improve the city's transportation landscape. However, their successful implementation requires a supportive infrastructure, clear regulatory frameworks, and active collaboration between the local government, transportation operators, and other stakeholders.
- Sustainability and Environmental Impact: The transition to smart transportation presents an opportunity to enhance environmental sustainability in Science City of Muñoz by reducing carbon emissions and traffic congestion. However, achieving sustainability will require careful planning, investment in eco-friendly technologies, and ensuring that the transportation system remains affordable and accessible to all residents.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are proposed to facilitate the transition to a smart and modern transportation system in Science City of Muñoz:

- Infrastructure Improvement: The local government should prioritize the improvement of transportation infrastructure, including the repair and maintenance of waiting sheds, terminals, and road networks. Upgrading infrastructure is essential to support the efficient operation of modern transportation systems.
- Comprehensive Training and Support for Operators: To address the financial and technical challenges faced by transportation operators, the local government should implement training programs and provide financial assistance or incentives for operators to upgrade their vehicles and adopt new technologies. This support will help build operator capacity and ensure a smoother transition to modernized systems.
- Inclusive Technology Adoption: The introduction of smart transportation solutions should be accompanied by efforts to make these technologies accessible and user-friendly for all commuters, including older and less tech-savvy individuals. Public awareness campaigns and hands-on assistance can help bridge the digital divide and ensure that all residents benefit from transportation improvements.
- Regulatory and Policy Development: Clear and supportive regulatory frameworks are needed to guide the adoption of smart transportation technologies. The local government should develop policies that facilitate the integration of modern transportation solutions while addressing potential challenges, such as data privacy, cybersecurity, and the regulation of digital payment systems.
- Public-Private Partnerships and Stakeholder Engagement: The successful implementation of smart transportation initiatives will require strong collaboration between the local government, transportation operators, private sector partners, and the community. Establishing public-private partnerships and involving stakeholders in the planning and decision-making process will help ensure that transportation solutions are aligned with the needs and priorities of all parties involved.
- Environmental Sustainability Focus: To maximize the environmental benefits of smart transportation, the local government should promote the use of eco-friendly technologies, such as electric vehicles, and integrate sustainability considerations into transportation planning. This includes investing in green infrastructure and encouraging the use of public transportation to reduce the city's carbon footprint.
- Monitoring and Evaluation: The local government should establish a system for monitoring and evaluating the implementation of smart transportation initiatives. Regular assessments will help identify areas for improvement, ensure that transportation solutions are meeting the needs of the community, and guide future transportation planning efforts.

5.1. Future Research Directions

While this study provides valuable insights into the readiness of Science City of Muñoz for smart and modern transportation, further research is needed to explore additional aspects of the transition process. Future studies could investigate the long-term impacts of smart transportation on the city's economy, social equity, and overall quality of life. Additionally, research on the experiences of other cities that have successfully implemented smart transportation solutions could offer valuable lessons and best practices for Science City of Muñoz.

In conclusion, the move towards smart and modern transportation in Science City of Muñoz presents a unique opportunity to enhance the city's transportation system, improve the quality of life for its residents, and contribute to sustainable urban development. By addressing the challenges identified in this study and implementing the recommended strategies, the city can position itself as a leader in innovative and sustainable transportation solutions.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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