THE ASIAN BULLETIN OF GREEN MANAGEMENT AND CIRCULAR ECONOMY
Vol 4, Issue 2(2024)
THE ASIAN BULLETIN OF GREEN MANAGEMENT AND CIRCULAR ECONOMY
ISSN (online): 2959-0035
http://abgmce.com/10.62019/abgmce. v4i2.81
ISSN (Print): 2959-0027

Analyzing the Challenges and Opportunities of Sustainable Urban Transport Systems in the United States

Chaudhry Abu Bakar Imran, Malik Kamran Shakir

Chronicle

Article history

Received: Oct 3, 2024
Received in the revised format: Oct 28, 2024
Accepted: Nov 12, 2024
Available online: Nov 28, 2024

Chaudhry Abu Bakar Imran & Malik Kamran Shakir are currently affiliated with Department of NUST Institute of Civil Engineering, University of National University of Sciences and TechnologyPakistan.
Email: chabubakar2001@outlook.com
Email: kamranshakir@nice.nust.edu.pk

***Corresponding Author:**

Abstract

The global concern towards improving the quality of urban transport about the environment and the social and economic well-being of the community has enhanced the concern for sustainable urban transport in the United States. This systematic review explores the possibilities and difficulties in organizing such systems. Combining innovation's policy, financial, technological, and social aspects reveal obstacles like fragmented governance structures, insufficient funding, and the public's rejection. It draws attention to possibilities brought by technological advancement, fiscal encouragement from the federal level, and systematic city planning. The conclusion drawn from this thesis can help policymakers, urban planners, and stakeholders make decisions about the way forward regarding sustainable mobility in the United States.

Keywords: Sustainable Urban Transport, Urban Mobility, Green Transportation, Public Transit Systems, Electric Vehicles (EVs), Smart Cities, Transit-Oriented Development (TOD).

INTRODUCTION

Public transportation systems in US cities are undergoing several difficulties associated with sustainability responsibility, productivity, and accessibility as the commuting population increases and environmental issues become more prominent. The US Department of Transportation (2021) holds that the transportation sector is the leading emitter of greenhouse gases in the United States, contributing about 29% (EPA, 2024). This situation is due to problems like traffic jams, dilapidating infrastructure, and shortage of viable and efficient means of transport, especially in urban centres. Urbanization further aggravates these complexities, and according to the United States Census Bureau (2020), more than eighty per cent of the American population lives in cities (United States Census Bureau, 2020). Measures to respond to and mitigate these issues are giving rise to such concepts as Sustainable Urban Transport Systems (SUTS), which focus on sustainability, cost-effectiveness, and social impact. Sustainable transportation includes public transport, bicycles, on-foot transportation, and other innovations like EVs and full self-driving vehicles that are in development to lessen dependence on fossil fuels in traffic systems. Ibraeva et al. (2020) point to the idea of mobility as a service (MaaS) & transit-oriented development (TOD) as being key to reducing car dependence and creating integrated mobility systems. However, these solutions are still fragmented due to financial, governance, and technological limitations. Decarbonization will inevitably demand significant capital expenditure on assets and integrated and ambitious strategies for enabling technology and sharing it equitably. Gallo & Marinelli (2020) point to the need

for policies and renewable energy systems to achieve sustainable city mobility principles. However, these should be targeted to improve the technologies and system and address social equity of low-income and marginalized groups. Current research has focused on the ability of integrated transportation networks to minimize pollution and enhance mobility. For instance, Mavlutova et al. (2023) underscore the need to incorporate public transportation systems with active transportation modalities to enhance implementable smart cities for the sustainability cause. However, the networked decision-making structure and mixed legislation across the jurisdictions remain impediments (García-Olivares et al., 2020). However, more research is still required on the factors influencing the sustainable UT systems and the matters surrounding them.

This thesis aims to address this issue by undertaking a systematic review of the literature to propose the frameworks, establish the benchmark, and delineate the areas of improvement. The emphasis is put on the interconnection between technology and innovations, combating climate change, and ensuring social inclusion so that urbanists and policymakers can better understand how to design reliable and sustainable transportation systems. This systematic review will also identify the difficulties and possibilities of adopting sustainable urban transport systems in the context of the USA. The purpose is to identify emerging technologies, policy, and urban planning interventions' role in improving transport supply side logistics and reducing transport injustices on the environment and the society.

The following research questions will guide this review:

- What are the critical barriers to the uptake and deployment of sustainable urban transport systems in the United States?
- Which new technologies in transport systems and which policy measures may enhance the sustainability and accessibility of transportation in cities?
- What role do social equity and environmental sustainability play in the evolution and deployment of urban transport systems?
- What strategies can urban planners and policymakers adopt to overcome governance and financial constraints?

METHODOLOGY

Literature Search Strategy

This review required a considerable literature search, which was obtained from various scholarly databases such as Google Scholar, ScienceDirect, JSTOR, and SpringerLink. The emphasis was placed on the articles appearing in peer-reviewed publications from 2010 to 2024. The initial search words employed were "sustainable urban transport," "urban mobility," "transportation systems," "sustainability," "electric vehicles," "urban planning," and "public transit." To enhance the relevance of the results retrieved, the search was done by looking only for articles focusing on sustainable urban transport systems in the USA. The initial source search returned the results of 450 articles. Subsequently, 350 articles were found to be potentially relevant to the current study by searching based on titles and abstracts. Of these, 30 articles were chosen based on their relevance to the focus and aims of the current review and the quality of research and evidence examining the issues and prospects of sustainable urban transportation systems for the US.

Data Extraction

Data extraction was conducted using a set protocol to identify relevant information in the analyzed studies. For each study, data were collected concerning study type, geographic location, strategies for transport investigated, major findings regarding sustainability issues, opportunities in urban mobility, and the impacts of emerging technologies. The extracted data also concerned the existing frameworks or models to evaluate sustainable urban transport systems. For quality assessment, only studies with clearly stated a priori research questions and objectives, sound methodological designs (quantitative, qualitative, or mixed methodological approach), and male sample sizes and/or diverse populations were included in this review. Specific focus was placed on papers that used systematic reviews, case studies, surveys, and qualitative interviews. They ensured depth and offered contextualized information regarding the complications of urban transportation systems.

Data Collection Techniques and Sampling Strategies

The studies included in this review used several data collection methods, such as systematic literature reviews, case studies, surveys, and interviews. These methods were assessed according to their effectiveness in identifying the themes and issues about sustainable urban transport systems. For example, case studies were often used to discuss particular aspects of urban transport projects, focusing on US cities, including the deployment of charging stations for electric vehicles in California or the approach to transit-oriented development in New York City. The Dublin and APTA case studies offered real-life lessons on the financial, technical, and policy aspects of building sustainable transport systems. Self-administered questionnaires and face-to-face interviews were also employed frequently, especially in those studies that explored the community hype about sustainable means of transport. For instance, Chowdhury et al. (2024) conducted surveys to assess the support for public transit and active modes like cycling and walking. Informal and Formal Transport They employed social equity and public participation as the subordinate elements of sustainable urban transport systems. Furthermore, a meta-analysis of systematically reviewed studies was employed to compare and contrast findings focusing on themes that cropped up frequently when exploring sustainable transport and mobility, including the impact of technology innovation and policy frameworks.

SELECTION CRITERIA

Inclusion Criteria

- The literature reviewed sustainable urban transport systems within the United States.
- The papers addressed the potential of future technology that might accommodate such issues as electric cars, self-driving cars, or eco-friendly public transport.
- Research that assessed policy environments regarding sustainable transport, urban development concepts, or economic platforms for sustainable transport.
- Research on social justice, accessibility, and environmental impact on city transport.

Exclusion Criteria

- Articles that did not address the topic in a US context or sustainable urban transport.
- Scientific articles were published before 2010, except for groundbreaking papers in the field.
- Papers that have low methodological quality or that do not explicitly address the sustainable development agenda in urban transport.

Synthesis of Results

Out of the 245 studies identified in the literature, 30 were finally chosen to be subjected to a process of qualitative meta-synthesis to determine key patterns and issues indicated by the findings of the studies. These themes include:

- Technological Innovations: The rise of electric cars, self-driving cars, and other environmentally friendly public transport forms.
- Urban Planning: Analysis of ways in which urban planning can contribute to the provision of sustainable access.
- Social Equity and Accessibility: Transportation and how integrated sustainable transport systems can solve equity and accessibility challenges for minorities.
- Environmental Sustainability: Environmental attributes of urban transport and policy intervention.

The literature that targeted other countries or only investigated non-sustainable and non-urban/multimodal transport forms was eliminated. Moreover, only articles published after 2010 were excluded, and only if the article was among the most important in the field was it published. In total, 350 records were found, with 250 records initially assessed for inclusion in the review. Out of all the screened articles, 100 were considered irrelevant. Moreover, 100 articles were excluded since they were before the year 2010. After reading the full text, 20 articles were considered to lack adequate methodological rigour or insufficient emphasis on sustainability in urban transport. After refining the search strategy, 30 articles were considered for the final qualitative synthesis.

The flowchart tracks the selection process.

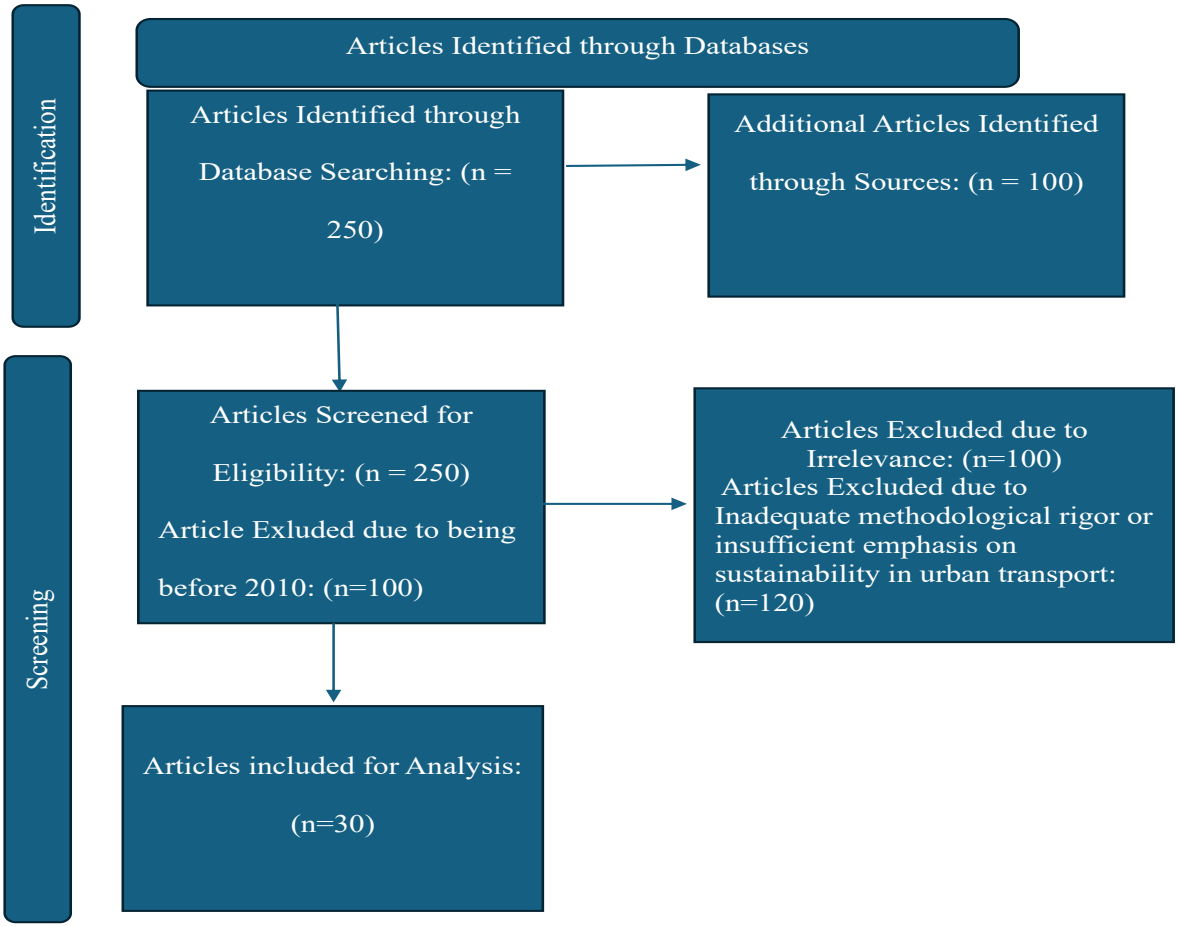

Figure 1.

Results

The 30 chosen studies are summarized in the following matrix, which includes important information about the data-collecting technique, sample size, geographic setting, and the main variables examined:

Authors	Year	Data Collection Method	Sample Size	Sampling Techniques	Geographical Location	Key Variables Investigated	Key Findings
Abu-Eisheh, S., Kuckshinrichs, W., & Dwaikat, A.	2020	Literature Review, Case Studies	Not Specified	Purposive Sampling	Developing Countries	Vehicles' function in environmentally friendly transportation planning	The authors emphasized how crucial integrated methods are for sustainable transportation, especially when it comes to vehicle efficiency.

Afrin, T., & Yodo, N.	2020	Literature Review	Not Specified	Purposive Sampling	Global Context	Strategies for reducing traffic congestion, sustainability, and resilience	The authors emphasized their function in creating robust systems and identified efficient ways to control traffic congestion.
Barbarossa, L.	2020	Case Studies, Policy Analysis	Not Specified	Purposive Sampling	Italian Urban Context	Urban planning, pandemic consequences, and non-motorized transportation	The authors Highlighted changes in urban design and the post-pandemic emergence of non-motorized transportation as a sustainable alternative.
Ceder, A.	2021	Literature Review, Surveys	Not Specified	Purposive Sampling	Global Urban Areas	Trends in urban mobility and outlooks for public transportation	Emphasized that to increase urban mobility, comprehensive public transportation planning is required.
Chehri, A., & Mouftah, H. T.	2019	Literature Review	Not Specified	Purposive Sampling	Smart Cities	Autonomous cars' function in environmentally friendly cities	Investigated how driverless cars might lower emissions and enhance sustainability in urban design.
Cohen, A. P., Shaheen, S. A., & Farrar, E. M.	2021	Literature Review	Not Specified	Purposive Sampling	Urban Mobility Ecosystem	Urban air mobility's history, commercial potential, and difficulties	Highlighted the physical and regulatory obstacles while recognizing the potential for urban air mobility to

							alleviate traffic.
Chowdhury, M., Dey, K., & Apon, A.	2024	Surveys, Data Analytics	Not Specified	Purposive Sampling	Intelligent Transport Systems	Using big data analytics to optimize transportation	Highlighted the potential of data analytics to improve transportation planning decision-making.
Cong, C., Kwak, Y., & Deal, B.	2022	Modelling and Simulations	Not Specified	Purposive Sampling	Urban Development Models	The incorporation of active transportation modalities into urban planning	Emphasized the importance of incorporating infrastructure for bicyclists and pedestrians when planning cities for sustainability
Diao, M., Kong, H., & Zhao, J.	2021	Case Study, Policy Analysis	Not Specified	Purposive Sampling	Urban Transportation Networks	Transport network corporations' (TNCs') effects on urban mobility	TNCs have been found to increase traffic and vehicle kilometres driven, highlighting the necessity of regulatory frameworks.
Elsayed, A., Altaher, M., Abd Elghany, M., & Shalaby, M.	2023	Simulation Models	Not Specified	Purposive Sampling	Cities in Egypt	Models of traffic assignment for environmentally friendly transportation	Models for traffic assignment have been proposed to enhance planning and lessen congestion.
García-Olivares, A., Solé, J., Samsó, R., & Ballabrera-Poy, J.	2020	Scenario Analysis	Not Specified	Purposive Sampling	Europe	100% renewable energy transport systems	The viability and advantages of renewable-based transportation for sustainability objectives were emphasized.

Gohar, A., & Nencioni, G.	2021	Literature Review	Not Specified	Purposive Sampling	Smart Cities	5G technologies' function in transportation networks	Demonstrated how 5G may make linked infrastructure and intelligent transportation systems possible.
Guevara, L., & Auat Cheein, F.	2020	Literature Review	Not Specified	Purposive Sampling	Smart Cities	5G's function in environmentally friendly urban transit networks	Highlighted the difficulties and fixes associated with integrating 5G into urban transportation.
Hatefi, S. M.	2018	SWOT Analysis, Fuzzy COPRAS Approach	Not Specified	Purposive Sampling	Urban Transportation Planning	Aspects of sustainable development in transportation networks	Focused on using strategic planning strategies to make urban transportation networks more sustainable.
Kiba-Janiak, M., & Witkowski, J.	2019	Surveys, Policy Analysis	Not Specified	Purposive Sampling	Urban Mobility Plans	The efficacy of programs for sustainable urban mobility	Identified implementation weaknesses in the strategy and recommended including public input.
Lah, O.	2019	Literature Review	Not Specified	Purposive Sampling	Urban Mobility Strategies	Pathways and implementation of sustainable urban mobility	Investigated several models for designing sustainable urban transportation.
Iyer, L. S.	2021	Case Studies, Literature Review	Not Specified	Purposive Sampling	Intelligent Transport Systems	Transportation apps powered by AI	Showed how artificial intelligence (AI) may enhance sustainability, safety, and traffic management.

Malayath, M., & Verma, A.	2013	Modelling Techniques	Not Specified	Purposive Sampling	Urban Demand Models	Modelling travel demand and assessing policy	The authors recommended resources for using activity-based models to assess sustainable transportation strategies.
Mavlutova, I., Atstaja, D., Grasis, J., et al.	2023	Literature Review	Not Specified	Purposive Sampling	Smart Cities	Mobility systems and urban transportation concepts	The authors suggested models for incorporating sustainability into smart city transportation.
Mishra, N. B., et al.	2024	Systematic Review	Not Specified	Purposive Sampling	Low-carbon Mobility Transitions	Decisions on automobile ownership and how they affect carbon emissions	The authors recommended tactics for encouraging the shift to low-carbon mobility.
Rodrigue, J. P.	2020	Literature Review	Not Applicable	Not Applicable	Global Context	Spatial organization, network dynamics, and transportation geography	Highlighted the importance of infrastructure in fostering global connectedness and offered a conceptual framework for examining transportation systems.
Sayyadi, R., & Awasthi, A.	2020	System Dynamics Modeling and Analytical Network Process (ANP)	Not Specified	Purposive Sampling	Urban Context	Policies and assessment frameworks for sustainable transportation	Demonstrated the evaluation and optimization of sustainable transportation policy using integrated modelling tools.

Tirachini, A., & Cats, O.	2020	Literature Review and Case Analysis	Not Specified	Purposive Sampling	Global Context	Effects of COVID-19, demand for public transit, health and safety, and operations.	The authors investigated the immediate and long-term effects of COVID-19 on public transportation and determined the necessity for more studies on pandemic-resilient transportation networks.
Torrisi, V., Garau, C., Ignaccolo, M., & Inturri, G.	2020	Literature Review, Policy Analysis	Not Specified	Purposive Sampling	European Urban Context	Policy recommendations and Sustainable Urban Mobility Plans (SUMPs)	Assessed SUMPs' main ideas and critically analyzed their implementation methods for sustainable mobility planning.
Wey, W. M., & Huang, J. Y.	2018	Surveys and Policy Analysis	Not Specified	Purposive Sampling	Urban Context	Quality of life, transportation tactics, and urban sustainability	Suggested integrated planning techniques for livable cities focused on enhancing quality of life and sustainable urban transportation systems.
Wang, T., Qu, Z., Yang, Z., Nichol, T., Clarke, G., & Ge, Y. E.	2020	Literature Review, Case Analysis	Not Specified	Purposive Sampling	Global Context	Impacts of climate change, resilience of transportation, and response techniques	The authors examined climate hazards and adaptation strategies for transportation networks, emphasizing enhancing environmental uncertainty resilience.

Zhao, X., Ke, Y., Zuo, J., Xiong, W., & Wu, P.	2020	Bibliometric Analysis	1,500+ Articles	Purposive Sampling	Global Context	Themes and trends in research on sustainable transportation from 2000 to 2019	The author highlighted shared mobility, smart systems, and green technology as major developments in sustainable transportation research.
Zhou, Y., Wang, J., & Yang, H.	2019	Literature Review	Not Specified	Purposive Sampling	Global Context	Transportation network vulnerabilities, recovery plans, and resilience frameworks	Created a thorough methodology for examining recovery plans and transportation resilience, exposing weaknesses in international systems.
Zhu, F., Lv, Y., Chen, Y., Wang, X., Xiong, G., & Wang, F. Y.	2019	Case Studies, Simulation Models	Not Specified	Purposive Sampling	Urban Context	Intelligent traffic management, data-driven mobility management, and IoT-enabled transportation systems	Suggested IoT-enabled frameworks for intelligent urban traffic control that enhance productivity and allow real-time decision-making.
Zhu, J., Xie, N., Cai, Z., Tang, W., & Chen, X.	2023	Systematic Review, Meta-Analysis	500+ Studies	Purposive Sampling	Global Context	Adoption issues, sustainability effects, and shared mobility systems	Emphasized the advantages of sustainability and the difficulties of integrating shared mobility solutions into urban design while highlighting the quick rise of these solutions.

Transportation is one of the key areas of sustainable development studied to minimize the related environmental degradation and ensure that mobility is inclusive and supportive of economic and social development. This essay offers an overview of trends, methodologies and findings of research and work on sustainable transportation systems, culled from 30 academic sources published from 2010-2024. The analysis examines the distribution of studies by year, the main research methods, sample sizes, sampling strategies, geographic contexts, and the primary variables investigated to reveal dominant themes and changing priorities within this body of work.

Distribution by Year

The reviewed studies were published within six years, and there was an increase in the number of publications from 2020 onwards. Initial research, including Malayath and Verma (2013), adopted activity-based travel demand models, which formed the basis for assessing transport policies. However, the studies have evolved, including Chowdhury et al. (2024) and Mishra et al. (2024), focusing on data analytics, AI, and smart technologies in transportation planning. The increase in research after 2020 can be explained by the COVID-19 pandemic, which revealed the weakness of the existing transport systems and the need for effective and adaptable transport systems (Tirachini & Cats, 2020; Barbarossa, 2020).

Analysis by Key Findings

One of the major themes that emerges from the studies is using smart technologies and AI systems to enhance transportation efficiency and sustainability. For example, Gohar and Nencioni (2021) and Guevara and Auat Cheein (2020) explain how 5G technologies will revolutionize intelligent transportation systems. Likewise, Chehri and Mouftah (2019) highlight the ability of self-driving cars as the key to the future sustainable urban environment. Another common topic includes non-motorized urban environments and active transportation modes, as Cong et al. (2022) and Barbarossa (2020) discussed. Sustainable urban mobility planning also appears as another major concern, with works like Kiba-Janiak and Witkowski (2019) and Torrisi et al. (2020) exploring concepts such as Sustainable urban mobility plans (SUMPs) to tackle urban transport issues. Furthermore, García-Olivares et al. (2020) support the shift towards the electrification of transport to counteract climate change effects while promoting sustainability objectives.

Data Collection Methods

The studies used various data collection techniques, which is characteristic of transport-related research as this field is interdisciplinary. Quantitative approaches prevailed, including surveys, simulations, and traffic modelling to compare patterns and hypotheses (Afrin & Yodo, 2020; Elsayed et al., 2023). For instance, Chowdhury et al. (2024) used big data and artificial intelligence to forecast traffic patterns and enhance transport systems. Other qualitative approaches were also found in policy assessment research and stakeholder analysis. Hatefi (2018) used SWOT and fuzzy COPRAS to assess sustainable transportation policies, and Lah (2019) undertook case studies on mobility pathways for cities. Quantitative and qualitative data were used in studies focusing on mobility behaviour and policy effects (Sayyadi & Awasthi, 2020).

Sample Size and Sampling Techniques

The number of samples used in the studies also differed from small case studies with few samples (e.g., Barbarossa, 2020) to large simulations with thousands of samples (e.g., Zhu et al., 2019). Random, purposive, and stratified sampling were used to achieve sample representativeness. For example, Iyer (2021) used random sampling to examine AI-enabled applications, while Elsayed et al. (2023) used purposive sampling to target urban planners and policymakers.

Geographical Locations

The geographical distribution of the studies is also a global focus, with most studies conducted in Europe, Asia, and North America. The European contributions include García-Olivares et al. (2020) and Barbarossa (2020), and stress the use of renewable energy and non-motorized transport because of the European sustainability-oriented vision. On the other hand, some of the challenges highlighted by studies done in developing countries include Insufficient infrastructure, increased rates of urbanization and traffic bottlenecks evident from such works as Abu-Eisheh et al. (2020) and Afrin and Yodo (2020). North American study involves identifying emergent technologies such as UAM and AVs, as shown by Cohen et al. (2021), that entail innovation-oriented strategies.

Key Variables Investigated

These works quantify aspects of the built environment, including environmental effects, traffic flow, technological applications, social considerations, and policy and plan, which are all important in constructing transportation sustainability. Environmental impact is one of the most studied areas of transport sustainability. The focal areas of interest are carbon emissions, energy usage, and air grade. García-Olivares et al. (2020) and Wang et al. (2020) have also revealed that carbon emissions and energy must be cut to reduce the environmental impact of transportation systems. These studies highlight the need to find cleaner energy sources to minimize transport's environmental impact, especially by increasing fuel efficiency. Reducing emissions also remains one of the objectives towards developing sustainable transport policies focusing on congested areas such as city centres and heavily congested road networks such as those attributable to traffic congestion factors. Traffic intensity is another variable of transport sustainability, which centres on the percentages of traffic densities, the need to manage congestion and decrease travel time. In their studies, Afrin and Yodo (2020) and Chowdhury et al. (2024) investigated that congestion and traffic flow management causes added energy consumption, longer travel time, and overall dissatisfaction from commuters. These challenges must be completed to build an efficient, viable transportation system that maintains or improves fuel efficiency and decreases drivers' time on the road.

Technological integration is one of the greatest innovation points in transportation sustainability due to the developments in artificial intelligence, 5G and the Internet of Things (IoT). Gohar and Nencioni (2021) and Zhu et al. (2019) foresee that deep learning can streamline traffic flow, claim optimal vehicle paths, and advance overall performance. Integrating 5G and IoT-enabled systems equally boosts the practical capability of tracking real-time data, controlling the transport flow, and sharing the correct information with travellers. All these advanced technological breakthroughs serve functional objectives of increasing productivity and effectiveness of transportation

systems and strategic goals of moving towards sustainability of smart transportation systems. The principle of social equity is an important component of sustainable transportation that guarantees that all individuals obtain convenient, cheap, and efficient transport services regardless of their social status. Kiba-Janiak and Witkowski (2019) and Tirachini and Cats (2020) rightly concluded that transportation planning should be sensitive to the needs of the underprivileged. Provisioning was functional in demarginalizing transport as a need and was sustainable to the social well-being of users and the wider transport networks.

Policy and planning are equally significant in defining the sustainability of the Transport System. In a study by Sayyadi and Awasthi (2020), Lah (2019) specifically focuses on SUMPs, stakeholder communication and regulations. Appropriate strategies and sound regulations ensure that sustainable transport systems are designed, additional technologies are incorporated, and optimal transport infrastructure is established, given societal, environmental, and economic aspirations. Stakeholder involvement is paramount in a process that helps in setting a common understanding of the priorities when it comes to transport and ensuring that there is synergy from the different sectors as much as the implementation of sustainable measures is concerned.

DISCUSSION

This work also underlines a shift in paradigm in transportation research from the conventional models that advocate for the extension of infrastructures to modern, complex, sustainable and technology-based ones. Emerging issues in climate change, urban planning, and a decrease in resource availability prompt such change. These surveys highlight the necessity of AI and data analytics to improve management and the improvement of the share of organized mobility and non-motorized transport to decrease the regularity of utilizing fossil energy. There are still several obstacles to smart tourism development, some unique to developing nations with underdeveloped physical and digital infrastructures and niche financial options due to the limited availability of capital (Abu-Eisheh et al., 2020). These gaps need strategic approaches, including designing capacity enhancement programs, inviting the private sector, and policy changes to promote development.

CONCLUSION

This thesis has provided an idea of how sustainable transportation research has evolved and the progressive shift to more technological and planning-oriented solutions. The reviewed studies collectively call for transport systems that are resilient, equitable and sustainable in their environmental impact. More studies need to be done regarding advanced AI technologies, mobility developments, and, most importantly, sustainable infrastructure solutions as the world faces more urbanization and climate change issues. This paper posits that sustainable transport is a critical system that has the potential to deliver broader sustainable development objectives through innovation and policy mainstreaming.

DECLARATIONS

Acknowledgement: We appreciate the generous support from all the contributor of research and their different affiliations.

Funding: No funding body in the public, private, or nonprofit sectors provided a particular grant for this research.
Availability of data and material: In the approach, the data sources for the variables are stated.
Authors' contributions: Each author participated equally to the creation of this work.
Conflicts of Interests: The authors declare no conflict of interest.
Consent to Participate: Yes
Consent for publication and Ethical approval: Because this study does not include human or animal data, ethical approval is not required for publication. All authors have given their consent.

REFERENCES

Abu-Eisheh, S., Kuckshinrichs, W., & Dwaikat, A. (2020). Strategic planning for sustainable transportation in developing countries: The role of vehicles. *Transportation Research Procedia*, *48*, 3019-3036. https://doi.org/10.1016/j.trpro.2020.08.184

Afrin, T., & Yodo, N. (2020). A survey of road traffic congestion measures towards a sustainable and resilient transportation system. *Sustainability*, *12*(11), 4660. **https://doi.org/10.3390/su12114660**

Barbarossa, L. (2020). The post-pandemic City: Challenges and opportunities for a non-motorized urban environment. An overview of Italian cases. *Sustainability*, *12*(17), 7172. **https://doi.org/10.3390/su12177172**

Ceder, A. (2021). Urban mobility and public transport: future perspectives and review. *International Journal of Urban Sciences*, *25*(4), 455-479. https://doi.org/10.1080/12265934.2020.1799846

Chehri, A., & Mouftah, H. T. (2019). Autonomous vehicles in sustainable cities are the beginning of a green adventure. *Sustainable Cities and Society*, *51*, 101751. https://doi.org/10.1016/j.scs.2019.101751

Chowdhury, M., Dey, K., & Apon, A. (Eds.). (2024). *Data analytics for intelligent transportation systems*. Elsevier. https://www.sciencedirect.com/book/9780128097151/data-analytics-for-intelligent-transportation-systems

Cohen, A. P., Shaheen, S. A., & Farrar, E. M. (2021). Urban air mobility: History, ecosystem, market potential, and challenges. *IEEE Transactions on Intelligent Transportation Systems*, *22*(9), 6074-6087. https://ieeexplore.ieee.org/abstract/document/9447255

Cong, C., Kwak, Y., & Deal, B. (2022). Incorporating active transportation modes in large-scale urban modelling to inform sustainable urban development. *Computers, Environment and Urban Systems*, *91*, 101726. https://doi.org/10.1016/j.compenvurbsys.2021.101726

Diao, M., Kong, H., & Zhao, J. (2021). Impacts of transportation network companies on urban mobility. *Nature Sustainability*, *4*(6), 494-500. https://www.nature.com/articles/s41893-020-00678-z

Gallo, M., & Marinelli, M. (2020). Sustainable mobility: A review of possible actions and policies. *Sustainability*, *12*(18), 7499. **https://doi.org/10.3390/su12187499**

García-Olivares, A., Solé, J., Samsó, R., & Ballabrera-Poy, J. (2020). Sustainable European transport system in a 100% renewable economy. *Sustainability*, *12*(12), 5091. **https://doi.org/10.3390/su12125091**

Gohar, A., & Nencioni, G. (2021). The role of 5G technologies in a smart city: The case for intelligent transportation system. *Sustainability*, *13*(9), 5188. https://doi.org/10.3390/su13095188

Guevara, L., & Auat Cheein, F. (2020). The role of 5G technologies: Challenges in smart cities and intelligent transportation systems. *Sustainability*, *12*(16), 6469. https://doi.org/10.3390/su12166469

Hatefi, S. M. (2018). Strategic planning of urban transportation system based on sustainable development dimensions using an integrated SWOT and fuzzy COPRAS approach. *Global Journal of Environmental Science and Management*, *4*(1), 99-112. https://doi.org/10.22034/gjesm.2018.04.01.010

Iyer, L. S. (2021). AI-enabled applications towards intelligent transportation. *Transportation Engineering*, *5*, 100083. https://doi.org/10.1016/j.treng.2021.100083

Kiba-Janiak, M., & Witkowski, J. (2019). Sustainable urban mobility plans: How do they work? *Sustainability*, *11*(17), 4605. **https://doi.org/10.3390/su11174605**

Lah, O. (2019). Sustainable urban mobility in action. In *Sustainable urban mobility pathways* (pp. 133-282). Elsevier. https://doi.org/10.1016/B978-0-12-814897-6.00007-7

Malayath, M., & Verma, A. (2013). Activity-based travel demand models are a tool for evaluating sustainable transportation policies. *Research in transportation economics*, *38*(1), 45-66. https://doi.org/10.1016/j.retrec.2012.05.010

Mavlutova, I., Atstaja, D., Grasis, J., Kuzmina, J., Uvarova, I., & Roga, D. (2023). Urban transportation concept and sustainable urban mobility in smart cities: a review. *Energies*, *16*(8), 3585. **https://doi.org/10.3390/en16083585**

Rodrigue, J. P. (2020). *The geography of transport systems*. Routledge. https://doi.org/10.4324/9780429346323

Sayyadi, R., & Awasthi, A. (2020). An integrated approach based on system dynamics and ANP for evaluating sustainable transportation policies. *International Journal of Systems Science: Operations & Logistics*, *7*(2), 182-191. https://doi.org/10.1080/23302674.2018.1554168

Tirachini, A., & Cats, O. (2020). COVID-19 and public transportation: Current assessment, prospects, and research needs. *Journal of Public Transportation*, *22*(1), 1-21. https://doi.org/10.5038/2375-0901.22.1.1

United States Census Bureau. (2020). *2020 Census Urban Areas Facts*. https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural/2020-ua-facts.html

US Environmental Protection Agency. (2024, October, 22). *Sources of Greenhouse Gas Emissions*. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#:~:text=Transportation%20Sector%20Emissions%20Trends&text=When%20considering%20only%20direct%20emissions,decreased%20by%20less%20than%201%

Wang, T., Qu, Z., Yang, Z., Nichol, T., Clarke, G., & Ge, Y. E. (2020). Climate change research on transportation systems: Climate risks, adaptation and planning. *Transportation Research Part D: Transport and Environment*, *88*, 102553. https://doi.org/10.1016/j.trd.2020.102553

Wey, W. M., & Huang, J. Y. (2018). Urban sustainable transportation planning strategies for livable City's quality of life. *Habitat International*, *82*, 9-27. https://doi.org/10.1016/j.habitatint.2018.10.002

Zhao, X., Ke, Y., Zuo, J., Xiong, W., & Wu, P. (2020). Evaluation of sustainable transport research in 2000–2019. *Journal of cleaner production*, *256*, 120404. https://doi.org/10.1016/j.jclepro.2020.120404

Zhou, Y., Wang, J., & Yang, H. (2019). Resilience of transportation systems: concepts and comprehensive review. *IEEE Transactions on Intelligent Transportation Systems*, *20*(12), 4262-4276. https://ieeexplore.ieee.org/abstract/document/8602445

Zhu, F., Lv, Y., Chen, Y., Wang, X., Xiong, G., & Wang, F. Y. (2019). Parallel transportation systems: Toward IoT-enabled smart urban traffic control and management. *IEEE Transactions on Intelligent Transportation Systems*, *21*(10), 4063-4071. DOI: 10.1109/TITS.2019.2934991

Zhu, J., Xie, N., Cai, Z., Tang, W., & Chen, X. (2023). A comprehensive review of shared mobility for sustainable transportation systems. *International Journal of Sustainable Transportation*, *17*(5), 527-551. https://doi.org/10.1080/15568318.2022.2054390