

Received: 22 Jan. 2026; Revised: 08 Feb. 2026; Accepted: 06 Apr. 2026
<https://doi.org/10.22306/atec.v12i2.321>

Advancements in sustainable public transportation systems: a systematic review

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Keywords: sustainability, public transportation, electrification, data-driven solutions, intelligent transportation systems.

Abstract: Sustainable public transportation system developments from 2020 to 2024 are examined in this systematic literature evaluation. It emphasizes the use of electric and hybrid buses, intelligent transportation systems (ITS), and data-driven approaches to improve operational efficiency, user happiness, and pollution reduction. The main goals were to identify trends in sustainable public transportation, evaluate technology and policy initiatives, and provide recommendations for future research and policymaking. Using the PRISMA methodology, the review initially identified 1,400 peer-reviewed papers from Scopus. In total, 11 articles were selected for their relevance to sustainable transportation. The results indicate notable progress in the use of sustainable technology, as the implementation of Intelligent Transportation Systems (ITS) and data-driven techniques has improved efficiency and satisfaction. Public involvement and instruction are crucial for successful acceptance. The study acknowledges limitations, including its narrow focus on English-language papers and its reliance on the Scopus database, which may result in the exclusion of pertinent studies. The study's findings indicate that although significant advances have been made, ongoing efforts are necessary to address remaining obstacles and deficiencies. Future study should expand their scope to encompass numerous languages, diverse databases, and the most recent technical advancements. This study offers significant insights and practical recommendations for promoting sustainable public transportation, thereby enhancing urban environments in terms of efficiency, environmental sustainability, and liability. The contributions encompass a thorough synthesis of recent progress, identification of key patterns and deficiencies, and practical recommendations for policymakers and researchers.

1 Introduction

Several cities are experiencing rapid growth that exceeds their capacity to manage urban design, infrastructure, and public services effectively. The primary concerns for municipal administration, particularly in large metropolitan centres, are security, education, healthcare, and transportation. In these areas, access to these vital services is disproportionately limited and costly. Smart cities, strategic digital city projects, and public transport play a crucial role in integrating all other public services. Transportation is essential for economic development, as workers and students rely on it to securely and comfortably carry out their everyday tasks [1]

The management of transportation networks is increasingly emphasizing environmental sustainability, with a shift toward a 100% renewable transportation system driven by concerns related to climate, energy, and sustainability [2]. This subject is discussed across all primary modes of transportation, including road transport [3,4], air transport [5], maritime transport [6], and railway transport [7]. While railway transit in Europe has a relatively low environmental impact compared to other modes of transportation [8] There are still ample chances to enhance the sustainability of (electric) railway travel, for example, by optimizing energy conversion.

The behavior and demand for public transportation have changed significantly in recent decades. These changes resulted from rapid technological advancements and increasing apprehension about climate change. In addition, public transportation has become a vital tool for reducing carbon emissions [9]. Public transportation plays a crucial role in sustainable mobility by providing an alternative to individual car use. Nevertheless, to promote greater use of public transportation, it is imperative to first understand individuals' travel patterns and preferences for flexible, environmentally friendly alternatives [10]. The transportation system is a vital component of contemporary civilization, facilitating the spread of industrialization, the advancement of agriculture, and the development of rural regions. Transport networks enable the movement of individuals and goods across regions, facilitating the exchange of resources and ideas. In the absence of a reliable transportation system, economic activities would be severely affected due to restricted access to markets and resources. Hence, it is evident that transportation plays a pivotal role in fostering economic growth and affluence [11]. In the absence of transportation development, the local market would be constrained, and manufacturing would be limited to meeting solely local demand. Consequently, the economy of any nation would stay undeveloped.

Transportation holds significance not only for its economic impact but also for its social, political, and cultural implications. In addition to economic advantages, transportation yields social benefits [12]. The transportation sector contributes significantly to global greenhouse gas emissions, air pollution, noise pollution, and habitat degradation. Road transportation is the primary mode, accounting for the majority of global transportation-related emissions [13]. The increasing number of private automobiles and traffic congestion are substantial contributors to atmospheric pollution, particularly in metropolitan regions [12].

The sustainability challenges confronting the transportation sector are intricate and require a multifaceted approach. Effective approaches to reduce transportation emissions include promoting low-emission vehicles, enhancing public transportation systems, and enacting sustainable land-use regulations that reduce dependence on private automobiles. Sustainable transportation legislation and reducing private car use can create a more sustainable transportation system that benefits people and the environment [14]. The importance of this factor in advancing sustainable mobility in urban areas was highlighted by [15] and further reinforced by [16]. In response to global concerns about climate change, air pollution, and traffic congestion, sustainable transportation legislation and initiatives have proliferated. These policies and efforts are environmentally friendly, energy-efficient transportation strategies that aim to reduce the negative environmental and public health impacts of transportation [17].

Despite extensive research on sustainable public transportation systems, there is a lack of analysis of trends, technological developments, and policy implications from 2020 to 2024. There are no recent studies in the literature on this topic, aside from those from previous years. To address this gap, a systematic literature review (SLR) will analyze publications from this period to assess the current state and future developments in sustainable public transport.

The major objectives of this research are to identify contemporary trends and developments in sustainable public transportation systems between 2020 and 2024 and to evaluate the effectiveness of recently introduced technologies and policies in promoting sustainability in these systems. What is the trend in annual research publications on sustainable public transportation systems between 2020 and 2024? What are some key environmental and social benefits resulting from the adoption of sustainable public transportation technologies and policies within this timeframe?

This study comprehensively reviews recent advancements and trends in sustainable public transportation, offering valuable insights for policymakers, researchers, and practitioners. The research explores best practices, emerging technologies, and policies for urban mobility to address challenges, reduce environmental impacts, and promote sustainable systems. It examines recent trends, the effectiveness of new technologies, and policy impacts from 2020 to 2024. The results section provides detailed information on publication trends, technological advancements, and policy impacts, ensuring a clear connection between the study's aims and outcomes.

2 Methodology

This section describes the steps for identifying publications on sustainable public transportation, which involve establishing stringent protocols and conducting a rigorous review of relevant sources. The identified relevant publications were using PRISMA and meta-analysis. Indeed, the PRISMA framework is the most critical component of the systematic review process, as the protocol requires that review reports focus on randomized trial-based analyses. It also sets out clear criteria for including and excluding studies, which are relevant to our study. According to [18], PRISMA is best suited to systematic reviews of randomized trials, particularly for therapeutic interventions. The PRISMA framework can be somewhat limiting for assessing qualitative and mixed-methods study designs. PRISMA comprehensively searches several well-known scientific databases and research sources to ensure a systematic location of any relevant literature, thus minimizing the chances of missing any major research work. In addition, as pointed out by [19], PRISMA streamlined the screening process by reducing the number of studies at each stage, as suggested by [18].

Although PRISMA is primarily a tool used in medical research, its focus on systematic reviews makes it applicable to operations management. This framework also provides clear guidelines for including or excluding data based on specific research aims. Other non-clinical researchers have increasingly turned to reports focused on methodological literature, as identified in systematic literature reviews, to address this deficiency in methodological guidance. According to [20], WoS and Scopus are the two major citation databases that compete with each other. However, this review retrieved only the target articles from the vast Scopus database. The decision was informed by the study done by [21], which concluded that Scopus yielded more documents than WoS. As such, Scopus was favored to seek more relevant papers for review. [22] have highlighted that Scopus is the largest abstract and citation database of journal articles across several disciplines, making it particularly useful for gathering related publications for a researcher. Scopus has recently gained ground as a key competitor and seriously threatened WoS's market monopoly position.

2.1 Search strategy and selection process

Scopus search strings were used to thoroughly explore review terms. Initially, researchers conducted a keyword search using the term "Sustainable AND Public Transportation" as the primary focus. Synonyms, related terms, and variations identified in prior studies as research keywords were incorporated to expand the scope. These extended keywords were subsequently used in the Scopus advanced search tool, yielding 1400 articles. The ability of a reviewer to undertake a

comprehensive evaluation greatly influences the quality of a literature review, as highlighted by [23]. To improve the quality of the results, this review exclusively incorporates journal papers [24]. To simplify the procedure and eliminate translation issues, only English-language documents were considered.

For this study, the publication year was not restricted, although many researchers commonly employ it as an exclusion criterion. The search results reveal that the publications span from 2020 to June 2024. Therefore, the publication year was not a factor in excluding articles. The inclusion and exclusion criteria for the selected article are summarized in Table 1.

Table 1: Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Articles indexed in Scopus	Articles not indexed in Scopus
Scholarly articles published in journals	Proceedings from conferences, chapters from books, and books
Articles written in English	Articles written in languages other than English
	Study based on conceptual analysis

The authors manually assessed 1400 articles by reviewing their titles, abstracts, and full texts. 94 abstracts were removed due to duplication, and 287 abstracts were excluded during screening. Furthermore, 959 articles were rejected after reviewing the full text, and an additional 339 were deemed ineligible after thorough evaluation. As a result, 11 documents were identified as suitable for further analysis.

Based on the relevance, quality, and comprehensiveness of the articles on sustainable public transportation, 11 articles were chosen. Technological advances, policy frameworks, and environmental impacts dominated the discussion. The articles undergo a rigorous peer-review process to verify their credibility. The individuals exhibited diverse perspectives across several academic disciplines and had substantial citation counts and influence. Selection ensured that the most relevant, high-quality, and influential contributions were included. The entire procedure adhered to the principles outlined in the PRISMA statement, ensuring transparency and methodological rigor. Figure 1 shows how PRISMA rules are applied to literature inclusion and exclusion at each review step.

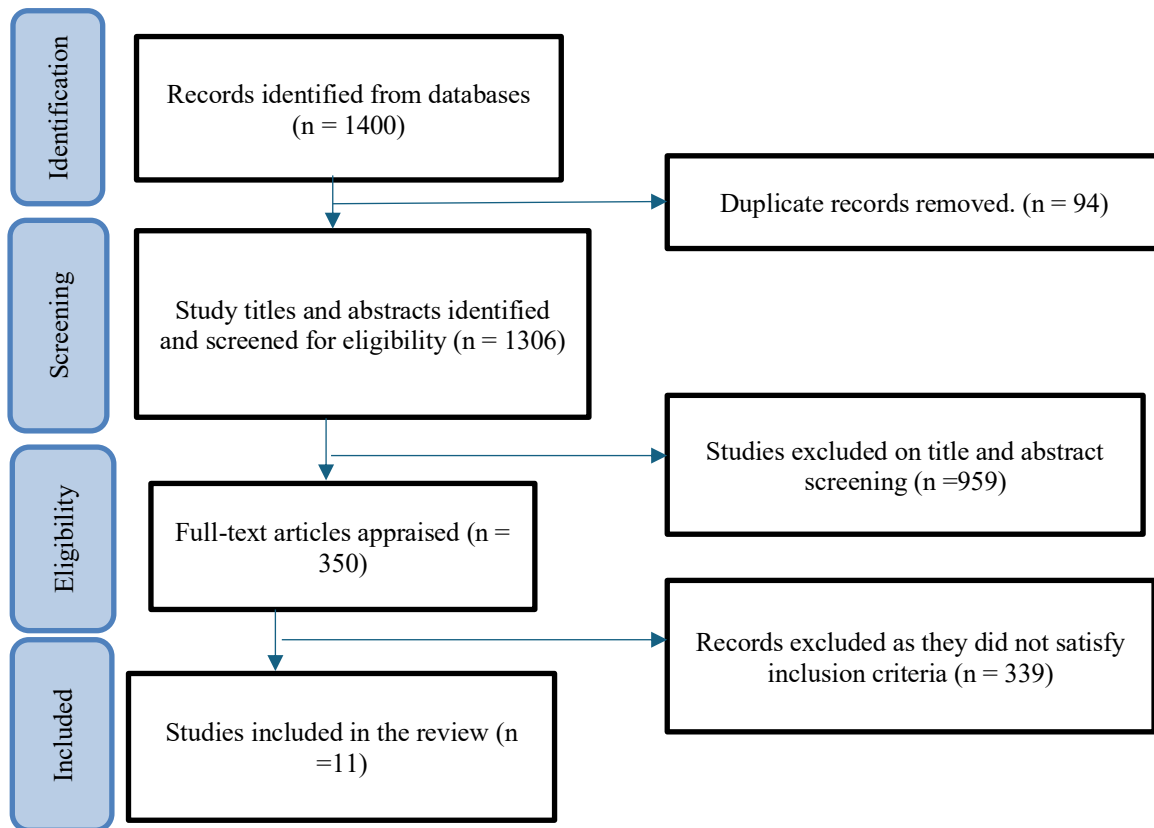


Figure 1 Selection process

3 Results and discussion

This section presents a succinct summary of the systematic literature review conducted from 2020 to 2024, with a specific focus on sustainable public transportation systems. The findings are organized into two primary sections: descriptive statistics and analysis of noteworthy discoveries from selected articles. Descriptive Statistics involves examining publishing trends, geographical distribution, and the categorization of documents by subject area. The Analysis of Key Findings section offers a succinct summary of the primary topics and outcomes examined in the 11 selected studies. An intricate analysis aims to uncover the correlation between sustainable public transportation systems.

3.1 The main information

Figure 2 presents a concise overview of the key attributes of 1400 documents about sustainable public transportation systems published between 2020 and June 2024. The documents originate from 314 distinct sources and are authored by 4221 writers. On average, each document has 3.74 co-authors, and 29.64% of them involve international collaboration. The average number of citations per paper is 13.38, indicating a significant scholarly impact. The yearly increase in research production is 1.65%. In addition, there are 4354 author keywords, and the documents cite a combined total of 83,733 references. The mean age of the documents is 1.94 years, indicating the research is recent.



Figure 2: The main information

3.2 Documents and citations per year

Analyze the annual distribution of articles from 2020 to 2024 to investigate the temporal progression of publications on sustainable public transportation systems. The purpose of this objective is to analyze and determine the patterns, changes, and new areas of interest that have emerged throughout the stated time frame, and to evaluate how citation patterns have developed. The graphs (Figure 3) illustrate the consistent upward trend in the number of articles about public transportation networks over time. In 2020, there were 237 publications. However, in 2023, publications increased consistently, reaching a total of 341. In addition, the average number of citations to publications released between 2020 and 2021 has increased steadily.

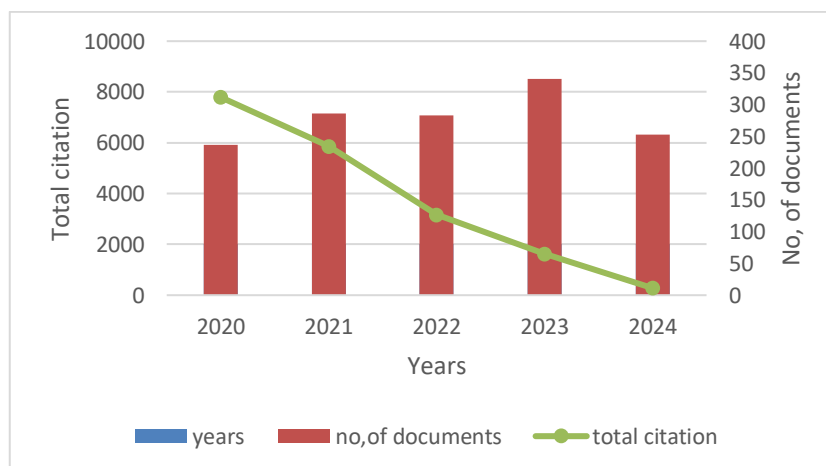


Figure 3 Documents and citations per year

However, there seems to be a decline in the number of papers receiving high citation counts. Consequently, the slope is decreasing because the time required to gather citations for current papers is greater than for prior ones. Over time, the proportion of extensively referenced articles to the total number of publications on the subject will remain consistent. The abundance of articles that have received significant citations further demonstrates the researchers' ongoing fascination with the publications and the subject matter. Public transportation systems remain a relevant subject even after several decades.

3.3 Documents by country

Figure 4 presents the ranks of the top ten countries that have conducted extensive studies on sustainable public transportation systems. The ranking is determined by the quantity of published papers. China ranks first on the list with 301 papers, underscoring its influential role in this field. The United States follows, with 160 documents, signifying a significant scholarly endeavor and interest in this subject. The United Kingdom (UK) ranks third, with 110 publications, indicating a strong research output. Italy boasts 90 publications, demonstrating its growing engagement in intellectual endeavors. Germany and India both demonstrate significant commitment to research on sustainable public transportation systems, with 81 documents each. Australia has 78 documents, whereas Spain has 72 publications. Both countries have made noteworthy contributions to this field. Canada and Turkey are ranked last on the list, having published 55 and 54 papers, respectively. This indicates their significant contribution to the area of study. The allocation of research outcomes across these countries indicates a strong global interest in sustainable public transportation systems. The prevalence of papers from countries such as China, the USA, and the UK suggests well-developed research infrastructures and academic communities committed to addressing this topic. These countries, namely Italy, Germany, and India, represent diverse regions of the world, demonstrating a comprehensive approach to enhancing our grasp of this topic in the future. Figure 4 presents significant achievements in the research of sustainability and its impact on public transportation systems. Thus far, the enhancement of comprehension appears to be a collaborative endeavor undertaken on a global scale.

Documents by country or territory

Scopus

Compare the document counts for up to 15 countries/territories.

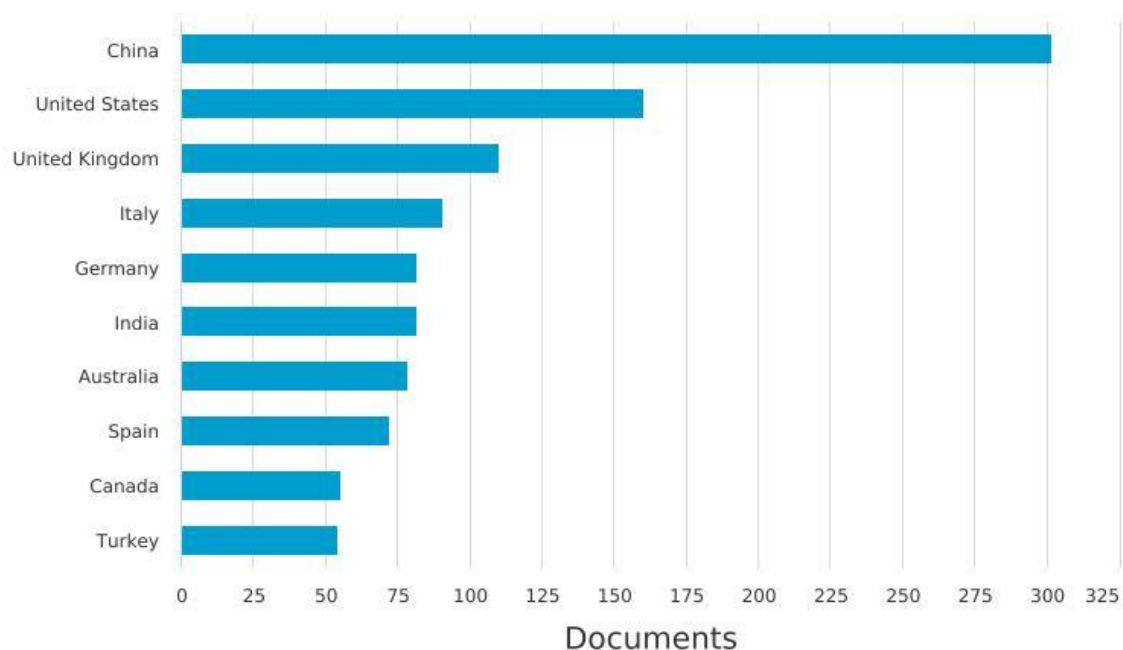


Figure 4 The most productive countries in this field

3.4 Documents by subject area

Figure 5 categorizes the 1400 documents by academic field. The study of sustainable public transportation systems is a multidisciplinary field, with Social Sciences being the largest category, accounting for 25.1% of the total documents. This indicates a focus on understanding social, behavioral, and policy dimensions of sustainable public transportation. Environmental Science accounts for 18.9% of the documents, emphasizing the environmental effects and ecological advantages of sustainable transportation systems. Engineering accounts for 18.2%, with emphasis on technological and

infrastructure advances. Energy-related research accounts for 15.0%, underscoring the link among energy use, renewable energy sources, and transportation sustainability. Computer Science, accounting for 8.1%, emphasizes the importance of digital technology, data analysis, and intelligent transportation systems in improving the efficiency of public transportation networks. Other fields, such as Business, Management, and Accounting, Economics, Econometrics, and Finance, and Decision Sciences, also contribute to the study. The presence of multiple disciplines highlights the complexity of achieving sustainable public transportation, emphasizing the need for an all-encompassing approach that integrates social, environmental, technological, economic, and managerial perspectives to develop comprehensive and efficient solutions.

Documents by subject area

Scopus

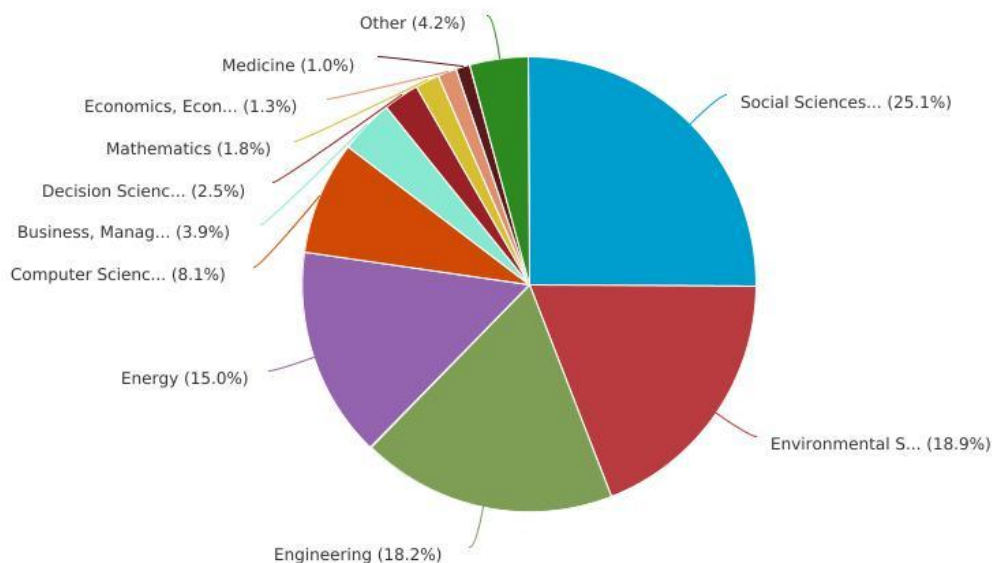


Figure 5: Documents by subject area

3.5 Analysis of Key Findings from the Selected Articles

This section presents a comprehensive analysis of the primary findings from 11 selected publications on sustainable public transportation systems. The assessed papers provide a comprehensive analysis of the significant influence that sustainability has on essential public transportation systems (Table 2).

Table 2 Selected publications on sustainable public transportation systems

Author	Title	Purpose	Methodology	Results
[10]	Design for sustainable public transportation: LCA-based tooling for guiding early design priorities	The paper highlights the significance of sustainable design in public transportation, particularly in train modernization projects, by presenting a Life Cycle Assessment tool to inform initial design choices and thereby improve environmental sustainability.	Case Study	The LCA tool, designed for train modernization projects, incorporates concepts into the initial design phases, thereby decreasing the need for extensive data and specialized knowledge. This tool enhances the accessibility and feasibility of Life Cycle Assessment (LCA), guiding design objectives toward sustainability and providing useful insights into potential environmental improvements. Consequently, it proves to be a great asset throughout the initial stages of the design process.
[6]	Environmental sustainability of public transportation fleet replacement with electric buses in Houston, a megacity in the USA	This study evaluates the environmental impacts and total costs over the full lifespan of replacing conventional diesel buses with electric buses in the Houston METRO system.	Case Study	Life Cycle Assessment (LCA) indicates that electric buses reduce greenhouse gas emissions relative to diesel and hybrid buses. The decrease in energy generation is primarily ascribed to Texas's heavy dependence on natural gas. However, electric buses still emit more, leading to higher environmental costs. Houston's target is to achieve significant annual cost reductions for electric buses by 2040, in order to further its long-term goals of environmental sustainability and improved air quality.

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[7]	Data Intelligence in Public Transportation: Sustainable and Equitable Solutions to Urban Modals in Strategic Digital City Subproject	Municipalities are responsible for overseeing many aspects of urban infrastructure, the competitiveness and attractiveness of public transport, and the use and pricing policies for fossil fuels. This is done to encourage equitable and sustainable transportation options. The research seeks to monitor these elements using analytical methods, with a focus on enhancing investments and services in a nimble, effective manner to benefit citizens.	Case Study	The analysis reveals a strong correlation between characteristics and demand for public transportation, suggesting that local authorities can use data to make informed investments in transportation infrastructure. A comprehensive approach to public transit can improve urban mobility, mitigate traffic congestion, and promote sustainable alternatives.
[5]	Sustainability of On-Demand Public Transportation from the Customer Perspective	This article analyzes the sustainability factors associated with on-demand public transportation systems.	Questionnaire	Given the growing awareness of the environmental and public health impacts of traditional transportation, flexible, convenient, sustainable alternatives are needed. To meet this obligation, lawmakers and transportation planners must collaborate to develop and implement public transportation systems that are environmentally sustainable, efficient, and accessible to all.
[13]	Environmental Sustainability Increase by Activation of Public Transport and Personal Mobility	The study aims to propose a personal mobility (PM) algorithm to optimize traffic efficiency and user convenience by enhancing first- and last-mile services.	Case study	The integration of personal mobility services with public transportation in Seoul, Korea, is expected to increase the user base by 2025, reduce air pollution, improve traffic efficiency, and enhance air quality. These advancements will facilitate the execution of shared mobility distribution strategies.
[1]	Sustainability Indicators of Surface Public Transportation	The objective of this research was to identify the most commonly used metrics for assessing the sustainability of public transportation.	Literature review	The findings emphasize that the long-term viability of public transportation is determined by an intricate interplay of multiple elements, requiring a comprehensive approach to planning and policy development.
[9]	The sustainable transport planning index: A tool for the sustainable implementation of public transportation	This paper presents a methodological approach for developing the Sustainable Transport Performance Index (STPI), which assesses the sustainability of a public transportation system by considering its environmental, social, and economic impacts.	Case study	The findings indicate that the STPI is an effective tool for advancing sustainable planning and progress in public transportation. Furthermore, it can be used to assess the long-term viability of existing systems.
[4]	Smart and Sustainable Public Transportation - A Need of Developing Countries	This study aims to introduce an innovative, environmentally sustainable transportation system that provides both economic and social benefits to developing nations.	Literature review	The paper presents the primary uses of intelligent transportation systems in enhancing transport station facilities, passenger information systems, intelligent traffic control and management systems, and smart parking systems, and eco-friendly transportation systems.
[23]	Optimization of renewable energy usage in public transportation: Mathematical model for energy management of plug-in PV-based electric metrobus	This study contributes to the existing literature by examining metrobus, which are widely used in the public transportation sector and are based in Istanbul, Turkey's most densely populated city.	Case study	The modeling results indicate that the daily total profit from energy trading for the EMs parking lot is estimated at 86,098 TL. The price of this item is subject to change based on fluctuations in energy prices. However, parking lots equipped with electric transportation can generate revenue.
[18]	Comparative Analysis of Sustainable Electrification in Mediterranean Public Transportation	The objective of this study is to analyze the implementation of electric-powered public transportation in developed and underdeveloped nations. Specifically, it focuses on the current public transport systems, namely buses and trams, in the Mediterranean region.	Literature review	The analysis suggests that more than 200 GWh of electricity consumption from public transportation, including buses, could reduce greenhouse gas emissions and help achieve Sustainable Development Goal 13. However, electric buses may not be the most cost-effective solution, particularly in developing nations. It emphasizes the need for environmental, social, and economic factors in sustainable urban mobility.
[27]	Implications of the Progression to Sustainable Public Transportation: An Insight into the Modern Jeepney Shift from the Philippines	This study evaluated the factors that influence passengers' inclination to use modern jeepneys, using a higher-order reflective construct and partial least squares structural equation modeling.	Questionnaire	The results indicate that travelers are more likely to use public transit because of their personal travel experiences rather than to seek societal approval.

The literature published between 2020 and 2024 was largely focused on the development of sustainable public transportation systems and on sustainability indicators and planning tools. These frameworks would be vital for

policymakers and urban planners in identifying crucial areas requiring enhancement, thereby ensuring the efficient and resource-efficient design of transport systems that are environmentally harmonious.

The applications of smart technologies and data analytics in public transport have recently been reviewed. Intelligent transportation systems and data-driven methods, in this regard, have a considerable effect on operational efficiency, emissions, and customer satisfaction [11]. Efficient and innovative public transport systems contribute to sustainable urban development, particularly in developing countries facing mobility challenges [12].

Substituting diesel buses with electric ones has been highly explored for their environmental benefits. Studies indicate whole reductions in GHG emissions and energy use. Expanding public transport to include bicycles and e-scooters provides an integrated solution for sustainable urban mobility by improving air quality and enhancing traffic efficiency. [25], shows that this integration has positive effects on urban mobility. [13] underscores several positive effects these integrations have on urban mobility.

[10] emphasize the importance of customer satisfaction in on-demand public transport systems and underscore that user feedback drives the development of offers for related services. [15] present an instrument based on LCA to support environmentally friendly design decisions already at the project's initial stages. This technology ensures that public transport networks are designed to effectively meet all sustainability objectives and user requirements. [27] Assess various plans for sustainable electrification in Mediterranean public transport networks.

They show the positive effects of these changes on the environment and the economy. In the paper, Saray et al. present a mathematical model to enhance the efficiency of renewable energy use in electric metro buses equipped with plug-in photovoltaic systems in 2024. The authors provided compelling evidence demonstrating the tangible benefits and feasibility of harnessing renewable energy sources for public transportation networks. Discuss the process of adopting environmentally friendly fleets in public transport for developing countries by replacing them with new and cleaner fleets. Their contribution is that sustainable transport solutions must be implemented through enabling policies, infrastructure, and public awareness campaigns.

This provides key lessons for similar transformations in other parts of the world. Several key patterns and conclusions have emerged from a careful review of the 11 selected articles, illuminating the development of public transport and the obstacles to its sustainability. All such data-driven approaches to the integration of Intelligent Transportation Systems have demonstrated their importance for improving operational efficiency, reducing emissions, and increasing consumer satisfaction.

These technologies offer solutions to improve operational efficiency and provide key data for decision-making, with a view toward future legislation on transport and the investment in related infrastructure. Our analysis highlights the need for advanced technologies to sustain the long-term development of public transportation networks, particularly in large cities with severe mobility challenges. Moreover, this study strongly underscored the ecological advantages of the diffusion of electric and hybrid buses. Replacing conventional diesel buses with electric buses would result in significant reductions in greenhouse gas emissions and energy use. Second, better models optimize the use of renewable energy to power public transport and improve efficiency, thereby facilitating the transition. We demonstrate that electric buses are feasible and efficient for communities seeking to reduce CO₂ emissions and support clean urban transport. Moreover, the success of any such emerging technologies will depend heavily on user satisfaction and public support; careful public involvement and education are therefore essential. The article is a critical review of studies on sustainable public transport systems published between 2020 and 2024. It provides critical insights for policy decision-makers, researchers, and practitioners on the prerequisites for effective, equitable, and environmentally sensitive systems to address urban mobility challenges and promote sustainable urban development. The integration of intelligent technologies and data-driven initiatives with renewable energy sources will be essential to promoting eco-friendly public transport systems.

4 Conclusions

This research into Sustainable Development on Public Transport Systems, 2020-2024: Commitment to Eco-friendly Technologies and Policies. The present study highlights the urgent need for a significant shift toward eco-friendly technologies and policies across all modes of transport. The drive behind the change under study is the urgent need to reduce GHG emissions and improve mobility within urban systems. The selected articles underscore the use of Intelligent Transport Systems and data-driven approaches to improve operational efficiency and increase user satisfaction.

Almost all the papers reviewed share the overarching theme: the ecological advantages of electric and hybrid buses. Substituting diesel buses significantly reduces emissions and yields substantial gains in energy efficiency. In this regard, there is a need to develop and implement models to fully exploit renewable energy in public transport. The results of our research clearly indicate that the effective working of all these technologies depends on user satisfaction and public acceptance. This underscores the need to fully implement strategies to engage the public. The SLR on sustainable public transport has several limitations.

The review primarily focuses on English-published articles, which may overlook studies in other languages or grey literature. The review's focus on Scopus databases may not capture emerging trends and technologies beyond 2024, resulting in shallow coverage. To improve coverage, recommendations include conducting broader, systemic reviews;

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integrating research from grey literature; updating results to include advances and technologies beyond 2024; and addressing issues such as improving self-managed public transport, integrating renewable energy sources, and the environmental implications of green transport systems. Policymakers and researchers must keep pace with advances to stay ahead.

Future studies should investigate the impact of sustainable urban planning and transport policies on long-term development and the socio-economic benefits of sustainable transport, including job creation and improved health outcomes. Additionally, further studies should focus on developing novel measures that leverage innovations, such as renewable energy sources, to address challenges and increase public acceptance of new technologies. This will help policymakers and researchers stay ahead of the curve in sustainable public transport.

Acknowledgement

The authors express their gratitude to the SIMAD University Center for Research and Development for providing financial support for their research grant and to all participants in the study.

Authors' contributions

Mohamed Ali Farah: conception and design, methodology, intellectual content, analysis and interpretation of data, and original draft preparation. Hassan Ahmed Mohamed Jakuula: conception, supervision, and reviewing.

Disclosure statement

The authors reported no potential conflict of interest.

Data availability statement

The data that support the findings of this study are available from the corresponding author, [Mohamud Ali Farah], upon reasonable request

References

- [1] AL-LAMI, A., TOROK, A.: Sustainability Indicators of Surface Public Transportation, *Sustainability*, Vol. 15, No. 21, pp. 1-15, 2023. <https://doi.org/10.3390/su152115289>
- [2] ALRYALAT, S.A.S., MALKAWI, L.W., MOMANI, S.M.: Comparing Bibliometric Analysis Using PubMed, Scopus, and Web of Science Databases, *Journal of Visualized Experiments*, Vol. 152, e58494, 2019. <https://doi.org/10.3791/58494>
- [3] ANAS, A., LINDSEY, R.: Reducing Urban Road Transportation Externalities: Road Pricing in Theory and in Practice, *Review of Environmental Economics and Policy*, Vol. 5, No. 1, pp. 66-88, 2011. <https://doi.org/10.1093/reep/req019>
- [4] ASHRAF, A., IDRISI, M.J.: Smart and Sustainable Public Transportation - A Need of Developing Countries, *International Journal of Networked and Distributed Computing*, Vol. 12, No. 1, pp. 144-152, 2024. <https://doi.org/10.1007/s44227-024-00023-2>
- [5] BUICS, L., SÜLE, E., SZALAY, M.: Sustainability of On-Demand Public Transportation from the Customer Perspective, *Chemical Engineering Transactions*, Vol. 107, pp. 427-432, 2023. <https://doi.org/10.3303/CET23107072>
- [6] DU, H., KOMMALAPATI, R.R.: Environmental sustainability of public transportation fleet replacement with electric buses in Houston, a megacity in the USA, *International Journal of Sustainable Engineering*, Vol. 14, No. 6, pp. 1858-1870, 2021. <https://doi.org/10.1080/19397038.2021.1972491>
- [7] FUMAGALLI, L.A.W., REZENDE, D.A., GUIMARÃES, T.A.: Data Intelligence in Public Transportation: Sustainable and Equitable Solutions to Urban Modals in Strategic Digital City Subproject, *Sustainability*, Vol. 14, No. 8, pp. 1-16, 2022. <https://doi.org/10.3390/su14084683>
- [8] GARCÍA-OLIVARES, A., SOLÉ, J., SAMSÓ, R., BALLABRERA-POY, J.: Sustainable European transport system in a 100% renewable economy, *Sustainability*, Vol. 12, No. 12, pp. 1-21, 2020. <https://doi.org/10.3390/su12125091>
- [9] GHAFOURI-AZAR, M., DIAMOND, S., BOWES, J., GHOLAMALIZADEH, E.: The sustainable transport planning index: A tool for the sustainable implementation of public transportation, *Sustainable Development*, Vol. 31, No. 4, pp. 2656-2677, 2023. <https://doi.org/10.1002/sd.2537>
- [10] HAANSTRA, W., RENSINK, W.J., MARTINETTI, A., BRAAKSMA, J., VAN DONGEN, L.: Design for Sustainable Public Transportation: LCA-Based Tooling for Guiding Early Design Priorities, *Sustainability*, Vol. 12, No. 23, pp. 1-17, 2020. <https://doi.org/10.3390/su12239811>
- [11] HARINI, B.K., PARKAVI, A., SUPRIYA, M., KRUTHIKA, B.C., NAVYA, K.M.: Increasing Efficient Usage of Real-Time Public Transportation Using IOT, Cloud and Customized Mobile App, *SN Computer Science*, Vol. 1, 159, pp. 1-8, 2020. <https://doi.org/10.1007/s42979-020-00161-8>
- [12] IRIS, Ç., LAM, J.S.L.: A review of energy efficiency in ports: Operational strategies, technologies and energy management systems, *Renewable and Sustainable Energy Reviews*, Vol. 112, pp. 170-182, 2019. <https://doi.org/10.1016/j.rser.2019.04.069>
- [13] JEONG, H., YANG, M.H., CHOI, M., KIM, S., LEE, S.: Environmental Sustainability Increase by Activation of Public Transport and Personal Mobility, *Chemical Engineering Transactions*, Vol. 106, pp. 253-258, 2023. <https://doi.org/10.3303/CET23106043>

- [14] KRAUS, S., BREIER, M., DASÍ-RODRÍGUEZ, S.: The art of crafting a systematic literature review in entrepreneurship research, *International Entrepreneurship and Management Journal*, Vol. 16, pp. 1023-1042, 2020. <https://doi.org/10.1007/s11365-020-00635-4>
- [15] KU, D., KIM, J., YU, Y., KIM, S., LEE, S., LEE, S.: Assessment of Eco-Friendly Effects on Green Transportation Demand Management, *Chemical Engineering Transactions*, Vol. 89, pp. 121-126, 2021. <https://doi.org/10.3303/CET2189021>
- [16] KUMAR PATEL, A., SINGH, M., SINGH, K., KUMAR PATEL, A., KUMAR VARMA, A., KURI, R.: Visualizing Publication Trends in Webology Journal: A Bibliometric Review based on the Scopus Database (2006-2020), *Library Philosophy and Practice (e-journal)*, Vol. 2021, 5995, pp. 1-22, 2021.
- [17] MELO, S.P., BARKE, A., CERDAS, F., THIES, C., MENNENGA, M., SPENGLER, T.S., HERRMANN, C.: Sustainability Assessment and Engineering of Emerging Aircraft Technologies—Challenges, Methods and Tools, *Sustainability*, Vol. 12, No. 14, pp. 1-26, 2020. <https://doi.org/10.3390/su12145663>
- [18] MIRAFTABZADEH, S.M., RANJGAR, B., NICCOLAI, A., LONGO, M.: Comparative Analysis of Sustainable Electrification in Mediterranean Public Transportation, *Sustainability*, Vol. 16, No. 7, pp. 1-24, 2024. <https://doi.org/10.3390/su16072645>
- [19] MOHER, D., LIBERATI, A., TETZLAFF, J., ALTMAN, D.G., GROUP, P.: Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement, *PLoS Med.*, Vol. 6, No. 7, pp. 1-6, 2029. <https://doi.org/10.1371/journal.pmed.1000097>
- [20] NICOLA, D.A., ROSEN, M.A., BULUCEA, C.A., BRANDUSA, C.: Some sustainability aspects of energy conversion in urban electric trains, *Sustainability*, Vol. 2, No. 5, pp. 1389-1407, 2010. <https://doi.org/10.3390/su2051389>
- [21] RETHLEFSEN, M.L., KIRTLEY, S., WAFFENSCHMIDT, S., AYALA, A.P., MOHER, D., PAGE, M.J., KOFFEL, J.B., & PRISMA-S GROUP: PRISMA-S: an extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews, *Systematic Reviews*, Vol. 10, 39, pp. 1-19, 2021. <https://doi.org/10.1186/s13643-020-01542-z>
- [22] ROSA, A.C.M., BRODAY, E.E.: Comparative Analysis Between the Industrial and Service Sectors: A Literature Review of the Improvements Obtained Through the Application of Lean Six Sigma, *International Journal for Quality Research*, Vol. 12, No. 1, pp. 227-252. <https://doi.org/10.18421/IJQR12.01-13>
- [23] SARAY, M., SARAY, M., KAZAN, C., GUNER, S.: Optimization of renewable energy usage in public transportation: Mathematical model for energy management of plug-in PV-based electric metrobuses, *Journal of Energy Storage*, Vol. 78, 109946, 2024. <https://doi.org/10.1016/j.est.2023.109946>
- [24] SIMIONESCU, V., SILVIUS, G.: Assessing Sustainability of Railway Modernization Projects; A Case Study from Romania, *Procedia Computer Science*, Vol. 100, pp. 458-465, 2016. <https://doi.org/10.1016/j.procs.2016.09.182>
- [25] ZHANG, X., LAM, J.S.L., IRIS, Ç.: Cold chain shipping mode choice with environmental and financial perspectives, *Transportation Research Part D: Transport and Environment*, Vol. 87, 102537, 2020. <https://doi.org/10.1016/j.trd.2020.102537>
- [26] ZHU, J.: A tale of two databases: The use of Web of Science and Scopus in academic papers, *Computer Science*, arXiv, pp. 1-17, 2020. <https://doi.org/10.48550/arXiv.2002.02608>
- [27] ZULUETA, T.M.T., ONG, A.K.S., GERMAN, J.D., GUMASING, M.J.J., CHICO, J.C.D.: Implications of the Progression to Sustainable Public Transportation: An Insight into Modern Jeepney Shift from the Philippines, *Sustainability*, Vol. 16, No. 10, pp. 1-37, 2024. <https://doi.org/10.3390/su16103912>

Review process

Single-blind peer review process.