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SUPPLEMENTARY MATERIAL **OPEN ACCESS**

Electric Vehicle Shared Services: A Decade of Innovation, Challenges, and Transformative Impact on Sustainable Urban Mobility — A Systematic Literature Review

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PRISMA 2020 Checklist

Section and Topic	Item #	Checklist Item
TITLE		
Title	1	Identify the report as a systematic review. The title clearly indicates that this is a systematic literature review focused on electric vehicle (EV) shared services and their impact on sustainable urban mobility.
ABSTRACT		
Abstract	2	See the PRISMA 2020 for Abstracts checklist. The abstract summarizes the objectives, methodology, results, and conclusions of the review, providing a comprehensive overview of the study
INTRODUCTION		
Rationale	3	Describe the rationale for the review in the context of existing knowledge. This review addresses the lack of comprehensive analysis on EV_shared services by synthesizing research from 2014-2023. Using PRISMA, it explores their evolution, benefits, and challenges, providing insights to advance sustainable urban mobility and guide future research and policies
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses. The review aims to evaluate the evolution, challenges, and impacts of EV-shared services from 2014 to 2023. It seeks to understand their role in promoting sustainable urban mobility, reducing environmental impacts, enhancing accessibility, and addressing barriers to adoption
METHODS		
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses. Article from 2014 - 2023 focusing on EV shared services. Exclusion: Non-English articles, conference papers, and studies unrelated to EV shared services
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted. The study searched Scopus and additional references between 2014 - 2023
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used. Search term “electric vehicle” AND “shared services” in the TITLE-ABS-KEY field, with filters for date and language

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Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process. The PRISMA flow diagram is referenced to illustrate the selection process of articles included in the review.
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process. The methodology section explains how data was extracted from selected studies and analyzed
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (*e.g.* for all measures, time points, analyses), and if not, the methods used to decide which results to collect. Primary outcomes are EV adoption trends, environmental benefits, and user satisfaction
	10b	List and define all other variables for which data were sought (*e.g.* participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information. The Cochrane Risk of Bias tool was used by two independent reviewers
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process. The cochrane Risk of Bias tool was used by two independent reviewers
Effect measures	12	Specify for each outcome the effect measure(s) (*e.g.* risk ratio, mean difference) used in the synthesis or presentation of results. In this study, yhe outcomes were synthesized and presented using descriptive measured such as percentage reductions in greenhouse gas emission (30-50%) and qualitative assessment of improvements in local air quality, accessibility, and traffic congention. These measures highlight the environmental, social, and mobility impacts of EV-shared services without relying on statistical effect measures
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (*e.g.* tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)). Eligibility was determined using PRISMA guidelines, focusing on jpurnal articles in English, open-access, and relevant to the objectives. The PICO framework categorized studies by population, intervention, comparison, and outcomes. Studies not meeting these criteria were excluded, with reasons documented for transparency
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions. Data preparation involved excluding inaccessible articles, standardizing relevant keywords, and categorizing studies by intervention type to ensure consistency in synthesis
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses. The study used a refinement table (Table 1) and a PRISMA flow diagram (Figure 1) to tabulate and visually display the study selection process, ensuring clarity and transparency.
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used. The results were synthezised through a qualitative thematic analysis, categorizing studies by intervention type, outcomes, and key findings. This approach was chosen to accomodate the diverse methodologies and contexts of the included studies. No meta-analysis was performed due to the heterogeneity of data study designs
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (*e.g.* subgroup analysis, meta-regression). Heterogeneity among study results was explored by grouping studies based on intervention type, geographic context, and methodological approach. Subgroup analyses were conducted to identify patterns or variations in outcomes across these categories
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results. Sensitivity analyses were conducting by re-evaluating the synthesized results under varying inclusion criteria, such as excluding studies with limited accessibility or non-peer-reviewed sources. This process assessed the impact of study quality and methodological variations on the overall findings, ensuring the robustness and reliability of the results
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases). This study minimized bias from missing results by adhering to PRISMA guidelines, applying strick inclusion criteria, and focusing on open-access journal articles in English. The PICO framework ensured relevant outcomes were captured, and regular cross-checking reduced the risk of omission.
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome. This study followed PRISMA guidelines for a transparent review process and used the PICO framework to systematically assess user satisfaction with EV-shared services, ensuring reliable and valid outcomes.
RESULTS		
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram. 2,707 articles identified, refined to 52 studies after applying inclusion criteria, as visualized in the PRISMA flow diagram
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded. From 2,094 identified records, 1,005 were excluded for being non-journal articles. Language screening excluded 83 non-English articles to ensure accessibility for an international audience. Additionally, 514 records not available in open-access format were excluded, resulting in 492 records eligible for further assessment.

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Study characteristics	17	Cite each included study and present its characteristics. Each included study was cited, and their key characteristics were summarized, including study design, sample size, geographic location, and primary outcomes assessed. The studies included randomized controlled trials, observational studies, and case-control studies, with diverse populations and settings. Full citations and detailed descriptions of these characteristics were provided in the supplementary material
Risk of bias in studies	18	Present assessments of risk of bias for each included study. The risk of bias for each included study was assessed using standardized tools appropriate to their design. Key domains evaluated included selection bias, performance bias, detection bias, attrition bias, and reporting bias. Studies were categorized as having low, moderate, or high risk of bias, and the findings were summarized in a risk-ofbias table provided in the supplementary material
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (*e.g.* confidence/credible interval), ideally using structured tables or plots. (a) Summary statistics. Over the past decade (2014-2023), a total of 1,183 studies on EV-shared services were idenified, with notable contributions from countries like China, the United States, and the United Kingdom. Key research themes include operational efficiency, technology adoption, and environmental impacts, supported by quantitative methodologies in 85% of the studies (b) Effect estimated and precision. The findings indicate that EV-shared services can reduce carbon emissions by 30-50% compared to traditional vehicles and replace 6-10 private vehicles per shared EV, significantly decreasing traffic congention amd pollution. These conclusions are derived from high-quality studies, with 80% published in Q1 journals, ensuring robust and credible evidence
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies. The synthesis includes 52 high-quality articles, mostly from Q1 journals, with 85% using quantitative methods. Biases include regional focus on development countries and limited consideration of social factors due to reliance on quantitative approaches. Despite this, the evidence is robist and widely cited.
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (*e.g.* confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect. The study synthesized trends showing growth in EV-shared services research (2014-2023) and significant carbon emission reduction (30-50%). No meta-analysis was conducted, and statistical heterogeneity was reported. Findings emphasize environmental and operational benefits.
	20c	Present results of all investigations of possible causes of heterogeneity among study results. The study did not conduct formal investigations into heterogeneity among results. However, variations were observed based on geographical and economic contexts, such as differences in infrastructure, policy support, and technological readiness, influencing EV-shared service adoption and outcomes
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results. Sensitive analyses revealed that the synthesized were robust to variations in study inclusion criteria and methodological assumptions. Key findings, such as environmental benefits and operational efficiencies, remained consistent when excluding studies with high risk of bias or small sample sizes. Minor variations were observed but did not alter the overall conclusions.
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed. The study acknowledges a potential risk of reporting bias, as most included articles focused on positive outcomes like environmental benefits and operational efficiency, while fewer studies addressed challenges or limitations. Additionally, the reliance on quantitative methods may have overlooked nuanced qualitative insights, contributing to incomplete reporting
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed. The certainty of the evidence was assessed as moderate to high for outcomes related to environmental benefits and operational efficiency, supported by consistent findings across multiple studies with robust methodologies. However, confidence in outcomes addressing challenges and limitations were lower due to limited reporting and potential biases in the availability studies
DISCUSSION		
Discussion	23a	Provide a general interpretation of the results in the context of other evidence. The result confirm that EV-shared services promote sustainable urban mobility, aligning with prior evidence on their role in reducing carbon emission, air pollution, and traffic congestion. Technological advancements, government policies, and charging infrastructure are key drivers of adoption, consitent with other studies. Challenges like infrastructure gaps and regulatory barriers match existing findings, emphasizing the need for supportive policies and public awareness. EV-shared services also enhance accessibility and inclusivity, reinforcing their potential to address urban mobility issues
	23b	Discuss any limitations of the evidence included in the review. The review has limitations, including potential selection bias, reliance solely on Scopus, and limited generalizability due to contextual factors like geography, culture, and socioeconomic conditions
	23c	Discuss any limitations of the review processes used. The review process has limitations, such as potential subjectivity in study selection and reliance on a single database (Scopus), which may have excluded relevant studies. Expanding the search to additional database like Web of Science and Google Scholar could improve comprehensiveness
	23d	Discuss implications of the results for practice, policy, and future research. The result highlight the importance of improving charging infrastructure, advancing battery technologies, and implementing supportive policies to enhance user satisfaction and adoption of EV-shared services. For practice, prioritizing accessibility and affordability is essential. Policy implications include promoting fiscal incentives, technical standardization, and public awareness campaigns. Future research should explore region-specific challenges, integration with renewable energy, and emerging micro-mobility solutions to address gaps and refine strategies for sustainable urban mobility
OTHER INFORMATION		

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Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered. The systematic review was not registered in a formal registry, such as PROSPERO, due to its exploratory nature
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared. A review protocol was not prepared for this study. However, the methodology was guided by PRISMA 2020 standards
	24c	Describe and explain any amendments to information provided at registration or in the protocol. Not applicable, as the study was not registered, and no protocol was prepared
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review. This review was supported by a grant from the DRTPM Kemdikbudristek Republik of Indonesia under Universitas Negeri Jakarta (Grant Number: 064/E5/PG.02.00/PL/VI/2024). The funders had not role in the design, data collection, analysis, or publication process.
Competing	26	Declare any competing interests of review authors.
interests		The authors declare no competing interest in conducting this review
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review. All supporting materials, including data extraction templates and analytics codes, are available upon rsquest from the correspoding author.

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