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Bibliometric Analysis of Electric Vehicle Adoption Research: Trends, Implications, and Future Directions

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ABSTRACT

The study aims to comprehensively understand the research landscape surrounding electric vehicle (EV) adoption. Through bibliometric analysis, the research explores critical questions related to EV adoption trends, leading countries and universities, subject areas of interest, and potential research gaps. The study utilizes data from the Scopus database, covering the period from 2017 to 2023, resulting in 181 publications. The findings reveal a positive trend in EV adoption research, reflecting the growing interest in sustainable transportation solutions. The dominance of the United States and China in EV adoption research highlights their proactive approach towards addressing climate change and advancing EV adoption. Meanwhile, Indonesia's limited representation indicates research gaps within the country's unique context. The research highlights the significance of environmental impact and charging infrastructure in promoting sustainable EV integration. The implications suggest opportunities for further investigation into the environmental benefits of EV adoption and technological advancements. Future research directions include conducting in-depth studies in Indonesia, investigating the economic and financial implications of EV adoption, and assessing the long-term impact of EV adoption on transportation and the environment. Collaborative interdisciplinary research is crucial for developing effective strategies for accelerating EV adoption and achieving sustainable transportation systems globally.

1. INTRODUCTION

The carbon-intensive economy has significantly impacted global climate change and has deeply affected humanity [1]. The transportation sector is a significant contributor to global carbon emissions [2], and the shift towards sustainable and low-carbon transportation solutions has become imperative to mitigate climate change [3]. The adoption of electric vehicles (EVs) has garnered significant attention in recent years as a promising solution to address climate change and reduce greenhouse gas emissions in the transportation sector. EVs represent a promising alternative to conventional internal combustion engine vehicles, offering cleaner and more environmentally friendly mobility options. Understanding the factors influencing EV adoption and the policies that can accelerate its uptake is crucial in promoting sustainable transportation and achieving climate goals.

Despite the growing interest in EV adoption research, there may be gaps in the existing literature. The main problem addressed in this bibliometric analysis is the need to comprehend the current state of EV adoption research, its trends, and implications on a global scale. Identifying research gaps and opportunities in different subject areas and countries can guide future research endeavors and policy formulation to promote widespread EV adoption and sustainable transportation systems.

While the importance of transitioning to low-carbon transportation solutions is evident, it is essential to underline the specific significance of this study. This research is not only timely but also vital as it delves into the complexities of EV adoption, offering insights that can drive meaningful change. The global community is critical in addressing climate change, and the transportation sector is pivotal. This study contributes to this global effort by providing a comprehensive analysis of the state of EV adoption research and identifying critical areas of focus and potential gaps. By doing so, it offers a roadmap for policymakers, researchers, and stakeholders to formulate strategies to foster the widespread adoption of EVs and promote sustainable transportation systems.

This study addresses the following research questions: (1) What is the trend in EV adoption research publications from 2017 to 2023, and what implications does it have for sustainable transportation policies and practices? (2) Which countries and universities are leading in EV adoption research, and what are the theoretical implications for global EV adoption efforts? (3) How does EV adoption research vary across different subject areas, and what multidimensional aspects of EV adoption does it encompass? (4) What are the main themes and areas of interest within EV adoption? (5) What are the potential gaps in EV adoption research, particularly in countries with limited representation in the literature? (6) What are the future research directions and opportunities to enhance knowledge on EV adoption, climate change mitigation, and sustainable transportation strategies?

The primary purpose of this bibliometric analysis is to provide an in-depth understanding of EV adoption research

trends, implications, and future directions. This study aims to identify research gaps and opportunities for promoting EV adoption globally by analyzing the publication landscape, subject areas, and countries' contributions. The findings will contribute to evidence-based decision-making, policy formulation, and interdisciplinary collaborations to accelerate the worldwide transition towards sustainable and low-carbon transportation systems.

2. METHODOLOGY

This paper employs bibliometric analysis. Bibliometrics is defined as using mathematical and statistical techniques to analyze scientific publications, including papers, books, and other forms of communication [4]. It involves applying these methods to gain insights and understand scientific publication patterns [5, 6]. Bibliometric analysis is a robust and systematic research method that allows for thematic analyses based on selected studies using bibliometric parameters, such as authors, citations, keywords, and publication countries [7, 8]. The study obtains valuable insights and comprehensive analyses of the chosen research themes by utilizing these bibliometric parameters.

2.1 Data source

In this study, we systematically searched for data for our bibliometric analysis. The data sources analyzed using bibliometric methods include a wide range of academic documents, such as journal articles, conference papers, book chapters, and other scholarly materials, all accessible through the Scopus database. Our search strategy employed the specific search term "Electric vehicle adoption" to retrieve relevant publications. This term was chosen to ensure a comprehensive coverage of research related to the adoption of electric vehicles.

Our data collection process focused on publications from 2017 to 2023. This timeframe was selected to capture the most recent developments and trends in EV adoption research. It encompasses 181 publications from Scopus.com, which we subsequently analyzed using bibliometric techniques.

2.2 Data handling and analysis

Once the data was collected, a systematic process was followed. The bibliometric analysis method involved several key steps:

Step 1: Clearly defining the objectives and scope of the bibliometric study.

Step 2: Selecting appropriate bibliometric analysis techniques.

Step 3: Carefully collecting and organizing the data for the bibliometric analysis.

Step 4: Conducting the bibliometric analysis, which includes the utilization of Scopus analysis and VOSviewer to visualize and analyze research trends related to EV adoption [4, 9].

The analysis aimed to uncover patterns, connections, and developments in electric vehicle adoption research, allowing for a comprehensive understanding of the field.

2.3 Validity and reliability

Ensuring the validity and reliability of the bibliometric analysis is crucial for the integrity of the study. The study maintains the quality of research by following several best practices:

- *Data Quality*: We relied on the Scopus database, known for its comprehensive coverage of academic literature. This ensured that the data used in our analysis was of high quality.
- *Search Strategy*: The search strategy used the specific term "Electric vehicle adoption" to retrieve relevant publications. This precise search term was chosen to target research directly related to the adoption of electric vehicles, enhancing the relevance and accuracy of our dataset.
- *Timeframe Selection*: The chosen timeframe of 2017 to 2023 was selected to capture the most recent developments and trends in EV adoption research. This decision ensured that our analysis focused on up-to-date and relevant publications.
- *Bibliometric Analysis Tools*: The study utilized Scopus analysis and VOSviewer, established tools in the bibliometric field, to conduct the analysis. These tools are well-regarded for their reliability and accuracy in revealing research trends and patterns.

By adhering to these rigorous methods and utilizing established data sources and analysis tools, the study sought to maintain the validity and reliability of our bibliometric analysis.

3. RESULTS

The search term "Electric vehicle adoption" on Scopus.com yielded a total of 181 publications within the timeframe of 2017 to 2023. These publications were categorized into various types based on their formats. The majority of the publications, constituting 77.9% of the total, were Article journals (141 publications). Conference papers accounted for 12.7% with a total of 23 publications, followed by 8 Reviews (4.4%), 5 Book chapters (2.8%), 2 Erratum (1.1%), 1 Note (0.6%), and 1 Data paper (0.6%) (see Figure 1).

The substantial number of Article journals indicates the prevalence of scholarly research articles on electric vehicle adoption. This demonstrates a strong academic interest in understanding and contributing to the field of electric vehicle adoption. These research articles likely delve into various aspects of electric vehicle adoption, such as consumer behavior, policy analysis, market trends, and technological advancements.

The presence of Conference papers suggests that electric vehicle adoption is also a subject of interest in conference proceedings and presentations. Such papers are often a result of the latest findings and research updates, providing valuable insights to attendees from diverse backgrounds, including researchers, practitioners, policymakers, and industry representatives.

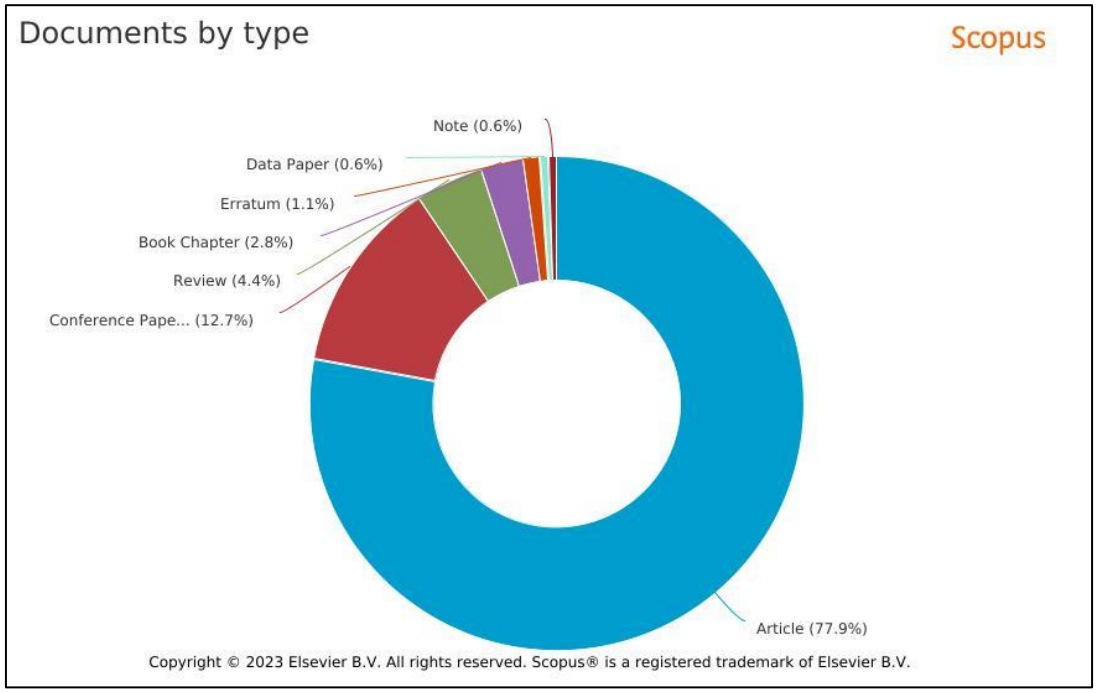
3.1 The trend in EV adoption research publications

Figure 2 illustrates a continuous increase in research and publications related to electric vehicles from 2017 to 2023. The data reveals a positive trend, indicating the growing interest and significance of electric vehicle research within the studied period. In 2017, there were 12 publications, which saw a notable increase to 20 publications in 2018. The trend

continued to rise in 2019 with 21 publications and remained stable with 21 publications in 2020. The following year, in 2021, there was a significant surge, reaching 34 publications, demonstrating a substantial growth in research activities. The upward trajectory continued in 2022, with 46 publications indicating a robust interest in electric vehicle-related studies. As of July 2023, there have already been 27 publications, which will likely continue to increase, surpassing the publications in 2022.

The increasing trend of research and publications on electric vehicles carries several implications. Firstly, the growing number of publications reflects the rising importance of electric vehicles as a sustainable and environmentally friendly transportation solution in addressing climate change and reducing greenhouse gas emissions. The escalating interest in electric vehicle research indicates a commitment from the scientific community and policymakers to seek solutions for sustainable mobility.

Secondly, the trend suggests expanding knowledge of electric vehicle technology, adoption, and policy implications. The accumulating research findings can be valuable for academics, policymakers, and industry stakeholders, facilitating evidence-based decision-making and formulating effective policies to promote electric vehicle adoption and sustainable transportation systems.



Source: Scopus analyze

Figure 1. Document by type

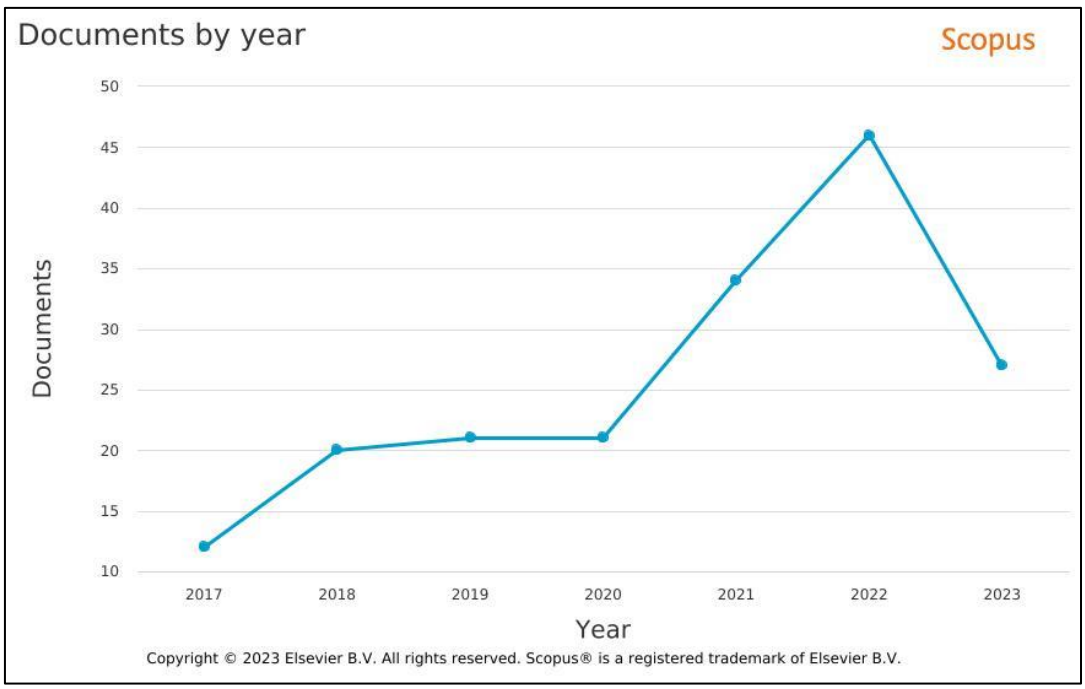


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Figure 2. Document by year

The continuous increase in publications signals a dynamic and evolving research landscape. Researchers are likely exploring various aspects of electric vehicle technology, including battery advancements, charging infrastructure, consumer behavior, and policy analysis. This diversity in research themes opens opportunities for interdisciplinary collaboration, encouraging researchers from different fields to come together and contribute to advancing electric vehicle research.

3.2 Countries and universities are leading in EV adoption research

The dominance of research on EV adoption is primarily led by researchers affiliated with institutions from the United States, followed by China, India, United Kingdom, Canada, Australia, Denmark, Netherlands, Sweden, and France, making up the top 10 (see Figure 3). Meanwhile, Indonesia occupies the 21st position, with only three research studies and publications on EV adoption recorded in the Scopus database.

Theoretically, this information has significant implications for understanding the global landscape of EV adoption research and its potential impact on sustainable transportation policies and practices. The overwhelming representation of the United States and China in EV adoption research indicates their proactive approach towards advancing sustainable mobility solutions and addressing climate change concerns. Their substantial research output suggests a solid commitment to exploring various aspects of EV adoption, such as technological innovations, consumer preferences, and policy frameworks, which can serve as valuable benchmarks for other countries seeking to promote electric vehicle adoption.

While our analysis highlights the prominence of countries such as the United States and China in electric vehicle (EV) adoption research, it is equally important to underscore the significance of focusing on a specific context like Indonesia. Indonesia presents a unique socio-economic and environmental landscape, which poses distinctive challenges and opportunities for EV adoption. By directing our attention to Indonesia, we can delve into the intricacies of a developing country that faces rapid urbanization, a growing middle class, and a burgeoning need for sustainable transportation solutions. Understanding the barriers and enablers of EV adoption in Indonesia is essential, as it can inform targeted policies, incentives, and sustainable transportation strategies tailored to the country's distinct needs. Moreover, addressing the research gap in Indonesia aligns with the broader global effort to promote sustainable transportation, as it contributes to the diversity of insights and experiences needed to develop comprehensive strategies that can be applied in varying socio-cultural contexts. In this light, our focus on Indonesia is not only relevant to the country but also holds implications for advancing sustainable transportation practices on a global scale.

Moreover, the underrepresentation of certain countries in EV adoption research highlights the importance of fostering research collaborations and knowledge-sharing among countries. Collaborative efforts between researchers from different regions can provide a more comprehensive understanding of global EV adoption trends, best practices, and transferable policy measures. This interdisciplinary and cross-cultural approach can contribute to developing effective strategies for widespread EV adoption, considering diverse socio-cultural contexts and infrastructural constraints.

Overall, the information in Figure 3 highlights the need for increased research engagement and collaboration across nations to collectively address the challenges and opportunities in accelerating EV adoption globally. Theoretical implications underscore the significance of data-driven research in formulating evidence-based policies and strategies to accelerate the transition towards sustainable and low-carbon transportation systems worldwide.

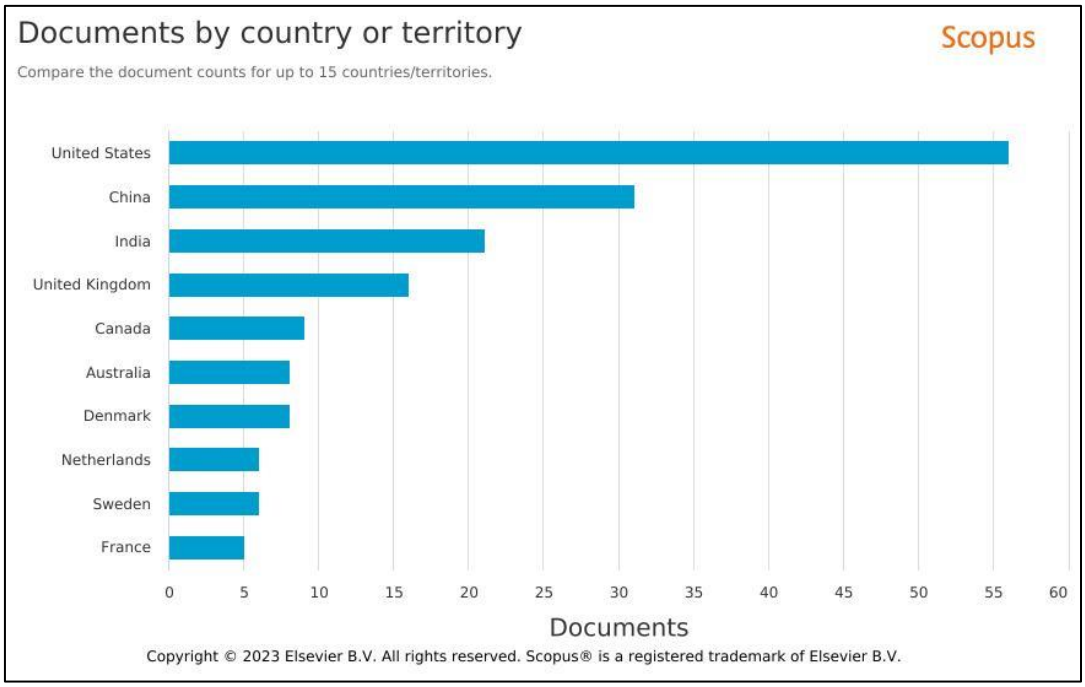

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Figure 3. Documents bu country

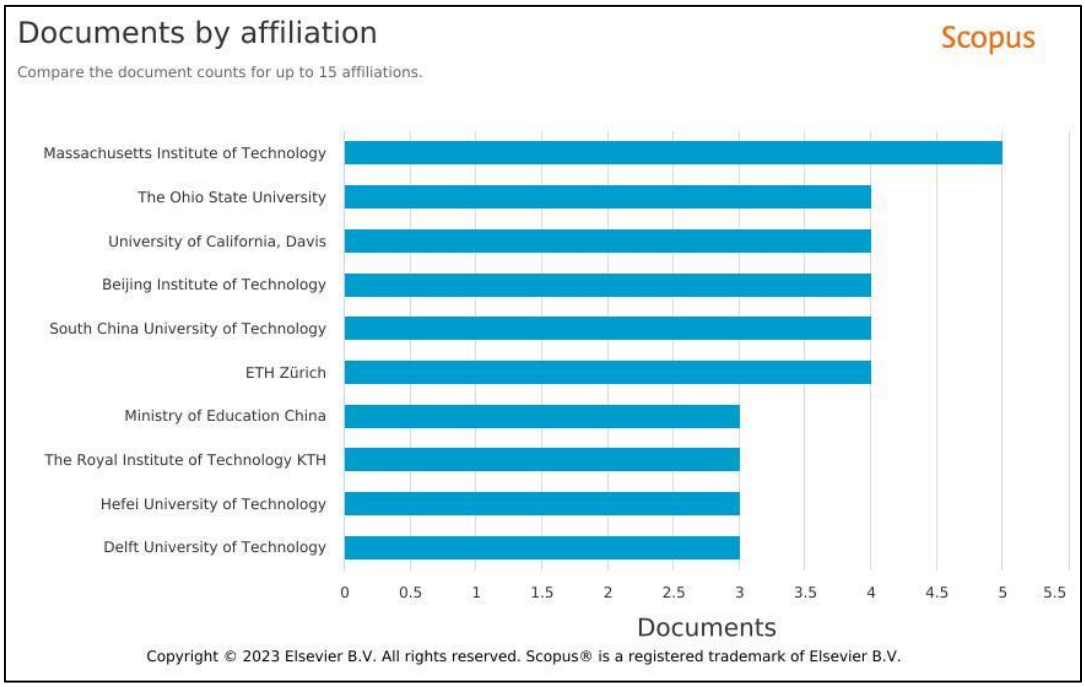

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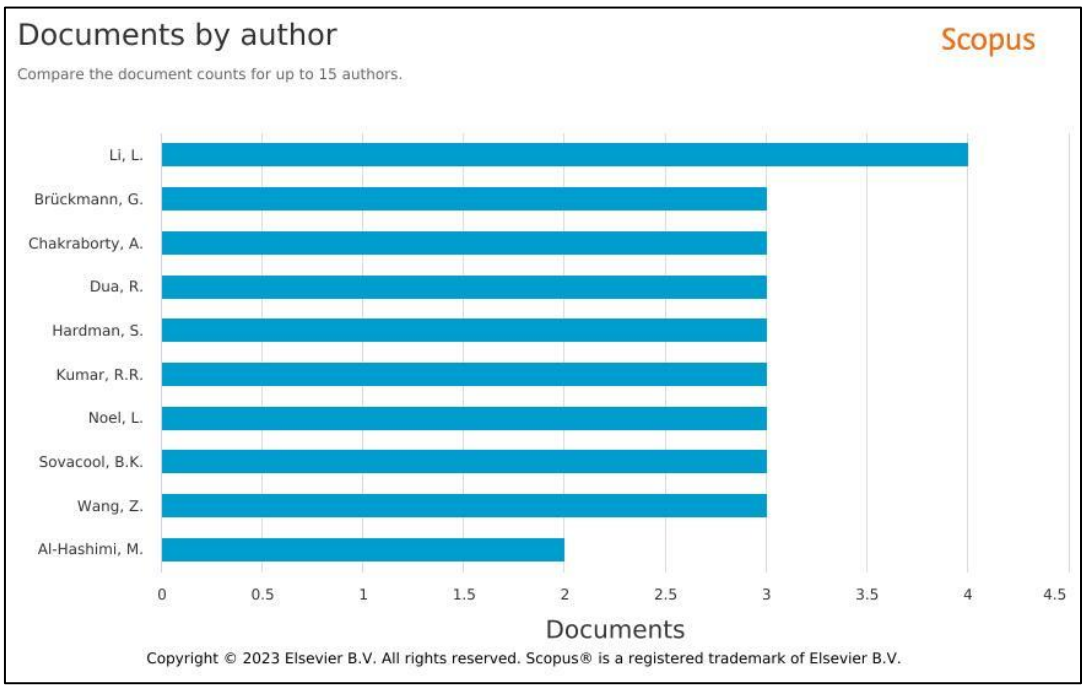
Figure 4. Documents by affiliation



Source: Scopus analyze

Figure 5. Documents by author

The ranking of the top 10 universities with researchers who have published research on EV adoption is as follows: Massachusetts Institute of Technology (MIT) holds the first position, followed by The Ohio State University in second place, and the University of California, Davis in third place. The subsequent positions are occupied by Beijing Institute of Technology, South China University of Technology, ETH Zürich, Ministry of Education China, The Royal Institute of Technology KTH, Hefei University of Technology, and Delft University of Technology (see Figure 4).

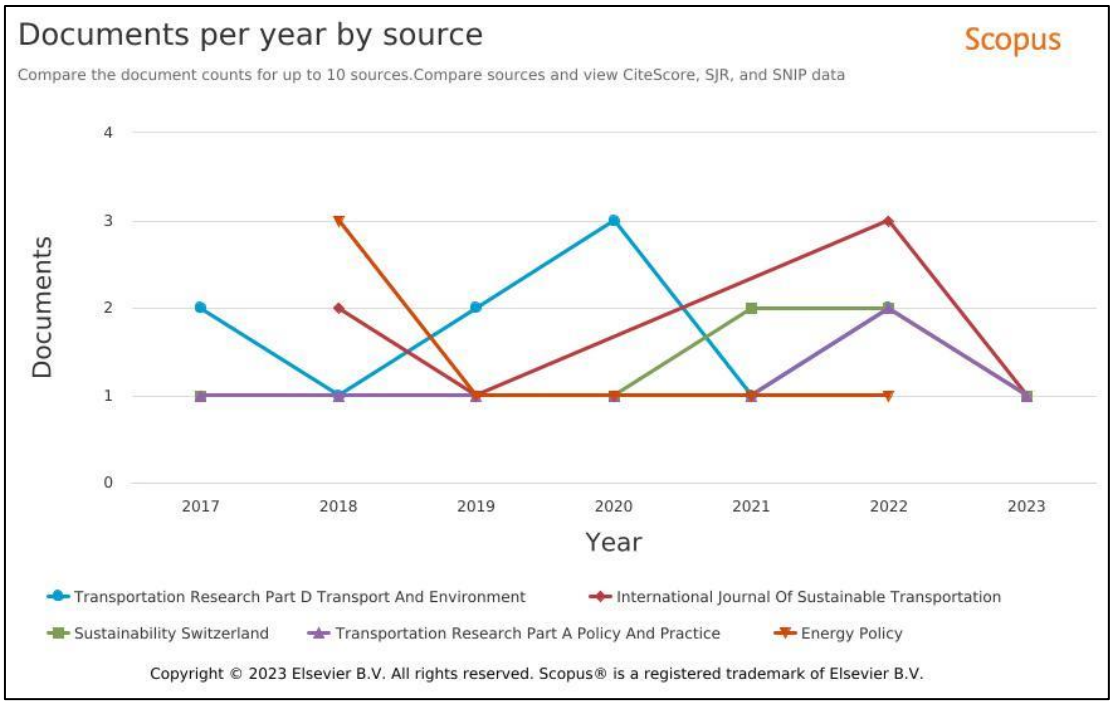
The prominence of these universities in EV adoption research has several research implications. Firstly, their positions signify their expertise and commitment to advancing knowledge in electric vehicle adoption. Researchers and scholars from these institutions can collaborate and exchange insights to further deepen the understanding of various aspects of EVs, including technological advancements, consumer behavior, policy implications, and environmental impact. Moreover, the diversity of universities on the list, including representation from China and Europe, presents a unique opportunity for cross-cultural research collaboration, enabling a broader perspective on global EV adoption trends and challenges.

Figure 5 presents the top 10 researchers from the

universities, as mentioned earlier, who have made significant contributions to the field of EV adoption through their published research. Leading the pack is Li et al. [10-12] and Huang et al. [13], occupying the first rank and closely followed by the several studies [14-29]. Their research findings have shed light on various aspects of electric vehicle adoption, such as consumer behavior, policy implications, infrastructure development, and the environmental impact of EVs. These scholars' valuable insights have undoubtedly advanced our understanding of the challenges and opportunities in promoting sustainable and widespread adoption of electric vehicles.

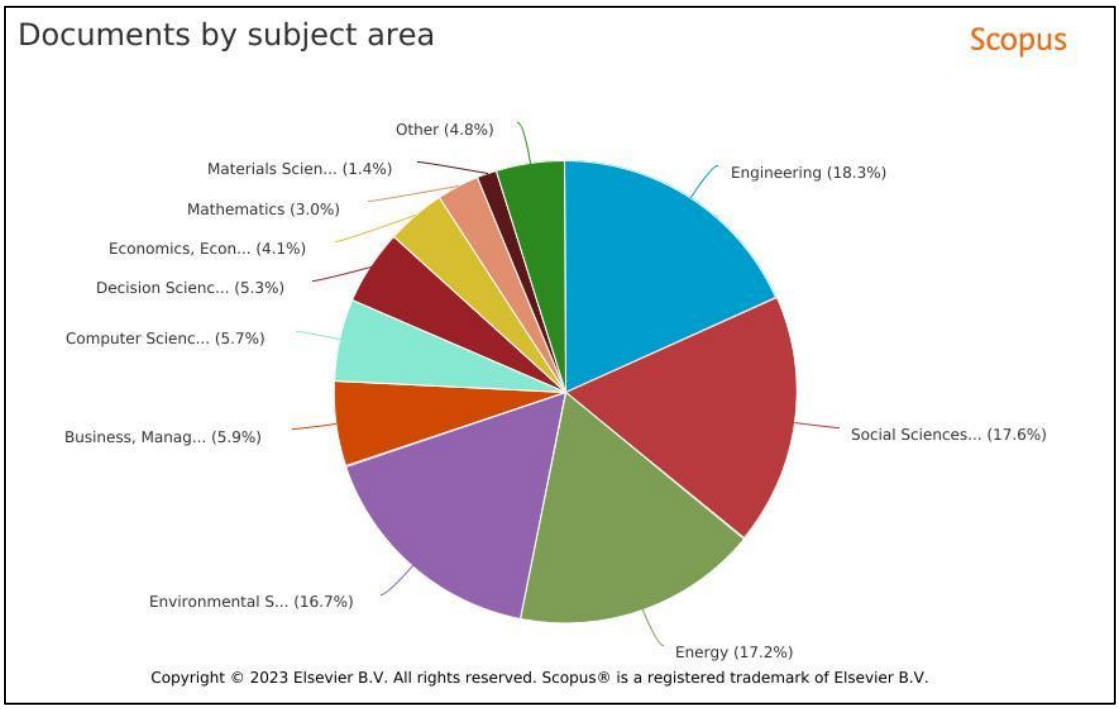
3.3 Subject areas EV adoption research

Based on the documents per year by source, the top five reputable journals publishing research related to EV adoption: *Transportation Research Part D: Transport and Environment*, *Transportation Research Part A: Policy and Practice*, *Energy Policy*, *International Journal of Sustainable Transportation*, and *Sustainability Switzerland* (see Figure 6).



Source: Scopus analyse

Figure 6. Documents per year by source



Source: Scopus analyze

Figure 7. Documents by subject area

Table 1 presents the distribution of EV adoption research across various subject areas. The Engineering subject area encompasses 80 publications, accounting for 18.3% of the total (Figure 7). The Social Sciences subject area has 77 publications, representing 17.6% of the total (Figure 7). The Energy subject area includes 75 publications, making up 17.2% of the total (Figure 7). Environmental Science comprises 73 publications, constituting 16.7% of the total (Figure 7). Lastly, the Business, Management, and Accounting subject area comprises 26 publications, contributing 5.9% of the total (Figure 7).

The distribution of EV adoption research across different subject areas provides valuable insights into the interdisciplinary nature of this topic. The prevalence of research in the engineering field reflects the technological aspects and advancements related to electric vehicles. On the other hand, the significant number of publications in the social sciences subject area indicates the growing interest in understanding consumer behavior, attitudes, and adoption patterns towards electric vehicles. Moreover, the emphasis on energy and environmental science subject areas highlights the environmental implications and sustainable aspects of electric vehicle adoption. Lastly, research in business, management, and accounting suggests the relevance of electric vehicles in the business landscape and the importance of understanding economic and financial aspects related to EV adoption.

Table 1. Top 5 subject area

Subject Area	Number
Engineering	80
Social sciences	77
Energy	75
Environmental science	73
Business, management and accounting	26

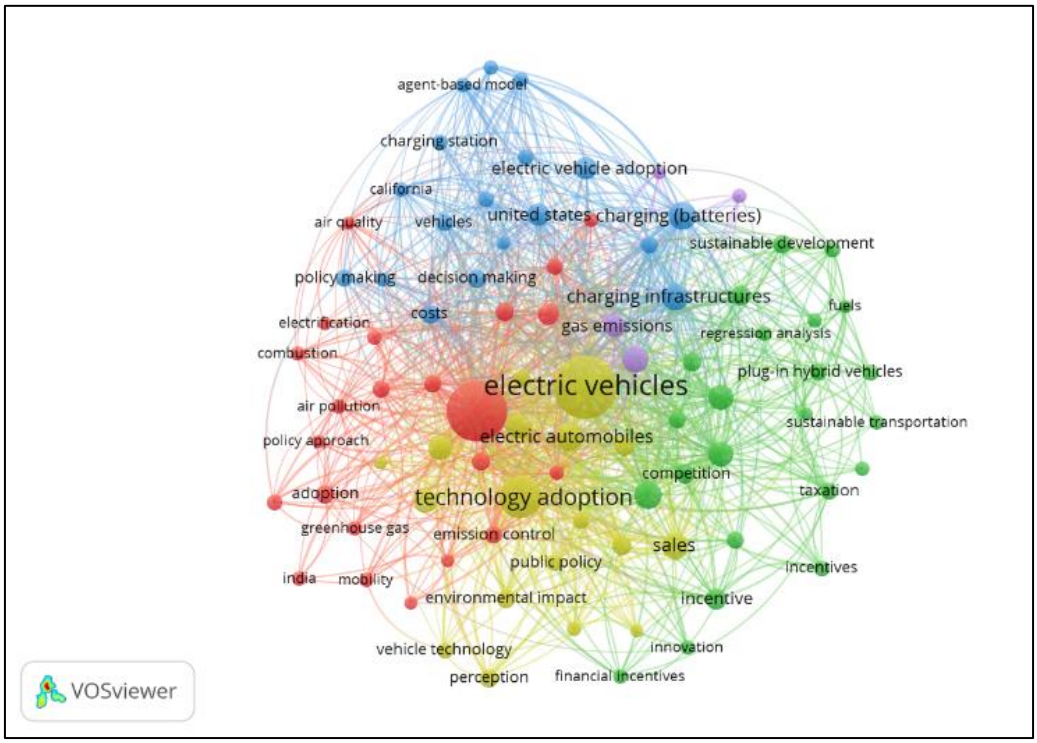
Source: Scopus analyze

These findings indicate the diverse and multidimensional aspects of electric vehicle adoption, which require collaborative efforts and interdisciplinary approaches to address the challenges and opportunities in promoting sustainable transportation solutions. Researchers and policymakers should consider the contributions from various subject areas to develop comprehensive strategies for fostering electric vehicle adoption and achieving a more sustainable future for transportation in our society.

3.4 The main themes and areas of interest within EV adoption

Figure 8 illustrates the emerging themes related to electric vehicles, including environmental impact, technology adoption, charging infrastructure, charging (batteries), incentives, purchase intention, and electric vehicle adoption. Identifying these themes provides valuable insights into the diverse research areas and interests within electric vehicle adoption. Understanding these themes can facilitate interdisciplinary collaboration among researchers from various fields, such as environmental science, engineering, economics, and social sciences, to address the multifaceted challenges and opportunities associated with the widespread adoption of electric vehicles.

The emphasis on environmental impact and charging infrastructure underscores the need for sustainable and eco-friendly solutions to integrate electric vehicles into transportation systems successfully. Researchers can leverage these findings to focus on areas requiring further investigation, such as the environmental benefits of EV adoption and the development of efficient and accessible charging infrastructure. Furthermore, exploring various themes in EV adoption research opens avenues for future investigations into technological advancements, market dynamics, and social acceptance of electric vehicles.



Source: VOSviewer

Figure 8. Co-occurrence all keywords

Within the Business, Management, and Accounting subject areas, there are opportunities for more focused research, including but not limited to:

1. *Economic Viability*: Investigating the economic aspects of electric vehicle adoption, such as cost-benefit analyses, financial incentives, and the impact on businesses and accounting practices.
2. *Policy and Regulation*: Examining the role of government policies, regulations, and financial incentives in promoting electric vehicle adoption and their implications for businesses and management strategies.
3. *Business Models*: Exploring innovative business models, such as electric vehicle charging networks, mobility services, and sustainable transportation solutions, and their relevance in the context of business and management.

By delving into these specific topics within the business, management, and accounting fields, researchers can contribute to a more comprehensive understanding of the economic and financial dimensions of electric vehicle adoption. This, in turn, can inform business strategies, financial decision-making, and policy formulation to accelerate the transition toward sustainable and low-carbon transportation systems.

The emphasis on environmental impact and charging infrastructure, as well as the emerging themes within EV adoption research, underscores the need for interdisciplinary collaboration among researchers from various fields, including environmental science, engineering, economics, social sciences, and business, to address the multifaceted challenges and opportunities associated with the widespread adoption of electric vehicles.

3.5 The potential gaps in EV adoption research

Based on the presented bibliometric analysis, the following research gaps can be identified:

3.5.1 Limited representation of Indonesia

The analysis indicates that Indonesia has relatively low representation in EV adoption research, with only three publications in the Scopus database. This suggests a research gap in understanding the barriers and enablers of EV adoption within Indonesia's unique socio-economic and environmental landscape. Further research is needed to explore the factors hindering EV adoption in Indonesia and to develop targeted policies and strategies to incentivize and promote electric vehicle adoption in the country.

3.5.2 Exploring underrepresented subject areas

While the analysis shows a diverse distribution of EV adoption research across subject areas, there may still be underrepresented areas that warrant further investigation. For instance, 26 publications in the “Business, Management, and Accounting” subject area indicate a potential research gap in understanding the economic and financial aspects of EV adoption. Future research could delve deeper into electric vehicle adoption's economic viability and financial implications to provide valuable insights for policymakers and businesses.

3.5.3 Understanding EV adoption in developing countries

The dominant representation of the United States, China, and other developed countries in EV adoption research raises questions about the applicability of their findings in the context of developing countries. Research on EV adoption in developing nations, including their unique challenges and opportunities, is crucial for achieving global sustainable transportation goals. Exploring the barriers specific to developing economies and tailoring strategies accordingly can help accelerate EV adoption in these regions.

Developing countries face a distinct set of challenges that can impact the adoption of electric vehicles. These challenges may include:

1. *Infrastructure Limitations*: In many developing nations, inadequate charging infrastructure and limited access to electricity can hinder the widespread adoption of EVs. Research can delve into solutions for overcoming these infrastructure challenges.
2. *Affordability*: The initial cost of electric vehicles, as well as concerns related to battery replacement and maintenance costs, can be significant barriers in developing economies. Research can focus on innovative financing models and incentives to make EVs more affordable.
3. *Consumer Behavior and Preferences*: Cultural factors, consumer behavior, and preferences in developing countries may differ from those in developed nations. Understanding these nuances is vital for tailoring marketing strategies and product offerings.
4. *Policy and Regulation*: Developing economies may need more comprehensive policies and regulations that promote and support EV adoption. Research can identify effective policy measures and provide recommendations for implementation.
5. *Economic and Environmental Benefits*: Research can highlight the economic and environmental benefits of EV adoption in the context of developing countries, including job creation, reduced pollution, and energy security.

By addressing these specific challenges, researchers and policymakers can develop strategies tailored to the needs of developing nations, thus promoting sustainable and low-carbon transportation solutions on a global scale.

3.5.4 Comparative studies

The analysis highlights the leading positions of certain universities and countries in EV adoption research. Comparative studies that analyze the factors contributing to their success in promoting electric vehicle adoption can be beneficial. Identifying best practices and successful policies from top-performing countries and institutions can serve as benchmarks for other nations seeking to enhance their EV adoption efforts.

3.5.5 Long-term impact of EV adoption

While the analysis provides insights into the increasing trend of EV adoption research, there is a need to explore the long-term impact of such adoption on transportation systems, energy consumption, and environmental sustainability. Research assessing the real-world effects of EV adoption on reducing greenhouse gas emissions, improving air quality, and achieving sustainable mobility is essential for validating the benefits of electric vehicles as a viable alternative to conventional vehicles.

3.5.6 Interdisciplinary collaboration

The analysis acknowledges the diverse research themes explored by researchers, including battery advancements, charging infrastructure, consumer behavior, and policy analysis. However, further emphasis on interdisciplinary

collaboration can enhance the understanding of complex interactions between technical, social, economic, and environmental factors influencing EV adoption. Collaboration between scholars from different disciplines can lead to comprehensive solutions and policy recommendations for sustainable transportation systems.

3.6 The future research directions

Based on the research gaps identified in the bibliometric analysis, future studies should focus on exploring the electric vehicle (EV) purchase intention in Indonesia as the focal point of the investigation, as well as delving into the factors influencing it (refer to Figure 9). By investigating these aspects, researchers can gain valuable insights into the potential adoption of EVs in the Indonesian market, contributing to a deeper understanding of consumer behavior and aiding in developing strategies to promote sustainable transportation alternatives.

Several factors influencing EV Purchase Intention have been identified based on the systematic literature review conducted from publications in the Scopus database. These factors include Environmental Concern, Performance Expectancy, Effort Expectancy, Charging Point Network, Charging Time, Price, Operating Cost, and Incentives. Additionally, Attitude toward EV vehicles serves as a mediating variable.

He and Zhan [30], Asadi et al. [31], Gehrke and Reardon [32], and Hoang et al. [33] have demonstrated that Environmental Concern is an essential factor in EV purchase intentions. Furthermore, Hoang et al. [33], Lee et al. [34], Guo et al. [35], Jain et al. [36], and Gunawan et al. [37] have shown that Performance Expectancy is a significant determinant of EV Purchase Intention. Additionally, Hoang et al. [33], Guo et al. [35], and Jain et al. [36] have also confirmed the importance of Effort Expectancy in EV Purchase Intention. Junquera et al. [38], Miranda and Delgado [39], Kalthaus and Sun [40], Khazaei and Tareq [41], and Sriram et al. [42] have provided evidence that Charging Point Network plays a crucial role in influencing EV Purchase Intention. Moreover, Junquera et al. [38], Sriram et al. [42], and Schulze Darup et al. [43] have demonstrated that Charging Time is a crucial factor affecting EV Purchase Intention. Junquera et al. [38], Sriram et al. [42], Noel et al. [44], and Higueras-Castillo et al. [45] have proved that price is a highly significant factor for EV Purchase Intention. Additionally, He et al. [46], Kim et al. [47], and Higueras-Castillo et al. [45] have provided evidence that Operating Cost is a determining factor for EV Purchase Intention. In developing countries, according to Higueras-Castillo et al. [45] and Lévay et al. [48], government-provided Incentives have been shown to stimulate EV Purchase Intention. Moreover, Gunawan et al. [37], Bennett and Vijaygopal [49], Lim et al. [50], Jaiswal et al. [51], and Wang et al. [52] have confirmed that attitudes toward EVs significantly influence purchase intention.

Consequently, further research will aim to test the model of the influence of environmental concern, performance expectancy, effort expectancy, charging point network, charging time, price, operating cost, and incentives on attitudes and intentions to purchase electric vehicles in urban areas of Indonesia, as depicted in Figure 9. This study will contribute to a deeper understanding of the interplay between these variables, shedding light on the potential drivers and barriers to EV adoption in the Indonesian context.

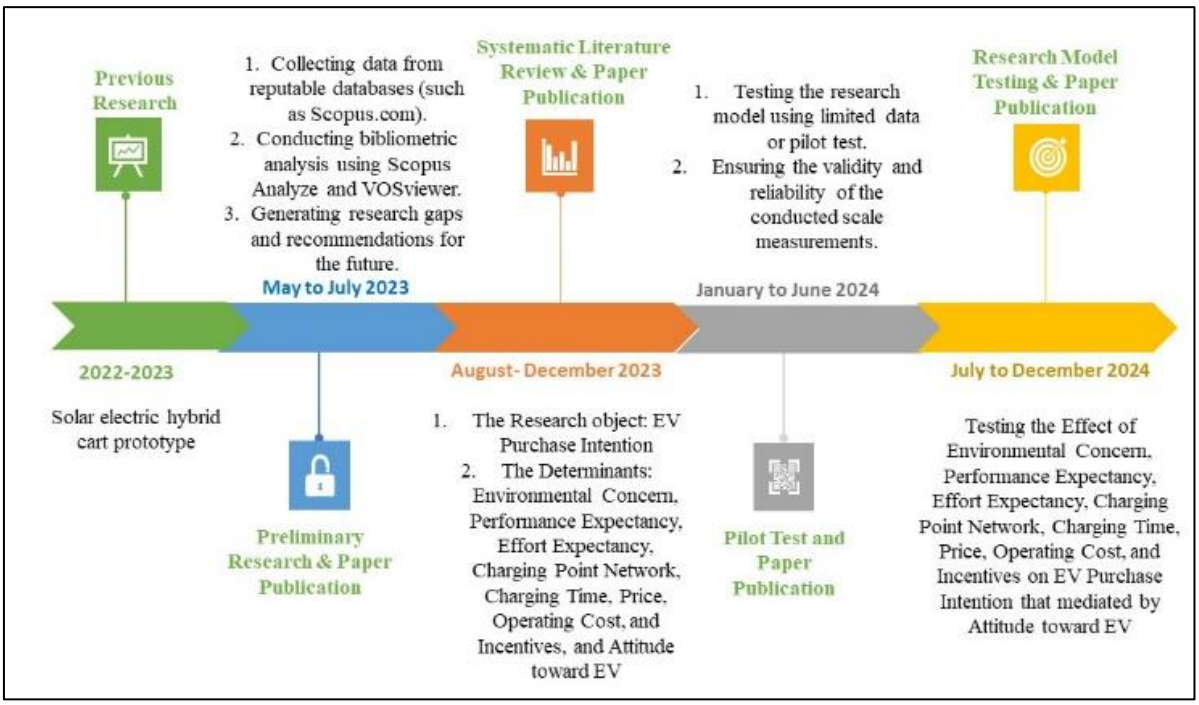


Figure 9. The research flow diagram

4. CONCLUSION

The bibliometric analysis on electric vehicle (EV) adoption research from 2017 to 2023 provides valuable insights into the trends, implications, and future directions in sustainable transportation policies and practices. The analysis reveals a continuous increase in EV adoption research publications, indicating a growing interest and significance of electric vehicles as a sustainable mobility solution. This upward trend underscores the importance of EV research in mitigating

climate change and reducing greenhouse gas emissions in the transportation sector.

The analysis also highlights the leading countries and universities in EV adoption research, with the United States and China at the forefront. The dominance of these countries in EV research underscores their commitment to advancing sustainable mobility solutions and serves as a benchmark for other nations seeking to promote widespread EV adoption. Additionally, the relatively low representation of certain countries, such as Indonesia, suggests research gaps and opportunities for further exploration in unique socio-economic and environmental contexts.

The diverse distribution of EV adoption research across subject areas, including engineering, social sciences, energy, environmental science, business, management, and accounting, underscores the multidimensional nature of electric vehicle adoption. This multidisciplinarity calls for collaborative efforts and interdisciplinary approaches to address the challenges and opportunities in promoting sustainable transportation systems.

The analysis identifies emerging themes in EV adoption research, such as environmental impact, technology adoption, charging infrastructure, incentives, and consumer behavior. Exploring these themes can provide valuable insights for policymakers, researchers, and businesses in developing effective strategies to accelerate EV adoption and achieve climate goals.

Despite the growing interest in EV adoption research, specific gaps have been identified, including limited representation in specific countries, underexplored subject areas, and the need for comparative studies. Addressing these gaps can enhance our understanding of EV adoption dynamics, particularly in developing countries, and inform evidence-based policies and strategies for sustainable transportation.

Future research directions should investigate EV purchase intention in Indonesia, including the factors influencing it, such as environmental concern, performance expectancy, charging infrastructure, and incentives. Understanding these factors will contribute to a deeper understanding of consumer behavior and aid in developing targeted policies to promote EV adoption in Indonesia and other developing economies.

The implications of the study's findings: this study emphasizes the growing importance of electric vehicles in the context of sustainable transportation. It underscores the need for continued research and collaboration to address the global challenges and opportunities in EV adoption. The findings provide a foundation for policymakers, researchers, and businesses to advance the transition towards low-carbon and sustainable transportation systems on a global scale.

In a global context, the implications of the study's findings underscore the importance of electric vehicles as a vital component of sustainable transportation in the face of climate change and environmental challenges. The research provides a foundation for policymakers, researchers, and businesses worldwide to make informed decisions, collaborate across borders, and advance the transition toward low-carbon and sustainable transportation systems. By addressing these global challenges and opportunities, we can collectively work towards a more sustainable and environmentally friendly future.

In light of the ever-increasing significance of electric vehicle (EV) adoption as a sustainable mobility solution, it is imperative to look ahead and consider the evolving landscape of EV research and adoption. The trends identified in this bibliometric analysis, together with the emerging themes and research gaps, provide a roadmap for future exploration.

As we move forward, researchers, policymakers, and businesses must stay attuned to the changing dynamics of EV adoption. Future research in this field should also address the real-world impact of EV adoption on reducing greenhouse gas emissions, energy consumption, and air quality. Assessing the long-term sustainability of EV adoption will be essential to track progress and adjust strategies accordingly.

In conclusion, the journey towards a more sustainable and environmentally friendly future through EV adoption is ongoing and promises a bright future. By fostering collaboration, staying informed, and addressing evolving challenges, we can collectively accelerate electric vehicle adoption and work towards a more sustainable, low-carbon transportation future globally.

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