

A Study of Electric Vehicle Market Development in 2015 – 2024: A Bibliometric Analysis

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Abstract

This study conducts a comprehensive bibliometric analysis to examine the development of the electric vehicle (EV) market from 2015 to 2024. By analyzing a large dataset of publications, the research identifies key trends, major contributing institutions, significant geographical regions etc that are driving the evolution of the EV industry. The study uses bibliometric techniques to investigate the underlying structure and dynamics of research in the EV sector. The findings reveal a growth trajectory in the number of publications, indicating a growing interest in EV among academic communities. Key contributors include leading research institutions from Europe, North America, and Asia, reflecting the global nature of EV research and development. The study also identifies emergent research themes, which are poised to shape the future of the EV market. This analysis contributes to the understanding of the EV market's academic landscape, providing valuable insights for researchers, policymakers, and industry stakeholders aiming to foster innovation and sustainable development in the transportation sector.

Keywords: Electric Vehicles, Marketing Research, Bibliometric Analysis

INTRODUCTION

The number of private vehicles in cities has grown significantly in recent years as a result of the rapid pace of urbanization and motorization, which has also contributed to a substantial rise in travel demand. This surge in urban car ownership has resulted in serious environmental consequences, as vehicle emissions have become the primary source of air pollution in many urban areas. The result is a series of pressing global challenges, including the deterioration of urban air quality and the exacerbation of global warming. In this context, China, Europe, and the United States have emerged as the leading regions for electric vehicle (EV) sales. Among them, China is experiencing the most rapid growth in both the production and consumption of EVs. This trend reflects a broader global shift towards electric vehicles in response to the environmental pressures caused by traditional internal combustion engine vehicles (Prushkivska et al., 2024).

The evolution and development of electric vehicles represent a pivotal moment in humanity's quest for environmental sustainability and energy efficiency. The transition to EVs is crucial in the effort to mitigate the ongoing environmental and energy crises, as the transportation sector is a major contributor to global carbon emissions. In addition to supporting the development of sustainable transportation systems, electric vehicles also significantly reduce carbon emissions, which align closely with several of the United Nations' Sustainable Development Goals (SDGs) (Hsu et al., 2023; Lipu et al., 2022; Mo et al., 2022). Therefore, experts view the shift towards EVs as a critical component in the broader strategy to address climate change and promote sustainable development.

Technological, economic, and social factors are driving the global market for electric vehicles. Among the most notable examples are the decreasing costs of EVs, government incentives intended to promote their adoption, and a growing public awareness of the importance of environmental sustainability. These factors have a significant impact on consumer behavior, leading to an increased interest in and adoption of electric vehicles across various regions (Novotny et al., 2022; Zhang et al., 2022). Additionally, cultural factors play a significant

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role in the adoption of EVs, as research has demonstrated that national cultural traits can influence market dynamics. For instance, cultures exhibiting a strong long-term orientation are inclined to have higher EV market shares, whereas those characterized by high levels of uncertainty avoidance or individualism may show slower adoption rates (Novotny et al., 2022).

On the economic front, financial incentives, such as subsidies and tax breaks, along with non-financial incentives, such as access to carpool lanes and free parking, significantly influence the adoption of EVs, particularly at the city level. These incentives make EVs more accessible and attractive to consumers, thereby accelerating market penetration (Zhang et al., 2022). Furthermore, EVs often serve as status symbols and are well-suited to modern, eco-conscious lifestyles, making social factors increasingly important. This social acceptance and the perceived prestige associated with owning an electric vehicle are contributing factors to the expanding EV market (Xia et al., 2022).

Research into consumer behavior and psychology is essential for understanding the factors that drive or hinder EV adoption. Researchers and policymakers can address existing knowledge gaps, enhance consumer awareness, and ultimately support the growth of the EV market by gaining insights into these behaviors (Durmus Senyapar et al., 2023). Understanding this concept is critical to tailoring marketing strategies and policy interventions that resonate with potential buyers.

However, there are still several challenges to overcome, despite the considerable progress and numerous benefits associated with electric vehicles. These include issues related to battery degradation over time, the widespread need for robust charging infrastructure, and the capacity of the current energy market to meet the increasing demand for electricity as more EVs are introduced. It is essential to address these challenges in order to realize the full potential of EVs and ensure their widespread adoption (Lipu et al., 2022; Sathiyaraj et al., 2022; Vrabie, 2022). Therefore, a comprehensive analysis of EV market development is critical to identifying and overcoming these barriers. This will facilitate deeper market penetration and contribute to the transition to a more sustainable transportation future.

LITERATURE REVIEW

Bibliometric analysis is a robust and systematic methodology used to explore and analyze extensive collections of scientific data. This approach is particularly effective for uncovering subtle evolutionary trends and identifying emerging areas within specific fields of study (Donthu et al., 2021; José de Oliveira et al., 2019). Bibliometrics facilitates the organization and synthesis of existing knowledge within various scientific disciplines by applying quantitative methods to analyze bibliographic material. This process enables the identification of patterns and relationships that may otherwise go unnoticed (Merigó & Yang, 2017).

Bibliometric analysis commonly employs several techniques to achieve these goals. These include citation analysis, which examines the frequency and patterns of citations between documents; co-citation analysis, which explores the relationships between documents cited together; bibliographic coupling, which identifies links between documents that cite common sources; co-author analysis, which investigates collaborative relationships among authors; and co-word analysis, which identifies the connections between key terms used in the literature (Zupic & Čater, 2015). Each of these techniques provides unique insights into the structure and dynamics of scientific research within a field.

The bibliometric analysis is facilitated by a variety of software tools, each offering distinct capabilities for data collection, performance analysis, and visualization (Moral-Muñoz et al., 2020). These tools are instrumental in assessing academic productivity, mapping inter-institutional collaborations, evaluating the impact of funding on research output, and measuring educational efficiency. The number of publications, citation counts, h-index (a measure of an author's productivity and impact), impact factors of journals, and SCImago Journal Rankings are among the key metrics employed in bibliometric analysis. These metrics collectively assist in evaluating the contributions of individual authors, journals, and institutions to the scientific community (Choudhri et al., 2015; Klein & Bloom, 2005).

Despite its strengths, bibliometric analysis is not without limitations. The potential for misinterpretation or manipulation of data is one of the primary challenges, leading to skewed or misleading conclusions. Additionally, the metrics must be clear and concise to ensure accurate and meaningful analysis. Another concern is that gaps or biases due to inconsistent coverage of different scientific fields across various bibliometric databases may influence the analysis (Klein & Bloom, 2005; Moral-Muñoz et al., 2020). These limitations highlight the importance of careful and critical application of bibliometric techniques.

Nevertheless, bibliometric analysis remains a powerful and indispensable tool for the scientific community. The ability to systematically organize and analyze large volumes of data makes it essential for generating new insights, identifying trends, and guiding the future direction of research. As the scientific landscape evolves, the use of bibliometric analysis will become increasingly important in shaping our understanding of complex research environments and informing strategic decisions in science and technology policy.

In recent years, bibliometric analysis has gained popularity in business research as a systematic approach to evaluating and measuring the impact of scientific publications. This methodology facilitates the identification of trends, influential authors, and emerging areas of study, thereby providing a comprehensive understanding of the development and direction of research within the field. Bibliometric analysis, which initially originated in the field of information science, has successfully penetrated interdisciplinary domains, including business research, where it has demonstrated significant practical value.

The rising popularity of bibliometric analysis in business research is not merely a transient trend but rather a reflection of the methodology's utility in several key areas. Bibliometric analysis offers a rigorous means of evaluating large volumes of scientific data, enabling researchers to quantitatively measure the impact of individual publications, authors, and entire research fields within the scientific community (Bitzenis et al., 2023; Chawla & Goyal, 2022; Donthu et al., 2021). This quantitative assessment provides valuable insights into the influence and reach of specific contributions to the literature, aiding in the clarification of the relative importance of various research outputs.

Moreover, bibliometric analysis is instrumental in identifying research streams, trends, and the evolution of emerging areas across various business domains. Researchers can offer crucial guidance for future research directions by identifying areas of study that are experiencing rapid growth and those that are in decline through the examination of patterns in publication and citation data (Ridwan et al., 2022; Talafidaryani et al., 2023). This capability is particularly valuable for scholars seeking to align their research efforts with the most dynamic and impactful areas of inquiry within the field.

In addition to tracking trends, bibliometric analysis provides a comprehensive overview of the literature by mapping the knowledge and conceptual structure of a particular field. This mapping process helps researchers understand the organization of knowledge within the field, enabling them to identify key themes and theoretical foundations (Bretas & Alon, 2021; Castillo-Vergara et al., 2023). An in-depth understanding is crucial for developing new research perspectives and formulating potential research questions that push the boundaries of existing knowledge.

Furthermore, bibliometric analysis offers valuable insights into future research directions by identifying gaps and hotspots in the literature. This aspect of the methodology enables scholars to focus on unexplored areas and emerging topics, thereby enhancing the relevance and impact of their research (Bretas & Alon, 2021; Thayyib et al., 2023). By identifying these gaps, researchers can more accurately predict future research trends and make informed decisions about where to direct their efforts. Having the foresight to anticipate and respond to the changing needs of the field is critical for maintaining a forward-looking research agenda (Talafidaryani et al., 2023).

In summary, bibliometric analysis has established itself as an essential tool in business research, offering a robust framework for evaluating scientific contributions, identifying trends, and mapping the conceptual landscape of the field. It is an invaluable resource for scholars aiming to stay at the forefront of their disciplines due to its capacity to identify research gaps and forecast emerging topics. Bibliometric analysis is expected to shape the direction and impact of future studies as the field of business research continues to evolve.

This study aims to explore the following key questions:

What is the trend / What are the research trends in electric vehicle market development according to the year of publication?

Who and how much has been published in the area with regard to the authors, their affiliated organizations, and countries?

What are the most cited articles?

What are the popular keywords related to the study, and have they evolved or changed during the last ten years?

MATERIALS AND METHODS

Data Source

The Scopus database was chosen for this study due to its extensive journal coverage, which surpasses that of many other databases. According to Falagas et al. (2008), Scopus offers approximately 20% more coverage for citation analysis than the Web of Science, making it notably effective for tracking citations and evaluating the impact of research. This broader coverage is crucial for ensuring that the study captures a comprehensive view of the existing literature in the field. Additionally, Scopus is known for its user-friendly interface and straightforward navigation features, which greatly benefit researchers who are conducting extensive literature reviews. The ease of use provided by Scopus simplifies the process of searching, organizing, and analyzing large volumes of scientific data.

Another significant advantage of Scopus is the richness of its metadata records, which include detailed author and institutional profiles. This feature enables more nuanced analyses of research trends, author collaborations, and institutional contributions. Furthermore, Scopus offers a wide range of conference proceedings, which are an essential resource for staying up-to-date with the latest developments and emerging trends in the field (Baas et al., 2020). Conference proceedings enhance the database's utility, particularly in fields where academic conferences frequently present cutting-edge research before journal publication.

Scopus's extensive global and regional coverage, which ensures the inclusion of high-quality data from a diverse range of sources, makes it a reliable and comprehensive tool for bibliometric studies (Vieira & Gomes, 2009). This broad coverage is particularly important for studies with a global focus, such as this one, which examines the development of the electric vehicle market across different regions.

Scopus indexed a total of 484 articles related to electric vehicles between January 2015 and August 2024. These articles form the basis for the subsequent data analysis in this study, providing a rich dataset for exploring research trends, identifying key contributors, and assessing the overall impact of research in the electric vehicle field. The comprehensive nature of the Scopus database further enhances the reliability and validity of the study's findings, ensuring that the analysis will be based on a robust and diverse set of sources.

Analysis software: VOS Viewer

Researchers aiming to interpret large volumes of bibliometric information widely recognize VOSviewer as an essential software tool for conducting bibliometric analysis and visualizing complex data. The software was chosen for this study because of its multiple advantages, particularly its ability to create clear and informative visual representations of bibliometric data. The robust graphical display and visualization capabilities of VOSviewer are the primary reasons for its exceptional standing in the field of bibliometric research (van Eck & Waltman, 2010). It is particularly adept at constructing and displaying large bibliometric maps in a way that is easy to understand, allowing researchers to generate network visualizations, co-citation maps, and density maps that clearly illustrate relationships and patterns within the data (Al Husaeni & Nandiyanto, 2021; Moral-Muñoz et al., 2020; Soegoto et al., 2021).

One of the key reasons for selecting VOSviewer for this study is its user-friendly design, which makes it accessible even to those with limited experience in bibliometric analysis. The software does not require advanced computer skills, and it provides step-by-step guidance that facilitates the completion of

comprehensive bibliometric analyses with relative ease by first-time users (Soegoto et al., 2021). This accessibility is crucial because it allows a broader range of researchers to leverage bibliometric methods in their work.

Moreover, VOSviewer's versatility and ability to integrate with various data sources further enhance its value as a bibliometric tool. It is capable of effectively managing large datasets and facilitating the import and export of data from multiple platforms such as Scopus, Google Scholar, and Web of Science, among others (Adrian & Muntazimah, 2023; Kirby, 2023). This flexibility ensures that researchers can access and analyze data from a wide array of sources, enhancing the comprehensiveness and robustness of their analyses. Additionally, the use of VOSviewer in conjunction with other analytical tools, such as CitNetExplorer, may provide a more complete solution for clustering and data analysis (van Eck & Waltman, 2017).

Furthermore, VOSviewer has text mining capabilities, which add another layer of utility and enable researchers to analyze large volumes of textual data. This feature is particularly valuable for exploratory research, as it allows researchers to uncover new research questions and insights from textual datasets (Kirby, 2023). The use of text mining expands the scope of bibliometric analysis, enabling a deeper and more nuanced understanding of the literature.

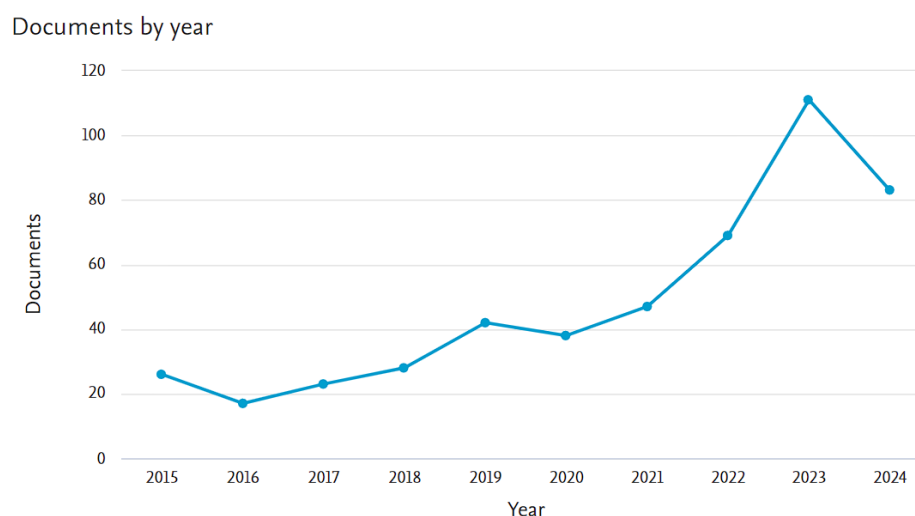
For this study, VOSviewer was selected because of its excellent visualization features, user-friendly design, versatility in handling large datasets, and integration and text mining capabilities. The aforementioned characteristics make it a powerful tool for conducting in-depth bibliometric analyses and revealing insights that might inform future research directions.

Data Search Strategy

A screening sequence was utilized to determine the search criteria for article retrieval. The study was initiated by querying the Scopus database for the key terms "Electric Vehicles," "Electric Car," and "Marketing." The search criteria were restricted to all English-language articles published in the field of business management within the last ten years, taking into account time, language, and research area. The specific search criteria were TITLE-ABS-KEY ("Electric Vehicle" OR "Electric Car") AND ("Marketing") AND PUBYEAR > 2014 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBJAREA, "BUSI")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j")). For bibliometric analysis, the final search string refinement included 484 articles.

Findings

What are the trend / What are the research trends in electric vehicles market development according to the year of publication?



(Figure 1: Trend of research in EVs market development by years)
(Source from Scopus)

(Table 1: Trend of research in EVs market development by year)

Year	No. of Total Publications
2024	83
2023	111
2022	69
2021	47
2020	38
2019	42
2018	28
2017	23
2016	17
2015	26

(Source from Author)

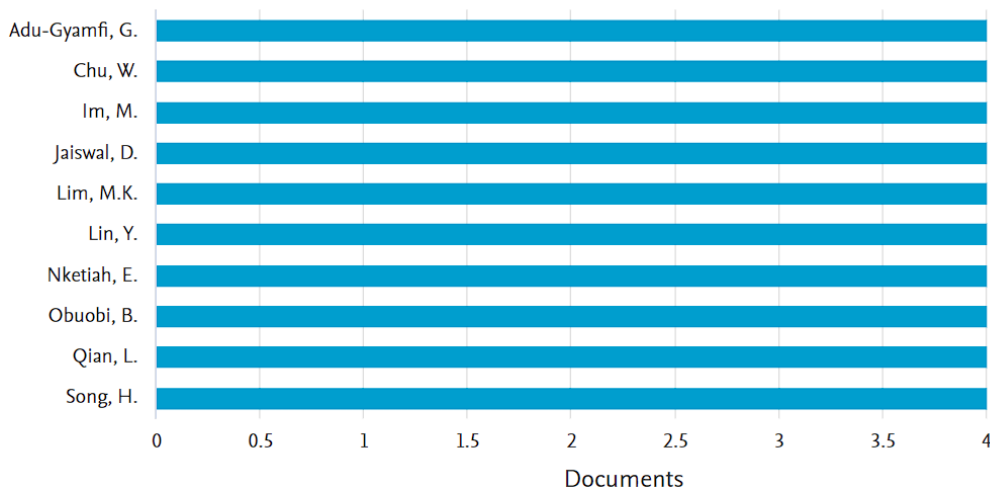
The data clearly illustrates an overall upward trend, as the number of research articles has increased significantly from 26 in 2015 to 83 in 2024. In the initial period from 2015 to 2019, the number of articles grew gradually, with a relatively slow increase from 26 to 42. However, this trend underwent a substantial shift starting in 2020, when the number of articles saw a marked increase, reaching 38 in 2020. Subsequently, the number of articles continued to grow at an even faster rate, with 47 articles in 2021 and a significant jump to 69 in 2022. Most strikingly, the year 2023 showed a notable surge in the number of research articles, amounting to a total of 111, demonstrating an unprecedented level of enthusiasm for research on the development of the electric vehicle (EV) market. Despite a slight decrease in 2024, the publication count of 83 remained substantial, indicating a strong and sustained interest in this research field. This upward trend is contributed to by various factors, such as policy incentives, technological advancements, growing market demand, and increasing public interest in sustainable transportation and green energy. The particularly rapid growth seen subsequent to 2020 is likely reflective of the global surge in emphasis and investment towards the development of the EV market.

Who and how much has been published in the area with regard to the authors, their affiliated organizations, and countries?

Who are the authors with the most published articles?

Documents by author

Compare the document counts for up to 15 authors.



(Figure 2: Top authors in publication)

(Source from Scopus)

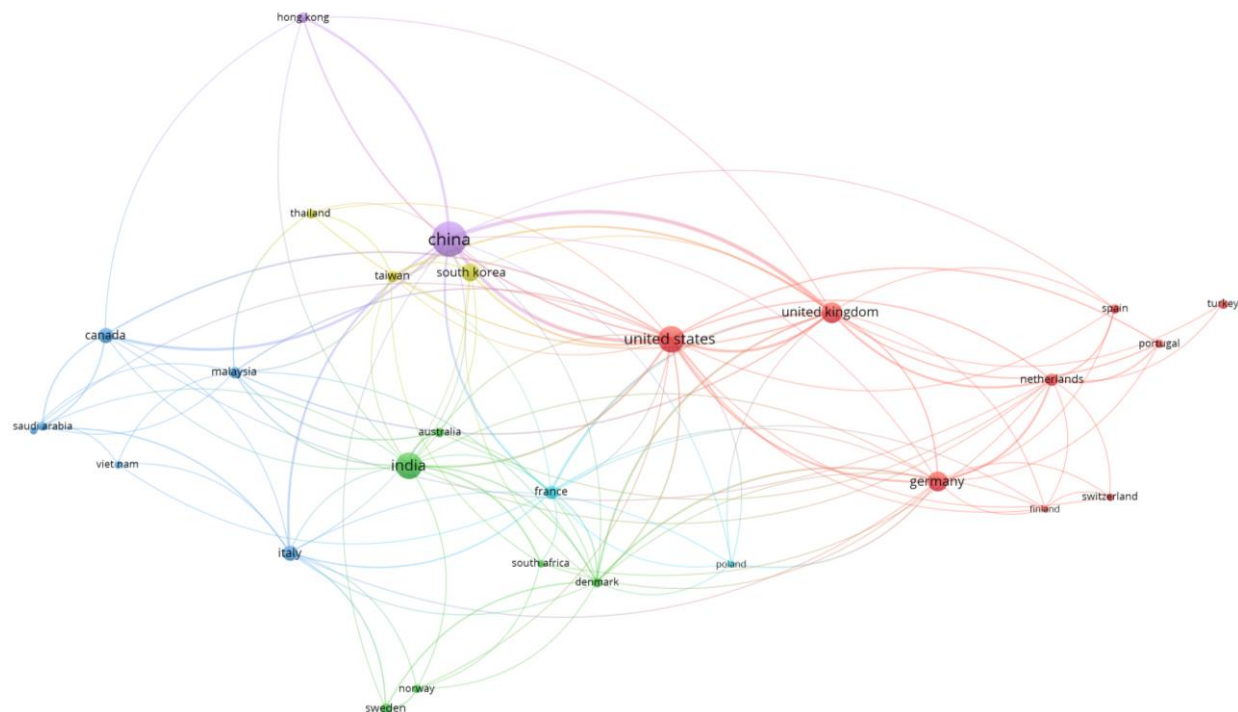
(Table 2: Top authors in publication)

Author	No. of Total Publications
Adu-Gyamfi, G.	4
Chu, W.	4
Im, M.	4
Jaiswal, D.	4
Lim, M.K.	4
Lin, Y.	4
Nketiah, E.	4
Obuobi, B.	4
Qian, L.	4
Song, H.	4

(Source from author)

This study conducted a statistical analysis of 484 articles published in the field of electric vehicle (EV) market development from 2015 to 2024, with a particular focus on the ten authors who had the highest number of publications. The findings reveal that each of these ten authors contributed equally, with each author publishing four articles. This uniform contribution means that each author accounts for the same proportion of the total publications. Specifically, with each author having four publications, their individual contribution represents 4 out of the 484 total articles, which is equivalent to approximately 0.83% of the overall publications. Collectively, these ten authors contributed 40 articles, constituting 40 out of the 484 total publications, or approximately 8.27% of the entire body of work in this field. This analysis highlights the significant, yet evenly distributed, contribution made by these leading authors in the field of EV market development throughout this period.

What are the countries with the most published articles?

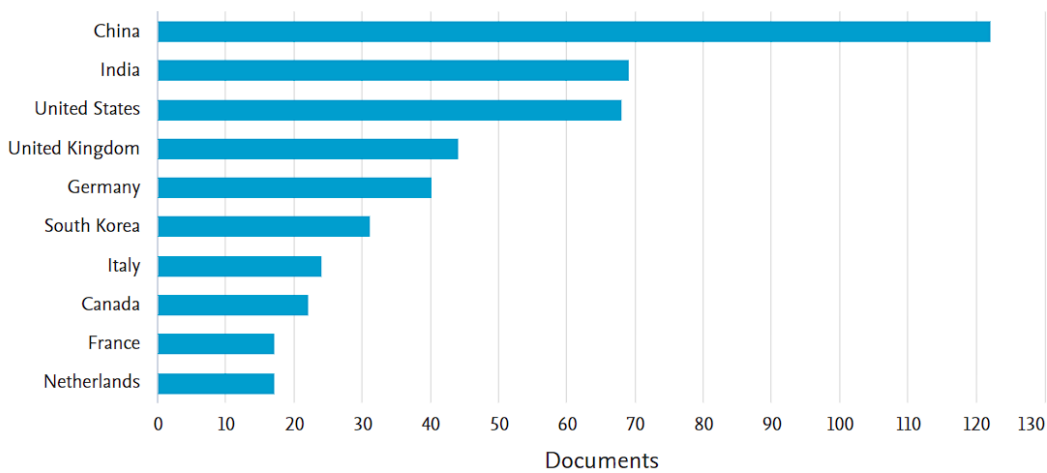


(Figure 3: Bibliometric VOSviewer of most-published countries)

(Source from author)

Documents by country or territory

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



(Figure 4: Top countries in publication)

(Source from Scopus)

(Table 3: Top countries in publication)

Country	No. of Total Publications
China	122
India	69
United States	68
United Kingdom	44
Germany	40
South Korea	31
Italy	24
Canada	22
France	17
Netherlands	17

(Source from author)

Research studies examining the development of the Electric Vehicles (EVs) market between 2015 and 2024 have identified a significant trend of geographic concentration, with a few countries emerging as key contributors to the global research output. This study analyzes the research activity in this field, focusing on the ten countries that have published the most articles. Furthermore, the study highlights each country's research contributions through descriptive statistics, shedding light on their roles in advancing the understanding of the EV market.

China is the biggest contributor to the list, with 122 articles, representing 25.21% of the total publications. This dominance positions China at the forefront of global research efforts, highlighting its leadership and strong research foundation in EV market development. Following China, India has made a significant impact with 69 articles, accounting for 14.26% of the total publications. This reflects India's strong momentum in the field and demonstrates its growing influence in electric vehicle research.

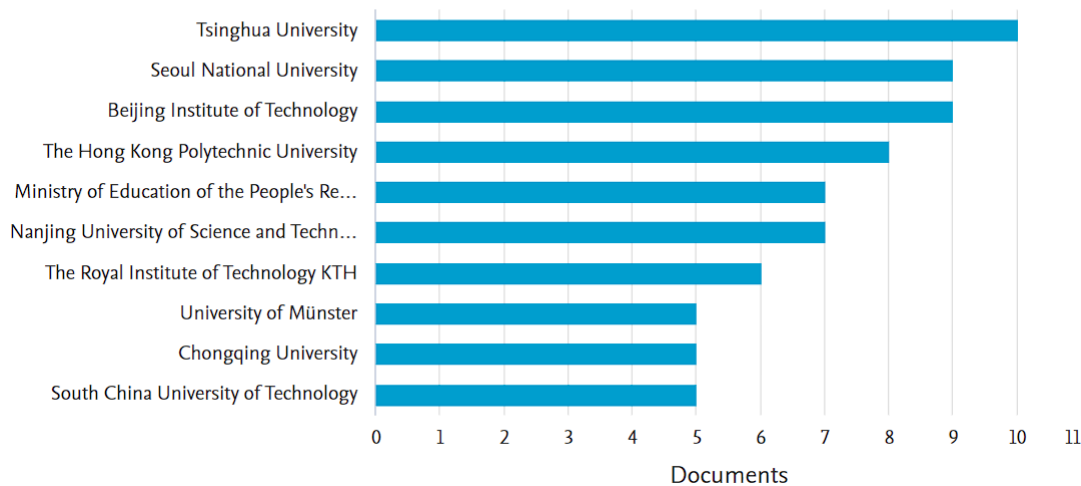
The United States ranks third with 68 articles, contributing 14.05% to the total. This solidifies the United States as a central player in global EV market research, further emphasizing its importance in the ongoing discourse on electric vehicle development. The United Kingdom and Germany occupy the fourth and fifth positions, with 44 and 40 articles, respectively. These figures account for 9.09% and 8.26% of the total publications, indicating the significant research investment and achievements of these two traditional automotive industry leaders as they transition to electric mobility (Lee, 2010).

With 31 articles and a 6.41% share, South Korea ranks sixth in the field of EV technology, demonstrating its rapid ascent and reflecting its growing prominence in global research. Additionally, Italy, Canada, France, and the Netherlands have contributed 24, 22, 17, and 17 articles, respectively. While these countries have produced fewer articles than the top six, their research activity has nevertheless made a meaningful contribution to the development of the EV market, indicating their active participation in this rapidly evolving field.

What are the affiliations with the most published articles?

Documents by affiliation

Compare the document counts for up to 15 affiliations.



(Figure 5: Top affiliations in publication)

(Source from Scopus)

(Table 4: Top affiliations in publication)

Affiliation	No. of Total Publications
Tsinghua University	10
Seoul National University	9
Beijing Institute of Technology	9
The Hong Kong Polytechnic University	8
Ministry of Education of the People's Republic of China	7
Nanjing University of Science and Technology	7
The Royal Institute of Technology KTH	6
University of Münster	5
Chongqing University	5
South China University of Technology	5

(Source from author)

This study conducted an in-depth analysis of articles published by various institutions between 2015 and 2024, identifying ten institutions as leading contributors to the development of the electric vehicle (EV) market. These institutions have demonstrated significant research strength and active involvement in this field.

With 10 articles published, Tsinghua University emerges as the leading institution in this field, making up approximately 2.07% of the total 484 articles analyzed. This positions Tsinghua University as a leader in EV market research, demonstrating its strong commitment and influence in the area. Seoul National University and Beijing Institute of Technology follow closely, each publishing nine articles and tying for second place. These contributions represent about 1.86% of the total publications, underscoring the notable research efforts of these institutions.

Hong Kong Polytechnic University ranks third, with eight published articles, accounting for approximately 1.65% of all publications. This is indicative of its active involvement in advancing research in the EV market. The Ministry of Education of the People's Republic of China also plays a significant role, with seven published

articles, ranking fourth and contributing about 1.45% of the total. This reflects the significant impact of the Ministry on research initiatives related to EVs in China.

Further down the list, institutions such as Nanjing University of Science and Technology, KTH Royal Institute of Technology, the University of Münster, Chongqing University, and South China University of Technology have each published between five and six articles, placing them in the fifth to tenth positions. Despite their slightly lower publication numbers, these institutions have made valuable contributions to the body of knowledge in the field of EV market development.

The statistical analysis of the number and proportion of articles published by these institutions leads to two key conclusions. First, these ten institutions exhibit exceptional research strength and activity in the field of EV market development. Their high-quality research publications have made a significant contribution to the accumulation of knowledge and the promotion of technological innovation within this domain. Second, the geographic distribution of these leading institutions highlights the prominent contributions made by China and Korea. This geographic concentration may be closely linked to the robust policy support and substantial technological investment these countries have provided for the EV industry. Furthermore, this pattern emphasizes the critical role of the Asian region in shaping research and development in the global EV market.

What are the most-cited articles?

This study presents the most cited articles in the field of electric vehicle marketing, along with their authors and years. Table 5 presents the ten most cited articles, while Table 6 organizes the research questions and conclusions of these ten articles.

(Table 5: Most-cited articles)

Cited No.	Authors	Title	Year
373	Helveston J.P.; Liu Y.; Feit E.M.; Fuchs E.; Klampfl E.; Michalek J.J.	Will subsidies drive electric vehicle adoption? Measuring consumer preferences in the U.S. and China	2015
248	Sang Y.-N.; Bekhet H.A.	Modelling electric vehicle usage intentions: An empirical study in Malaysia	2015
215	Hagman J.; Ritzén S.; Stier J.J.; Susilo Y.	Total cost of ownership and its potential implications for battery electric vehicle diffusion	2016
214	Huang X.; Ge J.	Electric vehicle development in Beijing: An analysis of consumer purchase intention	2019
212	Rietmann N.; Hügler B.; Lieven T.	Forecasting the trajectory of electric vehicle sales and the consequences for worldwide CO2 emissions	2020
197	He X.; Zhan W.; Hu Y.	Consumer purchase intention of electric vehicles in China: The roles of perception and personality	2018
195	He X.; Zhan W.	How to activate moral norm to adopt electric vehicles in China? An empirical study based on extended norm activation theory	2018
186	Jansson J.; Nordlund A.; Westin K.	Examining drivers of sustainable consumption: The influence of norms and opinion leadership on electric vehicle adoption in Sweden	2017
171	Larson P.D.; Viáfara J.; Parsons R.V.; Elias A.	Consumer attitudes about electric cars: Pricing analysis and policy implications	2015

156	Junquera B.; Moreno B.; Álvarez R.	Analysing consumer attitudes towards electric vehicle purchasing intentions in Spain: Technological limitations and vehicle confidence	2016
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(Source from author)

Table 6 presents the research subject and key findings of the top-cited articles, which were previously presented in Table 5.

Title	Research Subject	Key Findings
Will subsidies drive electric vehicle adoption? Measuring consumer preferences in the U.S. and China	How do Chinese and American consumers' preferences and attributes for electric vehicles (including Hybrid Electric Vehicles, Plug-in Hybrid Electric Vehicles, and Battery Electric Vehicles) differ, and how do these preferences impact the market competitiveness of EVs?	There are significant differences in consumer preferences between China and the US for EVs, with Chinese consumers showing higher acceptance of Battery Electric Vehicles (BEVs) while American consumers prefer Hybrid Electric Vehicles (HEVs). Additionally, subsidy policies have a significant influence on EV market competitiveness, particularly in China, where BEVs demonstrate strong market potential with subsidies.
Modelling electric vehicle usage intentions: An empirical study in Malaysia	What are the key factors influencing the willingness to use electric vehicles in Malaysia?	Factors such as social influence, performance attributes, economic benefits, environmental concerns, demographics, infrastructure readiness, and government interventions significantly influence the acceptance and intention to use electric vehicles in Malaysia.
Total cost of ownership and its potential implications for battery electric vehicle diffusion	How can a consumer-centric total cost of ownership (TCO) model be constructed to analyze and compare the cost differences between battery electric vehicles (BEVs), internal combustion engine vehicles (ICEVs), and hybrid electric vehicles (HEVs), and what are the potential implications of this comparison for BEV diffusion?	BEVs may have a lower total cost of ownership compared to ICEVs and HEVs when considering factors such as depreciation, fuel costs, maintenance, taxes, and subsidies. This means that a comprehensive TCO analysis may reveal that BEVs are more cost-effective, potentially promoting their wider adoption.
Electric vehicle development in Beijing: An analysis of consumer purchase intention	What are the factors influencing consumers' intention to purchase electric vehicles (EVs) in Beijing, particularly focusing on the impact mechanisms of government incentive policies, product perceptions, and consumers' cognitive status?	Attitude, perceived behavioral control, cognitive status, product perception, and monetary incentive policy measures have significant positive effects on consumers' intentions to purchase EVs in Beijing. In contrast, subjective norms and non-monetary incentive policy measures do not have a significant impact. Additionally, there are notable differences in the influence path of purchase intention among demographic variables.
Forecasting the trajectory of electric vehicle sales and the consequences for worldwide CO2 emissions	How to forecast the sales trajectory of electric vehicles (EVs) across 26 global countries, as well as its implications on worldwide carbon dioxide emissions?	30% of all passenger vehicles worldwide will be electric by 2032. While the proliferation of EVs will significantly reduce carbon dioxide emissions, its impact depends on nations' energy mix and EV infrastructure development.
Consumer purchase intention of electric vehicles in China: The roles of perception and personality	How do consumer perceptions and personality traits influence their intention to purchase electric vehicles (EVs) in China?	Consumer perceptions of positive utilities, namely monetary benefit and symbol, positively impact the intention to purchase electric vehicles (EVs), whereas negative utilities, including perceived risk and fee negatively affect this intention. Personality traits such as personal innovativeness and environmental concern significantly influence EV purchase intention both directly and indirectly through mediating effects on perceptions.
How to activate moral norm to adopt electric vehicles in China? An empirical study based on	How to activate moral norms to promote the adoption of electric vehicles (EVs) among Chinese consumers?	The study reveals that external costs, such as perceived price and perceived complexity, moderate the positive influence of personal norms on EV adoption intentions. Perceived price has a

extended norm activation theory	Specifically, there is a need to examine the impact of personal norms on EV adoption intentions, the moderating effects of external costs, and the antecedents of personal norms.	negative moderation effect, while perceived complexity has a nonlinear moderation effect. Furthermore, the antecedents of personal norms, including awareness of consequences, ascription of responsibility, and perceived consumer effectiveness, are positively related to personal norms, which in turn impact EV adoption intentions.
Examining drivers of sustainable consumption: The influence of norms and opinion leadership on electric vehicle adoption in Sweden	What are the main factors influencing the adoption of electric and flexible fuel vehicles (FFVs) by Swedish consumers?	Personal norms, opinion leader status, and opinion-seeking attitudes significantly influenced EV adoption, whereas ecological attitudes had a negative effect on early EV adoption.
Consumer attitudes about electric cars: Pricing analysis and policy implications	What is consumer's acceptance of EV pricing, and how does this affect EV marketing strategies?	Consumer acceptance of pricing for electric vehicles is similar to that of conventional vehicles, but most consumers are unwilling to pay a high premium, while experienced users have a higher willingness to pay a premium for electric vehicles, suggesting that marketing should focus on consumer education and experience promotion.
Analyzing consumer attitudes towards electric vehicle purchasing intentions in Spain: Technological limitations and vehicle confidence	What key factors explain the willingness of Spanish consumers to purchase electric vehicles?	Price perception, range, and charging time are the main factors influencing Spanish consumers' willingness to purchase electric vehicles, and lowering the price of electric vehicles, increasing battery range, and reducing charging time are essential to increasing market penetration.

(Table 6: The research problem and conclusion of the most-cited articles)

(Source from author)

What are the popular keywords related to the study and have they evolved/changed during the last ten years?

The search results from this study have been categorized into six distinct clusters of phrases, each of which reflects different aspects of the research on the electric vehicle (EV) market. These clusters help in the organization and clarification of the key themes and topics that emerged in the literature between 2015 and 2024.

The first cluster, represented in red, contains 41 keywords and focuses on economic and policy-related aspects. Key terms in this cluster include "alternative fuel," "climate change," "commerce," "competition," "consumer preference," "diffusion of innovation," "economic analysis," "policy approach," "subsidy system," "taxation," and "cost effectiveness." These keywords suggest a strong emphasis on the economic and policy frameworks that influence the adoption and diffusion of electric vehicles.

The second cluster, shown in green, comprises 39 keywords and centers on consumer behavior and technology adoption. It includes terms such as "sustainable development," "technology adoption," "consumer behavior," "sales," "purchase intention," "perceived risk," "perceived value," and "perceived usefulness." This cluster highlights the factors that drive consumer decisions and the adoption of new technologies in the EV market.

The third cluster, illustrated in blue, includes 36 keywords and is focused on the technical and manufacturing aspects of electric vehicles. Prominent terms in this cluster include "electric vehicles," "secondary batteries," "automobile manufacture," and "supply chain." This suggests a significant focus on the production and technological advancements related to EVs.

The fourth cluster, represented in yellow, contains 24 keywords and emphasizes marketing strategies and business models. Keywords such as "consumption behavior," "business model," "marketing," and "strategy approach" are central to this cluster, indicating the importance of strategic planning and marketing in the commercialization of electric vehicles.

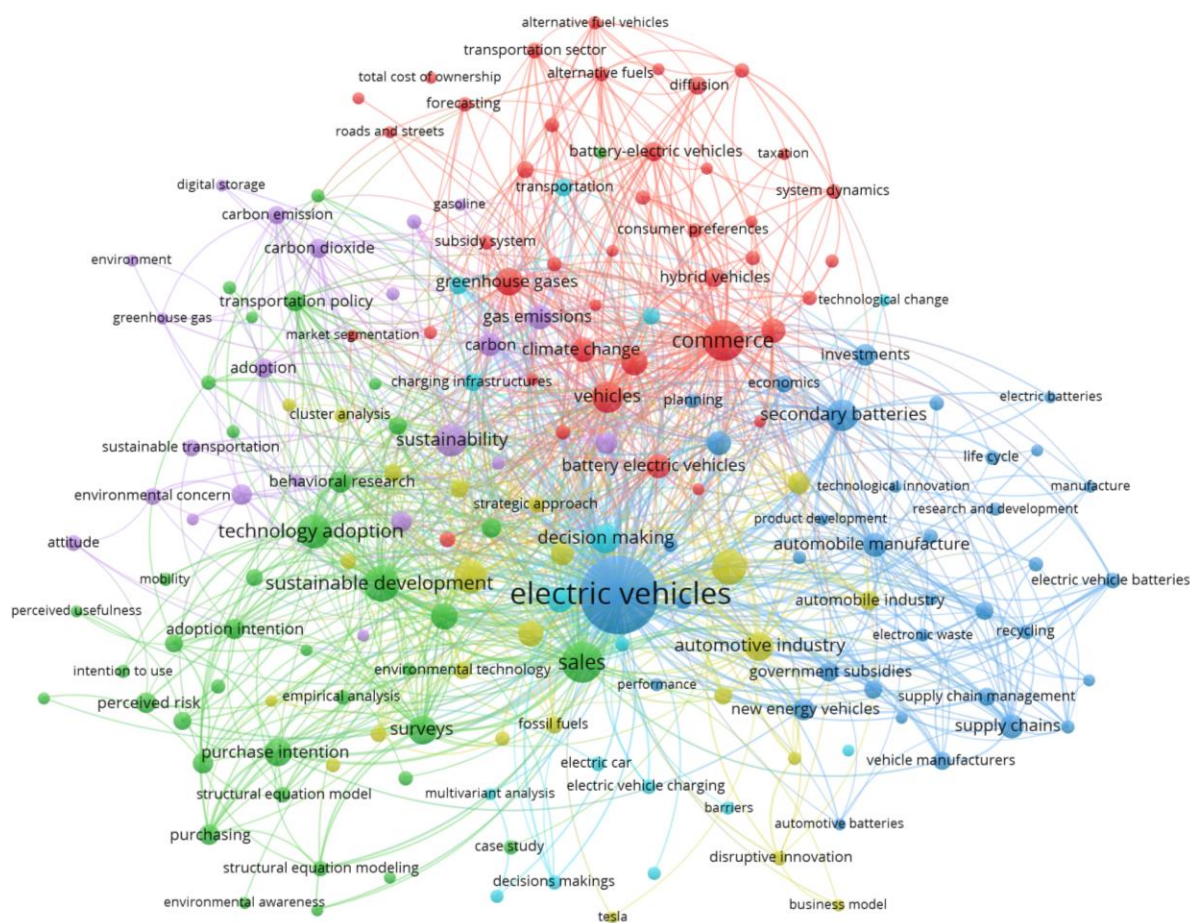
The fifth cluster, shown in purple, consists of 22 keywords that pertain to environmental sustainability and emissions control. Key terms include "sustainability," "carbon," "emission control," "carbon emission," and

"digital storage." This cluster emphasizes the environmental impact of EVs, as well as the importance of managing carbon emissions and sustainability in this market.

Finally, the sixth cluster, represented in sky blue, includes 16 keywords related to decision-making processes and charging infrastructure. Terms such as "decision making," "charging infrastructure," "charging (batteries)," and "charging station" suggest a focus on the logistical and infrastructural challenges associated with EV adoption.

Figure 6 identifies the most frequently occurring keywords, including "electric vehicles," "secondary batteries," "commerce," "sustainable development," "technology adoption," "consumer behaviors," and "public policy," among others. These frequently occurring terms reflect the core areas of interest in EV market research.

In addition to the keyword analysis, this study also highlights several commonly used theories in the field of electric vehicle market research. These include the "diffusion of innovation," which explains how new technologies spread through societies; "system theory," which looks at the interconnections within the EV ecosystem; "theory of planned behavior," which explores the psychological factors influencing consumer decisions; and "game theory," which analyzes strategic interactions among different stakeholders in the EV market. These theories provide a foundational framework for understanding the dynamics and complexities of the electric vehicle market.



(Figure 6: Bibliometric VOSviewer of popular keywords)

(Resource from author)

DISCUSSION AND CONCLUSION

In this bibliometric study on Electric Vehicle (EV) Market Development from 2015 to 2024, we present a comprehensive analysis of the research trends, key authors, contributing countries, leading organizations, most cited articles, and top keywords in this evolving field. Our research findings offer valuable insights into the progression and dynamics of research on EV market development, shedding light on the factors driving this area of study.

The study reveals a significant increase in research publications over the study period, with a particularly sharp rise after 2020. A combination of policy incentives, technological advancements, and heightened consumer awareness of the environmental and economic benefits of electric vehicles may be responsible for the increasing global interest and investment in EV market development. The consistent growth in the number of publications highlights the significance of this field in addressing global challenges such as climate change and the need for sustainable transportation solutions.

In terms of authorship, the analysis identifies several researchers who have made notable contributions to the literature on EV market development. Interestingly, the top ten authors each published four articles, suggesting that, despite the significant contributions of these scholars, there remains considerable room for further exploration and expansion in this research area.

When examining the contributions by country, China emerges as the leading contributor, with 122 publications, followed by India and the United States. The aggressive policies and substantial investments in the EV industry have positioned China as a key player in shaping the global market, as evidenced by its prominence in EV market research. The significant output from India and the United States, which have played crucial roles in advancing the field within their respective economic and political contexts, further highlights the global relevance of EV research.

The analysis of institutions shows that Tsinghua University is leading the field, with the majority of research outputs emerging from a diverse range of universities. Multiple institutions across different regions underscore the widespread interest and expertise in EV market development, indicating a strong and growing research community focusing on this area.

The analysis of the most cited articles reveals key research questions and findings that have significantly impacted the field. These highly cited works demonstrate the breadth and depth of research within the EV market development domain, addressing topics such as consumer preferences, barriers to adoption, policy implications, and market forecasts. Notable findings include the influence of subsidies on EV adoption rates, the importance of social impacts and perceived risks in shaping consumer attitudes, and the economic and environmental benefits associated with the widespread adoption of electric vehicles.

Furthermore, our keyword analysis identifies several recurring themes that have dominated EV market research over the past decade. These themes, which include sustainability, technology adoption, consumer behavior, and public policy, are indicative of the multidisciplinary nature of EV research. This study field integrates elements of engineering, economics, environmental science, and social psychology. The emergence of these themes highlights the diverse factors that influence the development and adoption of electric vehicles.

This study makes several significant contributions to the field. First, it provides a comprehensive overview of the evolution of research on electric vehicle market development over the past decade, highlighting key trends and emerging areas of focus. Second, it provides an overview of the research environment and potential opportunities for collaboration by identifying the most productive authors, countries, and institutions. Finally, the analysis of the most cited articles and popular keywords offers valuable guidance for future research directions, suggesting avenues for further exploration and innovation.

However, there are limitations to our study. The analysis is based solely on publications indexed in Scopus, which may exclude relevant studies published in other databases or repositories. Additionally, this study specifically examines the electric vehicle market as a broad research area, potentially overlooking the full

spectrum of trends within more specific subfields, such as corporate strategy or consumer behavior, which may have different research priorities and focuses.

Therefore, we recommend that future research continue exploring the intersection of EV market development with other disciplines, such as urban planning, energy policy, and consumer behavior. With the increasing global transition to sustainable transportation, there is a pressing need for interdisciplinary research to inform policy development, drive technological innovation, and ultimately contribute to a more sustainable future.

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