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A Bibliometric Analysis of Transportation Sector Transformation through Green Policies

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ABSTRACT

The transportation sector plays a critical role in economic development and societal mobility but is also a significant contributor to greenhouse gas emissions and environmental degradation. As global efforts to mitigate climate change intensify, green policies have emerged as essential mechanisms for transforming transportation systems toward sustainability. This study conducts a bibliometric analysis using VOSviewer, based on Scopus-indexed publications, to explore the evolution of research on transportation sector transformation through green policies. The findings reveal key thematic trends, including an early emphasis on emissions reduction and climate change, followed by a growing focus on renewable energy integration, electric vehicles, hydrogen fuels, and policy interventions. Co-authorship network analysis highlights fragmentation in global research collaborations, with dominant contributions from China, the United States, and Europe, but limited representation from developing economies. The results suggest that policy frameworks, technological innovations, and economic incentives play a vital role in shaping the transition to sustainable transportation. However, greater interdisciplinary collaboration and research inclusivity are needed to develop globally adaptable strategies. This study provides valuable insights for policymakers, researchers, and industry stakeholders seeking to enhance the sustainability of transportation systems through evidence-based policy and technological innovation.

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1. INTRODUCTION

The transportation sector has long been recognized as a critical pillar of modern economic development, underpinning global trade, urban mobility, and social connectivity. As urbanization accelerates worldwide, transportation systems are evolving to meet the demands of increasingly interconnected societies. However, this evolution comes at a cost. The sector is one of the major contributors to greenhouse gas emissions and air pollution, exacerbating climate change and negatively impacting public health [1]. Historically, transportation policies have focused predominantly on efficiency and

economic growth. Yet, with mounting environmental concerns and the pressures of sustainable development, there is a growing imperative to transform these systems through the integration of green policies. This shift reflects a broader trend in which economic imperatives are increasingly intertwined with environmental stewardship, urging policymakers and industry leaders to adopt a more sustainable approach to mobility and infrastructure development [2].

In recent years, environmental challenges have emerged as critical drivers of policy reform within the transportation sector. Climate change, driven by rising carbon emissions, has forced governments and international organizations to rethink their strategic priorities. The Intergovernmental Panel on Climate Change has repeatedly underscored the urgency of reducing carbon footprints, while agencies such as the International Energy Agency have highlighted transportation's outsized role in global energy consumption and emissions. These concerns have catalyzed a paradigm shift towards green policies that emphasize renewable energy, energy efficiency, and reduced dependence on fossil fuels. Consequently, the transportation sector is undergoing a significant transformation, one that not only aims to enhance operational efficiency and resilience but also to mitigate adverse environmental impacts. Such a transformation is essential for achieving broader sustainability goals and aligning with international environmental agreements [3]–[5].

Governmental and regulatory frameworks have been instrumental in catalyzing the transformation of the transportation sector. Over the past decade, numerous countries have implemented policies that promote sustainable transportation practices. For instance, initiatives such as subsidies for electric vehicles, investments in public transit infrastructure, and the introduction of low-emission zones in urban areas have been widely adopted [6], [7]. These green policies serve a dual purpose: they reduce environmental impacts and stimulate innovation by encouraging the development and adoption of new technologies. As urban centers grapple with congestion and deteriorating air quality, policy interventions are increasingly being viewed as essential tools to balance economic growth with environmental preservation. The policy landscape is thus characterized by a dynamic interplay between regulatory mandates, technological advancements, and market forces, all converging towards the common objective of a cleaner, more sustainable transportation future [8]–[10].

Parallel to these policy initiatives, the academic and research communities have increasingly focused on the intersection of transportation transformation and sustainability. Over the last few decades, a burgeoning body of literature has emerged, documenting the evolution of green policies and their impact on the transportation sector. Researchers have employed a variety of methodologies to explore these themes, ranging from case studies and comparative analyses to advanced quantitative methods such as bibliometric analysis. Bibliometric analysis, in particular, has proven to be a powerful tool for mapping the development of scientific knowledge, identifying research trends, and assessing the impact of policy interventions on scholarly discourse [11], [12]. By examining patterns in publications, citations, and collaborative networks, bibliometric studies offer unique insights into how green policies are conceptualized, implemented, and critiqued within the academic community. This methodological approach not only enhances our understanding of the current state of research but also illuminates potential pathways for future inquiry and policy development [13], [14].

Despite the growing body of research on sustainable transportation and green policies, significant challenges remain in synthesizing the diverse and rapidly expanding literature. The current landscape is marked by fragmentation, with studies often confined to disciplinary silos that use varied

definitions, methodologies, and evaluative metrics. This inconsistency hinders the ability to form a cohesive understanding of how green policies influence transportation sector transformation. Furthermore, the accelerated pace of technological innovation and policy reform means that traditional review methodologies may not fully capture the latest developments or emerging trends. The lack of a comprehensive, systematic analysis that integrates these disparate strands of research makes it difficult for both policymakers and researchers to discern the most effective strategies for sustainable transformation. Consequently, there is an urgent need for an analytical approach that can consolidate and clarify the complex interplay between green policies and transportation innovation, ensuring that decision-makers have access to timely and relevant insights [15].

The objective of this study is to conduct a comprehensive bibliometric analysis of the literature on transportation sector transformation through the lens of green policies. This analysis seeks to systematically map the evolution of research, identify influential works and authors, and delineate the major research clusters and trends that have emerged over time. By leveraging bibliometric tools and methodologies, the study aims to highlight how research in this area has evolved in response to both technological advancements and policy shifts, thereby providing a clearer understanding of the impact of green policies on sustainable transportation. Ultimately, the study endeavors to fill existing knowledge gaps, offering valuable insights for both policymakers and scholars. These insights are expected to guide future research directions and inform the development of robust, evidence-based strategies that promote sustainable mobility and environmental resilience in the transportation sector.

2. LITERATURE REVIEW

The transformation of the transportation sector in response to environmental imperatives has attracted considerable scholarly attention over the past few decades. Researchers have explored the integration of green policies within transportation planning and infrastructure development, addressing both technological and regulatory dimensions. Early works in the field primarily concentrated on the environmental impacts of traditional transportation systems, highlighting the sector's substantial contribution to greenhouse gas emissions and urban air pollution [16]–[18]. As concerns over climate change and sustainability have grown, the literature has increasingly focused on strategies to reduce the ecological footprint of transportation through policy reform and technological innovation. This review synthesizes the key themes emerging from previous studies, including the evolution of green policies, the role of technological innovation, and the application of bibliometric methods to assess research trends, while also identifying existing gaps in the literature [19], [20].

A significant body of research has investigated the development and implementation of green policies aimed at reducing the environmental impacts of transportation. These policies range from economic incentives—such as subsidies for electric vehicles (EVs) and renewable energy investments—to regulatory measures like low-emission zones and stricter fuel economy standards [21]. Studies by [1] and others have emphasized that the transition toward sustainable transportation systems requires not only technological advancements but also robust policy frameworks that can incentivize behavioral change and foster innovation. For example, research on urban mobility has shown that comprehensive policy approaches, which integrate land-use planning with transportation management, are more effective in reducing emissions than isolated interventions [22], [23]. Moreover, comparative analyses across different regions have revealed that policy success often depends on the interplay between local contexts, economic conditions, and

institutional capacities, highlighting the need for tailored approaches rather than one-size-fits-all solutions.

Parallel to the evolution of green policies, there has been an increasing focus on the role of technological innovations in transforming the transportation sector. Advances in vehicle electrification, intelligent transportation systems (ITS), and alternative fuels have been pivotal in driving sustainable mobility. The International Energy Agency has documented rapid advancements in EV technology and the corresponding infrastructure development that supports this transition. Research by [24], [25] further illustrates how innovations such as real-time traffic management and connected vehicle technologies can enhance operational efficiency and reduce energy consumption. However, while technological innovations offer promising avenues for reducing environmental impacts, their widespread adoption is often contingent upon supportive policy frameworks. As highlighted in several studies, the diffusion of green technologies in transportation is not merely a technical challenge but also a socio-economic and regulatory one, requiring coordinated efforts among government, industry, and academia [26], [27].

In addition to empirical and case study research, bibliometric analyses have emerged as a valuable methodological tool for understanding the evolution of research in sustainable transportation and green policies. Bibliometrics enables scholars to quantitatively assess publication trends, identify influential research works, and map collaborative networks across disciplines. [27] have demonstrated that bibliometric approaches can reveal the underlying structure of scientific research, providing insights into how policy debates and technological innovations are interconnected. Such analyses have been particularly useful in identifying shifts in research focus over time—from early concerns with pollution and energy efficiency to more recent explorations of integrated urban planning and smart mobility solutions. Furthermore, bibliometric studies have underscored the interdisciplinary nature of sustainable transportation research, showing that contributions come from diverse fields such as environmental science, engineering, economics, and urban studies [28], [29]. This methodological trend not only enriches our understanding of the research landscape but also points to the need for more integrative approaches that combine qualitative insights with quantitative data.

Despite the growing body of literature on green policies and transportation transformation, several challenges and gaps remain. First, much of the existing research has been conducted within disciplinary silos, resulting in fragmented insights that are difficult to integrate into a cohesive understanding of how green policies drive sector-wide transformation. For instance, studies focused on technological innovation may overlook socio-political factors that are crucial for policy implementation, while research on regulatory frameworks might not fully capture the technical feasibility of emerging transportation technologies. Moreover, the rapid pace of technological change and policy reform often means that traditional review methodologies struggle to keep up with the latest developments. There is also a notable imbalance in the geographic distribution of research, with a preponderance of studies emanating from developed regions, leaving developing economies underrepresented in the discourse [21]. This lack of diversity limits the generalizability of findings and constrains our understanding of how green policies might be tailored to different socio-economic contexts. Addressing these gaps requires not only a synthesis of disparate research strands but also the adoption of innovative methodologies, such as bibliometric analysis, to provide a more holistic view of the current state and future directions of sustainable transportation research.

Another emerging theme in the literature is the evaluation of policy effectiveness and the mechanisms through which green policies translate into tangible

environmental benefits. Empirical studies have attempted to quantify the impact of policies such as EV subsidies and low-emission zones on reducing urban air pollution and mitigating climate change. For example, research by [30] assesses the cost-effectiveness of various policy measures in achieving carbon emission reductions. However, the results of such studies are often mixed, reflecting the complex and context-dependent nature of policy outcomes. The interplay between local economic conditions, infrastructural capabilities, and societal attitudes means that even well-designed policies can yield uneven results. Additionally, the literature highlights the importance of considering rebound effects, where improvements in fuel efficiency or energy use might inadvertently lead to increased travel demand, thereby offsetting some of the environmental gains [30]. Such findings underscore the necessity for comprehensive policy evaluations that incorporate both direct and indirect effects, as well as long-term monitoring to ensure that intended outcomes are achieved.

3. METHODS

This study adopted a systematic bibliometric analysis approach that exclusively utilized data retrieved from the Scopus database and employed VOSviewer as the sole analytical tool. A comprehensive search strategy was developed in Scopus using carefully selected keywords such as "transportation," "green policies," "sustainable mobility," and "environmental transformation," with the search confined to peer-reviewed articles published between 2000 and 2024. The resulting dataset was meticulously cleaned to remove duplicates and irrelevant records, ensuring that only the most pertinent literature was included for analysis. VOSviewer was then used to conduct detailed mapping and visualization of the data, facilitating the identification of key research clusters, influential publications, and collaborative networks among authors.

4. RESULTS AND DISCUSSION

Table 2. Top Cited Research

Citations	Authors and year	Title
482	[31]	Who benefits from access to green space? A case study from Sheffield, UK
321	[32]	Impact of urbanization on CO2 emissions in emerging economy: Evidence from Pakistan
284	[33]	Limitations of carbon footprint as indicator of environmental sustainability
261	[30]	Modelling electric vehicle usage intentions: An empirical study in Malaysia
243	[34]	Co-benefits and synergies between urban climate change mitigation and adaptation measures: A literature review
221	[35]	Emissions from India's transport sector: Statewise synthesis
221	[36]	Impact of battery weight and charging patterns on the economic and environmental benefits of plug-in hybrid vehicles
215	[37]	A review on green energy potentials in Iran
212	[38]	Potential and economic viability of green hydrogen production by water electrolysis using wind energy resources in South Africa
197	[39]	Strategies to save energy in the context of the energy crisis: a review

Source: Scopus, 2025

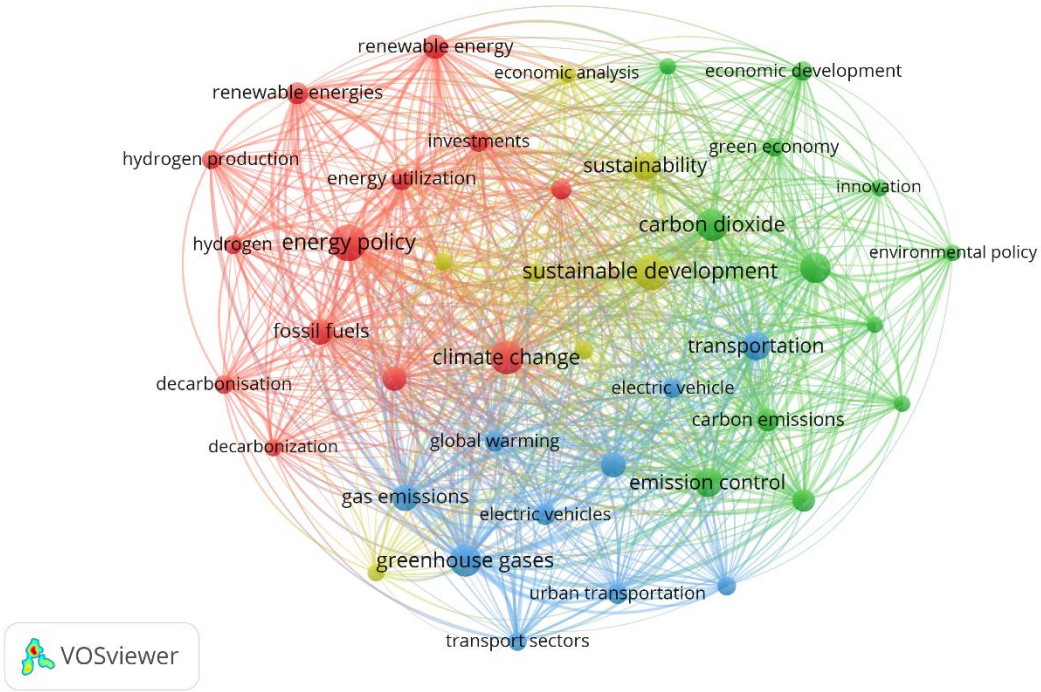

Figure 1. Network Visualization
Source: Data Analysis Result, 2025

The visualization represents a bibliometric network of key terms associated with the transformation of the transportation sector through green policies. The nodes in the network indicate frequently occurring keywords in the analyzed research corpus, while the links between them represent co-occurrence relationships. The different colors in the network signify distinct thematic clusters, providing insight into how research topics are interconnected within the field. The density of connections suggests a highly interdisciplinary nature of research in sustainable transportation and environmental policies. The red cluster, positioned on the left side of the network, is primarily associated with energy policy, renewable energy, fossil fuels, hydrogen production, and decarbonization. This cluster highlights the critical role of energy-related discussions in sustainable transportation transformation. Research in this area frequently explores policies aimed at reducing reliance on fossil fuels, promoting renewable energy adoption, and incentivizing decarbonization strategies. The presence of keywords such as "energy utilization" and "investments" suggests that economic considerations play a significant role in shaping energy policies for green transportation.

The green cluster, located on the right, revolves around sustainability, carbon dioxide, environmental policy, and economic development. This cluster emphasizes the policy and regulatory aspects of green transportation, focusing on sustainability measures and their broader economic implications. The interconnectedness between "green economy," "innovation," and "environmental policy" suggests that research in this domain often explores the intersection of technological advancements, government policies, and economic growth. This cluster indicates that achieving sustainable transportation requires integrated approaches that consider both ecological and economic dimensions. The blue cluster, positioned at the bottom, is primarily related to greenhouse gases, emission control, transport sectors, urban transportation, and electric vehicles. This cluster highlights the role of vehicle electrification and emissions reduction strategies in the transition towards greener transportation systems. The strong linkage

between "electric vehicles," "global warming," and "carbon emissions" signifies that much of the research in this domain is driven by concerns over climate change and air pollution. The presence of "urban transportation" further suggests that sustainable mobility solutions are particularly relevant for city planning and reducing congestion-related emissions.

Finally, the yellow cluster, dispersed throughout the network, represents cross-cutting themes such as "climate change," "sustainable development," and "gas emissions." This cluster acts as a bridge between the other thematic areas, indicating that sustainability in transportation is closely linked to broader environmental and climate-related discussions. The strong central positioning of "sustainable development" in the network suggests that it serves as a core concept integrating multiple research themes, reinforcing the idea that green transportation policies must align with global sustainability goals. The network visualization provides a comprehensive overview of research trends in sustainable transportation transformation. The extensive interconnectivity between clusters indicates that effective green policies require a multi-faceted approach, integrating energy policies, economic strategies, environmental regulations, and technological innovations. This bibliometric analysis highlights the importance of interdisciplinary collaboration in advancing knowledge and developing actionable solutions for a more sustainable transportation future.

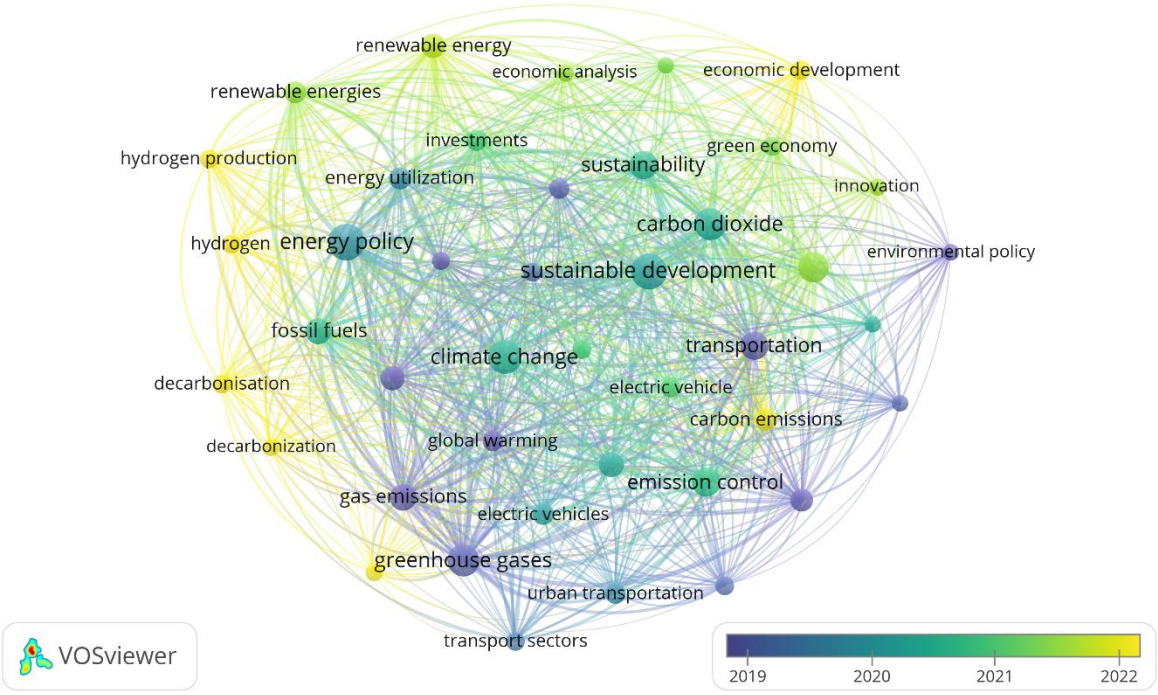

Figure 2. Overlay Visualization

Source: Data Analysis Result, 2025

This VOSviewer visualization presents a bibliometric analysis of keyword co-occurrence over time in research related to transportation sector transformation through green policies. The color gradient from blue (2019) to yellow (2022) indicates the temporal evolution of research themes. Keywords appearing in blue represent earlier research interests, while those in green and yellow indicate more recent research trends. The network structure remains dense, highlighting strong interconnections among themes, suggesting that sustainable development, carbon emissions, and climate change remain central to the discourse.

Earlier research (blue and green nodes) focused primarily on greenhouse gases, gas emissions, climate change, emission control, and global warming, which suggests that the initial emphasis was on understanding and mitigating environmental impacts. Keywords such as electric vehicles and urban transportation also emerged early, highlighting technological and policy-driven efforts to reduce emissions through cleaner transport alternatives. Meanwhile, energy policy, fossil fuels, and decarbonization appeared prominently, indicating that earlier discussions revolved around reducing dependence on fossil fuels and exploring policy mechanisms for emissions reduction.

Recent research trends (yellow nodes) emphasize economic development, renewable energy, green economy, and innovation, showing a shift towards integrating sustainability with economic policies and technological advancements. The growing prominence of hydrogen production and investments suggests an increasing focus on alternative energy sources and financial mechanisms to support sustainable mobility. The connectivity between sustainability, carbon dioxide, and transportation indicates that recent research is now more holistic, considering not just emissions but also economic, policy, and technological strategies for achieving long-term sustainability. This temporal mapping underscores the dynamic evolution of green policies in transportation, moving from problem identification to solution-oriented innovations and economic integration.

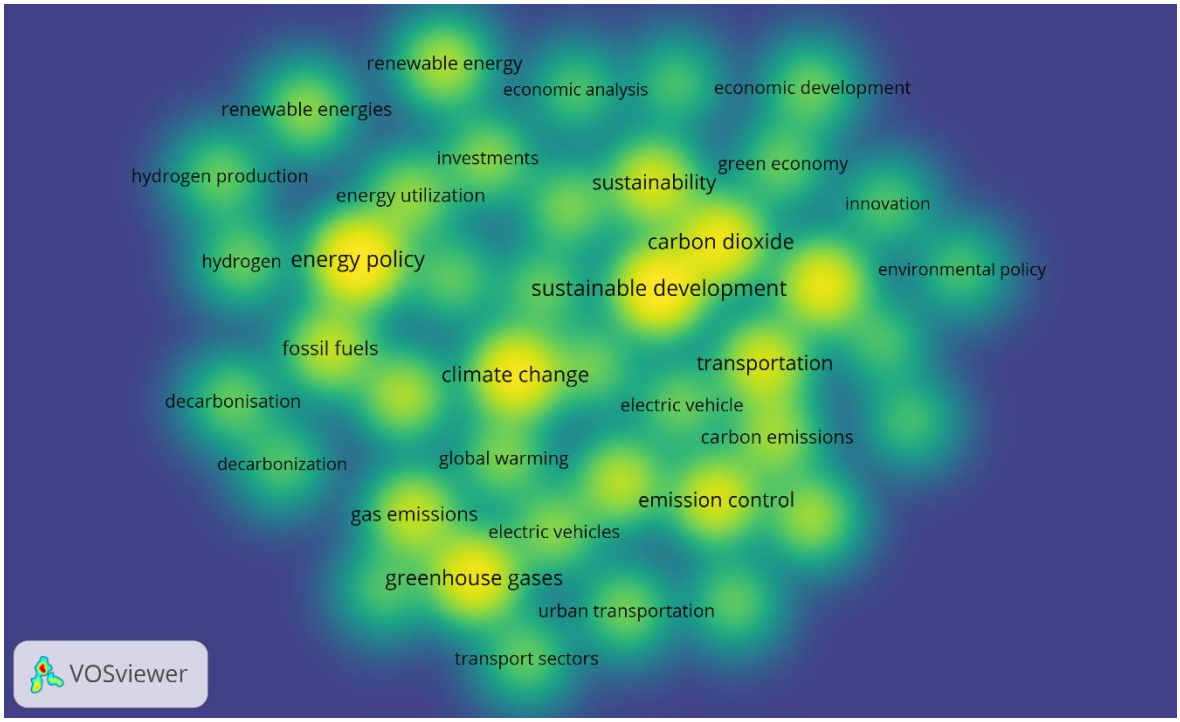

Figure 3. Density Visualization
Source: Data Analysis, 2025

This VOSviewer heatmap visualization represents the frequency and intensity of keyword occurrences in research related to the transformation of the transportation sector through green policies. The yellow areas indicate high-frequency keywords, meaning they have appeared frequently in the analyzed literature, whereas the green areas indicate lower frequencies. The distribution of bright yellow spots around "sustainable development," "climate change," "energy policy," "carbon dioxide," and "greenhouse gases" suggests that these are the most commonly discussed topics in

this research domain. This highlights the central role of sustainability, emissions reduction, and energy policy in driving discussions on green policies in transportation.

The presence of multiple yellow clusters across the heatmap suggests that research in this field is highly interconnected and multidisciplinary. Keywords such as "renewable energy," "electric vehicles," "hydrogen production," and "carbon emissions" also appear prominently, indicating a strong focus on alternative energy solutions and emissions control in sustainable transportation discussions. Additionally, terms like "economic development" and "innovation" suggest that recent research is not only addressing environmental concerns but also exploring the economic feasibility and technological advancements required for sustainable mobility. The wide dispersion of research themes implies that green policies in transportation are studied from multiple perspectives, including policy, technology, economics, and environmental science, reinforcing the necessity of an integrated approach to sustainable transportation transformation.

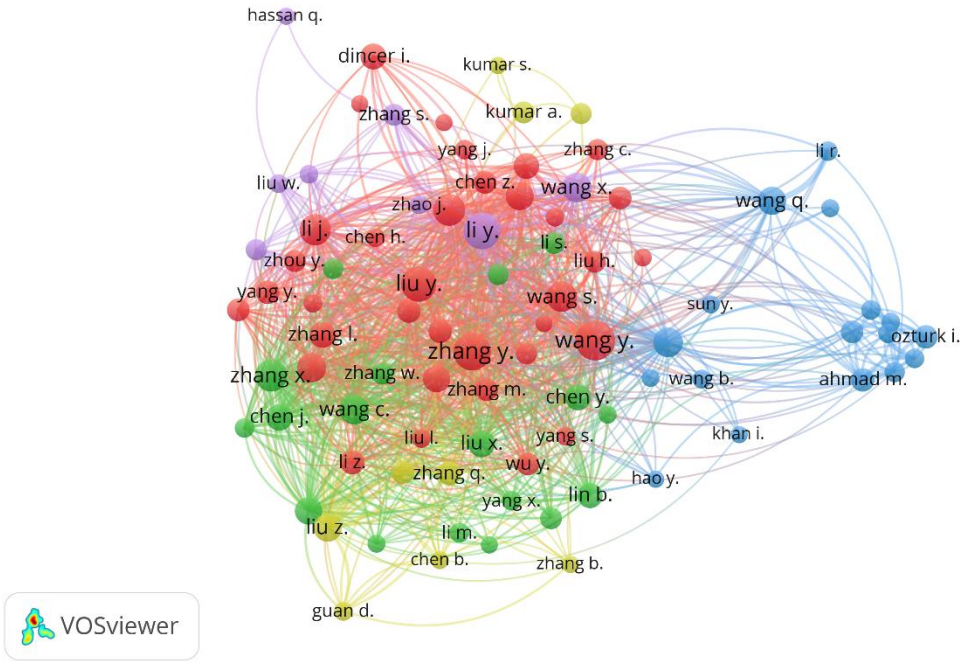

Figure 4. Author Collaboration Visualization
Source: Data Analysis, 2025

This VOSviewer co-authorship network visualization represents the collaborative relationships among researchers in the field of transportation sector transformation through green policies. Each node represents an author, and the size of the node indicates the frequency of their publications within the dataset. The links between nodes indicate co-authorship relationships, and the color clusters signify different collaborative groups or research communities. The dense interconnections in the red and green clusters suggest that these groups have a strong collaborative network, with several key researchers such as Zhang Y., Wang Y., Liu Y., and Li J. appearing as central figures in the field. The blue cluster, positioned more independently on the right, represents another research community with prominent authors like Wang Q., Ahmad M., and Ozturk I., which appears to have relatively fewer connections to the central

clusters. The presence of multiple collaborative groups indicates that research on sustainable transportation policies is highly interdisciplinary and globally distributed, yet there may be limited cross-collaboration between certain research communities.

Discussion

The findings of this bibliometric analysis provide valuable insights into the evolution of research on the transformation of the transportation sector through green policies. By mapping keyword co-occurrences, research trends over time, and co-authorship networks, this study sheds light on the interdisciplinary nature of sustainable transportation research. The results indicate a growing academic focus on policies aimed at reducing greenhouse gas emissions, integrating renewable energy sources, and promoting sustainable development in transportation. Additionally, the analysis highlights how collaborations between researchers have shaped the field, revealing prominent scholars and research clusters that have significantly contributed to the advancement of knowledge in this domain.

1. Thematic Evolution in Green Transportation Research

One of the key observations from the bibliometric analysis is the evolution of research themes within green transportation policies. Early studies focused predominantly on understanding the environmental impact of transportation, particularly its contribution to climate change, greenhouse gas emissions, and global warming. These studies laid the groundwork for identifying transportation as a significant source of pollution and energy consumption [2], [3], [40]. The strong emphasis on energy policy, fossil fuels, and decarbonization in earlier years underscores the initial concern with reducing transportation's dependency on non-renewable energy sources.

However, as research has progressed, the focus has shifted toward solutions and strategies to mitigate these environmental challenges. Recent years have seen an increasing emphasis on electric vehicles, hydrogen production, renewable energy, and sustainable mobility solutions. This shift reflects the global trend toward decarbonizing transportation and aligning with international sustainability goals such as the Paris Agreement and the UN Sustainable Development Goals (SDGs). Additionally, keywords such as economic development, innovation, and green economy indicate a growing interest in integrating sustainability with economic growth, recognizing that green transportation policies can also drive technological innovation and financial investment. The temporal analysis of research themes (as observed in the color-coded network) further illustrates this shift. Earlier research (2019-2020) was dominated by discussions on environmental problems, while more recent studies (2021-2022) have focused on policy interventions, renewable energy integration, and alternative fuel adoption. This trend suggests that research is moving beyond problem identification toward actionable solutions for sustainable transportation.

2. Policy Implications and the Role of Governments

The results of this analysis highlight the critical role of policy and regulation in transforming the transportation sector. Keywords such as "environmental policy," "emission control," and "sustainability" frequently co-occur with terms related to transportation, carbon emissions, and economic development, indicating that policies are central to shaping sustainable mobility initiatives. Studies have demonstrated that well-designed policies—such as subsidies for electric vehicles, stricter emission standards, and investment in public transport infrastructure—have a significant impact on reducing transportation-related carbon emissions. Governmental efforts in various countries have demonstrated the importance of policy interventions in accelerating the transition to green

transportation. For instance, the European Union's Green Deal has established stringent carbon neutrality targets, while China has aggressively expanded its electric vehicle market through subsidies and infrastructure investments. Similarly, the United States has introduced policies to promote electric mobility and clean energy adoption in transportation. The bibliometric network suggests that research in this field is closely following these policy developments, with scholars analyzing the effectiveness of different regulatory approaches.

However, challenges remain in policy implementation and global coordination. Many developing countries struggle with the high initial costs of green transportation infrastructure, limited technological capabilities, and a lack of regulatory frameworks to support sustainability initiatives. The co-authorship network analysis suggests that research is still concentrated within certain regions, with a dominance of scholars from China, the United States, and Europe. This lack of global research collaboration may hinder the development of policies that are adaptable to diverse socio-economic and geographic contexts. Future research should aim to bridge these gaps by encouraging more international collaborations and cross-regional studies to ensure that green policies are inclusive and effective across different economies.

3. Technological Advancements and Future Research Directions

The growing emphasis on **electric vehicles (EVs), hydrogen fuels, and alternative energy sources** in the bibliometric analysis highlights the critical role of technology in transforming the transportation sector. Innovations in **battery storage, charging infrastructure, and smart mobility solutions** have significantly contributed to reducing transportation-related emissions. The network analysis shows strong linkages between "**electric vehicles,**" "**emission control,**" "**renewable energy,**" and "**transportation,**" reflecting the interconnected nature of technological advancements in this space. Despite these advancements, there are still barriers to widespread adoption. **High costs, range anxiety, lack of charging infrastructure, and dependence on rare earth materials** remain major challenges for electric vehicle adoption. Similarly, while **hydrogen fuel cells** are seen as a promising alternative for heavy-duty transport, the technology is still in its early stages and requires substantial investment in **production, storage, and distribution infrastructure** [4]–[6]. The bibliometric analysis indicates that research is actively addressing these challenges, but further efforts are needed to **scale up technological solutions and improve economic feasibility**.

Future research should also explore the **integration of smart technologies** such as **autonomous vehicles, AI-driven traffic management, and Internet of Things (IoT)-enabled transportation systems**. These technologies have the potential to **enhance efficiency, reduce congestion, and minimize energy consumption**, aligning with sustainability objectives. The bibliometric network suggests that while these topics are emerging, they have not yet been fully explored in the context of **green transportation policies**. Further research in this area could contribute to a more holistic understanding of how digital transformation can complement sustainability efforts.

4. Research Collaboration and Knowledge Gaps

The **co-authorship network visualization** reveals key research clusters in the field of sustainable transportation. Prominent authors such as **Zhang Y., Wang Y., and Liu Y.** appear frequently in the network, indicating their significant contributions to the field. However, the presence of multiple **separate clusters** suggests that research communities remain somewhat fragmented, with **limited cross-collaboration between certain groups**. Notably, **Chinese researchers dominate the field**, with fewer collaborations seen with scholars from other regions. This pattern highlights a **geographic imbalance in**

research output, which may limit the diversity of perspectives and solutions presented in the literature. Another notable **research gap** is the **lack of studies focusing on developing countries and underrepresented regions**. Most of the existing literature examines green transportation policies in **high-income economies**, with limited insights into the challenges faced by **low- and middle-income countries**. These regions often face unique constraints such as **lack of infrastructure, weak regulatory frameworks, and financial limitations** that hinder sustainable transportation adoption. Future research should aim to fill this gap by focusing on **context-specific policy recommendations and adaptive solutions** that consider the socio-economic realities of these regions.

5. CONCLUSION

This bibliometric analysis provides a comprehensive overview of the research landscape on the transformation of the transportation sector through green policies, highlighting key trends, influential research clusters, and evolving thematic focuses. The findings indicate a shift from early discussions on the environmental impacts of transportation—such as greenhouse gas emissions and climate change—toward solution-oriented research that emphasizes policy interventions, renewable energy integration, and technological advancements like electric vehicles and hydrogen fuels. The study also underscores the critical role of **policy frameworks, economic incentives, and international collaboration** in driving sustainable mobility. However, the **fragmentation of research communities and the geographic imbalance in scholarly contributions** highlight the need for greater interdisciplinary cooperation and cross-regional studies, particularly in developing economies. Future research should focus on integrating **emerging technologies, digital transformation, and adaptive policy measures** to ensure an effective and globally inclusive transition toward sustainable transportation. By fostering a more interconnected research landscape and emphasizing **practical, scalable solutions**, policymakers and scholars can work together to create a greener, more efficient transportation system that aligns with global sustainability goals.

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