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Sustainable Development Goals (SDGs) in Road Transportation: A Bibliometric Analysis Using Biblioshiny for R

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Abstract

Road transportation plays a pivotal role in achieving the Sustainable Development Goals (SDGs) because it is closely linked to environmental sustainability, public health, urban development, the energy transition, and climate change mitigation. The rapid expansion of road transportation activities has created significant challenges related to greenhouse gas emissions, traffic congestion, road safety, and inequitable access to mobility services, underscoring the need for comprehensive research to better understand the evolution of sustainable transportation studies. This study aimed to examine global research trends, the intellectual structure, influential contributors, and emerging themes related to the SDGs in road transportation. A quantitative bibliometric analysis was conducted using 267 scientific documents indexed in the Scopus database and published between 2016 and 2026. Data were analyzed using the bibliometric package through the Biblioshiny for R interface, incorporating performance analysis, citation analysis, collaboration network mapping, keyword co-occurrence analysis, and thematic evolution analysis. The results indicate that research on the SDGs and road transportation has experienced substantial growth, particularly since 2023. China demonstrated the highest citation impact, whereas India contributed the largest number of publications. The thematic analysis identified sustainable transportation, urban mobility, smart cities, climate change, artificial intelligence, and intelligent transportation systems as the dominant and emerging research themes. Overall, the findings suggest that SDG-oriented road transportation research is increasingly evolving toward technology-driven and data-driven solutions to support sustainable mobility. Future research should emphasize empirical implementation, policy evaluation, and interdisciplinary approaches to accelerate the development of sustainable road transportation

INTRODUCTION

Sustainable development is no longer a distant aspiration; it is an agenda already in motion. The Sustainable Development Goals (SDGs) form a shared agenda set by the international community to advance human welfare worldwide. The agenda appears in the document *Transforming Our World: The 2030 Agenda for Sustainable Development*, comprises 17 goals and 169 measurable targets, and took effect on 1 January 2016 after its adoption in September 2015 (United Nations, 2015). Several of these goals run directly through the way people and goods move on roads, which makes road transportation a natural place to ask how far the agenda has reached.

Road transportation sits at the intersection of a number of SDGs. It shapes health and safety through SDG 3 and its target on halving road traffic deaths, clean energy through SDG 7 and the shift to electric vehicles, resilient infrastructure and innovation through SDG 9,

inclusive and sustainable cities through SDG 11 and its target on access to safe and affordable transport, and climate action through SDG 13 and the decarbonization of a sector that remains a major source of emissions (Maranghi et al., 2020). The sector is not a side issue in the climate conversation. Road vehicles account for a large share of transport energy demand, and the way cities grow around them locks in patterns of travel that are hard to undo. Work on urban mobility in India, for instance, shows how transport choices carry consequences for emissions and for the co-benefits that cities can capture, from cleaner air to safer streets (Ahmad & Puppim de Oliveira, 2016). The framing of an SDG indicator also matters. A critique of the urban transport indicator for SDG 11.2 argues that access and accessibility are not the same thing and should not be measured as if they were, since a bus stop within walking distance means little if the service does not take people where they need to go (Brussel et al., 2019).

The practical agenda is broad, and it has widened over the period covered by this review. Researchers have examined public transport systems in small cities as a route to the goals (Tiwari & Phillip, 2021), the health effects of urban transport interventions through systematic review and simulation (Stankov et al., 2020), and the greenhouse-gas footprint of urbanizing regions (Zhang et al., 2019). A second strand turns to technology and energy. It covers the planning of electric vehicle charging networks (C. Liu et al., 2025), congestion pricing as a demand-management tool (González-Aliste et al., 2023), curbside management for urban freight (Castrellon & Sanchez-Diaz, 2024), smart mobility solutions (Alotaibi et al., 2025), road safety around schools (Pichayapan et al., 2020), and the planning questions raised by autonomous vehicles (Gavanas, 2024). Energy supply and emerging technologies feed into the same conversation, from wireless energy for smart cities (Xie et al., 2023) to the prediction and optimization of transport energy demand with artificial intelligence (Hoxha et al., 2023; Olabi et al., 2023). Even questions that look purely local, such as suburb-level changes for active travel, are now framed against the SDGs and costed for their health benefits (Macmillan et al., 2020). Taken together, this body of work treats road transportation as one of the places where the SDGs are won or lost.

The field has grown quickly over the past decade, and the sheer volume of publications can leave newcomers unsure where their own work fits. A systematic literature review becomes useful here. Among the methods available, bibliometric analysis is one of the most dependable ways to order and map large bodies of scientific documents objectively, since it draws on citation and co-occurrence data rather than on the reviewer's reading of a small sample (Aria & Cuccurullo, 2017; Donthu et al., 2021). Bibliometric methods have been applied across many domains, including m-commerce consumer behaviour (Thangavel & Chandra, 2023) and the SDGs in science education (Maryanti et al., 2022), and they have proven able to surface both the structure of a field and the way it changes over time. Yet work that maps the specific intersection of the SDGs with road transportation remains scarce. A recent bibliometric review of electric vehicles and urban tourism in smart cities (Y.-Z. Liu et al., 2025) hints at the appetite for this kind of synthesis, without covering the road transportation field as a whole. The gap matters because road transport is both a large emitter and a daily necessity, so a clear map of what has been studied, by whom, and with what emphasis can help researchers and funders direct effort where it is most needed.

This study addresses that gap. It offers a thorough analysis of annual output, citations, collaboration patterns, and research trends in the SDGs-and-road-transportation literature from

2016 to 2026, based on Scopus, a curated database widely accepted as a comprehensive source. The contribution is fourfold. First, it provides a practical, reproducible account of how to run a bibliometric analysis for a systematic literature review, including the search protocol and the steps taken to compute the indicators. Second, it presents the most contributing authors, journals, institutions, and countries, along with the most impactful documents, so that newcomers know where to look and where to publish. Third, it visualizes how research trends have shifted over time and suggests directions for further work. Fourth, it gives a complete picture of the themes that have drawn the most attention from researchers around the world, and of the gaps that remain open.

The rest of the article is organized as follows. Section 2 sets out the methodology, including the search protocol and the way each indicator was computed. Section 3 presents the performance analysis and the science mapping with their interpretation. Section 4 offers the conclusions, the emerging trends, and suggestions for future research.

METHOD

This study applied a quantitative bibliometric analysis to the literature published between 2016 and 2026 on the SDGs in road transportation. Bibliometric analysis identifies the number of annual publications, citations, collaboration patterns, and the top-performing authors, institutions, and countries, and it brings emerging trends into view (Donthu et al., 2021). The analysis has two parts. Performance analysis evaluates the field through descriptive features of the contributions such as authors, journals, institutions, and countries. Science mapping, also known as the co-word network, reveals the conceptual structure that connects concepts through keyword co-occurrence (Cobo et al., 2011).

The analysis was carried out with the open-source bibliometric package *bibliometrix* through the Biblioshiny interface in RStudio (Aria & Cuccurullo, 2017), with supporting computation performed directly on the Scopus export so that every figure and table could be traced back to the raw data. The search and selection protocol is summarized in Table 1.

Table 1. Search and document selection protocol.

Stage	Description
Scope	Bibliometric analysis of SDGs research in road transportation, 2016 to 2026
Database	Scopus
Search field	TITLE-ABS-KEY
Boolean query	("sustainable development goals" OR "SDGs" OR "SDG" OR "2030 agenda") AND ("road transport*" OR "road traffic" OR "road freight" OR "road safety" OR "highway*" OR "motor vehicle*" OR "automobile*" OR "passenger car*" OR "urban mobility" OR "urban transport*" OR "public transport*" OR "traffic management" OR "electric vehicle*")
Time span	2016 to 2026
Language	English
Final screening	Manual screening and pruning based on titles and abstracts
Final corpus	267 documents
Processing	RStudio Biblioshiny, *bibliometrix* package, full RIS and CSV export including cited references

Phase I: Document selection

The scope was set first: research on the SDGs in road transportation from 2016 to 2026. Scopus was chosen because it is one of the main bibliographic databases, with consistent curation and reliable citation metadata. The search ran on the *Title-Abstract-Keyword* field with a single two-block Boolean query. The first block captures the SDG concept through the phrases for the goals, the abbreviation, and the 2030 Agenda. The second block captures the road transportation domain through terms for road transport, traffic, freight, safety, highways, motor vehicles, urban and public transport, traffic management, and electric vehicles. Joining the two blocks with the AND operator returned documents that span a broad range of topics on the SDGs in road transportation, from policy and planning to energy and technology.

The year 2016 was chosen as the starting point because the SDGs took effect on 1 January 2016. The search returned a small number of earlier records that used the same vocabulary, and those were excluded so that the analysis stays aligned with the period in which the SDGs were in force. Extending the analysis to 2026 captures as many relevant documents as possible, including the most recent ones. Selected documents were downloaded with all metadata fields, including the list of cited references, since those references are needed for the reference and co-word analysis.

The final corpus comprises 267 documents published in 187 sources and written by 952 authors, with an average of 3.84 authors per document and 28 single-authored documents. Together the documents have gathered 3,003 citations. The document types break down into articles (139), conference papers (80), book chapters (31), reviews (14), and books (3). The main information about the corpus appears in Table 2.

Table 2. Main information about the corpus.

Description	Value
Time span	2016 to 2026
Sources (journals, proceedings, books)	187
Documents	267
Authors (unique)	952
Average authors per document	3.84
Single-authored documents	28
Author keywords (unique)	1,014
Total citations	3,003
Document types	Articles 139; Conference papers 80; Book chapters 31; Reviews 14; Books 3

Phase II: Bibliometric analysis

The bibliometric analysis covers two areas. In the performance analysis, the features of the contributions are examined through indicators such as the number of annual publications, the most cited documents and journals, collaboration patterns, and the top-performing institutions and countries. Country attribution follows the corresponding author's address, and the journal h-index is computed within the corpus, so the impact figures describe local rather than global standing.

In the science mapping, the structural side of the field is revealed through author keyword co-occurrence. We built a co-occurrence network of the most frequent author keywords,

detected communities within that network, and placed each community on a strategic diagram by its Callon centrality and density (Cobo et al., 2011). Centrality measures how strongly a theme connects to others and stands for relevance, while density measures the internal strength of a theme and stands for development. A complementary trend analysis tracks the median publication year of each keyword, which shows how the focus of the field has shifted over time. The two views work together, since the strategic diagram gives a snapshot of structure while the trend analysis gives the direction of travel.

RESULT AND DISCUSSION

Performance Analysis

Annual scientific production and citations

Output on the SDGs in road transportation stayed in the single digits from 2016 to 2019, then began to climb (Figure 1). The count reached 22 documents in 2020, eased back to 9 in 2021, then rose again through 23 (2022), 31 (2023), and 37 (2024) before a sharp jump to 85 documents in 2025. The early swing between 2020 and 2021 reflects small absolute numbers, where a handful of papers move the line, so it should not be read as a real contraction. The figure of 45 documents for 2026 looks like a drop, but it simply reflects a data harvest partway through the year, which left 2026 incomplete. On the whole the field is growing fast, and the steep rise from 2023 onward suggests that the number of publications will keep climbing as more research groups take up the topic.

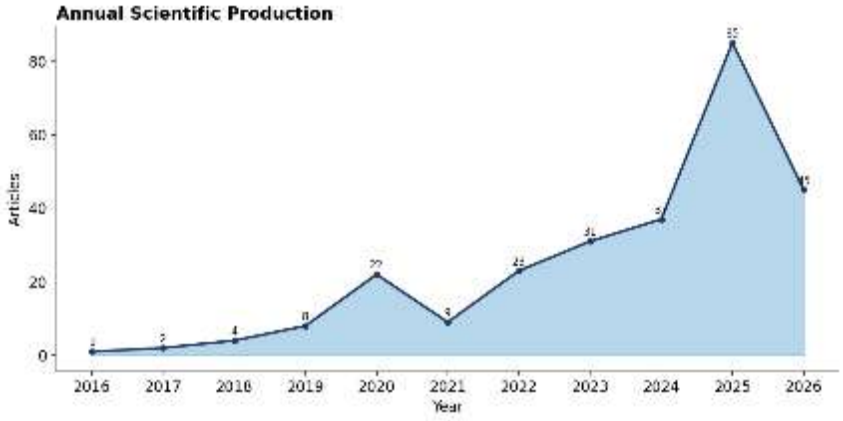

Figure 1. Annual scientific production on the SDGs in road transportation, 2016 to 2026.

The average citations per document per year fluctuate, with higher values in the earlier years and a downward trend toward the recent ones (Figure 2). The pattern is common in bibliometrics. Newly published articles have not had time to accumulate citations, and the large 2025 cohort pulls the recent average down even though several of those papers may go on to be well cited. The earlier peaks rest on a small set of documents that found a wide audience, which is why a single year can stand out.

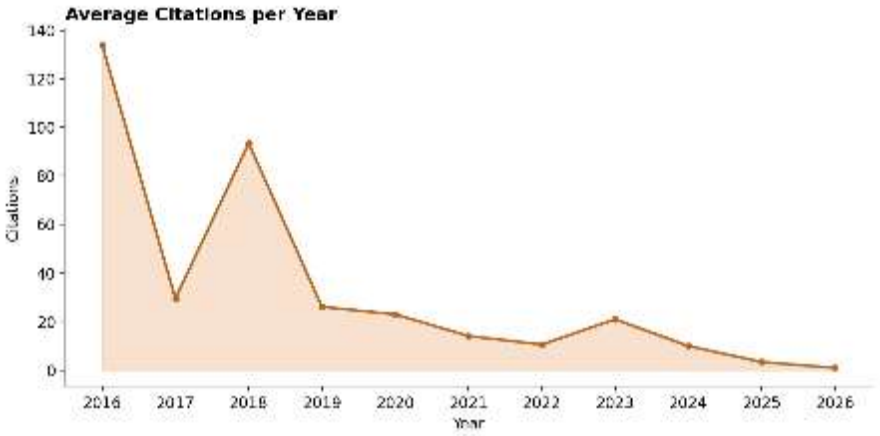

Figure 2. Average citations per document per year, 2016 to 2026.

Global contribution by country

China leads in citations by a wide margin with 854, followed by Germany (291) and the United States (180) (Figure 3 and Table 3). India, Japan, the United Arab Emirates, Italy, and Spain follow. The high citation counts for China and Germany rests on a small number of highly cited papers rather than sheer volume, which is why the citation ranking and the production ranking differ. The presence of the United Arab Emirates and Japan in the top tier reflects a few influential studies rather than a deep national literature.

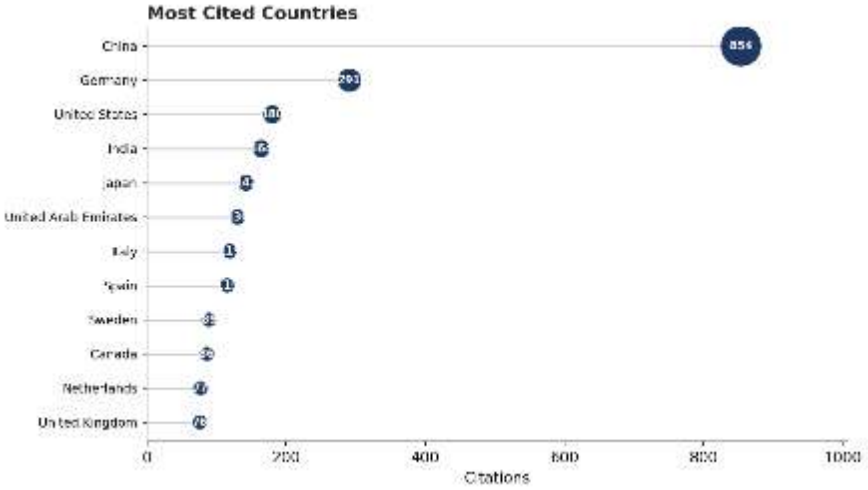

Figure 3. Most cited countries

Table 3. Ten most cited countries

No.	Country	Citations
1	China	854
2	Germany	291
3	United States	180
4	India	164
5	Japan	142
6	United Arab Emirates	130
7	Italy	119
8	Spain	115

9	Sweden	89
10	Canada	86

On the production side, India leads with 44 documents, just ahead of China with 41, then Italy and the United States with 17 each, Spain with 11, Thailand with 9, and Turkey with 8 (Figure 4). The strong showing of India and China reflects two large and fast-growing transport systems, where the pressure of urbanization and motorization meets an active research community and a clear policy need. The contrast between India's lead in output and China's lead in citations is a useful reminder that productivity and impact are different things. A country can publish a great deal without yet drawing heavy citation, and a smaller body of work can carry outsized influence if it lands in high-visibility journals.

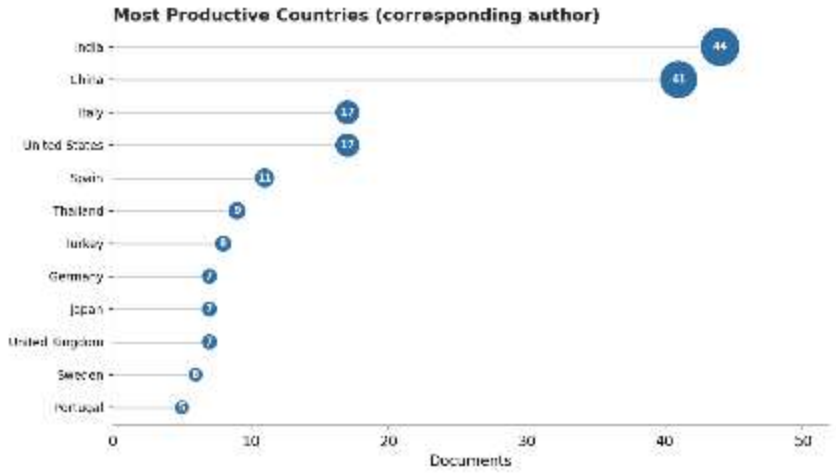

Figure 4. Most productive countries by corresponding author

Most productive institutions

No single institution dominates. Sichuan Vocational College of Culture and Communication and Shinawatra University top the list with five documents each, followed by the University of Basilicata, Tongji University, Arizona State University, and Beijing Normal University with four each (Figure 5 and Table 4). The spread of leading institutions across China, Thailand, Italy, the United States, India, and the United Kingdom matches the dispersed picture seen at the country level. The list mixes large research universities with more specialised institutions, which suggests that the topic is not yet concentrated in a few centres of excellence but is being taken up across a wide range of settings.

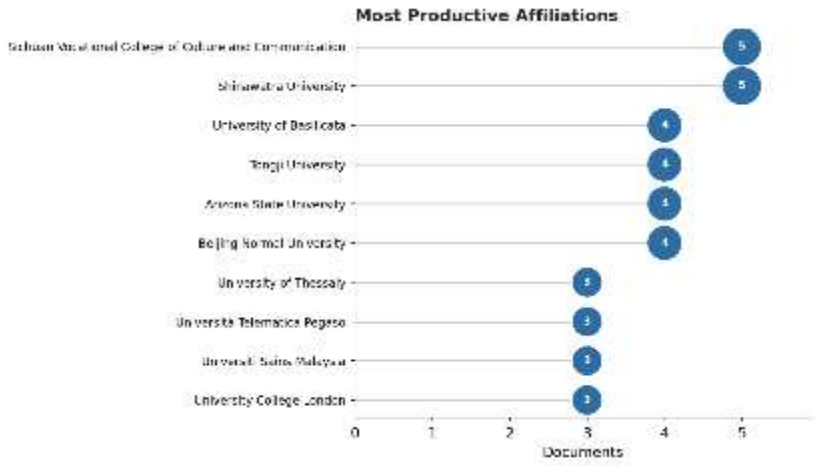

Figure 5. Most productive affiliations.

Table 4. Ten most productive affiliations.

No.	Affiliation	Documents
1	Sichuan Vocational College of Culture and Communication	5
2	Shinawatra University	5
3	University of Basilicata	4
4	Tongji University	4
5	Arizona State University	4
6	Beijing Normal University	4
7	University of Thessaly	3
8	Università Telematica Pegaso	3
9	Universiti Sains Malaysia	3
10	University College London	3

Most productive authors

The field has no dominant author yet. Zuo Y. leads with four documents, and a group of authors follows with three each, among them Scorza F. at the University of Basilicata, who works on urban planning and territorial development, and the pair of Mahadevia D. and Lathia S., who study Indian cities (Figure 6 and Table 5). The low counts and the prevalence of common surnames call for caution, since some entries may merge distinct researchers who share a surname and an initial, a point taken up in the limitations. The overall picture is of a young field where contributions are spread across many authors rather than concentrated in a few, which is what one would expect in a topic that has only recently gathered momentum.

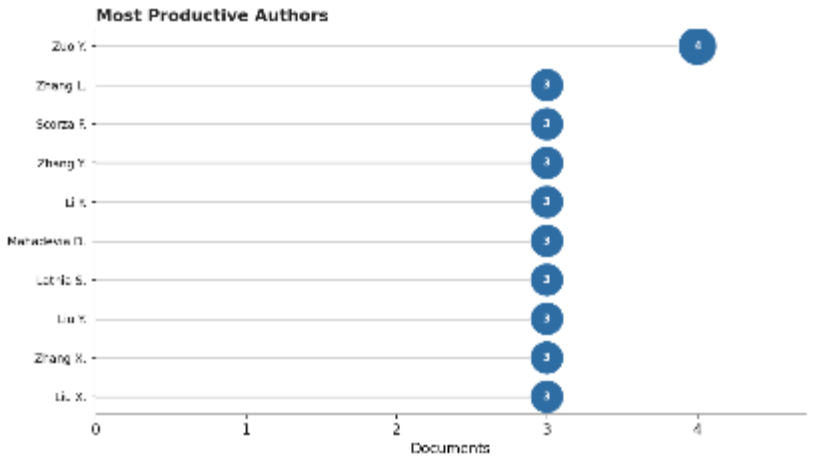

Figure 6. Most productive authors by number of documents.

Table 5. Most productive authors.

No.	Author	Documents
1	Zuo Y.	4
2	Scorza F.	3
3	Mahadevia D.	3
4	Lathia S.	3
5	Zhang L.	3
6	Zhang Y.	3
7	Li Y.	3
8	Liu Y.	3
9	Zhang X.	3
10	Liu X.	3

Source analysis

The 267 documents appeared in 187 sources. *Sustainable Cities and Society* leads with 13 documents, followed by *Lecture Notes in Civil Engineering* (10) and *Sustainability* (Switzerland) (9) (Figure 7 and Table 6). On impact, *Sustainable Cities and Society* again leads with an h-index of 9, ahead of the *Journal of Cleaner Production* at 6 and *Energies* and *Sustainability* at 5 (Figure 8). The combination of the highest output and the highest h-index mark *Sustainable Cities and Society* as the core journal of the field. The presence of transport-specific outlets such as *Transport Policy*, *Cities*, and the *Journal of Transport Geography* alongside broad sustainability journals shows that the topic draws both the transport and the sustainability research communities. It also tells prospective authors that work in this area can find a home in either kind of venue, which widens the audience for any single paper.

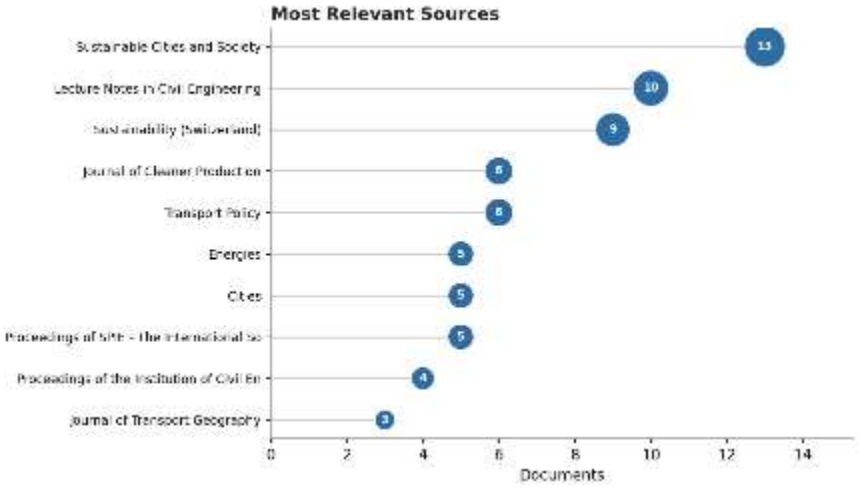

Figure 7. Most relevant sources by number of documents.

Table 6. Ten most relevant sources by output and impact.

No.	Source	Documents	h-index
1	Sustainable Cities and Society	13	9
2	Lecture Notes in Civil Engineering	10	–
3	Sustainability (Switzerland)	9	5
4	Journal of Cleaner Production	6	6
5	Transport Policy	6	4
6	Energies	5	5
7	Cities	5	4
8	Proceedings of SPIE	5	–
9	Proc. Institution of Civil Engineers: Municipal Engineer	4	–
10	Journal of Transport Geography	3	3

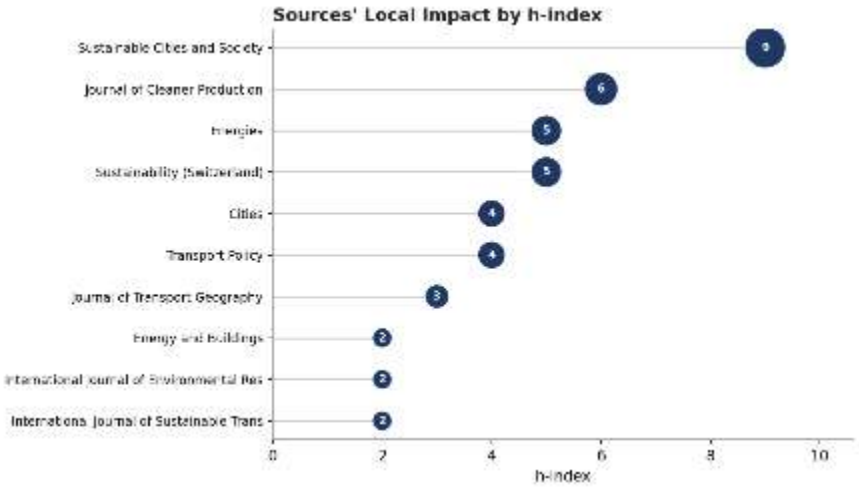

Figure 8. Sources' local impact by h-index.

Most cited documents and intellectual base

The documents with the most global citations appear in Table 7 and Figure 9. At the top is Mao et al. (2018) in *Land Degradation and Development* with 370 citations, then Yin et al. (2023) in *Sustainable Cities and Society* with 152 and a tie between Akuraju et al. (2020) and

Ahmad and Puppim de Oliveira (2016) at 134. The range of source journals, from remote sensing and ecological indicators to transport policy and applied energy, reflects the interdisciplinary character of the field. A caveat is in order. Several highly cited documents, such as Mao et al. (2018) on land degradation, Akuraju et al. (2020) on SDG monitoring, and Brussel et al. (2019) on accessibility indicators, sit at the measurement and monitoring edge of the SDGs rather than at the core of road transport. Their presence signals that the search query is still relatively broad, a point taken up in the limitations. The clearly on-topic anchors include Ahmad and Puppim de Oliveira (2016) on urban mobility and emissions, Zhang et al. (2019) on urbanization and greenhouse gases, and Hoxha et al. (2023) on transport energy demand. These anchors set the tone for much of the later work, which returns again and again to the link between mobility, energy, and emissions.

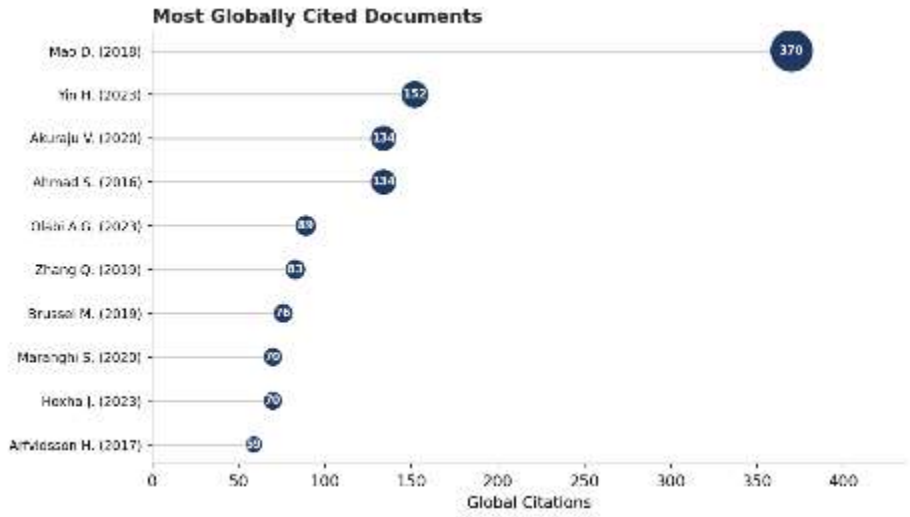

Figure 9. Most globally cited documents.

Table 7. Ten most globally cited documents.

No.	Author (Year)	Source	Citations
1	Mao D. et al. (2018)	Land Degradation and Development	370
2	Yin H. et al. (2023)	Sustainable Cities and Society	152
3	Akuraju V. et al. (2020)	Sustainable Cities and Society	134
4	Ahmad S. et al. (2016)	Transport Policy	134
5	Olabi A.G. et al. (2023)	International Journal of Thermofields	89
6	Zhang Q. et al. (2019)	Journal of Cleaner Production	83
7	Brussel M. et al. (2019)	ISPRS Int. Journal of Geo-Information	76
8	Maranghi S. et al. (2020)	Ecological Indicators	70
9	Hoxha J. et al. (2023)	Applied Energy	70
10	Arfvidsson H. et al. (2017)	African Geographical Review	59

The intellectual base rests on the policy framework of the SDGs. The 2030 Agenda for Sustainable Development (United Nations, 2015) appears in the reference lists of 44 of the 267 documents, which makes it the single most shared reference in the corpus and the policy anchor of the field. The pattern is telling. A field that cites a policy document more than any scholarly work is still defining itself against the agenda rather than against a settled body of theory, which fits the young profile seen elsewhere in the data. A precise ranking of the other

most locally cited references could not be produced reliably from this export, because the reference field does not carry DOIs and many distinct works share common author surnames. We return to this point in the limitations.

Keyword co-occurrence

The author keyword co-occurrence network shows how the vocabulary of the field clusters (Figure 10). *Sustainable development goals* sit at the center with the strongest links, surrounded by *sustainable transportation*, *urban transportation*, *public transport*, *smart cities*, *smart mobility*, and *climate change*. The network separates into a transport-and-SDG core, an urban-planning and smart-cities group, and a sustainability and climate group. The position of the SDGs at the center, rather than at the side, shows that most studies frame their transport question through the agenda itself rather than through a narrower technical lens. This sets up the thematic reading in the next section.

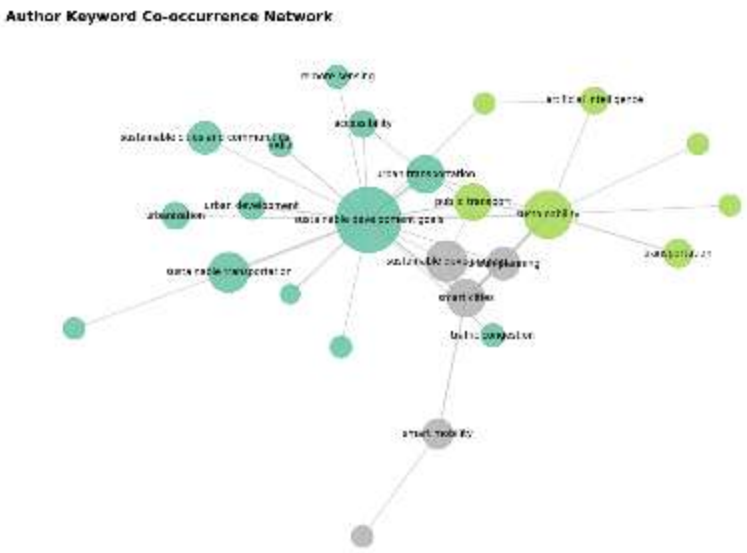

Figure 10. Author keyword co-occurrence network.

Science Mapping

Thematic map

We placed the keyword communities on a strategic diagram by their Callon centrality, which measures external linkage and relevance, and their density, which measures internal development (Figure 11). Three clusters emerge. The motor cluster, in the upper-right region, brings together *sustainable development goals*, *sustainable transportation*, and *urban transportation*. It is both central and well developed, and it represents the core of the field, the place where most of the substantive work is done. The basic cluster of *sustainability*, *public transport*, and *transportation* is highly central but less developed, the foundational vocabulary that most studies share without turning it into a research front of its own. The cluster of *sustainable development*, *smart cities*, and *urban planning* is well developed but more isolated, a niche where a distinct community works on the urban and digital side of mobility, often with its own methods and outlets. The map is compact because the corpus is still young and the

author keywords are diverse, so a single static map cannot capture every nuance. For that reason, the trend analysis below adds the temporal detail that the map leaves out.

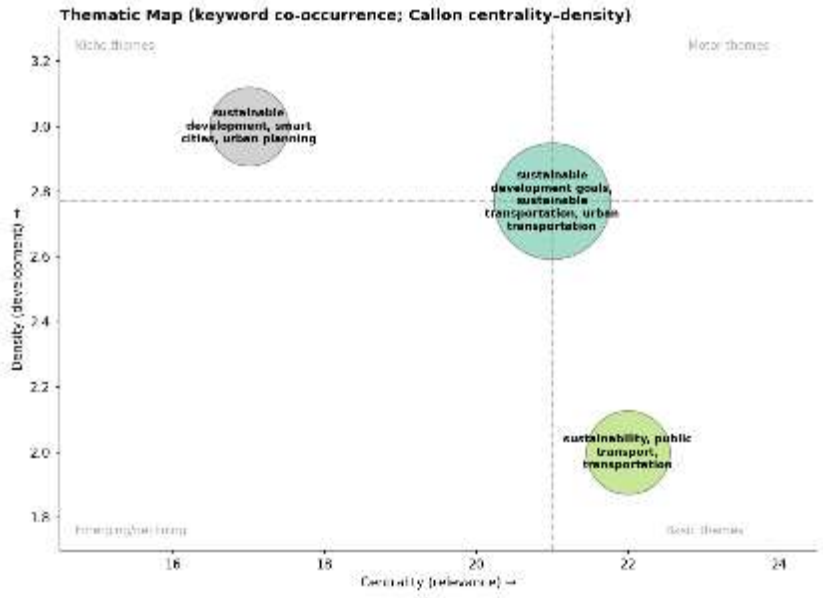

Figure 11. Thematic map from author keyword co-occurrence, by Callon centrality and density.

Trend topics over time

Tracking the median year of each author keyword reveals a clear progression (Figure 12). The earlier vocabulary, centered on 2022, covers *sustainable urban mobility*, *accessibility*, *electric buses*, and *autonomous vehicles*, together with a focus on India as a study setting. These topics reflect a first wave of work that asked how to move people more sustainably and who was being left behind. The middle period, around 2023, brings *climate change*, *mobility*, the *circular economy*, and *urban policy*, which reframe the same questions in terms of resources and emissions. The most recent vocabulary, in 2025, is dominated by *artificial intelligence*, *smart mobility*, *smart cities*, *traffic congestion*, *urban sustainability*, *resilience*, *remote sensing*, and *intelligent transportation systems*. The arc moves from basic mobility and access questions, through climate and resource framing, toward data, intelligence, and resilience. This progression is the clearest signal in the data of where the field is heading, and it lines up with the wider turn toward digital and data-driven approaches in transport research.

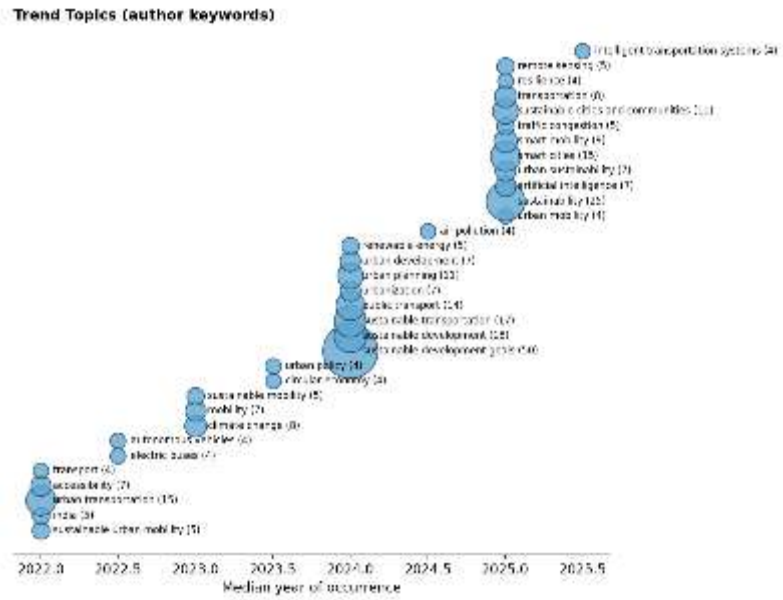

Figure 12. Trend topics based on the median year of author keywords.

CONCLUSION

This study provides a comprehensive bibliometric overview of research development on Sustainable Development Goals (SDGs) in road transportation during the period of 2016–2026. The findings indicate that this research field has experienced substantial growth, particularly after 2023, demonstrating increasing global attention toward sustainable mobility, smart transportation systems, climate mitigation, and resilient urban infrastructure. Based on the analysis of 267 documents indexed in Scopus, the study reveals that research on SDGs and road transportation is highly interdisciplinary, involving contributions from transportation engineering, sustainability studies, urban planning, energy systems, and digital technology. China emerged as the country with the highest citation impact, while India contributed the largest number of publications, indicating different patterns between research productivity and academic influence. Furthermore, keyword co-occurrence and thematic mapping analyses show that sustainable transportation, urban mobility, smart cities, climate change, and intelligent transportation systems represent the central themes shaping the field. The evolution of research trends also demonstrates a shift from fundamental issues of accessibility and sustainable mobility toward technology-driven solutions involving artificial intelligence, smart mobility, resilience, and data-based transportation management. Overall, this study confirms that SDG-oriented road transportation research continues to expand and plays an important role in supporting global efforts toward sustainable, inclusive, and environmentally responsible mobility systems. Future research should extend beyond bibliometric mapping by conducting more empirical and comparative investigations on the implementation of SDG principles in different transportation contexts. Further studies are encouraged to explore specific challenges in developing countries, including policy effectiveness, infrastructure readiness, public acceptance of sustainable transportation technologies, and socioeconomic barriers to inclusive mobility. Researchers may also examine emerging areas identified in this study, such as artificial intelligence applications, intelligent transportation systems, electric vehicle

ecosystems, and data-driven urban mobility planning through case studies or longitudinal approaches. In addition, future bibliometric studies could incorporate broader databases, multilingual publications, and more refined search strategies to reduce potential limitations related to database coverage and keyword selection. Collaboration between researchers, policymakers, transportation authorities, and industry stakeholders is also recommended to translate academic findings into practical strategies that accelerate the achievement of SDGs within the road transportation sector.

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