Bibliometric analysis of road safety research: trends and insights from 2010 to 2024

Rangganayagi Dewarajoo [1*], Abdul Kafi[2], Izatul Husna Zakaria[3]

[1] School of Technology Management and Logistics ,06010, Sintok, Kedah,

Email ID : rangganayagi5434@gmail.com

[2,3]Senior lecturer, Assistant Professor at Northern University of Malaysia, Sintok, Kedah, Malaysia

Email ID : md.abdul.kafi@uum.edu.my , izatul.husna.zakaria@uum.edu.my

*Corresponding author:

Email ID : rangganayagi5434@gmial.com

KEYWORDS	ABSTRACT
Road Safety, Bibliometric Analysis . . .	Road safety is a complex and critical concern that requires multidisciplinary strategies to mitigate accidents and protect road users. This study employs a bibliometric analysis of research published between 2010 and 2024 to identify key trends, influential works, and prominent areas of investigation within the field of road safety. The analysis, conducted using the Scopus database, examines publication patterns, author productivity, citation impact, and keyword co-occurrence. The findings reveal the evolution of road safety research, highlighting prolific authors, key publications, leading countries and institutions, and significant research themes. This information can be valuable for researchers, policymakers, and practitioners seeking to enhance road safety and reduce the burden of road traffic accidents issues... ..

1. INTRODUCTION

Road safety is a multidisciplinary field that involves monitoring and guiding the behaviour of all road users to significantly reduce road accidents, with the aim of achieving a safe environment, balanced transport performance, and efficiency in sustainable road transport (Elvik et al., 2019).It also proactive and systematic approach to make the road transport system safe for all users (Szymanek, 2020). Road safety is a key factor in fostering positive outcomes among society, stakeholders, infrastructure developers, enforcement planners, educators, safer vehicle performance, and responsible road user behaviour (WHO, 2023). Road safety element work to contribute effective and efficiency transport development, significantly create a safer road transport system to all users (Brömmelstroet, 2024). Similarly, road safety is ensured to positive outcome among drivers and all the road users (Prajapati & Nagar, 2022). This study expected to contribute theoretical foundation of road safety elements that reduce accident severity among both, road users and policy makers by develop intervention safety strategies. Ultimately, findings significantly contribute to accident reduction and injuries, damages and death. Although several studies were published indicate on road safety effectiveness and positive impact on road accident reduction. Direct studies is were related to bibliometric analysis to know the previous trend and most productivity research on this area has not uncovered. These is difficult to provide a clear information's regarding the present studies on road safety performance that impact on accident issues. Evidence from previous studies prove that, bibliometric studies have conduct on road traffic injuries (Butt et al., 2020), road safety education (Abdullah, 2021), pedestrians traffic safety (Dan et al., 2020). There's no review on bibliometric analysis conduct directly to road safety element. By find out earliest gaps, this study analyses to contribute and full fill gap by developing review on road safety evaluation since 2010 to 2024. As a quantitative analysis, a bibliometric technique was adopted to develop recent trend of evaluations (Antonio Martín-Jiménez et al., 2018). In bibliometric research able to define field of research, looking at the further direction of research, and getting intellectual structure among countries and universities. Current study mainly focuses to analyse the pertaining research questions to present trend of earliest study findings on road safety across the border.

What are the evaluation and trends of road safety literature?

What is the most cited article in road safety research from the past fifteen years?

What is the greater productivity author, countries, institution, and source titles in terms of publication numbers?

What is the most productivity keyword in road safety research?

What is the recent knowledge formation statues relating to co-occurrence, collaboration and co-authorship linkage in road safety research?

This recent study employed a bibliometric technique to analyse and identify literature on road safety research collected from the Scopus database, providing a comprehensive overview of global trends in road safety transformation over the past decade. Scopus is responsible to large database of preview literature and journals, covering uncountable range of subject areas. The findings of this study will help researchers, policymakers and road users to enhance to improve road safety performance.

To clearly analyse the question, these papers arrange all the sections accordingly. The first part of the introduction clearly outlines the research gap, the study's goal, and road safety issues and user understanding. The subsequent part elucidates the technique employed in this work, specifically the bibliometric flow chart and data analysis. The answer to the aforementioned query and potential avenues for further investigation are made evident in the results section. Lastly, discuss the contribution, limitations, gaps, and future recommendations about this scope in the conclusion section

2. LITRATURE REVIEW

Road traffic accidents represent a critical global issue, leading to the loss of an estimated 1.35 million lives annually and significantly impacting on road safety performance (Febres et al., 2020). Addressing this challenge eagerly requires comprehensive road safety strategies and elements designed to mitigate accident errors stemming from human, environmental, and vehicle factors (Goniewicz et al., 2016)(Esteban et al., 2021). Beyond these direct factors, non-compliance with traffic rules and regulations also significantly contributes to road safety concerns (Åberg, 1998). Early research, such as that by Poliak, 2016), emphasized that road safety is primarily contingent upon driver behaviour, road design conditions, and vehicle integrity. This perspective strongly argues that enhancing the quality of these fundamental elements can substantially improve overall road safety. Similarly, Shami, (2015) asserted that road safety is profoundly affected by the perfunctory adherence to rules and the presence of poor road infrastructure. To this, Ramesh et al., (2025) contend that improved road safety infrastructure, coupled with systemic changes in transport and traffic management, robust enforcement strategies, advanced signalling, and technological measures, can collectively create a significantly safer environment for all road users. A recent study by, Setyowati et al., (2024) highlighted the potential of road safety education to enhance safety outcomes. They posited that since drivers are a primary cause of accidents, targeted education campaigns can effectively reduce risky driving behaviours, thereby directly improving the road safety performance for all users. These studies collectively demonstrate that various safety elements, when effectively implemented, can substantially reduce road accidents and foster sustainable road safety performance (Goniewicz et al., 2016).

Bibliometric analysis and methods

Bibliometric analysis

Bibliometric studies are able to work with multiple range of studies to clearly understand the significant of studies (Jiddah et al., 2025; Passas, 2024). Normally bibliometric analysis can work with quantitative and qualitative studies to publish journals and articles. It is the use of statistical and mathematical techniques to study published works (Donthu et al., 2021). This current study mainly focuses on author, country and institution as major findings of previous reviews to improve the and guide the policymakers and society regarding the importance of road safety.

3. METHOD

DATA COLLECTION

This study has review by the online Scopus database from 2010- 2024 in road safety because it contains world's largest research data with valuable resources for researches, academic institution, and libraries and high-quality content with powerful citation analysis tools. Eventually if compare to other online database like Web of Science (WOS), Pub Med (PubMed), Google Scholar, Scopus has more publications and capable to provide a clear information to the keyword and bibliographic analysis. Scopus have 20% higher data information compare to WoS in terms of citation analysis, however google scholar has have lower results. Consequently, Scopus its consider as the best database analysis tool for this study. Figure 1 show the research strategy and steps for the data collection for this study.
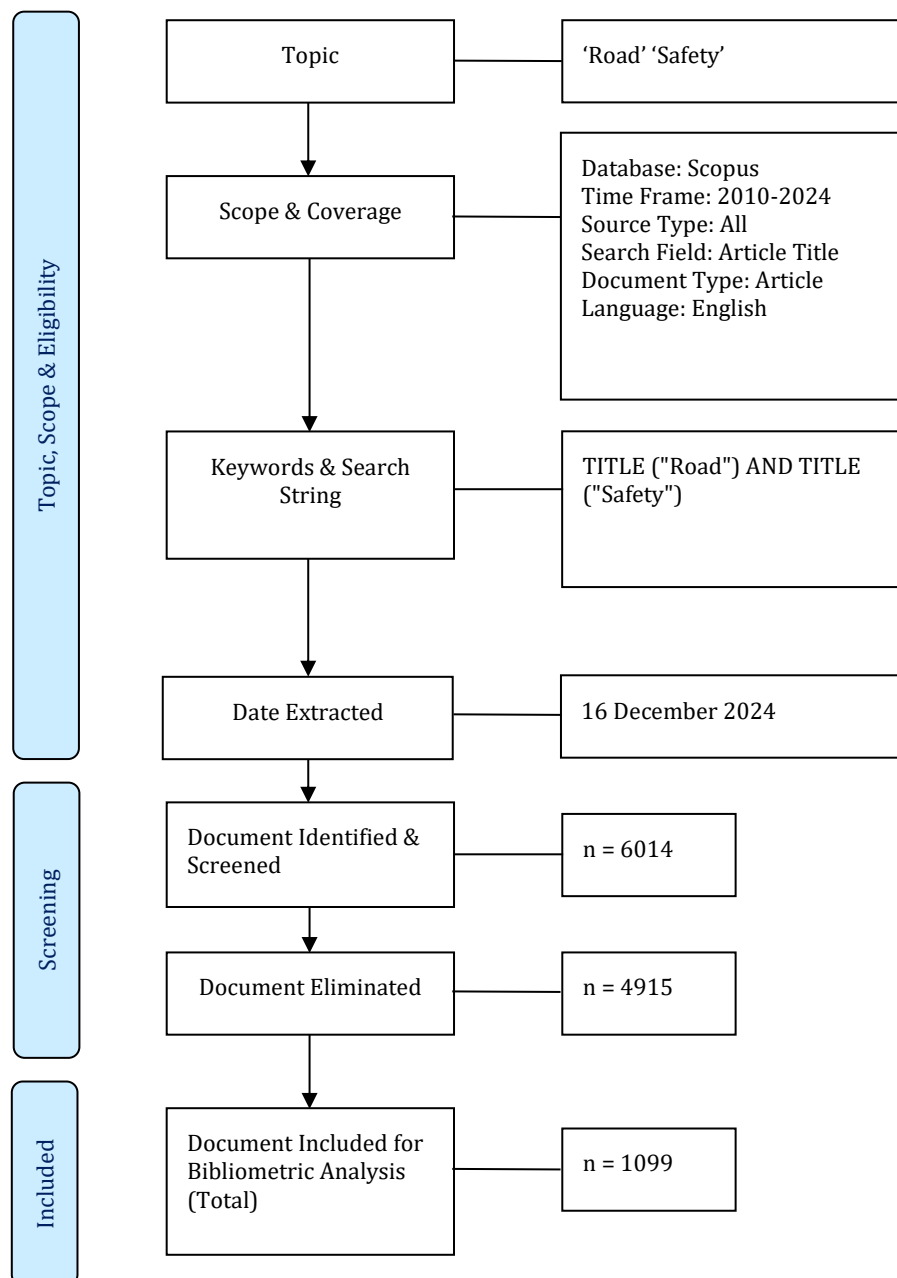
Fig.1 Flow diagram of article searching strategy of road safety documents.
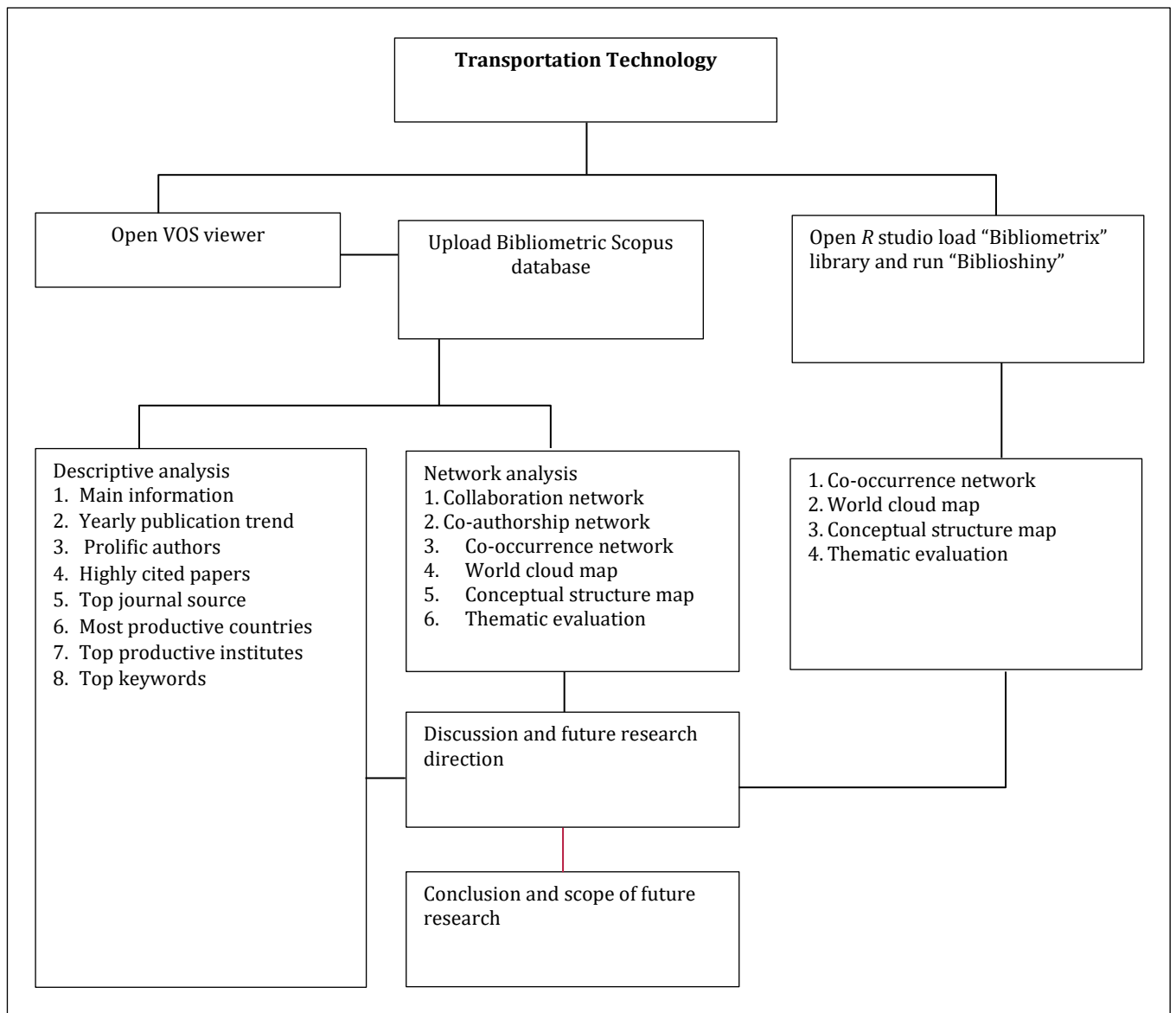
Transportation Technology

Open VOS viewer

Upload Bibliometric Scopus database

Open *R* studio load "Bibliometrix" library and run "Biblioshiny"

Descriptive analysis
1. Main information
2. Yearly publication trend
3. Prolific authors
4. Highly cited papers
5. Top journal source
6. Most productive countries
7. Top productive institutes
8. Top keywords

Network analysis
1. Collaboration network
2. Co-authorship network
3. Co-occurrence network
4. World cloud map
5. Conceptual structure map
6. Thematic evaluation

1. Co-occurrence network
2. World cloud map
3. Conceptual structure map
4. Thematic evaluation

Discussion and future research direction

Conclusion and scope of future research

Fig 2: Framework for Bibliometric analysis

SEARCH STRATEGY

In any bibliometric study, the selection of accurate keywords is paramount. Guided by our research questions, this study meticulously limited its search to two primary title keywords: "road" and "safety." This strategic choice yielded two possible keyword combination strings, directly relevant to our study's overarching topic. The title of an article plays a crucial role in capturing a reader's attention, serving as their initial point of engagement. Consequently, this study employed the following search query string: TITLE ("road") AND TITLE ("safety"). This refined search, conducted on the Scopus database, initially yielded 6,014 research documents published between 2010 and 2024, encompassing all document types. However, after applying specific exclusion criteria during the document retrieval process (as detailed in Figure 1), the final dataset for this study comprised 1,099 documents.

TOOLS AND DATA ANALYSIS

VOS viewer has become a widely adopted tool across numerous disciplines for conducting robust bibliometric analyses (Arifin, 2025; Saiz-alvarez, 2024). In this study, we leveraged VOS viewer software to achieve our research objectives and address our research questions, specifically by visualizing the geographical distribution, authorship, citations, keywords, and international collaborations pertinent to road safety topics. VOS viewer offers diverse methods for visualizing bibliometric maps, effectively presenting various features of a research field's literature structure. It employs an integrated approach to mapping and clustering, built upon a normalized term co-occurrence matrix and a similarity measure that quantifies the

strength of association between terms. Additionally, VOS viewer effectively generates clusters of authors' keywords, nations, and institutions based on citation and bibliographic coupling connections. These clusters provide valuable insights into the density and interconnectedness of articles, keywords, countries, and organizations within specific research areas.

4. RESULTS

DESCRIPTIVE ANALYSIS

This section offers a comprehensive descriptive analysis of the road safety research landscape from 2010 to 2024. It meticulously examines various bibliometric indicators to reveal key trends and characteristics within the field. Specifically, this analysis encompasses the current publication information, offering an overview of the volume and temporal distribution of research output. It identifies evolving research trends, pinpointing emerging themes, methodologies, and areas of focus. The analysis also recognizes prolific authors, highlighting the most influential researchers contributing to the field, and pinpoints highly cited papers that have significantly impacted road safety scholarship. Furthermore, it scrutinizes publication sources, examining the leading journals, conferences, and other outlets disseminating road safety research. We also identify the most productive institutions and countries, recognizing the key organizational and geographical hubs for road safety research. Finally, an analysis of authors' keywords provides insight into prominent research topics and their interconnections. The aggregated findings of this descriptive analysis are systematically presented in Table 1, offering a detailed profile of road safety research over the specified period.

Descriptive analysis

This section examines the road safety research profile from 2010 to 2024, encompassing current publication data, academic trends, prolific authors, highly cited papers, publication sources, and the most productive universities and countries, along with the authors and keywords, as presented in Table 1.

Table 1: Yearly Publication trend

Year	TP	TC
2024	146	122
2023	131	573
2022	150	941
2021	127	1020
2020	120	2083
2019	96	1633
2018	62	1156
2017	50	1132
2016	37	646
2015	42	805
2014	39	655
2013	36	794
2012	31	845
2011	13	330
2010	19	260

Note: TP = Total publications; TC = Total citations; C/P = Citation per paper; C/Y = Citations per year.
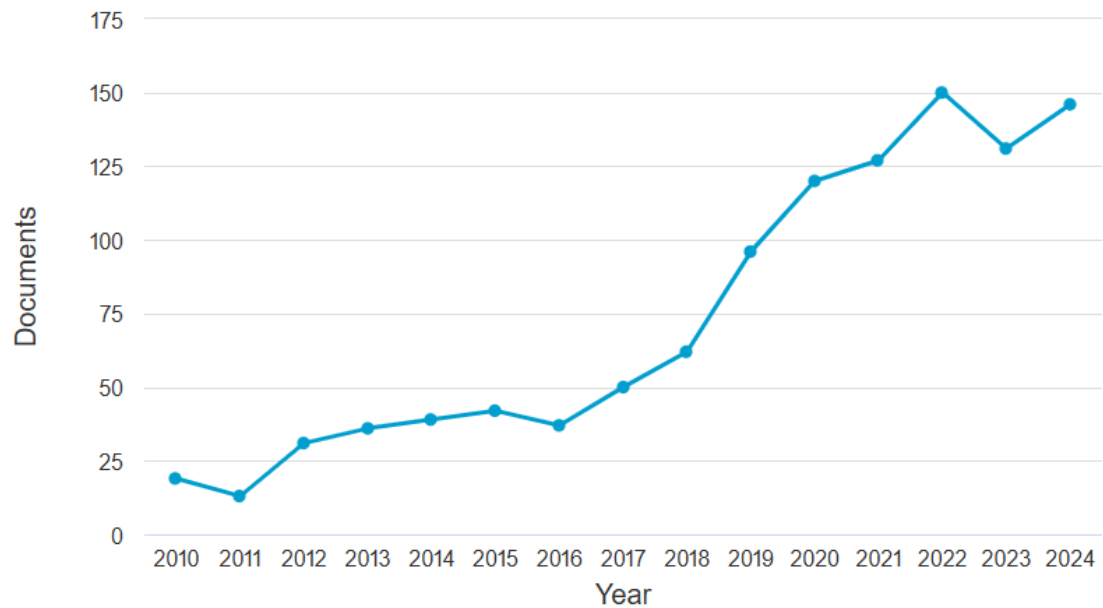
Fig 3: Documents by Year 2010 to 2024

Based on Yearly publication trend

The review of initial publishing patterns evaluated total publications, total citations, citations per article, and citations per year for works released from 2010 to 2024. The tables 2 and Figure 3 demonstrate each year's publication trends in road safety. The number of publications on road safety significantly increasing compare to previous years. The huge growth of publication past three years on this field, highlight this topic on urge situation. As result of this December 2024, total 1099 documents mainly selected to explore new attributed to the global road safety issues.

Most productivity authors

The total number of publications, total citations, and h-index have been analysed to identify the leading writers in the field of road safety research. Table 3 presents the twenty greatest writers, with Elvik, R. lead in publications, with 27, supporting 390 citations and an h-index of 10 in this field. Research indicates that Hyder, A. and Yannis, G. are leading authors in the domain of road safety.

Table 2. Most productive authors that published 5 and more publications in the Road safety

No	Author	TP	TC	h	PY start
1	Elvik, R.	27	390	10	2012
2	Hyder, A.A.	12	259	10	2012
3	Yannis, G.	10	282	6	2019
4	Nævestad, T.O.	9	84	6	2017
5	Alonso, F.	8	110	5	2019
6	Bachani, A.M.	7	54	4	2015
7	Berloco, N.	7	48	5	2019
8	Castro-Nuño, M.	7	197	6	2012
9	Intini, P.	7	48	5	2019
10	Ranieri, V.	7	48	5	2019
11	Useche, S.A.	7	53	4	2020
12	Bhalla, K.	6	88	5	2016

13	Brijs, T.	6	186	6	2011
14	Castillo-Manzano, J.I.	6	165	6	2012
15	McIlroy, R.C.	6	96	5	2019
16	Moslem, S.	6	203	5	2020
17	Shen, Y.	6	142	5	2015
18	Wets, G.	6	116	5	2011
19	Christie, N.	5	45	3	2019
20	Esteban, C.	5	88	3	2019

Note: TP=Total publication; TC = Total citation; h=h-index; 1PY = Year of 1st publication

Highly cited papers

The table 4 clearly provide information of (authors, article title, total citation, and citation per year) of the top 20 most productivity journals. Applications of unmanned aerial vehicle (UAV) in road safety, traffic and highway infrastructure management: Recent advances and challenges, 278 total citation and 13.88 citation per year. Followed by, A descriptive analysis of the effect of the COVID-19 pandemic on driving behavior and road safety with the total citation of 173 and 9.70 citations per year, and Updated estimates of the relationship between speed and road safety at the aggregate and individual levels, "had total citation 97 and 5.27 citation per year.

Table 3. Top twenty highly cited papers published in the road safety

No.	Author (s)	Title	TC	C/Y	Document type	Publisher
1	Outay, Fatma 2020 (Outay et al., 2020)	Applications of unmanned aerial vehicle (UAV) in road safety, traffic and highway infrastructure management: Recent advances and challenges	278	13.88	Journal	Elsevier Ltd
2	Katrakazas, Christos 2020 (Katrakazas et al., 2020)	A descriptive analysis of the effect of the COVID-19 pandemic on driving behavior and road safety	173	9.70	Journal	Elsevier Ltd
3	(Oviedo-Trespalacios et al., 2019)	The impact of road advertising signs on driver behaviour and implications for road safety: A critical systematic review	106	5.53	Journal	Elsevier Ltd

No.	Author (s)	Title	TC	C/Y	Document type	Publisher
4	(Elvik et al., 2019)	Updated estimates of the relationship between speed and road safety at the aggregate and individual levels	97	5.27	Journal	Elsevier Ltd
5	(Baniya & Timilsina, 2018)	Knowledge and Practice of Road Safety Rules and Regulations among Secondary School Students	95	5.21	Journal	Prithvi Academic Journal
6	Camacho-Torregrosa, Francisco J. 2013 (Camacho-torregrosa et al., 2013)	New geometric design consistency model based on operating speed profiles for road safety evaluation	93	2.57	Journal	Accident Analysis & Prevention
7	Schepers, Paul (Schepers et al., 2014)	A conceptual framework for road safety and mobility applied to cycling safety	91	4.28	Journal	Accident Analysis & Prevention
8	Mindell, Jennifer S 2012 (Mindell et al., 2012)	Exposure-Based, 'Like-for-Like' Assessment of Road Safety by Travel Mode Using Routine Health Data	83	1.55	Journal	PlosOne
9	Moslem, Sarbast 2020 (Moslem et al., 2020)	An integrated approach of best-worst method (bwm) and triangular fuzzy sets for evaluating driver behavior factors related to road safety	74	8.61	Journal	MDPI AG

No.	Author (s)	Title	TC	C/Y	Document type	Publisher
10	(Simić et al., 2020)	A novel critic-fuzzy FUCOM-DEA-fuzzy MARCOS model for safety evaluation of road sections based on geometric parameters of road	63	6.45	Journal	Multidisciplinary Digital Publishing Institute (MDPI)
11	(Hyder et al., 2012)	Addressing the implementation gap in global road safety: Exploring features of an effective response and introducing a 10-country program	61	3.80	Journal	PubMed
12	Alonso, Francisco 2018 (Alonso et al., 2018)	Effect of road safety education on road risky behaviors of spanish children and adolescents: Findings from a national study	58	2.30	Journal	MDPI AG
13	Albalate, Daniel 2019 (Albalate, 2019)	Congestion, road safety, and the effectiveness of public policies in urban areas	46	1.99	Journal	MDPI
14	Hyder, Adnan A. 2017 (Hyder et al., 2017)	Monitoring the Decade of Action for Global Road Safety 2011–2020: An update	46	2.54	Journal	Global Public Health
15	McDonald, Noreen 2019(McDonald et al., 2019)	Urban freight and road safety in the era of e-commerce	45	2.92	Journal	Taylor and Francis Inc.
16	Daniels, Stijn 2019 (Daniels et al., 2019)	A systematic cost-benefit analysis of 29 road safety measures	39	2.21	Journal	Elsevier Ltd

No.	Author (s)	Title	TC	C/Y	Document type	Publisher
17	Antonio Martín-Jiménez, José 2018 (Antonio Martín-Jiménez et al., 2018)	Road safety evaluation through automatic extraction of road horizontal alignments from Mobile LiDAR System and inductive reasoning based on a decision tree	28	0.74	Journal	Elsevier B.V.
18	Pires, Carlos 2020 (Pires et al., 2020)	Car drivers' road safety performance: A benchmark across 32 countries	28	1.76	Journal	Elsevier B.V.
19	Thompson, Jason (Thompson et al., 2015)	Reconsidering the Safety in Numbers Effect for Vulnerable Road Users: An Application of Agent-Based Modelling	27	2.72	Journal	Bellwether Publishing, Ltd
20	Oskarbski, Jacek 2020 (Oskarbski et al., 2020)	Assessment of the speed management impact on road traffic safety on the sections of motorways and expressways using simulation methods	16	0.90	Journal	MDPI AG

Most productivity source titles

The are 1099 articles have published in different journals. The table 5 provide information's of the most, top twenty source that publishes on road safety from 2010 to 2024. Accident Analysis and Prevention, journal of Crash data quality for road safety research: Current state and future directions it's in leading by total publication 67, secondly Sustainability Switzerland with the total publication of 66, continently by Journal of Road Safety with 35 publications. Total citation is 122, 47 and 9.

Table 5. Most productive source titles

No.	Source journal name	Paper Title	TP	TC	h	PYS
1	Accident Analysis and Prevention	Crash data quality for road safety research: Current state and future directions	67	121	25	2018
2	Sustainability Switzerland	Road safety risk assessment: An analysis of transport policy and management for low-, middle-, and high-income Asian countries	66	47	12	2018
3	Journal Of Road Safety	Features of Low-Income and Middle-Income Countries making Road Safety more Challenging	35	9	4	2021
4	International Journal of Environmental Research and Public Health	The dilemma of road safety in the eastern province of Saudi Arabia: Consequences and prevention strategies	27	59	12	2020
5	Iatss Research	Quantifying the impact of road lighting on road safety - A New Zealand Study	25	87	13	2014
6	Traffic Injury Prevention	Urban freight and road safety in the era of e-commerce	22	45	10	2020
7	Baltic Journal of Road and Bridge Engineering	An analysis of road pavement collapses and traffic safety hazards resulting from leaky sewers	21	22	6	2019
8	European Transport Research Review	An improved approach for association rule mining using a multi-criteria decision support system: a case study in road safety	18	40	10	2017
9	Transportation Research Part F Traffic Psychology and Behaviour	Relationships amongst psychological determinants, risk behaviour, and road crashes of young adolescent pedestrians and cyclists: Implications for road safety education programmes	17	43	8	2017
10	Applied Sciences Switzerland	Method to assess and enhance vulnerable road user safety during impact loading	16	39	7	2019
11	IEEE Access	Performance Analysis of IEEE 802.11p Safety Message Broadcast with and Without Relaying at Road Intersection	16	63	9	2018
12	Periodica Polytechnica Transportation Engineering	Road Safety Analysis of Autonomous Vehicles	16	18	6	2022
13	Safety	Road safety analysis of urban roads: Case study of an Italian municipality	16	36	8	2019

No.	Journal	Title	TP	TC	h	PYS
14	Transport Problems	Application of the AHP method to analyse the significance of the factors affecting road traffic safety	14	14	4	2016
15	Sensors	An adaptive game-based learning strategy for children road safety education and practice in virtual space	13	51	9	2021
16	Plos One	Exposure-Based, 'Like-for-Like' Assessment of Road Safety by Travel Mode Using Routine Health Data	12	83	5	2013
17	Promet Traffic and Transportation	Application of a multi-criteria approach to road safety evaluation in the Bushehr province, Iran	12	27	6	2013
18	BMC Public Health	Effectiveness of an improved road safety policy in Ethiopia: An interrupted time series study	9	26	5	2016
19	Injury Prevention	The association of road safety knowledge and risk behaviour with paediatric road traffic injury in Guangzhou, China	9	36	5	2012
20	Journal Of Konbin	Road safety inspection as a tool for road safety management-the polish experience	9	4	3	2019

Note (s): TP = Total publications; TC = Total citations; h = *h-index*; PYS = Publication year start

Most productivity countries

According to the Scopus database road safety document were extracted from 55 countries. The table 6 the top twenty-five most prolific countries with minimum 15 papers published. Among of them United States is the most productive country with highest leading publication of 148 articles accounting to (9.60%), followed by China with total publication with 93 articles (6.03%), and the third position is own by United Kingdom with 91 publications average (5.90%), Australia ranked as fourth place with 90 publications (5.85%) and fifth place is Italy 75 publications and (4.86%). As indicated, all these productive countries have huge concerns on road safety research compare the other developed countries.

Table 6. Top 25 most contributing countries

No.	Country	Total Publication	Percentage
1	United States	148	9.60
2	China	93	6.03
3	United Kingdom	91	5.90
4	Australia	90	5.85
5	Italy	75	4.86
6	Spain	75	4.86
7	Poland	63	4.10

8	India	53	3.43
9	Canada	45	2.92
10	Norway	42	2.72
11	Netherlands	40	2.59
12	Germany	35	2.27
13	Sweden	34	2.20
14	Malaysia	32	2.07
15	Iran	26	1.68
16	Belgium	25	1.62
17	South Korea	25	1.62
18	France	24	1.55
19	Greece	23	1.49
20	Saudi Arabia	23	1.49
21	Lithuania	21	1.36
22	Hungary	19	1.23
23	Pakistan	18	1.16
24	Austria	17	1.10
25	Russian Federation	17	1.10

Most prolific institutions

The table 7 provide a clear information of the institutions that highly publish papers according road safety research. The first is owned by Transportøkonomisk institutt with total publication of 33 the average is (3.6%), followed by Queensland University of Technology with total publications 32 with (3.4%), thirdly by Centre for Accident Research and Road Safety – Queensland with 20 publications.

Table 7. Top 10 productive institutions

| No.	Affiliation	Total Publication	Percentage
1	Transportøkonomisk institutt	33	3.6
2	Queensland University of Technology	32	3.4
3	Centre for Accident Research and Road Safety – Queensland	20	2.1
4	Vilniaus Gedimino Technikos Universitetas	19	2.02
5	Johns Hopkins Bloomberg School of Public Health	17	1.81
6	Monash University	17	1.81
7	National Technical University of Athens NTUA	15	1.6
8	Delft University of Technology	15	1.6
9	SWOV Institute for Road Safety Research	15	1.6
10	Ministry of Education of the People's Republic of China	12	1.3

Top frequency authors keyword

The table 8 clearly define the top frequency used authors key word in the road safety. There are 458 occurrences of the road safety put in first place, followed by 309 and 307 occurrences of Roads and Streets, and Accident Prevention respectively.

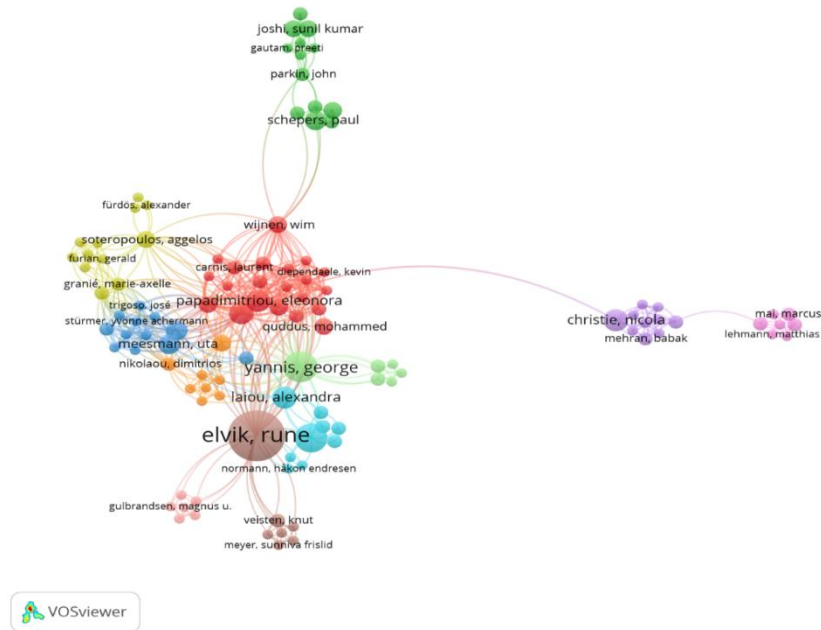**Table 8. Top 10 frequent author's keywords -**

Words	Occurrences
Road Safety	458
Roads And Streets	309
Accident Prevention	307
Safety	279
Human	276
Motor Transportation	272
Humans	236
Traffic Accident	233
Accidents, Traffic	204
Article	171

Co-authorship analysis
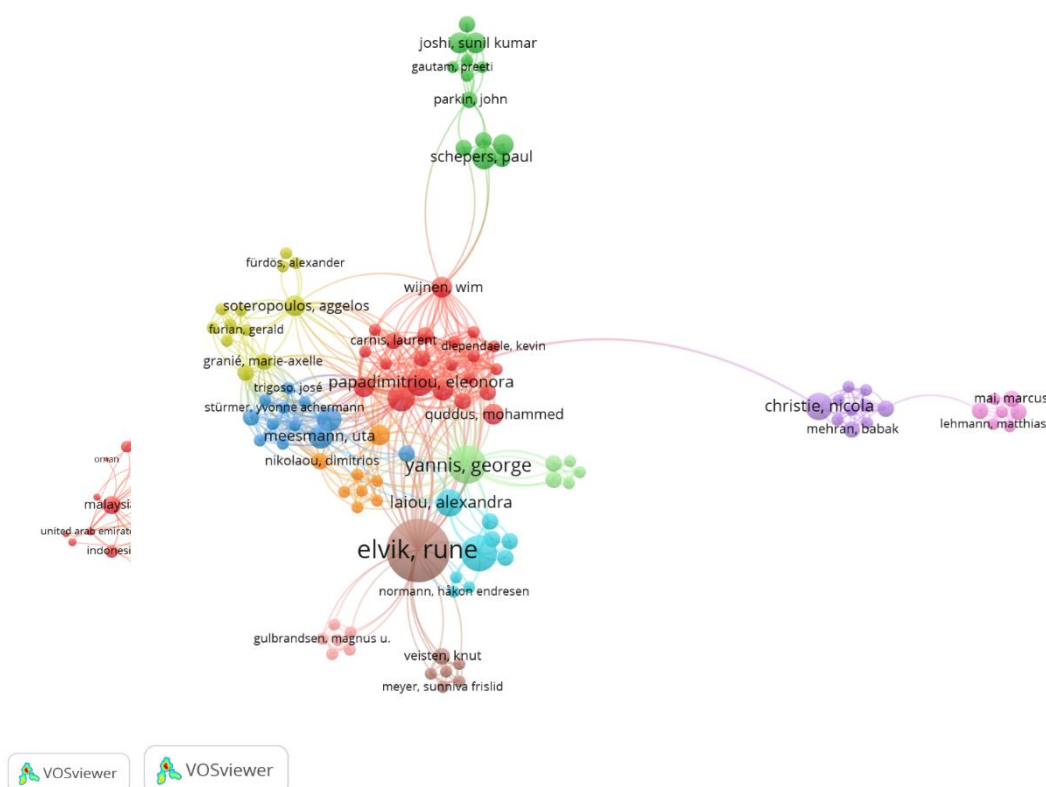
Countries collaboration network

Fig visualization of countries Co-authorship

Keywords co-occurrence analysis
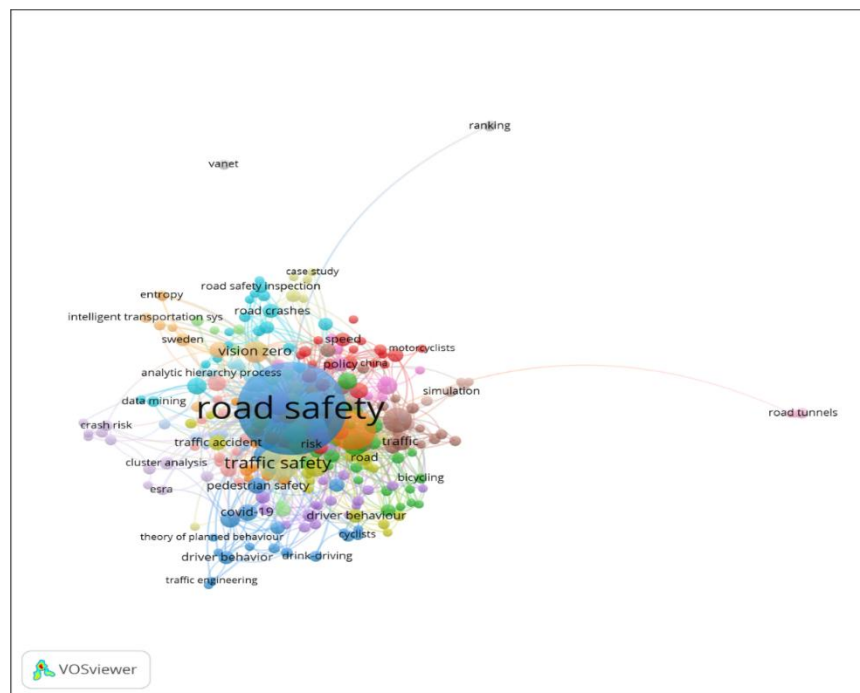
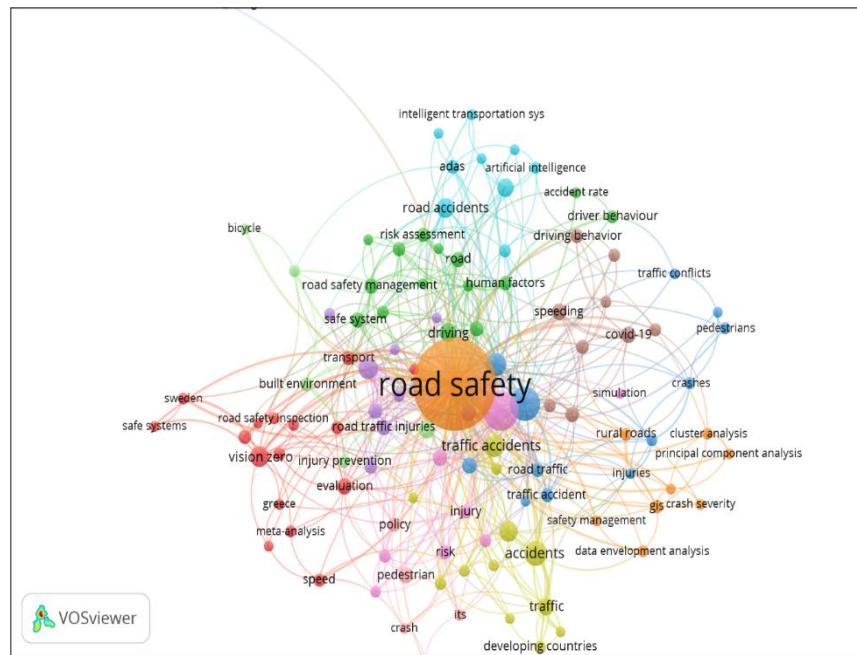Step IV- Thematic analysis/ Word cloud/conceptual framework/Bibliographic coupling

Fig. visualization of key word

2. CONCLUSION

Conference papers and journal articles comprise the bulk of documents retrieved (2010-2024) on road safety from Scopus data base. More than 95 percent of articles in this field originate from these two categories. The primary sources of literature on port road safety are journal articles and conference proceedings. Mechanical Engineering was identified as the predominant discipline in road safety research, including more than fifty percent of the published publications. Additional contributing fields encompass earth and planetary sciences, environmental science, and management and social sciences. The terms road safety, roads and streets, accident prevention, safety, and human are prominently incorporated in the titles of road safety publications. The study placed the United States as the most research producing country in port facility research, with 148 publications, followed by China, the United Kingdom, and Australia. The leading journal is Accident Analysis and Prevention, succeeded by Sustainability Switzerland and the Journal of Road Safety.

3. RECOMMENDATIONS

Based on the study's findings, future road safety research should broaden its scope beyond the currently dominant fields of Engineering and Earth and Planetary Sciences. We recommend a greater focus on Logistics Management, Computing, Maritime studies, and other underexplored disciplines to address existing gaps in the literature. To maximize the dissemination and cross-fertilization of ideas, researchers should prioritize publishing in high-ranking journals like Journal of Humanitarian Logistics and Supply Chain Management, as well as other prominent logistics and related publications.

4. CONTRIBUTIONS TO KNOWLEDGE

This study's novelty lies in its pioneering and comprehensive bibliometric analysis of the existing road safety literature. As one of the initial attempts to systematically map this field, the research meticulously examined a corpus of 1,099 publications, including journal articles, conference papers, and books. This comprehensive analysis identified essential primary sources, prevailing research themes, and rising areas of interest, providing useful insights for both scholars and practitioners, and making a substantial contribution to the growth of road transport research..

REFERENCES

[1]   Abdullah, K. H. (2021). A bibliometric review of six decades of road safety education research. Global Academic Journal of Economics and Business, 3(2), 60–65. https://doi.org/10.36348/gajeb.2021.v03i02.002

[2]   Åberg, L. (1998). Traffic rules and traffic safety. Safety Science, 29(3), 205–215. https://doi.org/https://doi.org/10.1016/S0925-7535(98)00023-X

[3]   Albalate, D. (2019). Congestion , Road Safety , and the E ff ectiveness of Public Policies in Urban Areas. MDPI, 11, 1–21.

[4]   Alonso, F., Esteban, C., Useche, S., & Colomer, N. (2018). Effect of road safety education on road risky behaviors of spanish children and adolescents: Findings from a national study. International Journal of Environmental Research and Public Health, 15(12), 1–14. https://doi.org/10.3390/ijerph15122828

[5] Antonio Martín-Jiménez, J., Zazo, S., Arranz Justel, J. J., Rodríguez-Gonzálvez, P., & González-Aguilera, D. (2018). Road safety evaluation through automatic extraction of road horizontal alignments from Mobile LiDAR System and inductive reasoning based on a decision tree. ISPRS Journal of Photogrammetry and Remote Sensing, 146(October), 334–346. https://doi.org/10.1016/j.isprsjprs.2018.10.004

[6] Arifin, S. (2025). Bibliometric Analysis using Vosviewer: A Simple Analysis and Trend. https://doi.org/10.13140/RG.2.2.17897.40802

[7] Baniya, S., & Timilsina, A. (2018). Knowledge and Practice of Road Safety Rules and Regulations among Secondary School Students. Prithvi Academic Journal, 1(1), 23–33. https://doi.org/10.3126/paj.v1i1.25897

[8] Brömmelstroet, M. (2024). Increase road safety or reduce road danger: challenging the mainstream road safety discourse. Traffic Safety Research, 5, e000043. https://doi.org/10.55329/vfer7646

[9] Butt, F. M., Ashiq, M., Rehman, S. U., Minhas, K. S., & Khan, M. A. (2020). Bibliometric analysis of road traffic injuries research in the Gulf Cooperation Council region. F1000Research, 9, 1155. https://doi.org/DOI:10.12688/f1000research.25903.2

[10] Camacho-torregrosa, F. J., Pérez-zuriaga, A. M., Campoy-ungría, J. M., & García-garcía, A. (2013). New geometric design consistency model based on operating speed profiles for road safety evaluation. Accident Analysis and Prevention, 61, 33–42. https://doi.org/10.1016/j.aap.2012.10.001

[11] Dan, M., Yulong, P. E. I., & Kun, T. (2020). Literature review of pedestrian traffic safety research based on bibliometric analysis. China Safety Science Journal, 30(8), 101. https://doi.org/10.16265/j.cnki.issn1003-3033.2020.08.015

[12] Daniels, S., Martensen, H., Schoeters, A., Van den Berghe, W., Papadimitriou, E., Ziakopoulos, A., Kaiser, S., Aigner-Breuss, E., Soteropoulos, A., Wijnen, W., Weijermars, W., Carnis, L., Elvik, R., & Perez, O. M. (2019). A systematic cost-benefit analysis of 29 road safety measures. Accident Analysis and Prevention, 133(July), 105292. https://doi.org/10.1016/j.aap.2019.105292

[13] Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research, 133, 285–296. https://doi.org/https://doi.org/10.1016/j.jbusres.2021.04.070

[14] Elvik, R., Vadeby, A., Hels, T., & van Schagen, I. (2019). Updated estimates of the relationship between speed and road safety at the aggregate and individual levels. Accident Analysis and Prevention, 123(2), 114–122. https://doi.org/10.1016/j.aap.2018.11.014

[15] Esteban, F., Molina, E., Arenas, V., Izquierdo, F. A., & Carolina, D. (2021). Road Safety Perception Questionnaire (RSPQ) in Latin America. International Journal of Environmental Research and Public Health, 18(5), 21. https://doi.org/10.3390/ijerph18052433

[16] Febres, J. D., García-Herrero, S., Herrera, S., Gutiérrez, J. M., López-García, J. R., & Mariscal, M. A. (2020). Influence of seat-belt use on the severity of injury in traffic accidents. European Transport Research Review, 12(1). https://doi.org/10.1186/s12544-020-0401-5

[17] Goniewicz, K., Goniewicz, M., Pawłowski, W., & Fiedor, P. (2016). Road accident rates: strategies and programmes for improving road traffic safety. European Journal of Trauma and Emergency Surgery, 42(4), 433–438. https://doi.org/10.1007/s00068-015-0544-6

[18] Hyder, A. A., Allen, K. A., Di Pietro, G., Adriazola, C. A., Sobel, R., Larson, K., & Peden, M. (2012). Addressing the implementation gap in global road safety: Exploring features of an effective response and introducing a 10-country program. American Journal of Public Health, 102(6), 1061–1067. https://doi.org/10.2105/AJPH.2011.300563

[19] Hyder, A. A., Paichadze, N., Toroyan, T., & Peden, M. M. (2017). Monitoring the Decade of Action for Global Road Safety 2011–2020: An update. Global Public Health, 12(12), 1492–1505. https://doi.org/10.1080/17441692.2016.1169306

[20] Jiddah, S. A., Hanan, S. A., & Anuar, N. K. (2025). Assessing the adoption of barcode payment systems in Nigeria's transportation sector: An empirical study. Sustainable Futures, 9(May), 100659. https://doi.org/10.1016/j.sftr.2025.100659

[21] Katrakazas, C., Michelaraki, E., Sekadakis, M., & Yannis, G. (2020). A descriptive analysis of the effect of the COVID-19 pandemic on driving behavior and road safety. Transportation Research Interdisciplinary Perspectives, 7, 100186. https://doi.org/10.1016/j.trip.2020.100186

[22] McDonald, N., Yuan, Q., & Naumann, R. (2019). Urban freight and road safety in the era of e-commerce. Traffic Injury Prevention, 20(7), 764–770. https://doi.org/10.1080/15389588.2019.1651930

[23] Mindell, J. S., Leslie, D., & Wardlaw, M. (2012). Exposure-Based , ' Like-for-Like ' Assessment of Road

Safety by Travel Mode Using Routine Health Data. Plos One, 7(12), 1–10. https://doi.org/10.1371/journal.pone.0050606

[24] Moslem, S., Gul, M., Farooq, D., Celik, E., Ghorbanzadeh, O., & Blaschke, T. (2020). An integrated approach of best-worst method (bwm) and triangular fuzzy sets for evaluating driver behavior factors related to road safety. Mathematics, 8(3). https://doi.org/10.3390/math8030414

[25] Oskarbski, J., Kamiński, T., Kyamakya, K., Chedjou, J. C., Żarski, K., & Pędzierska, M. (2020). Assessment of the speed management impact on road traffic safety on the sections of motorways and expressways using simulation methods. Sensors (Switzerland), 20(18), 1–33. https://doi.org/10.3390/s20185057

[26] Outay, F., Mengash, H. A., & Adnan, M. (2020). Applications of unmanned aerial vehicle (UAV) in road safety, traffic and highway infrastructure management: Recent advances and challenges. Transportation Research Part A: Policy and Practice, 141(September 2020), 116–129. https://doi.org/10.1016/j.tra.2020.09.018

[27] Oviedo-Trespalacios, O., Truelove, V., Watson, B., & Hinton, J. A. (2019). The impact of road advertising signs on driver behaviour and implications for road safety: A critical systematic review. Transportation Research Part A: Policy and Practice, 122(January), 85–98. https://doi.org/10.1016/j.tra.2019.01.012

[28] Passas, I. (2024). Bibliometric Analysis: The Main Steps. Encyclopedia, 4(2), 1014–1025. https://doi.org/10.3390/encyclopedia4020065

[29] Pires, C., Torfs, K., Areal, A., Goldenbeld, C., Vanlaar, W., Granié, M. A., Stürmer, Y. A., Usami, D. S., Kaiser, S., Jankowska-Karpa, D., Nikolaou, D., Holte, H., Kakinuma, T., Trigoso, J., Van den Berghe, W., & Meesmann, U. (2020). Car drivers' road safety performance: A benchmark across 32 countries. IATSS Research, 44(3), 166–179. https://doi.org/10.1016/j.iatssr.2020.08.002

[30] Poliak, M. (2016). Factors Affecting the Road Safety. Journal of Communication and Computer, 13(3), 146–152. https://doi.org/10.17265/1548-7709/2016.03.006

[31] Prajapati, M. S., & Nagar, K. (2022). Safety Education on Knowledge , Attitude and Practice Towards Road Traffic Signs and Regulations Among College Students At , Gujarat. Journal of Pharmaceutica, 13(4), 948–958. https://doi.org/10.47750/pnr.2022.13.S04.112

[32] Ramesh, A., Thomas, R., Goyani, J., & Arkatkar, S. (2025). Evaluating Indian Provincial Road Safety Performance Based on Traffic Crashes. Transportation in Developing Economies, 11(1), 13.

[33] Saiz-alvarez, J. M. (2024). Innovation Management : A Bibliometric Analysis of 50 Years of Research Using VOSviewer ® and Scopus. MDPI, 901–928.

[34] Schepers, P., Hagenzieker, M., Methorst, R., Van Wee, B., & Wegman, F. (2014). A conceptual framework for road safety and mobility applied to cycling safety. Accident Analysis and Prevention, 62, 331–340. https://doi.org/10.1016/j.aap.2013.03.032

[35] Setyowati, D. L., Setyaningsih, Y., Suryawati, C., & Lestantyo, D. (2024). The Relationship Between Driving Behavior and Road Safety Education Concerning Road Traffic Accidents Among Young Drivers : A Scoping Review. Malaysian Journal of Medicine and Health Sciences (EISSN, 20, 155–162.

[36] Shami, S. (2015). Reducing Accidents by Improving Road Safety Infrastructure. RedPEC.

[37] Simić, J. M., Stević, Ž., Zavadskas, E. K., Bogdanović, V., Subotić, M., & Mardani, A. (2020). A novel critic-fuzzy FUCOM-DEA-fuzzy MARCOS model for safety evaluation of road sections based on geometric parameters of road. Symmetry, 12(12), 1–27. https://doi.org/10.3390/sym12122006

[38] Szymanek, A. (2020). System Approach in Road Safety Studies. Communications - Scientific Letters of the University of Zilina, 22, 201–210. https://doi.org/10.26552/com.C.2020.4.201-210

[39] Thompson, J., Savino, G., & Stevenson, M. (2015). Reconsidering the Safety in Numbers Effect for Vulnerable Road Users: An Application of Agent-Based Modeling. Traffic Injury Prevention, 16(2), 147–153. https://doi.org/10.1080/15389588.2014.914626

[40] WHO. (2023). Global status report on road safety 2023. https://www.who.int/publications/i/item/9789240086517
.