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A bibliometric analysis of driving behaviour of commercial transport drivers: An African perspective

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Abstract. Road traffic accident is highly correlated with the behaviour of who is behind the wheel. Reports have shown that Africa as a region leads in the rate of road traffic fatality globally. Despite the growing road safety challenges associated with commercial transport drivers in Africa, and the various interventions by stakeholders to minimise road traffic accidents, little attention is given to the prevalence of the adverse driving behaviour of commercial transport drivers. Consequently, this study, therefore, established a bibliometric analysis to obtain an in-depth understanding of the driving behaviour of commercial transport drivers in Africa. For this study, 219 articles between 1978 and May 21, 2023, extracted from the Scopus database and key bibliometric indicators were established which includes; publication trends, keywords on driving behaviour among commercial drivers, authors, institutions, citation and co-citation analysis, subject categories, and co-occurrence of terms. Furthermore, information collected in this study was analysed using Microsoft Excel and VOSviewer software. The study showcased the views of researchers in terms of Accident risk factors, accident prevention analysis and accident proneness. However, the result revealed insufficient publications in both quantity and quality on commercial vehicle drivers' behaviour despite the significant contribution of commercial drivers to accidents in Africa. This research established a new direction by linking drivers' behaviour, and traffic safety with the commercial transport industry and understanding the factors and influence of drivers' behaviour.

1. Introduction

Among all the systems people must deal with every day, the road traffic system is the most complex and dangerous. It was estimated by [1] that every year, approximately 1.2 million people are killed in road crashes and 50 million are injured. It is predicted that over the next 20 years, these numbers are expected to rise by approximately 65% if new initiatives are not taken to prevent them [2]. It was further established that road traffic injuries will become the fifth leading cause of death by 2030, according to



the World Health Organization. However, according to a WHO estimate, 91% of road deaths occur in low- and middle-income nations, which have just 48% of the world's registered automobiles, of which Africa is a part. Result from WHO's Global Status Report claimed that in Africa, an average mortality rate of 26 deaths was recorded per 100,000 inhabitants.

Risk factors that influence road traffic accidents according to [2] are said to be human-related, infrastructure-related, vehicle-related and inadequate law enforcement. The primary cause of traffic accidents, however, has continuously been determined to be human error, and the relationship between human error and traffic safety has therefore been extensively established in the literature.

[3] affirmed that human error is responsible for about 85 percent of all traffic deaths worldwide. [4] established that 67% of road traffic crashes are human-related, 29% due to road conditions and 4% from vehicle defects. More than 50% of traffic accidents are human-related while another 30% to 40% are a result of the interplay between human, vehicle and environmental variables [5], [6] ranked 80% of road traffic accidents in Nigeria to human error and mechanical related issues, human factors significantly and highly correlated with road traffic crashes [5]-[9].

[10] affirmed that driver behaviour plays a crucial role in determining the level of traffic safety. [11] acclaimed that driver behaviour is the most significant human factor that influences road safety and studies have also shown that poor driving safety behaviour is due to underestimation of risks are one of the major causes of traffic accidents [3], [8], [12], [13]. However, unsafe driving practices are thought to be the major contributing cause of road traffic accidents in Africa [5],[14],[15].

[1] reports that overcrowded, unsafe and unregulated modes of public transport and commercial transport operations contribute to road traffic injuries and deaths in Africa. However, commercial transport is common in most African cities, including Nigeria, Ghana, and South Africa, commercial transport also dominates the urban transportation sector [3],[16]. In this context, commercial transport means "the transportation of people or goods from point of origin to point of destination in exchange for compensation". Commercial vehicles are commonly in the form of big buses, minibuses, taxis, tricycles and in some cases motorcycles.

Commercial drivers are liable to take significant risks while driving. Commercial drivers' unsafe driving practices are one of the leading contributors to traffic fatalities and injuries on metropolitan roadways. A report from [17] shows that 60.29% of accidents in Nigeria involves commercial vehicle while speed is reported to contribute 50.56% of all crashes followed by tire bursts and reckless driving with 8.59% and 8.40% respectively among other factors. Even though driver behaviour has been recognized as the key component in RTIs, However, identifying the key driving behaviours that have the most impact on Road traffic accidents is challenging.

[18]-[20], In South Africa, minibus taxis are more frequently involved in road traffic accidents than other types of vehicles and are responsible for twice the number of traffic accidents compared to any other mode of passenger transportation. [20] examined the driving behaviours of taxi drivers in Cape Town as well as those of other drivers to compare their experiences. The study revealed that compared to other drivers, taxi drivers were statistically more likely to drive recklessly and aggressively.

[21] a study also revealed that risky driving behaviour is a high predictor of road crash involvement among bus drivers in Cameroon. Among the behavioural factors considered, violations and sleepiness were significant predictors of road crash involvement. [22], in a study in Abuja and Lagos Nigeria shows that Drivers' behaviours, such as speeding, using a phone while driving, being fatigued while driving, having blurry vision, and drinking or using drugs before driving, all contribute to 61% of the variation in accidents. [23], acclaimed that major contributor to road fatalities in Ghana are driver-related challenges including reckless driving, drunk driving, and mobile phone usage while driving. It states that drivers were to blame for 56.2% of road accidents in Ghana, even though human error was the cause of 77% of those incidents. In summary, the discussion above has demonstrated that road user behaviour is fundamental in promoting a road safety culture in Africa. Consequently, understanding drivers' behaviour is essential to lowering accident rates in Africa.

However, despite several research studies on the role of drivers' behaviour on the growing accident rate in Africa [3], [18], [19], [21] metric studies or assessments of research output on commercial drivers'

behaviour has been published in Africa, to the best of the author's knowledge. specifically, using bibliometric analysis, this study examined the growth of publications, authorship, geographical distribution, international research collaboration, important themes discussed, and highly cited articles on commercial drivers' behaviour concerning road traffic accidents in Africa.

2. Materials and Methods

Because there is a lot of information readily accessible and continuously being published on various study subjects, scholars and researchers find it challenging to assess the current knowledge, utility, and future orientation of their research [18]. Consequently, researchers employ specific techniques, such as bibliometric analysis, to tackle the challenge of abundant information and diverse research subjects [24], [25]. These methods assist in obtaining a comprehensive understanding of overall progress and the continuous nature of research, enabling a broader or more detailed perspective. As argued by [25]-[27], utilizing quantitative techniques on bibliographic data, bibliometric analysis offers a tangible depiction of extensive scientific literature, allowing for a comprehensive exploration of vital information. However, researchers employ this method to identify emerging patterns, investigate interconnections between various study types, map the body of scientific knowledge within well-established domains, and discover developing trends.

Bibliometric methods have two primary purposes: performance analysis and science mapping [28]. Performance analysis focuses on evaluating the research and publication achievements of individuals and institutions. Science mapping, on the other hand, aims to uncover the growth and structure of scientific fields [24], [28], [29], and is a method for examining connections between research consequences that focuses on the intellectual and structural linkages between research constituents [28]. Citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis are all techniques used in scientific mapping. Bibliometric analysis is currently often used to assess the development of publications, publishing countries, and institutions. It aids in identifying important elements for researchers, such as the publication's evolution trend, study areas, and major authors.

This study aims to create a comprehensive overview of published studies from Africa focusing on unsafe driving behaviour. The objective is to identify research trends in this area and provide readers with a summary of critical analyses conducted on unsafe driving behaviour. This will give a clear understanding of the existing work in this field. Studies that have used a similar technique include works on Driver Behaviour and Traffic Safety Scholarship [18], Safety Behaviour Research [30] Distracted Driving Research [31].

3. Data sources and search strategy

The bibliometric review in this study is based on the two primary techniques categories: [1] performance analysis and [2] science mapping, [28], [32]. The Scopus database was used to collect data for this study. While Scopus and Web of Science (WoS) are the most comprehensive sources for conducting Bibliometric analysis, however, Scopus has certain advantages. Scopus covers a wider range of content, is more user-friendly, and provides individual profiles for authors, institutions, and serial sources. Furthermore, Scopus indexes a greater number of distinct sources compared to WoS [24], [28], [33].

In the current study, the search term "commercial drive*" AND behav* AND in AND Africa was utilized within the Article title, abstract, and keywords but the result was limited to very few articles, (3 initial results) returned. However, the search was expanded to include keywords relating to commercial drivers, drivers' behaviour, and Africa, and an improved result was observed. The final search term is shown in Figure 1 below with 295 results. After a manual screening of the result, 35 items that were not related to the topic and outside the context of Africa were removed, consequently, 260 items were available for analysis. The retrieved items (title, abstract, author, date of publication, source of publication, keywords, citation count etc.) were exported from Scopus as a CSV file and pre-processed using MS Excel.

For this study, data analysis was performed using a combination of spreadsheet and bibliometric analysis software packages such as VOSViewer (version 1.6.19) and bibliometric analytics within Scopus. The performance of the research was analysed using the bibliometric analytics within Scopus while science mapping was analysed with the help of VOSViewer. The duration of the present study spanned from 1978 to 2023. However, upon comparing the same timeframe and search criteria, a

comprehensive global literature search unveiled more than 6,000 publications. This indicates a scarcity of documents concerning the current subject matter in Africa and a relatively recent surge in research interest.

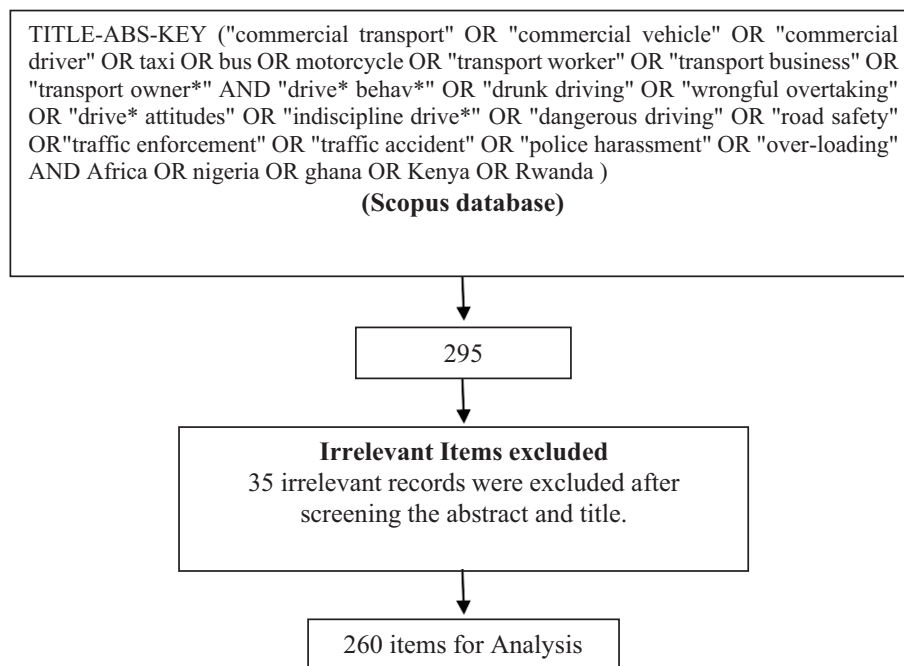


Figure 1. Flow Diagram for Document search process

4. Result and Discussion

4.1. Performance analysis

4.1.1. Publication Growth. The result from Figure 2 shows the annual research productivity in terms of documents in the area of commercial drivers' behaviour in Africa. The earliest research document appeared in 1978. Over time, the number of research documents gradually increased but remained relatively low. The number of research publications noticeably increased between 2002 and 2022 with the highest number of research documents in the year 2018. The increase in the volume of documents in recent years suggests advancement in scientific research which suggests that recently, more attention is drawn to traffic safetybehaviour, increased concern about commercial drivers' driving behaviour and increase road traffic accidents in Africa. However, the number of contributions to research documents in this area is relativelylow in Africa (295 documents) compared to the global level of research document production (above 6,000 documents) with the same search term.

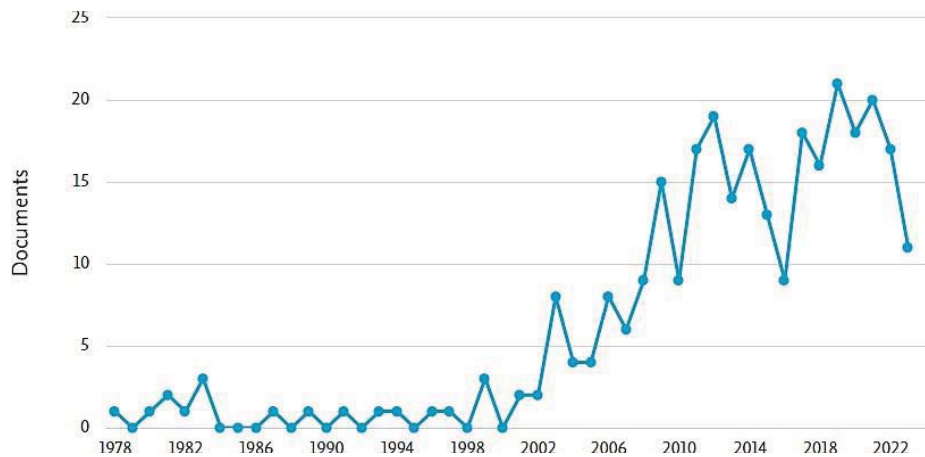


Figure 2. Annual document production based on Scopus search.

4.1.2. Source Growth. Figure 3 depicts the top five documents published between 1980 and 2023. East African Medicine Journal had earlier research documents publications on areas of study related to Africa since 1980 but had produced a relatively low volume of documents to date with 9 numbers of documents to date. Accident Analysis and Prevention's debut publication was in 1998, followed by Traffic Injury Prevention in 2003. The surge in source growth was observed in 2004 with Traffic Injury Prevention producing the highest (22 documents) number of documents on commercial drivers' behaviour, followed by Accident Analysis and Prevention and the International Journal of Injury Control and Safety Promotion, as shown in Table 1. However, in general, the output of research documents on commercial drivers' behaviour is still very low. Most articles within the top sources focus on specialized investigations conducted at the country level and targeting specific aspects which are in accordance with [18]. In light of this outcome, it is suggested that these resources have provided valuable insights that can be utilized by researchers in their future investigations on road user behaviour.

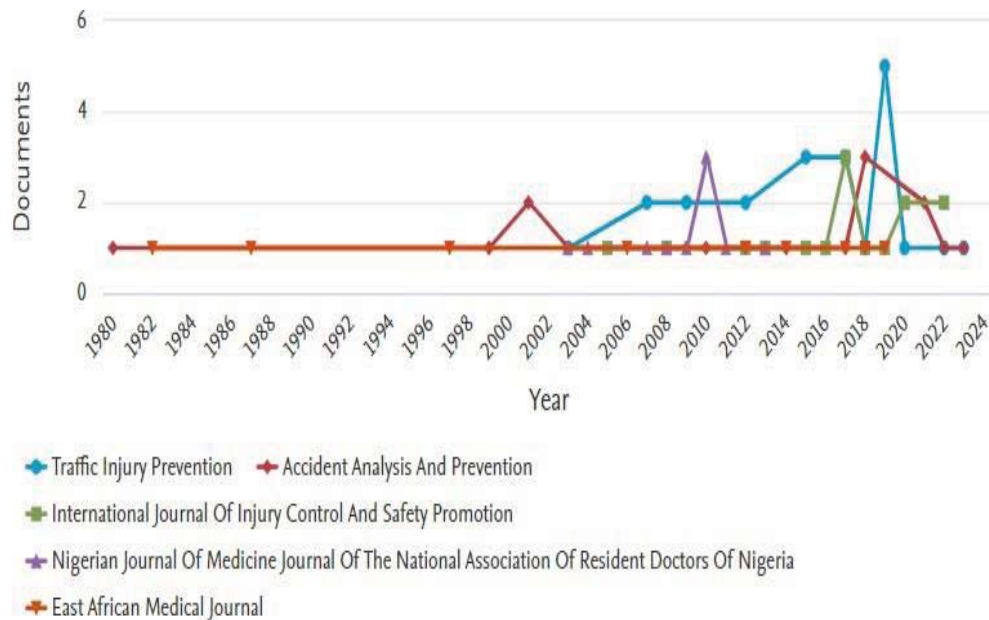


Figure 3. Document Count per year by Source based on Scopus search.

Table 1. Number of Documents per Source

Source	Documents	%
Traffic Injury Prevention	22	30.6
Accident Analysis and Prevention	16	22.2
International Journal of Injury Control and Safety Promotion	15	20.8
Nigerian Journal of Medicine Journal of the National Association Of Resident Doctors Of Nigeria	10	13.9
East African Medical Journal	9	12.5
	72	100.0

4.1.3. *Subject Areas.* It is essential to provide key insights into the distribution and features of scientific documents within commercial drivers’ safety behaviour research. Figure 4 shows the contribution of the top 10 research areas. The areas include Medicine (233 documents) which dominates 55.3% of the research area, followed by social sciences (97 documents), Engineering (34 documents), nursing (12 documents) and environmental science and Psychology (10 documents) respectively. The outcome revealed that the subject matter is significant from a public health impact point of view [34], given that its essential to understand the causes, risk factors, behaviour and environmental factors contributing to road crashes. The output shows that research in road traffic safety and drivers behaviour is multi-disciplinary nature, including medicine, social sciences, engineering, psychology, and. [22], the multidisciplinary approach

allows for a comprehensive understanding of the complex factors contributing to road crashes and effective interventions.

Table 2. Subject trends in commercial drivers' safety behaviour

Subject Area	Documents	%
Medicine	233	55.3
Social Sciences	97	23.0
Engineering	34	8.1
Nursing	12	2.9
Environmental Science	10	2.4
Psychology	10	2.4
Computer Science	8	1.9
Arts and Humanities	6	1.4
Multidisciplinary	6	1.4
Earth and Planetary Sciences	5	1.2
	421	100.0

4.1.4. Publishing Countries. Employing bibliometric analysis helps to understand the geographical spread of research advancement, and the quality, and concentration of scientific research within different countries. The most influential country by research knowledge sharing in commercial drivers' safety behaviour in Africa is Nigeria (129 documents), United State (65 documents), Ghana (62 documents), South Africa (30 documents), Kenya (16 documents), figure 4 depicts top 10 publishing countries. The result revealed that the bulk of the published documents is from developing countries in Africa. This suggests that commercial driver safety behaviour phenomenon in developing countries like Nigeria among others due to increased urbanization and travel demand.

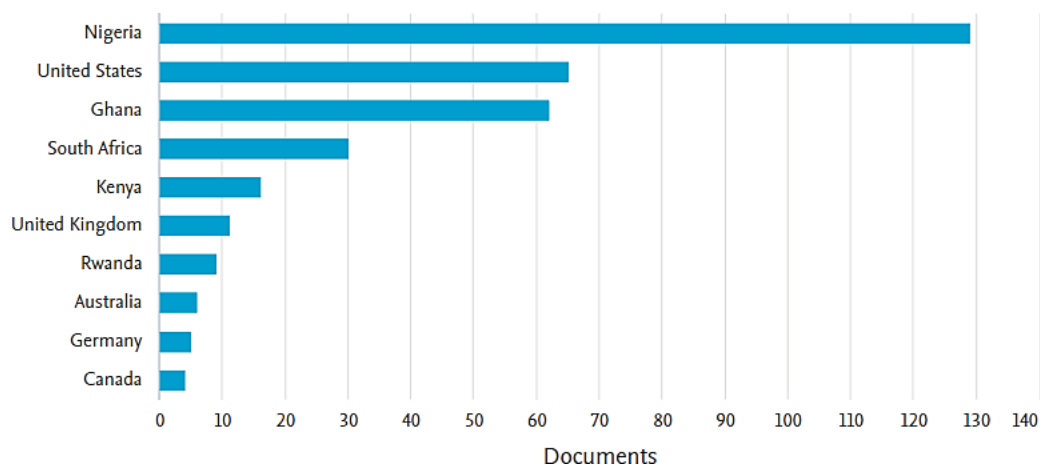


Figure 4. Top 10 Publishing Countries based on Scopus search.

4.1.5. *Institutional Analysis.* Table 3 shows the analysis of the top 10 institutions that researched commercial drivers' safety behaviour in Africa. Kwame Nkrumah University of Science and Technology had the most published documents with 23 documents, the second-ranked goes to University College Hospital, Ibadan (21 documents) and in the third place is CSIR - Building and Road Research Institute (18 documents). The analysis shows that Ghanaian Institutions dominate the top 10 institutions with scientific research publications on commercial drivers' safety behaviour as shown in Table 3. Despite the relatively low volume of documents in the area of study, results depict that scholars have been actively involved in safety behaviour publications. Therefore, this shows that commercial drivers' safety behaviour in Africa significantly impacts the rate of road fatality, which therefore needs attention, [11],[35].

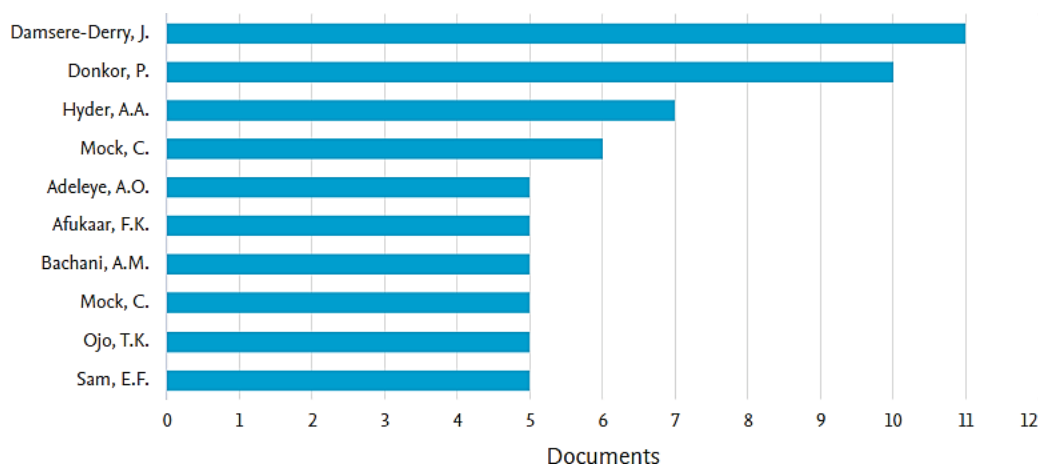
Table 3. Institutional Analysis Commercial Drivers' Safety Behaviour Research

Affiliation	Country	Documents	%
Kwame Nkrumah University of Science and Technology	Ghana	23	15
University College Hospital, Ibadan	Nigeria	21	13.7
CSIR - Building and Road Research Institute	Ghana	18	11.8
University of Ibadan	Nigeria	17	11.1
University of Washington	USA	16	10.5
Harborview Injury Prevention and Research Center	USA	16	10.5
Obafemi Awolowo University	Nigeria	14	9.2
University of Ilorin	Nigeria	10	6.5
Council for Scientific and Industrial Research Ghana	Ghana	9	5.9
University of Cape Coast Ghana	Ghana	9	5.9
		153	100

4.1.6. *Documents Count of Influential Authors.* Table 4 and Figure 5 show the analysis of the top 10 most productive individual authors on commercial drivers' and traffic safety behaviour research in Africa. Only two authors produced 10 or more documents: Damsere-Derry, J. (11 publications), which was cited 174 times with a citation impact of 15.8 and Donkor, P. (10 publications), cited 122 times and a citation impact of 12.2. however, Mock, C. have a relatively high volume of publications (6 publications) but a low level of citation (8) and a low citation impact of 1.3. on the contrary, authors like Afukaar, F.K. produced a low volume of publications (5) but have the highest number of citations (294) and highest number of citation impact (58.8), likewise Bachani, A.M. with a low number of publications (5) but high citations (119) and high citation impact of 23.8.

Table 4. Top 10 most productive individual authors

Author	Total Documents	Total Citations	Citation impact
Damsere-Derry, J.	11	174	15.8
Donkor, P.	10	122	12.2
Hyder, A.A.	7	184	26.3
Mock, C.	6	8	1.3
Adeleye, A.O.	5	40	8.0
Afukaar, F.K.	5	294	58.8
Bachani, A.M.	5	119	23.8
Mock, C.	5	92	18.4
Ojo, T.K.	5	38	7.6

**Figure 5.** Documents Count of top 10 influential Authors based on Scopus search.

4.2. Science Mapping

4.2.1. Analysis of Co-occurrence of Authors' Keywords. A co-occurrence network displays collections of themes that the author's keywords have identified. Figure 6 shows the prevalent keywords used by authors in African publications about commercial drivers' safety behaviour research. The size and colour of the circles indicate the frequency of occurrences of keywords and various coupling clusters, accordingly. The result shows keywords with at least 4 occurrences, where out of the 1,846 keywords 289 meet this threshold. The research shows major keywords to be, motorcycle (99 occurrences), risk factors (45 occurrences), helmet (22

occurrences), law enforcement (17 occurrences), Alcohol drinking (13 occurrences), age factor (12 occurrences), and socioeconomic factor (9 occurrences). Based on the analysis, commercial drivers' safety behaviour research focuses on driving behaviour and the risk factors associated with unsafe driving behaviour. These results are crucial because they represent the search terms used to build up the searchstring for document retrieval for this study and also provide direction for researchers in further studies.

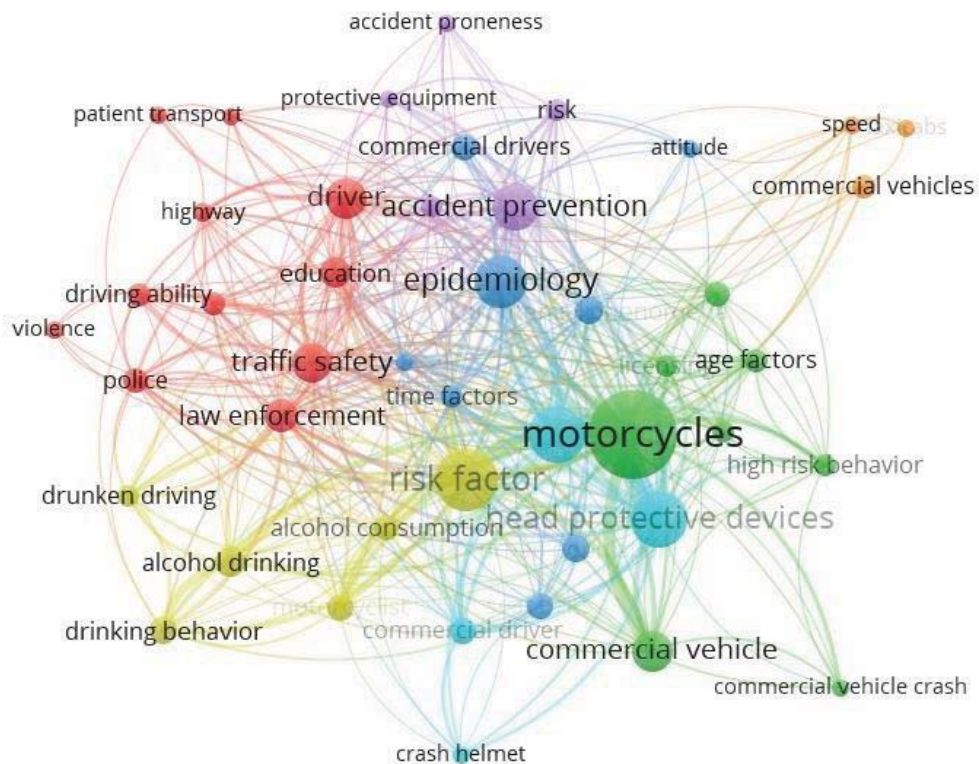


Figure 6. Network Visualization of the Co-occurrence of Authors' Keywords

4.2.2. Analysis of Co-Citation of Cited Authors. Co-citation analysis assumes publications that are cited together frequently are similar thematically (29). Furthermore, the analysis reveals the intellectual structure of drivers' safety research. Figure 7 shows the author co-citation networks by publications in the Scopus journal. The minimal number of citations for an author in this study is set at 20, and 38 of the 10,516 authors satisfy the criterion. The links represent the cited authors by publications in the journal where the size and the colour of the node mean the citation author. To be specific, the bigger the node is, the broader the author is, and the deeper the colour is, the more citations the author has. Therefore, some large-sized nodes highlighted in Figure 5 mean the top cited authors by publications in Commercial driver's safety behaviour research. Table 5 shows that "Mock C.N" topped the link strength of citations with (1,379) link strength followed by "Peden.M" with (1150) and "Hyder" A.A. with (9,82) respectively.

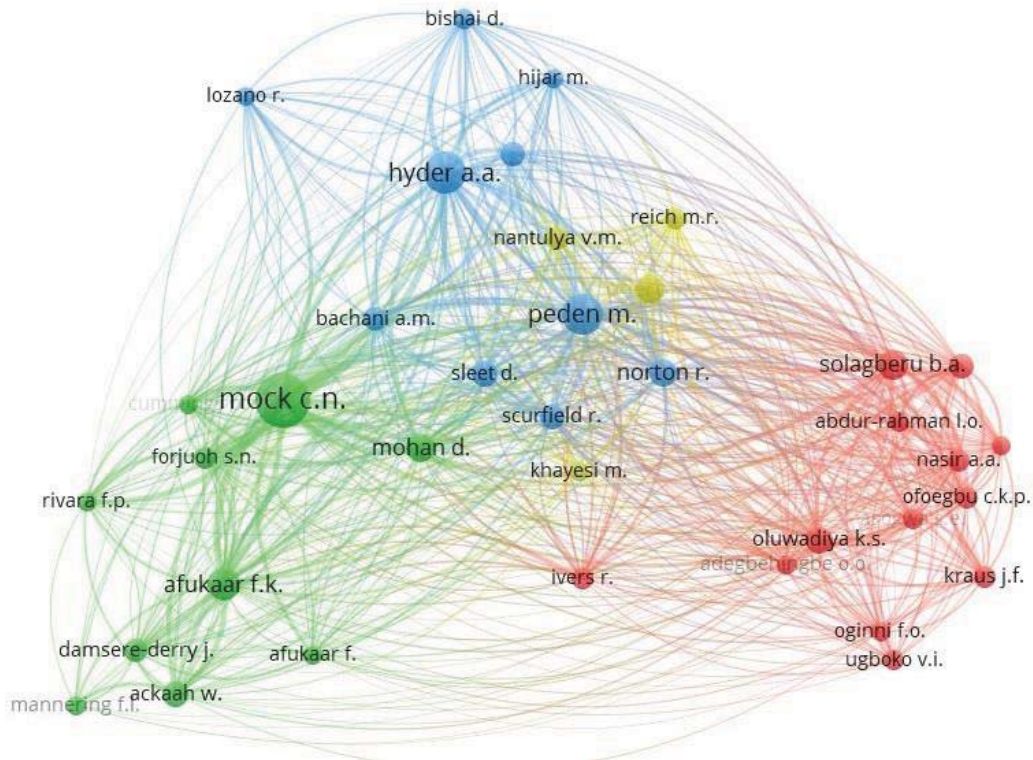


Figure 7. Network Visualization of Co-citation Analysis. Source: Author’s own, based on Scopus search.

Table 5. Top 10 Co-cited Authors

Author	Citations	Total link strength
mock c.n.	147	1379
peden m.	87	1150
hyder a.a.	91	982
afukaar f.k.	58	623
norton r.	42	586
mohan d.	45	574
odero w.	44	543
solagberu b.a.	47	538
scurfield r.	34	480
sleet d.	36	473

5. Discussion

After the bibliometric analysis, we engaged in additional discussions concerning the overall analysis. Here are the summarized results for publication performance and mapping outcomes.

- The result revealed that the earliest document on commercial drivers and safety behaviour was recorded in 1978, an increase in document publication was observed not until between 2002 and 2022 with the highest volume publication in the year. However, the number of contributions to research documents in this area is relatively low in Africa. Nevertheless, the result shows that research in the study area is still minimal and needs to be further explored in the future, as road behaviour is one of the determining factors that led to road collisions.
- The most notable sources of documents were Traffic Injury Prevention producing the highest (22 documents) number of documents on commercial drivers' behaviour and followed by (Accident Analysis and Prevention with 16 documents)
- Medicine has been identified to be a top-notch research hotspot, this is because medical research in this area aims to identify risk factors and evidence-based interventions that focus on prevention and aligns with the broader goals of public health research.
- The research on Commercial drivers' and safety behaviour is multiple disciplines in nature, including medicine, social sciences, engineering etc. This multidisciplinary approach allows for a comprehensive understanding of the complex factors contributing to road crashes and enables the development of effective interventions.
- Documents cover countries mainly from Africa, Europe, and North America. In terms of publication, Nigeria (129 documents), USA (65 documents), and Ghana (62 documents) are prominent, which shows that publications in the journal from these three countries have a higher influence. Documents published are predominately from West Africa.
- Kwame Nkrumah University of Science and Technology (Ghana) have more publications as an Institution on commercial drivers' unsafe traffic behaviour Research, this is followed by University College Hospital, Ibadan (Nigeria). By the publication, Ghanaian Institutions are more dominant in drivers' safety behaviour compared to others in the top 10 as mentioned.
- Only two authors produced 10 or more documents: Damsere-Derry, J. (11 publications) and Donkor, P. (10 publications), however, Afukaar, F.K produced the highest citation impact.
- Consistent with the Documents-related findings, the most commonly listed keywords in Commercial drivers' unsafe traffic behaviour research in Africa were motorcycle (99 occurrences), risk factors (45 occurrences), helmet (22 occurrences), law enforcement (17 occurrences), Alcohol drinking (13 occurrences), age factor (12 occurrences), socioeconomic factor (9 occurrences). From this result, the following research topics can be considered in the future.
- Co-citation analysis shows that researchers can pay more attention to those authors (Mock C.N, Hyder. A.A. and Solagberu B.A.)

6. Conclusion

This study aims to conduct a bibliometric analysis between 1978 and 2023 of published academic works which focused on commercial drivers' safety behaviour in Africa. This research was limited to document reviews from the Scopus database. The study considered research publication growth, document source growth, subject area, institutional and individual authorship, and authors' keywords related to safety behaviour research in Africa. VOS viewer and Scopus Journal Analyzer were used for the data analysis. The number of publications has almost been steadily increasing since 2002. Nigeria is the most productive country. The top 3 productive institutions are Kwame Nkrumah University of Science and Technology (Ghana), University College Hospital, Ibadan (Nigeria) and in the third place is CSIR -Building and Road Research Institute respectively. The prominent author is Damsere-Derry, J. Overall, the paper offers an objective view of documents on the driving behaviour of commercial drivers in Africa through bibliometric analysis, which is a vital tool for academics to grasp some of the popular research topics and directions in road traffic and safety behaviour.

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