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A Scientometric Analysis and Review for Studies Related to Applying Road Safety Data to Transportation Planning

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Abstract

Traffic crashes are the leading cause of fatalities and severe injuries in several nations worldwide since they are widely recognized as a primary cause of mortality. They have emerged as a significant societal worry, representing one of the foremost challenges that deplete material resources and human efforts, specifically targeting the fundamental aspect of existence, namely the human element. Safety refers to being protected from harm, danger, or risk. The road has significant social and economic significance on a global scale. As the number of vehicles on the road continues to rise, it is imperative to intensify efforts to mitigate preventable fatalities and injuries. This may be achieved by carefully analyzing past incidents and developing appropriate recommendations and solutions. The study's objective is to locate and gather the most important research articles on including safety considerations during the creation of transportation planning. This includes identifying the countries, journals, authors, and their collaborations that have published such information. WOS (Web of Science) is used for this purpose. To get advantages from these studies, the factors behind crashes must be comprehended in their assessment, as well as the methods used for their resolution to ensure the establishment of a sustainable urban transportation system.

Keywords: Bibliometric analysis; Safety; Safety transportation planning; Scientometric Analysis; Traffic crashes; Transportation.

1. Introduction

Safety represents an essential part of the transportation planning method, so it requires those involved in the transportation process, including state departments of transportation, urban planning organizations, transportation agencies, etc., to include safety into the transportation planning process. For safe transportation, thoughtful guidelines must be followed to monitor and predict safety issues before they arise [1]. One strategy used to include safety into the transportation planning process is long-range and short-range planning activities planners strive to create long-term plans and solutions that meet future needs through short-term planning activities through the Transportation Improvement Program (TIP) where they are programmed (TIP is a multimedia programming document for specific projects) or the Statewide Transportation Improvement Program (STIP) through programming. After completing the project evaluation process, transportation planners work to finance and include them in the STIP program. Including or considering safety into account when planning transportation effectively reduces human and economic losses associated with traffic crashes [2].

The whole world is concerned about road crashes because it is one of the most important factors contributing to the overall global death rate. According to the World Health Organization [3], it is expected that by 2030, this will rank among the five leading causes of death. The World Health Organization estimates that there are approximately 1.3 million victims of road traffic crashes annually, equivalent to more than two deaths every minute It is worth noting that 90% of these avoidable deaths occur in low- and middle-income countries. Car crashes are the leading cause of death among children and young people between the ages of 5 and 29 years [4]. In addition, there are some “non-financial losses”, such as psychological distress, pain, loss of the wonderful joy of life, and other things [5]. There are many main reasons for the global increase in injuries resulting from traffic crashes, including the increasing number of cars on the road. Many studies have proven a relationship between the increased number of cars and the number of road injuries and crashes [6].

Iraq has recently witnessed a sharp increase in the number of cars without modernizing its transportation infrastructure, leading to more traffic crashes accordance to the report of the statistics and geographic information systems authority of the Iraqi Ministry of Planning for the year 2023. The most accurate indicator of road safety is traffic accidents. Therefore, to reduce their size and seriousness, we must focus on this issue due to the large number of deaths and injuries resulting from them in Iraq. It is a tragic and expensive byproduct of modern transportation that continues to impact our country. Legally, road authorities are obligated to implement appropriate measures to tackle the problem of accidents, as

they represent a substantial economic burden on society [5]. The importance of safety lies in reducing car crashes and deaths that affect the comfort and safety of vehicle drivers, pedestrians, and cyclists who use transportation. According to a study conducted in the United States on 85 urban areas showing the impact of crashes on the economy, it was found that the cost amounts to $164.2 billion annually in urban areas in the United States [7].

To integrate safety into transportation planning, planning activities require a large number of data, such as traffic, land use, and demographic data. This data is analyzed using several tools, including geographic information systems and software availability [1]. Factors that affect transportation safety are transportation system construction, design, operation, and maintenance. Therefore, safety must be considered in the transportation system during the transportation planning process to avoid many crashes that cause congestion and risks for vehicle drivers and passengers. Therefore, safety is integrated into the transportation planning process. Transportation safety planning (TSP) as a proactive approach. By establishing transportation networks that are intrinsically safe, the occurrence of crashes and unsafe conditions is minimised [8].

This research aims to provide a clear definition of Traffic Safety and the factors that affect it, in addition to identifying the factors that lead to traffic crashes. Where the WOS was used to identify the importance of traffic safety among countries and universities around the world; in addition to the knowledge of research publications related to this topic and the extent of researchers ' interest in it, then the VOS viewer program was used to analyze data and published research papers to obtain more information related to traffic safety. This study provides information on identifying programs used to analyze incidents and identify keywords for academic research.

2. Literature Review

2.1. Overview

Transportation facilitates Transporting individuals and commodities between different locations. However, transportation problems, including crashes, are common worldwide due to the sharp increase in cars and lack of development in the transportation infrastructure. As a result, society bears a heavy financial burden from traffic crashes [5]. The World Health Organization estimates that there are approximately 1.3 million victims of road traffic crashes annually, equivalent to more than two deaths every minute [4]. Therefore, laws are being imposed on road authorities to respond appropriately to address this issue and try to integrate safety into the transportation planning process, as safety-conscious

planning is a new proactive strategy that integrates safety concerns into transportation planning procedures [9].

2.2. The purpose of Incorporating safety into the transportation planning process

Safety aims to ensure that the trip is completed without any damage to property. For investigative purposes, transportation planners have mostly focused on the consequences of crashes, such as property damage, assaults on transportation infrastructure, vehicle collisions at intersections, and risks to pedestrians and cyclists. Emphasizing safety is crucial to advancing and enhancing the engineering design and operations of transportation facilities and minimizing damage to them [7]. Predicting safety in the planning process is useful through knowing and identify safety problems by examining networks and developing planning solutions when predicting crashes [10]. Safety is integrated into the planning process by studying all influencing factors and considering them during planning. Although some safety measures are included in traditional transportation planning, they lack the integration of safety-conscious planning into every transportation planning step. From the beginning of the planning process, consideration must be given to how to build, maintain, as well as study the influencing factors using ArcGIS tool to find out, for example, the shortage of streets, the hottest areas for crashes (11), the best location for hospitals and service areas, and submit proposals during planning, thus having a direct impact on traffic safety (7).

2.3. TSP's practice

In order to facilitate proactive road safety planning, a group of Scientists have lately created high-level crash prediction models specifically designed for the planning stage [12]. The main goal of these studies was to create a decision-support tool for safety planning that allows for a proactive assessment of the consequences of different networks or Land use planning activities and situations regarding road safety. This tool is intended to be used for medium- to long-term implementation.

To evaluate road safety as part of a regional transport plan, a study was conducted in [13] detailing the application of previously established macro-level crash prediction models at the community level. The data, including results from regional transportation models, was taken from more than 400 Greater Vancouver neighborhoods in British Columbia, Canada. Collision prediction models(CPMs) predicted reduced average crash frequency because of the proposed three-year district-level transportation plan rather than a do-nothing scenario.

The use of geographic information systems (GIS) in safety applications is relatively new. A geographic information system is a computerised system utilised for the purpose of gathering, retaining, and

examining geographical data. and present location-based data. These characteristics have prompted the use of geographic information systems in transportation planning [14]. One of the applications of geographical information systems(GIS) that the researcher mentioned in the study (10), where the author explained that it is possible to predict the number of crashes, as it is possible to know the areas with the hottest crashes, know the factors that affect them, and present proposals to decision-makers, which helps them to know how to address the problems that may be faced in The current or future time and developing treatments and solutions for them during planning. Many countries were interested in developing laws that consider safety in transportation planning processes. In the United States, it was the Transportation Equality Act (TEA-21) [14], which integrated safety and security into transportation planning operations and activities. Among other laws, the Responsible, flexible, and Efficient Transportation Act was established. In August 2005, it was established as A legacy for users to focus on traffic safety. The (SAFETEA-LU) law works to improve safety and reduce traffic congestion. SAFETEA-LU has established a program to improve highway safety and work to reduce deaths [15].

A study was done utilizing [9] The approach used is a generalised linear regression model that incorporates the likelihood of a negative binomial error rate. This is done to explore The relation between the occurrence rate of crashes in the planning area and other variables such as traffic density, land use, and other factors economic, social, demographic, and traffic demand metrics. The benefit of these models is that They can serve as instruments that assist planners in incorporating safety into the transportation planning process.

A study included work done on the highway from Point A to Point B to rebuild and improve safety. Figure 1 is a project diagram in which the map and incident history are reviewed. The highway was a two-lane rural arterial highway carrying 14,000 vehicles daily. This study's purpose was to reorganize to improve safety and expand the number of lanes to four instead of two, as shown in Figure 2. The result of the study was a reduction in the number of crashes by 40% to 60% [14].

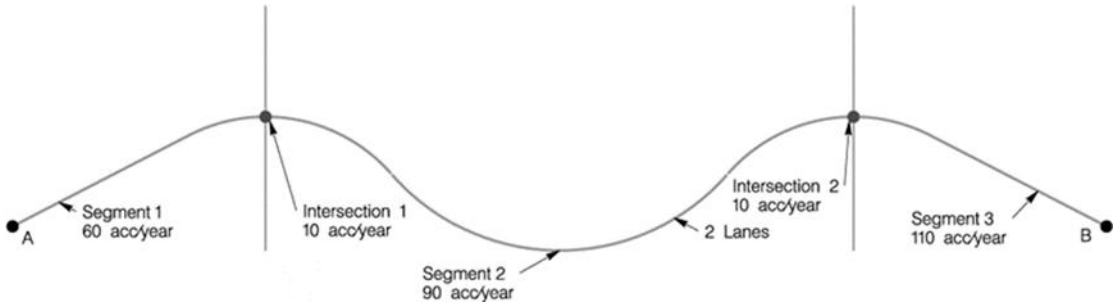

Figure 1: Project map schematic and crash history [14].

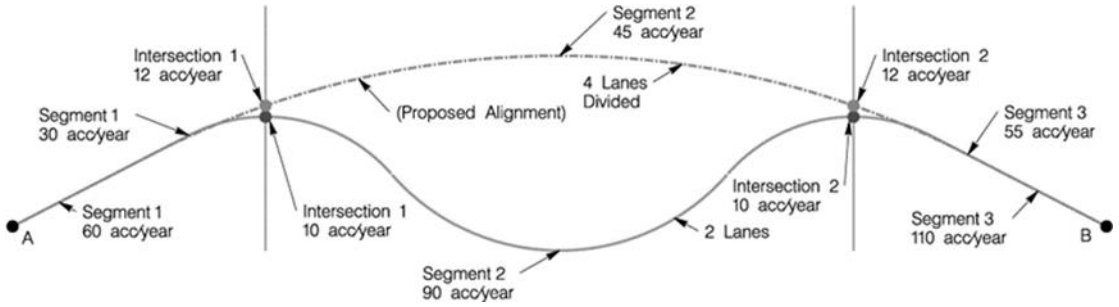

Figure 2: Expected crash frequency after realignment and widening [14].

A study by metropolitan planning organizations in Ames (AAMPO), Iowa, was conducted to determine how safety factors contributed to the transportation planning process. Table 1 provides an overview of how MPO address safety as stated in TIPs (Transportation Improvement Plans) and/or Long Range Transportation Plans (LRTPs). Most planning documents under review show that small planning agencies strongly emphasize safety during the transportation planning and that safety goals and objectives are Integrated into the process through TIPs and LRTPs [16].

Table (1) Summary of MPOs Safety Planning Performance [16].

	MPOs TIP and LRTP					
Standards	**AAMPO**	**JCCOG**	**CAMPO**	**WVTC**	**LCVMPO**	**BENDMPO**
Mention Safety Planning	√	√	√	√		√
Instrument or Approach for Safety Planning						
Safety Performance Listed in Objectives / Goals	√	√	√	√	√	√
Consider all Modes of Transportation	√	√	√	√		√
Candidate Sites to be improved	√	√	√	√	√	√
GIS – based Crash Map	√	√	√			

Note: √ => the criteria were found in the TIP and/or LRTP of the MPO

AAMPO = Ames Area MPO, JCCOG = Johnson County COG, CAMPO = Corvallis Area MPO, WVTC = Wenatchee Valley Transportation Council, LCVMPO = Lewis-Clark Valley MPO

Lovegrove and Sayed conducted a study to develop Models for predicting crashes for assessing neighbourhood traffic safety [17]. Lovegrove and Sayed evaluated four neighbourhood network topologies in two applications for road safety planning using these models. Lovegrove and Sayed discovered that their conceptual networks exhibited greater safety compared to neighbourhood street designs using dead-end streets and typical grids. Lovegrove and Sayed (2010) employed these models to evaluate the road safety of a regional transport strategy in the neighbourhoods of Greater Vancouver, British Columbia, Canada [13].

3. Programs for spatiotemporal analysis of road traffic crashes

To predict crashes and link variables that occur in geographical units, prediction models and statistical models for the frequency of crashes have been used to determine the extent of the relationship between the frequency of traffic crashes and the factors contributing to the increase in crashes, including traffic volumes, land use, social and demographic composition, and road characteristics. These models assist transportation planners in incorporating safety considerations into the process of long-term transportation planning [18]. The primary focus of safety improvement studies has been to examine the relationship between different features and crashes, such as the following: vehicle features [19], road features [20], and traffic conditions [21], [22], weather, land use and many others [23]. The relationship between collisions and these features has been the main focus of these studies. Furthermore, factors that contribute to fatal collisions include increased average daily traffic (ADT) and vehicle miles travelled (VMT) [24]. Although these studies are very useful, the socioeconomic status and minority status of the population may also be very important in determining crash risks at the local level [25]. Several variables have been addressed in several studies [25-30]. These variables include population, race, income, residential environment, mode of transportation, and educational attainment.

A study conducted in Qatar utilized different methodologies, including spatiotemporal cube analysis, geographically weighted regression (GWR), emerging Hotspot analysis, and spatial autocorrelation analysis. The aforementioned techniques were utilized on historical traffic crash statistics spanning the years 2015 and 2019, as illustrated in Figure 3. The study aimed to furnish policymakers with a thorough comprehension of the policy. The assessment of road accidents and the ability to provide prompt responses at the regional level. The findings suggest that road traffic accidents are most common in the central-eastern region of the nation, which has the largest population density. This indicates that the existing traffic management strategies in metropolitan areas are inadequate in terms of avoiding or reducing the adverse consequences of accidents. Furthermore, the likelihood of injury to other road users escalates as time progresses. The study findings indicate several avenues for additional research and methods to enhance existing transport networks in terms of safety and sustainability [31]. A vital component of analyzing road traffic collisions is examining their geographical distribution to identify areas with a high concentration of incidents and to provide valuable information for implementing road safety measures. Many studies conducted in several countries, including Germany, China, the USA, and Colombia, have examined the geographical distribution of traffic hot spots and areas of high occurrence using diverse techniques, such as time-space cubes, spatial

autocorrelation, and Bayesian maximum entropy. In a study conducted by Scheiner and Holz-Rau (2011) [32], it was found that the likelihood of suffering fatal or severe injuries in traffic crashes was greater in both in rural and suburba areas of Germany when compared to densely populated metropolitan areas. Cheng et al. found a concentrated location with a high frequency of Crashes on the roads in the northeastern region of Wujiang's primary metropolitan area in China [33]. As well Dezman et al. determined that crashes mostly occurred in Baltimore's densely populated core in the United States [34].

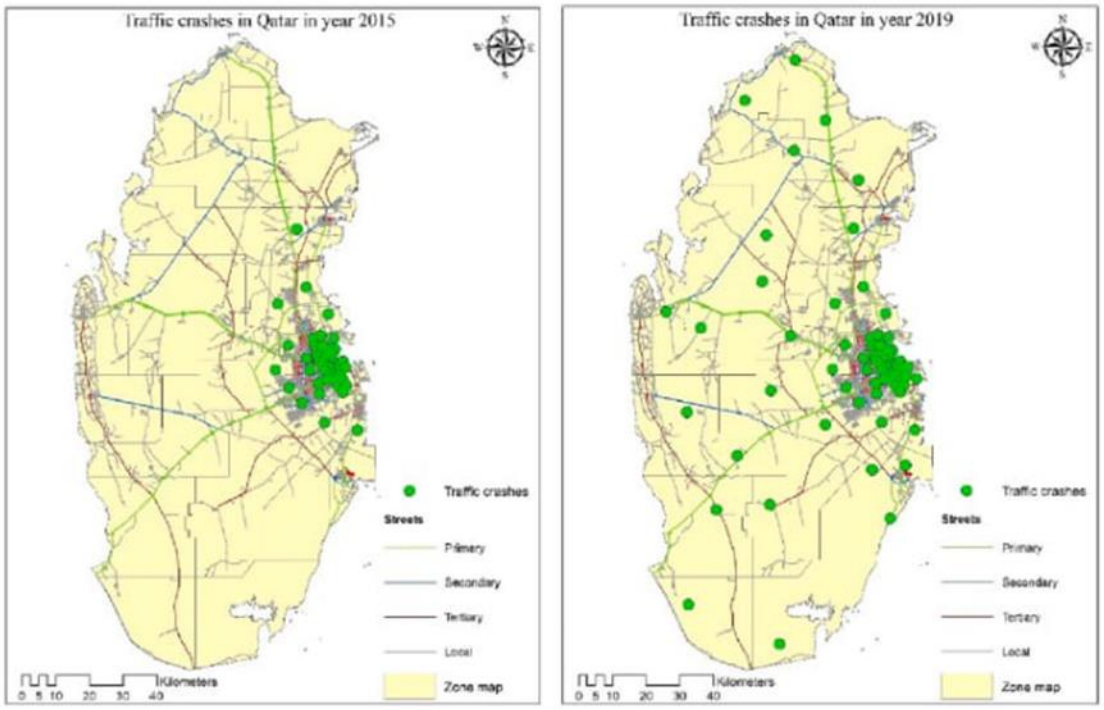

Figure 3: The geographical arrangement of traffic crashes in Qatar for the years 2015 and 2019[31].

A multitude of scholarly investigations have Concentrated on spatial forecasts of crash data using a Bayesian approach. These research have employed various statistical techniques, drawing on data from diverse geographical units at the aggregate level. Table 2 presents a concise overview of the methodologies, geographical units, and collision intensities employed in prior research.

Table (2) Analysis of traffic crashes investigating safety and including spatial correlation.

Study	Methodology	Crash level	Spatial Unit
(Wang and Wang, 2011) [35]	PLANSAFE models Empirical Bayes (EB) US Road Assessment Program	Total Crash	TAZ
(Aguero-Valverde, 2013)[36]	Multivariate and Univariate, FB	Canton	PDO, fatality, and injury
(Zhang et al., 2015)[37]	GWPR	Total number of crashes involving cyclists and pedestrians	CT
(Huang et al., 2016) [38]	Bayesian spatial model with CAR prior, Bayesian spatial joint model	Total crashes	TAZ
(Lee and Abdel-Aty, 2018)[39]	Multivariate Bayesian Poisson lognormal CAR	Total crashes involving pedestrians and bicycles	ZIP
(Cai, Abdel-Aty and Lee, 2017)[40]	Bayesian joint modeling	Total crash, Non-motorist crash, Percentage of crashes involving non-motorists	TAD
(Osama and Sayed, 2017)[41]	Multivariate conditional autoregressive (CAR)	Number of pedestrian crashes, Number of bicycle crashes	TAZ
(Cai et al., 2017)[42]	Aspatial Poisson-Lognormal model (PLN), Poisson-lognormal Conditional	Total crashes serious crashes, all bicycle and pedestrian crashes	TAZs, TADs
(Cai et al., 2019a)[43]	Bayesian Poisson-lognormal	Total crashes	TAD

(Yasmin and Eluru, 2018)[44]	Joint NB-Ordered Logit Fractional Split	Number of overall crashes, crashes without injuries, crashes with mild injuries, crashes with incapacitating injuries, and crashes resulting in fatalities.	STAZ
(Cai et al., 2018)[45]	Grouped random parameters multivariate spatial	Total crashes	TAD
(Islam et al., 2022)[46]	spatial pattern analysis G.I.S	Total crashes	TAZ
(Rahman et al., 2022)[47]	BBN	Unintentional Driver Behavior Intentional Driver Behavior Vehicle Condition Seasons Accident Type crashes severity	TAZ
(Mohammed et al., 2023) [31]	Time-Space Cube analysis GWR Emerging Hot Spot analysis Spatial Autocorrelation analysis	Total crashes	TAZ

Note: FB = Full Bayesian, TAD = Traffic Analysis District, CAR = Conditional Autoregressive, TAZ = Traffic Analysis Zone, NB = Negative Binomial, STAZ = Statewide Traffic Analysis Zone, PLN = Poisson-lognormal, GWPR = Geographically Weighted Poisson Regression, CT = Census Tract, GWR = Geographically Weighted Regression, BBN = Bayesian belief network.

4.Data collection

Web of Science (WoS) offers an extensive citation search [48,49], Until recently, the Web of Science (WoS) was the exclusive means of evaluating scientific output [51]. The database comprises three citation indexes: The Arts & Humanities Citation Index (covering from 1975 onwards), the Social

Sciences Citation Index (covering from 1956 onwards), and the Science Citation Index Expanded (covering from 1900 onwards). It encompasses more than 10,000 journals [49,50]. Over 38 million records are present in the WoS, and every year, over 1.5 million new records and 23 million new cited references from over 250 scientific, social sciences, and artistic and humanities disciplines are added [52]. Several researchers used the Web of Science (WoS) with the VOSviewer program, VOSviewer a freely available computer program, to create and display bibliometric maps [53,54]. The term "safety transportation planning" was entered into WOS to find studies and research on applying safety to transportation planning. The total number of researchers was 9,133, of whom 711 had the minimum total number of documents of two.

5.Analytical method

Bibliometric analysis is a widely used and reliable approach for finding and assessing extensive scientific material. It aids in comprehending the nuances of the advancement of a specific discipline while illuminating its emerging patterns [55]. Visualisation can be achieved using software tools such as CiteSpace, HiteSpace, VOSviewer, Gephi, and BibExcel [56]. The congruence map was created in this study by analyzing statistical evidence derived from the data source using VOSviewer software [54]. A program called VOSviewer is used to create and display bibliometric and graphical maps. According to [57] the software provides the necessary functionality to display large bibliometric networks understandably. VOSviewer is free to use, has unique features such as network mapping and normalization, and is easier to use than many other visualization tools [57]. The field of business research has witnessed a significant surge in the use of bibliometric analysis in recent years [58,59]. This growth can be attributed to two factors: (1) the development of bibliometric software; (2) the availability and accessibility of bibliometric databases like Scopus and Web of Science; and (3) the interdisciplinary cross-pollination of bibliometrics methodology from information science to business research [55].

5.1. Top contraptions

The top ten contributions made by authors, countries, and Organizations are shown in Table 3. The top three authors, in order of overall link strength, are Abdel Aty, Mohamed (40 publications), Lee, Jaeyoung (30 publications), and Huang, Helai (22 publications). The USA is a major contributor with

310 articles, followed by people from China (276 publications) and England (130 publications). Chinese Acad Sci, with 43 publications; NATL University Singapore, with 42 publications; and Wuhan University Technol, with 38 publications, represent the top three universities in terms of overall link strength [60-63].

Table (3) Top 10 contributions of organizations, countries, and authors.

No.	Organizations	Freq*	Authors	Freq*	countries	Freq*
01	Chinese acad sci	43	Abdel-aty,M.	40	usa	310
02	Natl U. singapore	42	Lee,J.	30	china	276
03	Wuhan U.technol	38	Huang,H.	22	england	130
04	Tongji U.	37	Wets,G.	22	canada	110
05	Tsinghua U.	33	Ballemans ,T.	20	australia	75
06	Southeast U.	32	Ozguren , E.	19	italy	68
07	U.cent florida	32	Zhang,yi	19	germany	57
08	Delft U.technol	31	Sandamali ,G.	17	sweden	56
09	Texas a&m U.	29	Su,R.	17	Neth erland	53
10	Southwest jiaotong U.	27	Zhang,Y.	17	South korea	49

Note: * Freq= Frequency, **U= University

Figure 4 shows the extent of the connection between the authors who worked on studying traffic safety and how to take it into account during the transportation planning process. The maps depict various information through the use of lines with varying diameters that link circles of varied sizes and colours. The items are presented in the form of distinct clusters, with each cluster being assigned a certain colour. To measure or know the extent of the connection between the authors Through lines between items, depending on the distance between these lines and the thickness of the line, indicates the strength of the connection between items. There are 42 items and 10 cluster networks. The size of the node indicates the effectiveness or influence of the author. The number of authors reached 711 who have at least two joint publications. Among the most influential authors are Mohamed Abdel-aty Jaeyoung Lee, Helai Huang, Xuesong Wang, and Tarek Saye. The closeness between groups of authors or their presence within one group Denotes the level of collaboration and engagement among researchers.

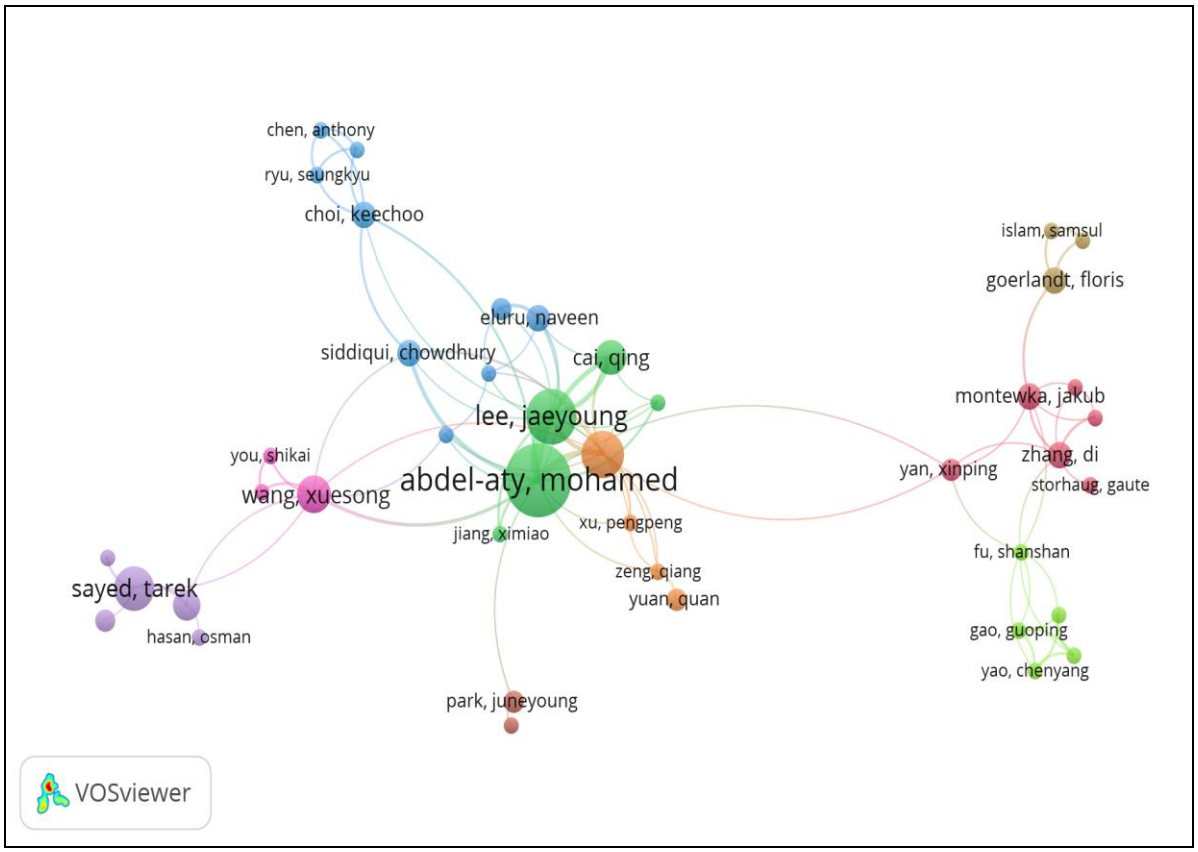

Figure 4: A network visualization map representing the author.

Figure 5 shows A map with several authors sharing papers with at least two co-authored publications can be explained as a visual representation of the collaboration network among researchers. Each author is classified according to the institutes they are affiliated with in a scientometric analysis.

The map shows the connections and collaborations between authors based on their shared publications. The size and color of each node on the map may represent the number of co-authored publications or the impact of their research. The lines between nodes indicate co-authorship relationships, with thicker lines representing stronger collaborations.

By analyzing this map, we can gain insights into the patterns of collaboration within and across different institutes. This can help us understand the dynamics of scientific research and identify key players in specific research areas. Additionally, it can provide valuable information for funding agencies, institutions, and researchers looking to foster collaborative relationships and enhance scientific productivity. The map includes 592 items in 33 cluster networks. Among the universities with

a higher contribution are Beijing Jiaotong University, University Cent Florida, Pursue University, the University of California Berkeley, and the University of British Columbia.

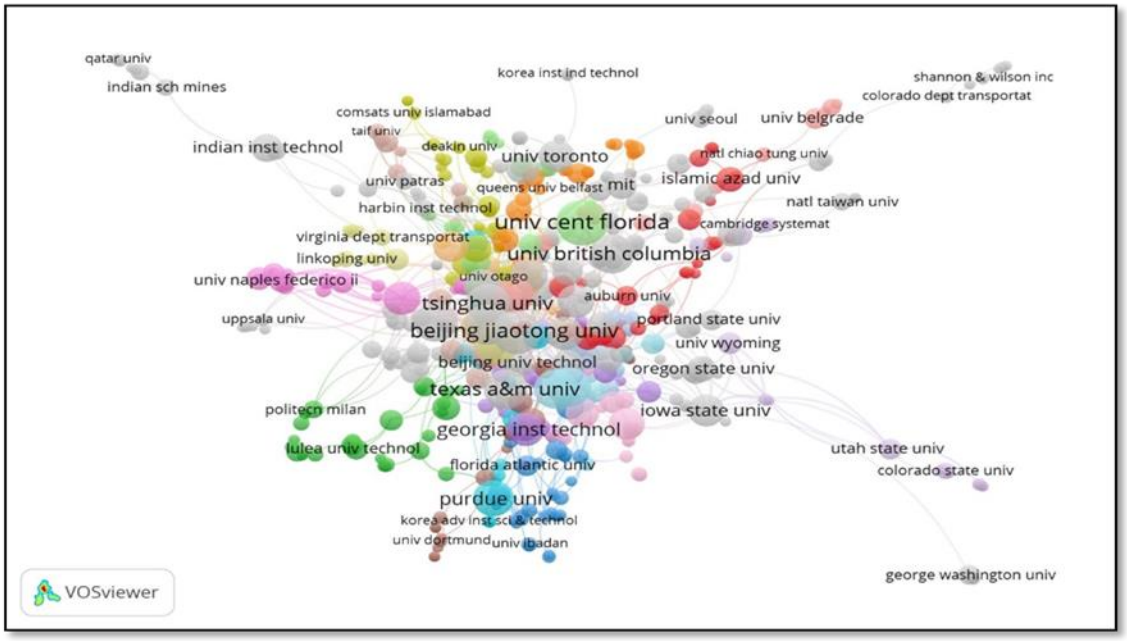

Figure 5: Graphical representation of the Institute's network.

Figure 6 depicts the network diagram illustrating the nations that produce the highest amount of research publications related to safe transportation. The diagram consists of 79 objects, organized into 13 groups, all of which pertain to safe transportation. These groups represent different aspects of safe transportation, such as road safety, traffic management, and vehicle safety.

Among the countries contributing to integrating safety into the planning process and reducing traffic accidents in this scientometric analysis are those with a high volume of research publications on the topic are the United States, China, Australia, Italy and Canada. These countries have shown a commitment to studying and implementing measures to improve safety in transportation systems.

The network diagram visually represents the connections and collaborations between these nations in the field of safe transportation research. It provides valuable insights into the global efforts to address road safety and reduce traffic accidents through scientific research and collaboration.

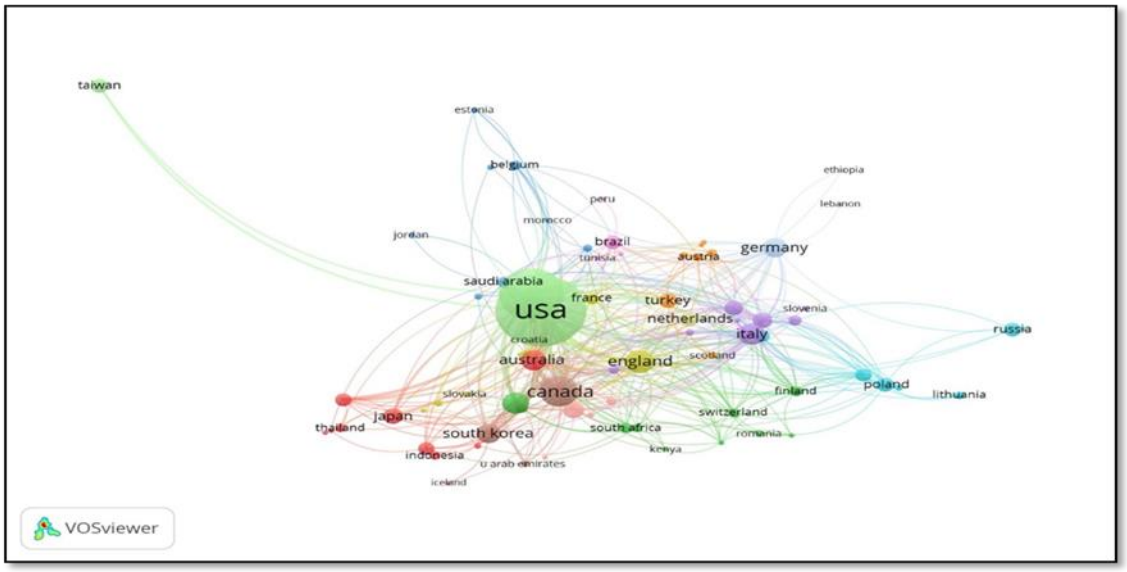

Figure 6: Network visualization map of the Country.

Figure 7 shows a set of Keywords in the search analysis are words or phrases that researchers use to find relevant published papers on a particular topic. In this case, the search analysis resulted in 1000 items being categorized into 11 clusters based on the keywords used. These keywords help researchers narrow down their search and find papers that are specifically related to studying and implementing measures to improve safety in transportation systems.

The analysis results appear as a map, showing the co-occurrence of keywords used in the search. This means that the map visually represents how often certain keywords appear together in the search results. The size of each node on the map indicates the frequency of that word or phrase in the search, with larger nodes representing more frequently used keywords.

The proximity of words on the map indicates their co-occurrence with other words in the research. Words that are closer together on the map are more likely to appear together in the search results, indicating a relationship between those keywords.

Overall, this type of analysis helps researchers understand which keywords are most commonly used when searching for papers on a specific topic, and how those keywords relate to each other within the body of research. This can be valuable for identifying trends and patterns within a particular field of study.

A map visualizing the density of co-occurrences is shown in Figure 8. The density of co-occurrences is shown in yellow. In this map, the density of co-occurrences, which refers to the frequency with which certain terms or concepts appear together in the literature, is represented by the intensity of yellow shading. Areas with a higher density of co-occurrences indicate stronger associations or correlations between the terms related to safety measures in transportation systems. This visualization helps researchers identify key themes, trends, and potential areas for further exploration within the realm of transportation safety research.

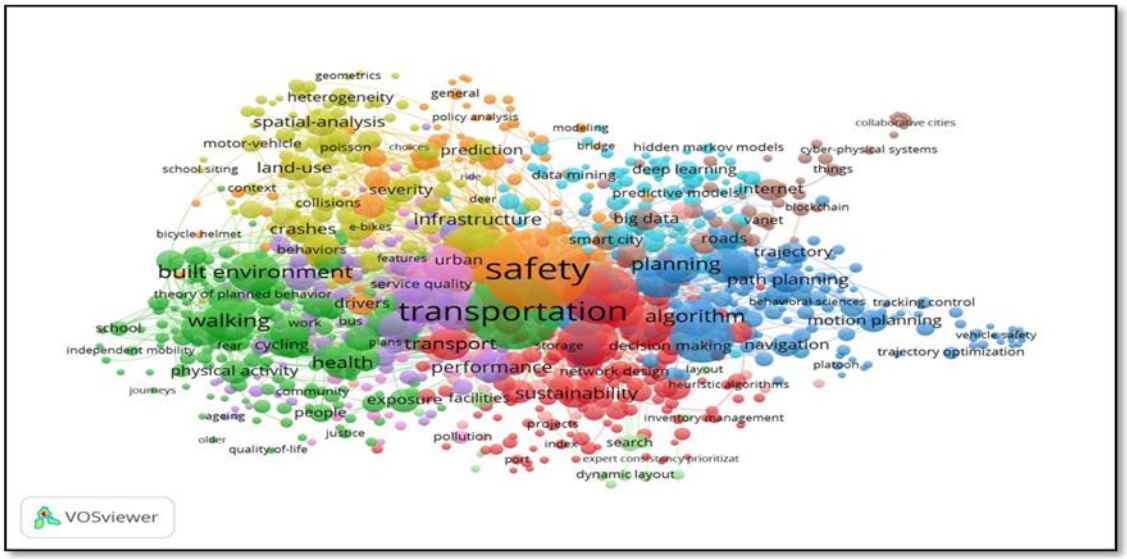

Figure 7: Network visualization map displaying all keywords.

Figure 8: Density visualisation map of all the keywords.

6. Conclusion and Recommendation

In conclusion, the field of traffic safety has made significant contributions to its integration into transportation planning. Through extensive research and analysis, traffic safety experts have identified key factors affecting safety on our roads, including infrastructure design, vehicle technology, human behavior, and policy frameworks. By understanding these factors and implementing evidence-based measures, such as improved road design, advanced driver assistance systems, public awareness campaigns, and stringent enforcement strategies, transportation planners can effectively prioritize safety within their planning processes. Furthermore, the collaboration between traffic safety specialists and transportation planners has led to the development of integrated approaches that consider safety as a fundamental component of transportation systems. This holistic perspective emphasizes the importance of designing roads and transportation networks with safety as a primary objective, rather than an afterthought. The VOS program highlighted key researchers in the field of traffic safety and their contributions to its integration into transportation planning. Among these researchers are Mohamed Abdel-Ati, Jaeyong Lee, Hilai Hwang, Xiosong Wang, and Tariq Sai. The VOS program identified the United States, China, Australia, Italy, and Canada as the most prominent countries interested in this field of study. These countries exert a stronger influence on research publications than other countries. Beijing Jiaotong University, the University of Florida, Purdue University, the University of California

Berkeley, and the University of British Columbia are currently engaged in extensive research on traffic safety. They studied the relationship between traffic safety and crashes and explored ways to integrate them into the transportation planning process. To prevent injuries resulting from traffic crashes, it is necessary to implement appropriate measures to ensure the safety of roads, vehicles, and road users. In addition, it is important to include road safety features in the transportation planning process. This study provides a clear and detailed plan for future research endeavors. This document provides a comprehensive overview of the Next Generation Planning methodology, sometimes called TSP. This study recommends:

- Encourages future research efforts aimed at achieving a comprehensive understanding of the safety impacts of all aspects and stages of transportation planning.
- In order to enhance road safety and reduce fatalities, there must be widespread recognition of the newly formulated policy among planners.
- Electronic monitoring must be used to monitor violations of traffic laws and crashes.
- Paying attention to traffic statistics and using programs based on geographic information systems. Taking advantage of the modern technologies provided by these programs in building a spatial database for traffic accidents is beneficial. This is to build an important information reserve that helps in completing research and reports to study the causes of accidents. Traffic reveals the mutual relationships between the elements of the geographic system and provides the necessary solutions to help decision-makers make the right decisions in dealing with traffic accidents.

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تحليل ومراجعة علمية لتطبيق بيانات السلامة على الطرق في تخطيط النقل

الخلاصة: تعد حوادث المرور السبب الرئيسي للوفيات والإصابات الخطيرة في العديد من الدول حول العالم حيث يتم الاعتراف بها على نطاق واسع كسبب رئيسي للوفيات. لقد برزت كقلق مجتمعي كبير، حيث تمثل أحد أهم التحديات التي تستنزف الموارد المادية والجهود البشرية، وتستهدف على وجه التحديد الجانب الأساسي للوجود، ألا وهو العنصر البشري. تشير السلامة إلى الحماية من الأذى أو الخطر أو المخاطر. يتمتع الطريق بأهمية اجتماعية واقتصادية كبيرة على نطاق عالمي. ومع استمرار ارتفاع عدد المركبات على الطريق، فمن الضروري تكثيف الجهود للتخفيف من الوفيات والإصابات التي يمكن تجنبها. ويمكن تحقيق ذلك من خلال التحليل الدقيق للحوادث السابقة ووضع التوصيات والحلول المناسبة. هدف الدراسة هو تحديد وجمع أهم المقالات البحثية حول تضمين اعتبارات السلامة أثناء إنشاء تخطيط النقل. يتضمن ذلك تحديد البلدان والمجلات والمؤلفين والجهات المتعاونة معهم التي نشرت هذه المعلومات. تستخدم شبكة العلوم (Wos) لهذا الغرض. للحصول على مزايا من هذه الدراسات، يجب فهم العوامل المسببة للحوادث في تقييمها، بالإضافة إلى الأساليب المستخدمة لحلها لضمان إنشاء نظام نقل حضري مستدام.

الكلمات المفتاحية: التحليل الببليومتري **;** السلامة**;** تخطيط النقل الآمن**;** التحليل السينتومتري**;**الحوادث المرورية، النقل**.**