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Development of Transportation Planning: A Systematic Literature Review of Methods

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Abstract

Planning transportation is essential to sustainable development, but problems such as traffic congestion and excessive emissions persist in many areas. This study examines the evolution of transportation planning strategies using a systematic literature review (SLR) approach, drawing on research indexed by Google Scholar. The prime focus is on the trend of data-based approaches and technology integration. The results show that the dominant topics include regulation, planning, transportation planning, and accidents. The largest publisher is Elsevier, followed by Springer and Taylor & Francis, indicating the dominance of high-reputation journals. The types of sources vary, with the majority falling under the "Other" classification, as well as books. Publications increased significantly in 2009–2010 and decreased in the last decade. This study provides a comprehensive overview of the primary objectives and directions of transportation research, serving as a foundation for future research.

Keywords: Transportation Planning, Planning Methods, Transportation Development, Systematic Literature Review

1. Introduction

Community activities have increased as a result of the rapid growth of large cities worldwide, particularly in emerging nations [1]. Transportation planning thus becomes a critical component of sustainable development across nations. In Asia, for instance, countries like Malaysia have experienced significant progress over the past decades [2]. Population growth and global urbanisation have posed substantial challenges to transportation systems, as most daily activities rely on efficient mobility. High population density in urban areas further intensifies the impact and demands on transportation infrastructure [3]. Many significant cities worldwide suffer from chronic traffic congestion, rising carbon emissions, and a decline in quality of life due to inefficient transportation systems. International organisations, including the UN and the World Bank, have emphasised the importance of inclusive and data-driven transportation planning. Furthermore, advancements in information technology have facilitated the development of more sophisticated and integrated transportation planning methods [4].

Road infrastructure is crucial for promoting economic growth and enabling cross-regional travel [5]The majority of nations prioritize the transportation sector in their national development objectives. Economic growth is essential for a nation to improve its residents' standard of living and overall welfare [6]. High economic growth and population mobility have led to a substantial increase in transportation demand. Economic growth and development, a consequence of the rapid urbanization worldwide, have increased the need for human mobility [7]. However, uneven infrastructure and a lack of integration between modes are serious challenges. Various programs, such as the construction of toll roads, have been initiated to accelerate the development of road networks. These initiatives, often funded partially or entirely by road users, aim to reduce the government's financial burden, improve traffic flow in developed areas, promote equitable distribution of development benefits, and encourage public participation in infrastructure funding [8].

Rapid economic development has resulted in widespread access to land transportation for nearly the entire global population [9]. Congestion, long travel times, and air pollution are increasing challenges. Currently, many cities in Indonesia face land transportation problems, such as never-ending congestion [10]. Additionally, many current planning approaches are not fully grounded in data analysis or long-term forecasting. This gap often results in transportation solutions that do not adequately meet the community's mobility needs.

Road users in Majalengka report that infrastructure damage, particularly on urban roads, directly impedes mobility and driving comfort [11]. Without proactive improvements in facilities, infrastructure, and regulatory frameworks, these issues can escalate, leading to severe traffic congestion and environmental impacts that negatively affect local communities [12]. The presence of the West Java International Airport has a significant impact on the need for regional connectivity. However, public transportation access to the airport and the city centre is still limited and has not been optimally integrated. Access to public transportation to West Java International Airport (BIJB) Kertajati has proven to be inadequate, with travel times from Bandung and Karawang still exceeding 90 minutes, making mode integration a key factor that has yet to be fulfilled [13]. Low community participation and limited technical capacity are additional obstacles in the planning process. Therefore, it is essential to evaluate and develop a more systematic transportation planning method that aligns with local characteristics. Majalengka is experiencing rapid urbanisation and high dependence on private vehicles, which is putting significant pressure on infrastructure conditions and environmental quality, including air pollution [14].

The methods used in transportation planning can differ from region to region and also from year to year. These differences arise because transportation planning in each region necessitates adjustments to the existing traffic system's needs, as well as applicable regulations. and use and associated taxes are determined by the government's urban planning regulations, which also finance and provide public services such as transportation infrastructure, regulate industry, housing, automobile use, and transportation costs, and promote economic growth [15]. Therefore, it is essential to be aware of the development of transportation planning techniques, including methods used in various countries from year to year, which can be obtained through the results of a Systematic Literature Review (SLR). Therefore, the researcher chose the research title "Development of Transportation Planning: A Systematic Literature Review of Methods" as the right title for this purpose. To find peer-reviewed research on intelligent transportation systems published between 2021 and 2025, a thorough search was carried out across all major academic databases, including Google Scholar. The search focused on big data, digital twins, and decision support tools in traffic planning, emphasizing the value of a methodical and technologically based approach in transportation planning studies [16]. Transportation systems' multicriteria decision-making techniques: a systematic review of recent literature highlights that SLR enables researchers to create protocols, identify pertinent literature, and apply pre-established search strategies and inclusion/exclusion criteria, which improves the transparency and reproducibility of transportation planning research [17].

2. Research Methods

The SLR method is conducted systematically, adhering to established protocols that minimise bias and subjectivity throughout the research process [18]. A range of data-driven transport planning approaches has emerged in recent years to leverage new datasets and technologies [19]. Various types of sensors have been implemented to continuously collect traffic data within ITS [20]. A Systematic Literature Review (SLR) is an orderly method for examining and evaluating the results of earlier research. The objective of this approach is to collect relevant data, assess its quality, and provide a comprehensive analysis of the subject. In contrast to standard literature reviews, systematic literature reviews (SLRs) are carried out using well-established procedures. This procedure provides a robust framework for systematically identifying relevant literature with high precision and minimal bias [21].

2.1. Data

A descriptive and correlational design, a quantitative research tool, is employed in this study to describe the traits, patterns, and connections related to the research issue [22]. The data for this study were obtained from foreign journals listed on Google Scholar. Global journals are generally selected from Google Scholar based on several primary factors, including the ease of free access, the broad range of disciplines covered, quality assurance features such as peer reviews and citations, and the ability to locate current and relevant references. A freely accessible database is the best [23]. Google Scholar finds 88% of all citations, many of which are not found by other sources, while the other sources find nearly all of them (89–94%) [24].

Additionally, Google Scholar offers various features that facilitate researchers' management of references and tracking of the latest research developments in their fields of interest. Thus, the use of international journals from Google Scholar not only improves the quality of research but also broadens researchers' insights into global scientific developments. This platform facilitates reference management and tracking of research progress through export features to EndNote and Zotero, as well as an alert system for specific topics and authors [25].

A piece of software called Publish or Perish, developed by Harzing, gathers and analyzes scholarly citations [26]. The goal of Publish or Perish is to assist both individuals and scholars in locating and evaluating information sources [27]. Data are drawn from the Publish or Perish database of journals published between 2000 and 2025, ensuring that the sources of information used in this study encompass relevant and up-to-date scientific developments over a period of more than two decades. Applying Harzing's Publish or Perish for database research

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offers several advantages, including being open-source, free to use, and providing automatic citation metrics (such as number of publications, citation years, citation ratio, h-index, etc.) [28]. As the number of journals published annually has doubled over the last 25 years, co-authors and international collaboration have also expanded [29]. This period was selected to capture trends, innovations, and significant developments in the field of study, while providing a robust and comprehensive theoretical foundation. The studies included in this search are those released from 2013 to August 2024. During this time, revolutionary technology including decision-support systems, large data analytics platforms, and digital twins are emerging and gaining widespread adoption in transportation planning [30]. Furthermore, by choosing this time frame, researchers can compare present findings with those of earlier studies, thereby improving the accuracy and contextualization of the analysis.

The initial stage involves determining pertinent keywords for the study first [31]. The keywords "transportation," "transportation planning," "roads," "transportation methods," "traffic," "transportation development," and "traffic regulations" all appeared in the titles of the publications that were chosen. The targeted keywords modified the gathered data [32]. The systematic literature review utilized 1,000 journals, which were obtained by inputting keywords and years of publication to achieve a broad and representative coverage of the literature, thereby providing a comprehensive picture of the research topic. With this number of journals, the analysis carried out becomes more valid and reliable because it is based on various diverse and in-depth sourcesUsing text mining capabilities, VOS enables the creation of networks of co-occurrence for significant terms extracted from the corpus of scientific literature [33].

2.2. Data Collection

The Publish or Perish (PoP) application enables users to enter search parameters, facilitating data collection. A literature review on the selected topic is carried out using Publish or Perish [34]. Through the use of technologies such as Publish or Perish and VOSviewer, this study will analyze patterns among researchers, identify research trends, and assess the impact of scientific publications in this area [35]. By obtaining bibliographic metadata from numerous prestigious journal databases, including Google Scholar, Scopus, and Web of Science, Publish or Perish (PoP) is a free program created to help researchers and academics manage and evaluate the references in their coursework. The software known as Publish or Perish (PoP) scans Google Scholar for pertinent papers [36]. So that PoP automatically sorts journals that suit research needs. After the journals are selected, the data is then exported from PoP in RIS (Research Information System) file format. Numerous reference management software programs use the RIS format, a standard for exchanging bibliographic data. Its structured information, which includes title, author, publication year, journal name, and other details, makes it simpler to manage and incorporate reference data into other programs, such as EndNote, Mendeley, or Zotero.

2.3. Data Processing

Data processing is carried out using the VOSviewer application. VOSviewer is an application for building and visualising bibliometric networks [37]. In addition, bibliometric analysis has emerged as a valuable technique for quantifying the factors that determine the quality of research [38]. VOSviewer is highly useful in academic research, significantly aiding researchers in understanding citation networks and trends in the scientific literature [39]. RIS files from PoP are imported into VOSviewer to complete the data processing step, as the program supports the RIS format as a standard for exchanging bibliographic data from various sources. After importing the RIS file, VOSviewer automatically reads and organizes the bibliographic information, then presents the findings of the systematic literature review (SLR) as visual maps. These maps include information about keyword networks, author collaboration, publication year distribution, the number of journals associated with specific keywords, publishers, authors, and citations. The VOSviewer program facilitates the visualization of data, making it easier to read [40]. This visualization enables researchers to analyze patterns, trends, and relationships between data interactively and comprehensively, tailored to their specific research needs.

VOSviewer is software used to analyse bibliometric data [41]. The steps of VOSviewer involve collecting relevant journals for the topic being discussed, analyzing these journals, and reviewing them in more detail to obtain the desired results [42]. Three visualizations are then created from data sourced from a predefined database: network, overlay, and density [43]. VOSviewer's output includes Network Visualization. This graphic illustrates the web of connections among components, including keywords, writers, publications, and institutions. A node (point) represents each element, while an edge (connecting line) represents the relationships between items. The thickness of the line shows how strongly the elements are related to one another, whilst the size of the node shows how frequently the element occurs. In research, this image facilitates the identification of groups or clusters of interconnected themes.

Additionally, Density Visualisation displays the density or concentration of elements in a specific area. Areas with a denser or darker colour indicate topics or keywords that appear more frequently and are the primary focus in the literature being analysed. This visualization helps identify the areas of research that receive the most attention.

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3. Results and Discussions

A comprehensive and accurate method for reviewing and evaluating large volumes of scientific data is bibliometric analysis [44]. With the aid of bibliometric analysis, researchers can examine bibliographic information, including the examination of citations from journal articles and other scientific literature [45]. The bibliometric analysis employed for mapping these themes utilizes the software tools Publish or Perish and VOSViewer to examine the literature, which is then visualized through data mappings according to the standards of scientific writing [46]. Data gathered and sorted using Publish or Perish, based on pertinent keywords, are used in this study to demonstrate the correlation, density, and year of publication. After that, the data was analyzed and shown in VOSviewer [47]. VOSviewer offers three distinct types of visualizations: network, overlay, and density [48].

3.1. Network Visualisation

Visualisation of the correlation results shows a cluster between each keyword in this study, based on Publish or Perish and VOSviewer, using 1000 papers with the keywords' transportation', 'transportation planning', 'roads', 'transportation methods', 'traffic', 'transportation development', and 'traffic regulation'. Each cluster illustrates the relationship between two terms [49]. Furthermore, VOSviewer displays various keywords related to the selected keywords, as shown in the correlation results displayed by VOSviewer in the following image.

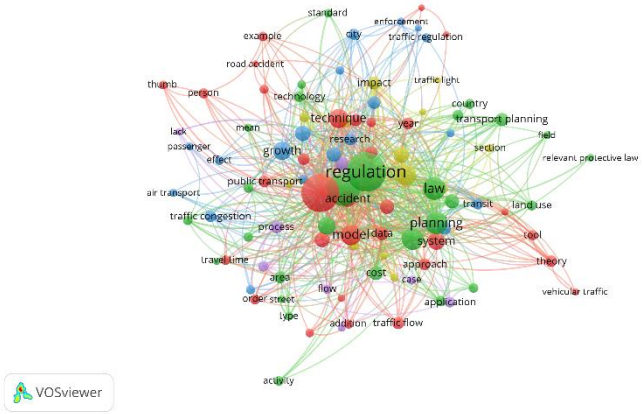

Figure 1 Network Visualisation

Data based on the VOSviewer visualisation image displays a network map of various keywords that often appear in article journal. This association reveals numerous keyword types that are strongly related to one another [50]. Each circle in the image represents a term, and the circle's size indicates the frequency with which that word appears. The more times a word appears in different research journals, the bigger the circle. In the VOSviewer results, the words "regulation," "accident," "planning," "model," and "law" emerge as the most dominant, indicating that these topics are at the center of attention in studies related to transportation, road safety, and public policy. Each line connecting the words indicates that the two words frequently appear together in the same document. For example, planning and Transport have a strong connection, meaning that both are often discussed together in the context of transportation planning. Using high-frequency keywords from the literature as the basis, word frequency analysis is employed to complete the keyword frequency statistics. By extracting high-frequency words that exceed a certain threshold for keyword analysis, we can construct a keyword network graph and represent topics through high-frequency word cluster [51].

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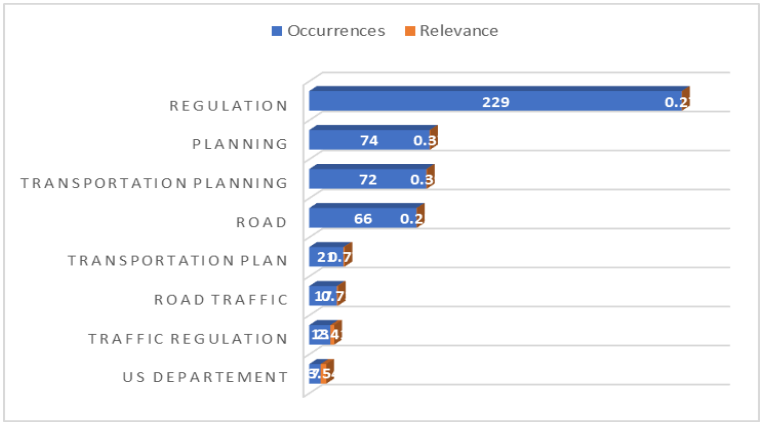

Figure 2 Keyword Graphics

The bar graph above displays the eight main keywords that appear most frequently in the research data set analyzed using VOSviewer, along with their occurrences and relevance levels. These results are related to keywords collected with Vosviewer [52]. The keyword 'regulation' occupies the top position, with a total of 229 occurrences, indicating that regulatory and policy issues are the primary focus in the analyzed publications. Although the number of occurrences is very high, the relevance level is at 0.2, which means that this word is quite commonly used but does not always describe the core content of a study specifically.

Several keywords have a low number of occurrences but high relevance, such as "transportation plan" and "road traffic," which indicate that although they do not appear frequently, these words are specific and relevant in describing the core of the studyIn this situation, a word's statistical importance increases in direct proportion to its frequency within the text. Still, it also has an inverse relationship with its frequency throughout the entire corpus of documents [53]. Overall, this graph illustrates that the focus of research is mainly on aspects of transportation regulation and planning. Keywords with high occurrences indicate broad and frequently discussed topics, while words with high relevance, even though the number is small, indicate the depth and specificity of the topic. This analysis is crucial for understanding the direction and priorities of research in the field of transportation. It can serve as a reference for designing further studies or determining the focus of a study.

3.2. Density Visualisation

The keyword density level refers to the degree of closeness between the elements in the network [54]. In density visualisation, each point on the map is colored based on the density of items around it. Colour indicates areas with high density, where many items or topics appear frequently and are interconnected, and areas with low density, where few items or topics appear rarely. The more terms or articles that are interconnected in an area, the more yellowish the colour will be, while areas that are rarely discussed will appear bluish.

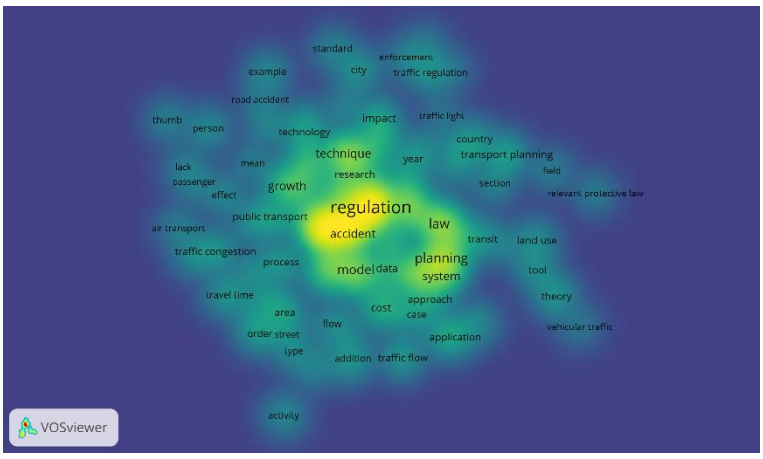

Figure 3 Density Visualisation

Density visualisation displays keywords that are more widely discussed in yellow, indicating that they are frequently discussed in research. Specifically, the keywords in this study are regulation and accident, which suggests that these keywords are popular and often serve as the primary focus. Meanwhile, the more bluish the colour of the keyword, the fewer the number of studies, namely in this study, relevant protective law, thumb, air

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transport, and activity, indicating that these topics have not received much attention or have only been discussed in a limited way.

3.3. Annual Publication Development

We can retrieve the distribution of the research year by using Publish or Perish [55]. Every year, research experiences developments in both terms of research topics and the number of studies conducted that year. Thus, the goal of this study is to illustrate the evolution of the subject and the number of publications. he influence of new developments and technologies that make it possible for researcher to conduct their studies may be what encourages researchers to write in a given year [56].

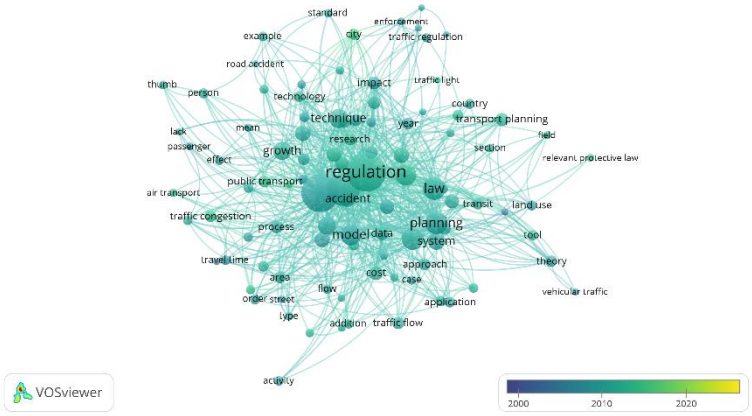

Figure 4 Overlay Visualisation

For overlay visualisation, it displays the year in which the keyword began to be discussed frequently as a keyword trend in that year. The more purplish the colour of the keyword, the longer the year the keyword was most discussed, namely the 2000s; the more yellowish the colour of the keyword, the more recent the keyword was most discussed, namely around the 2020s. In this study, the keywords that have been discussed extensively in the past include vehicular traffic and theory. The keywords most discussed at present are regulation, accident, and planning. This map helps track the development of research trends over time, allowing for comparison between active topics and those that are starting to become obsolete. Every circle in the graphic represents a keyword; the circle's size indicates the frequency of the word in the literature, and its color transitions from dark blue to yellow to illustrate the chronological distribution of the keywords [57].

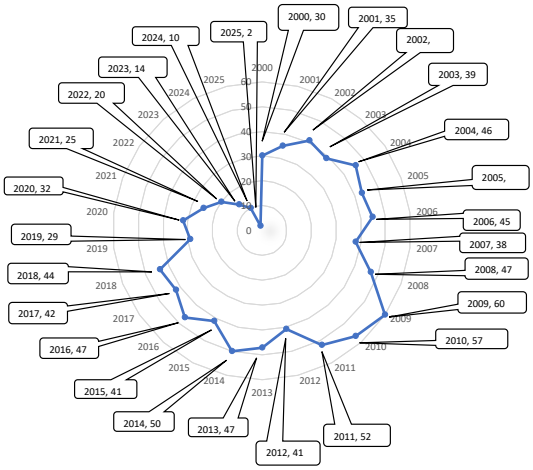

Figure 5 Annual Publication Trend

The distribution of research years can be seen in the database produced by the Perish utility or the publisher [58]. This diagram provides an overview of the annual research volume development. According to the visualization, the number of publications started to rise sharply in the early 2000s, peaking in 2009 and 2010. These two years marked the peak period of scientific productivity, which was most likely caused by the increasing global attention

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to issues of transportation, regulation, and urban planning, along with the growth of urbanisation and technology. After 2010, the quantity of publications has been decreasing, particularly in the period from 2011 to 2013, as shown by the graph, which indicates a relatively low number. However, the trend gradually increased again in the following years, especially from 2015 to 2018, with a stable figure in the range of 41–47 publications per year. Between 2019 and 2023, the number of publications declined. In 2019, there were 29 publications; however, this number dropped to 25 in 2021 and further to 14 in 2023. Overall, this graph indicates that research productivity in the analyzed field has fluctuated over time, with the most active period occurring between 2004 and 2010, followed by a fairly sharp decline in recent years.

3.4. Study Publisher Classification

Furthermore, related research is published using the data produced by the Publish or Perish service [59]. Each study has a different publisher, so the publishers are grouped with the publishers who published each study. The results of the publishers are presented in a graph that displays them from the largest to the smallest number of study publications.

Figure 6 Study Publisher

The most dominant publisher is Elsevier, with a total of 315 studies, indicating that Elsevier is the primary source of reference in related studies. Meanwhile, sites that contribute a relatively small number of publications still demonstrate a variety of sources from open databases, government institutions, and informal research-sharing platforms.

3.5. Study Type

Compilation of bibliometric information derived from a variety of publications, such as books, journal articles, components, uploaded materials, proceedings articles, reference entries, and reports [60]. The data were subsequently subjected to clustering analysis [60]. The types of studies used as sources for systematic literature reviews vary, so a graph is created to categorize these types of studies and identify the types of research publications they encompass.

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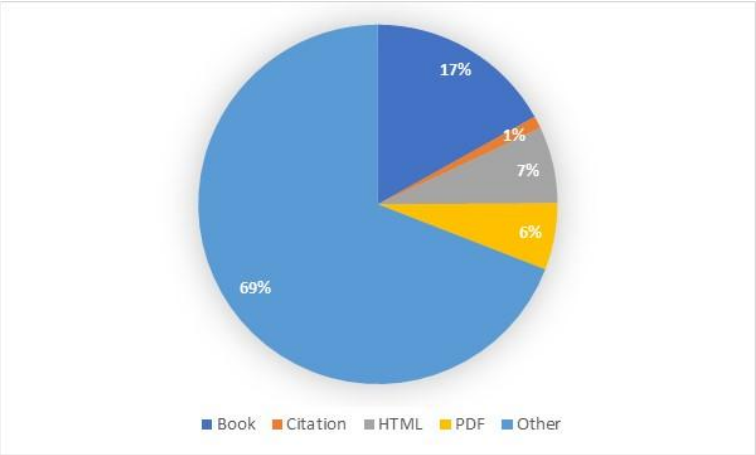

Figure 7 Study Type

From this visualisation, the reference sources used are very diverse, and each part contributes a different portion to the total data. The majority of systematic literature review results are not classified, so they are categorized as 'other'. Furthermore, there aren't many citations, which means that there aren't many references cited.

4. Conclusion

The primary focus in transportation-related research is centred on topics such as regulation, planning, and accidents. These keywords not only appear frequently but also become a connecting point between various themes in the fields of transportation and regulation. The largest publisher contributing to the field is Elsevier, indicating that journals from this publisher are the primary references in academic studies on transportation. The annual distribution shows that the peak of publication productivity occurred in 2009–2010, followed by a fluctuating trend with a decline in the last few years. The types of reference sources used vary greatly, but are dominated by the other category, which includes various unclassified document formats, as well as books that show the importance of theoretical references. Visualisation of the relationship between keywords and their distribution shows a strong link between the concepts of regulation, planning, and the transportation system as a whole. This study offers a visual representation of transportation research trends, facilitating the identification of scientific advancement paths and untapped research potential.

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