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Charting Knowledge Structures in E-Hailing Studies

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ABSTRACT

Urban transportation has undergone a global change caused by E-hailing platforms like ride-hailing and transportation network companies (TNCs). This is especially true for places like Malaysia, where Grab originated, which is still underrepresented in international e-hailing studies despite its significance. Numerous academics are interested in this field because of the possibilities of E-hailing. Readers may learn more about the subject from this study report. The study is a thorough analysis of 208 papers that were gathered between 2013 and 2025. This paper will concentrate on the results of influential authors, articles, countries/territory, and subject area. Utilizing the use of co-citation and co-occurrence networks, this paper also made an effort to identify different themes that developed and changed during the active years. The rising amount of research articles and the general acceptance of E-hailing in several nations require the implementation of bibliometric analysis to provide a comprehensive set of information that is able to assist researchers in identifying the most pertinent work that has been conducted thus far. This can be accomplished by exploring various aspects of the E-hailing research domain and identifying possible future study directions using the VOS Viewer and Biblioshiny tools

1. Introduction

The emergence of digital platforms that provide on-demand ride services also known as e-hailing, ride-hailing, transportation network companies (TNC), or ride-sharing apps has caused a paradigm change in transportation systems across the world in recent years. This was also conducted by Goh [8], contrast to traditional street-hailing of taxis or pre-booked automobiles, e-hailing refers to services where passengers request a car (or other vehicle) using an app or online platform that connects them with drivers utilizing private vehicles. These solutions maximize pricing, matching, routing, and driver availability by utilizing algorithms, mobile apps, GPS, and online payments. With

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businesses like Uber, which was established in the US in 2010 and has since spread into other foreign markets, the e-hailing industry began to take shape globally in the early 2010s. The approach offers riders more convenience, often at a reduced cost, and freedom for drivers, who are frequently independent contractors. Urbanization, traffic congestion, smartphone penetration, the constraints of current taxi or public transportation systems, and regulatory regimes have all had an impact on adoption. Due to regional legal, regulatory, economic, and geographic factors, Malaysia's e-hailing sector has developed in a significantly distinct way. In Kuala Lumpur, Uber debuted in 2013 or 2014. Local firms like Grab have grown in popularity over time. This was also conducted by Al-Shakhrit *et al*., [3], Jais *et al*., [12], since e-hailing was recognized and licensed under the rules governing public transportation and commercial vehicle operations, the legal status, regulation, and monitoring of e-hailing services have changed. For instance, e-hailing services in Malaysia have been formally regulated since January 2018 and Transportation Network Companies have been codified in policy. In Malaysia, the growth of e-hailing has brought up both benefits and difficulties. This was also conducted by Isa *et al*., [11], Jais *et al*., [12], Jamaluddin *et al*., [14], Jayaraj *et al*., [16], Mahayuddin [19] and Sadom et al., [27], it provides increased accessibility, particularly in cities; it can supplement public transportation; on the other hand, it may decrease the number of people who own cars or use inefficient taxi services. However, it also raises concerns about driver compensation, safety, legal risk, rivalry with taxi operators, environmental effect (e.g., emissions), vehicle age/safety regulations, traffic externalities, and fairness. Many of these aspects have been the subject of scholarly research, including factors that influence customer adoption, driver travel profiles and distances, user satisfaction, legal hazards, insurance and vehicle safety requirements, competition from taxis, regulatory policies, and social and economic effects. In Southeast Asia (including Malaysia), there are also issues that are specific to a given region, like the effects on the environment (air pollution, traffic), the health effects on drivers who spend a lot of time in traffic, the need for regulations to adapt to TNCs, and the need to balance the interests of traditional taxis, public transportation, e-hailing companies, drivers, and passengers. This was also conducted by Mahayuddin [19], an analysis of the literature on e-hailing services in Southeast Asia, for example, has brought to light both the possibility of lowering traffic and the number of people who own cars, as well as worries about emissions and other environmental aspects. In summary, technology, changing consumer expectations, and legislative changes have made it possible for e-hailing to revolutionize mobility. In order to design policy and ensure safety, social equality, environmental sustainability, and economic viability, Malaysia must have a thorough awareness of its history, present practices, and future directions.

E-hailing, also known as ride-hailing, ride-sourcing, or app-based for-hire transportation, has become a game-changing type of urban transportation in recent years. Smartphones, location-based services, and the trend toward more convenient, adaptable, and efficient travel are its main drivers. E-hailing is expected to become increasingly important in the next years as cities get more crowded, people become more urbanized, and people want real-time services. The scope of this expansion, its causes, effects, and obstacles to its sustainable incorporation into upcoming transportation systems are all examined in this introduction. According to a number of market projections, e-hailing will significantly grow both domestically and internationally. This was also conducted by Statista [30], with a compound annual growth rate (CAGR) of around 6.83% from 2025 to 2030, ride-hailing income in Malaysia is expected to reach about US$523.98 million by 2025. By 2030, the market's size is anticipated to reach around US$729.25 million, and user penetration will increase to approximately 31.0%. This was also conducted by Statista [30], similar trends are anticipated for the entire ASEAN region: revenues of around US$9.41 billion by 2025, increasing to US$12.63 billion by 2030, and rising revenue per user in tandem with growing user numbers (210.46 million by 2030). This was also

conducted by News Room [24], due to reasons including growing urbanization, increased internet penetration, technical innovation, and customer preference for on-demand transportation, market growth predictions are even more aggressive globally.

E-hailing can increase urban vehicle miles traveled (VMT) due to "deadheading," or drivers cruising without passengers, and the diversion of trips from more environmentally friendly modes (walking, public transportation), this was also conducted by Agarwal *et al*., [1], according to several studies on congestion and induced demand. In order to lower emissions per trip, solution strategies include regulating idle driver cruising through improved platform incentives including driver repositioning, aggregating pooling, integrating multi-modal pricing and public transportation cooperation programs, and encouraging pooled/shared e-hailing. This was also conducted by Morrison *et al*., [22], Wang *et al*., [31], some research on road safety and collision risk relates the growth of ride-hailing services to shifts in crash trends, however the findings differ depending on the situation. Platforms and regulators can implement solution methods that need in-app safety features, tiredness management, driver safety training, and crash data monitoring to pinpoint risk hotspots. Driver partners frequently deal with unstable incomes, ambiguous algorithms, and uncertain access to social safeguards, raising labor and welfare problems. Minimum-earning floors, open algorithmic accountability, transferable benefits, and regionally specific labor laws (rather than one-size-fits-all) are some of the solutions. Policy design can benefit from empirical pilots like guaranteed minimums and incentives to cut down on idle mileage.

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E-hailing, often known as ride-hailing or ride-sharing, is the term for technology-enabled services that use online platforms and mobile applications to connect drivers and customers. This “was also conducted by Jais *et al*., [12]”, Beginning in the early 2010s, e-hailing rapidly changed local labor markets, urban mobility, and regulatory frameworks in Malaysia. The first well-known local competitor was MyTeksi (later rebranded Grab), which let users to schedule rides using a smartphone app in order to solve issues with long wait times, unsafe rates, and unreliable taxis. Because of its indigenous roots, Malaysia was able to establish itself as a pioneering domestic player that could quickly expand throughout Southeast Asia and spark the development of a new transportation

ecosystem centered on smartphone use and mobile internet. Grab (formerly MyTeksi) became a multi-service "super app" in 2012 after growing from a basic taxi booking service to private car ride alternatives (GrabCar), then into food delivery, payments, and other on-demand services. This “was also conducted by Jais *et al*., [12], Lin *et al*., [17]”, with the help of the fast-growing smartphone use in Malaysian cities, this growth both mirrored and fueled growing consumer acceptance of app-based transportation. International competitors like Uber temporarily entered the Malaysian market at the same time, sparking fierce competition and public discussion over the future of passenger safety, driver protection, and taxi regulation. Scholars and policymakers interested in labor consequences, urban congestion, platform governance, and consumer protection were drawn to these platforms' explosive rise. As e-hailing grew, Malaysia's public policy reaction changed accordingly. Because digitally mediated intermediation services were not specifically covered by the road-transport laws and taxi licensing structures that were in place at the time, the business first functioned in a legal limbo. This “was also conducted by Agensi Pengangkutan Awam Darat (APAD) [2], Manaf *et al*., [20], Wong [32]”, the Land Public Transport Act and related statutes were amended by Malaysian lawmakers in July 2017 to formalize the legal status of e-hailing operators. This was a significant step that acknowledged ride-hailing as a valid transportation service and gave regulators the authority to establish safety, vehicle fitness, and driver requirements standards. In order to align e-hailing operations with public transportation safety objectives while managing disruptive market effects, subsequent regulations that were introduced in 2018 and 2019 required e-hailing drivers to obtain specific permits, PSV (Public Service Vehicle) training or licenses, insurance, and annual vehicle checks. In Malaysia's transportation literature, these legislative changes continue to be a major topic of study and policy discussions. Following that first market launch, the Malaysian e-hailing scene rapidly grew, attracting a number of regional and local competitors, including Uber for a while, local platforms like MyCar, EzCab, and MULA, and ultimately a plethora of smaller operators. This “was also conducted by Isa *et al*., [11]”, the Land Public Transport Act and related statutes were amended by Malaysian lawmakers in July But because of its active local adaption, collaborations, and service bundling (transport, food delivery, and payments), Grab became the biggest player in terms of market share and brand awareness, solidifying a platform-centric mobility ecosystem throughout Southeast Asia. A few major platforms are favored by scaled network effects and altered competition dynamics as a result of this consolidation into multi-service "super-apps." In summary, the history of e-hailing in Malaysia is a brief tale of swift technological adoption, market consolidation led by Grab, which originated in MyTeksi, tense relations with established taxi industries, and a developing regulatory framework that aims to strike a balance between innovation and the general welfare. This “was also conducted by Ideas Malaysia [10], Manaf *et al*., [20]”, this historical and institutional background offers crucial context for studies on consumer purchase intention and related constructs in e-hailing contexts. It clarifies why elements like trust, perceived safety, price sensitivity, service quality, and regulatory clarity are important to Malaysian consumers and platform strategy.

The world's cities are becoming more crowded due to urbanization and transportation congestion. Traffic congestion increases with the number of private vehicles on the road. This “was also conducted by Mahayuddin [19], News Room [24], Olayode *et al*., [25]”, e-hailing provides a substitute for automobile ownership and, with proper management, may ease traffic. Environmental issues and sustainability Ride-hailing and other shared mobility solutions may be helpful as cities look to lower emissions and their environmental impact. This “was also conducted by Mahayuddin [19], Olayode *et al*., [25]”, according to certain data, e-hailing can, in some circumstances, lower the number of people who own cars, expand or enhance public transportation, and ease traffic. But there are compromises. Policy & Regulation of the legalization and regulation of digital network transport and e-hailing businesses has allowed them to expand in many nations, including Malaysia. This “was

also conducted by Jais *et al*., [12], Olayode *et al*., [25]", how e-hailing works with current public transportation, how driver welfare is preserved, how safety is guaranteed, and how environmental effects are reduced are all determined in large part by regulation. The growth of e-hailing is favored by shifting consumer behavior among younger populations, shifting views on ownership vs access, and expectations for flexible, on-demand services. This "was also conducted by Lu *et al*., [18]", in "The Impact of Travel Scenarios and Perceptions on Choice Behavior towards Multi-Forms of Ride-Hailing Services: Case of Nanjing, China," greater use is correlated with attributes including younger age, no automobile ownership, and prior ride-hailing experience.

A wealth of empirical research examines the variables affecting the uptake and sustained usage of e-hailing. The Unified Theory of Acceptance and Use of Technology (UTAUT/UTAUT2), the Theory of Planned Behavior (TPB), the Diffusion of Innovations (DOI), and the Technology Acceptance Model (TAM) are examples of common theoretical frameworks. This "was also conducted by Elnadi *et al*., [7], Moon *et al*., [21]", Behavioral intention and adoption are strongly predicted by perceived usefulness (PU) / performance expectation and perceived ease of use (PEOU) / effort expectancy in a variety of scenarios. Commonly observed moderators or mediators include social impact, enabling factors like smartphone availability, mobile data, price sensitivity, perceived risk (safety and privacy), and trust in drivers and platforms. Information elements including real-time tracking, pricing transparency, service quality, and e-trust have a significant impact on perceived usefulness and, consequently, intention to use, according to studies that apply TAM/UTAUT to ride-hailing. Lifecycle effects are also demonstrated by longitudinal and repeated cross-section studies: platform modifications (promotions, features) modify usage patterns over time, and early adopters have different demographics and travel habits than later users. Externalities (emissions, modal shifts, congestion) and other effects on public transportation use are also measured by empirical study. These results support the idea that user behavior is a socio-technical interplay of platform design, human perceptions, urban form, and regulation that all work together to determine results.

Perceived utility (PU) and perceived ease of use (PEOU) are essential determinants of behavioral intention, according to the Technology Acceptance Model (TAM). This "was also conducted by Moon *et al*., [21]", PEOU pertains to the ease of use of the app and the payment process, whereas PU is frequently associated with time savings, dependability, and pricing transparency in e-hailing. TAM extensions in e-hailing scenarios have been validated by several research. Performance expectation, effort expectancy, social influence, enabling situations, hedonic motivation, price value, and habit are all highlighted by UTAUT/UTAUT2. This "was also conducted by Baeshen [5], Soares *et al*., [29]", variants of UTAUT better represent consumer environments where uptake is influenced by price promotions, habits, and social conventions. Strong explanatory power is demonstrated by research using UTAUT2 in ride-hailing, particularly when mediators like trust and e-satisfaction are included. Perceived behavioral control is emphasized by the Theory of Planned Behavior (TPB), attitude, and subjective standards. This "was also conducted by Javid *et al*., [15]", TPB is helpful in relating ride-hailing attitudes to intention and behavior, especially when researching public transportation substitution and modal shift. Innovation diffusion (DOI) and sociotechnical viewpoints: In addition to emphasizing structural and contextual restrictions (infrastructure, regulation). This "was also conducted by Ruangkanjanases *et al*., [26]", that are essential for policy research, these frameworks explain adoption through relative advantage, compatibility, complexity, trialability, and observability.

Although e-hailing has attracted growing scholarly attention in recent years, existing studies are often fragmented, focusing on isolated themes such as consumer adoption, safety, environmental concerns, or regulatory challenges. A major research gap lies in the absence of a comprehensive bibliometric analysis that systematically maps the intellectual structure, influential authors, dominant countries, and thematic evolution of e-hailing research. Additionally, there is a strong

regional imbalance, where countries such as China, Singapore, and the United States dominate in both publications and citations, while Malaysia despite being the birthplace of Grab and a key player in Southeast Asia's e-hailing landscape remains underrepresented in terms of global scholarly impact. Important but underexplored areas include the systemic integration of e-hailing with public transportation, the long-term welfare of gig workers, sustainability through electrification, and the application of cutting-edge technology for congestion control and fleet optimization, such as artificial intelligence. The significance of this study lies in its ability to consolidate and synthesize fragmented knowledge through bibliometric analysis, providing a clear overview of publication trends, leading journals, influential works, and evolving research themes. By highlighting underexplored areas and regional disparities, the study not only enriches academic understanding but also offers practical insights for policymakers and industry stakeholders. In particular, it informs regulatory decisions that must balance innovation with public safety, driver welfare, environmental sustainability, and the integration of e-hailing into broader urban mobility systems. Moreover, by focusing on Malaysia and the ASEAN context, this study contributes a localized perspective to a field often dominated by research from developed economies, thereby offering guidance for future research and supporting the development of more sustainable and inclusive e-hailing ecosystems. Through bibliometric analysis, the endeavor will provide answers to a number of questions. To find the entire number of publications on the subject of e-hailing, explore scholarly databases and research archives. Examine the publishing pattern over time by analyzing the annual number of research articles published. List the names of reputable scholarly publications that regularly publish articles about e-hailing. To find out which nations are publishing the most on this subject, look for studies or analysis on the geographic distribution of e-hailing research. Determine which writers, based on their volume of publications and number of citations, are most pertinent and important in the e-hailing space. Locate the titles of research articles that have received a lot of citations, making a distinction between papers that have received a lot of citations locally and those that have received a lot of citations globally. Locate the research paper title that has received the most citations or references. To ascertain the present and developing theme structure of e-hailing research, examine previous literature reviews and meta-analyses. The purpose of this study was to enhance earlier findings by describing publishing trends on E-hailing using bibliometric analysis of the Scopus database. In addition to the most often cited works, publishing patterns, and co-occurrence of the author's keywords, this study looked at a range of publications in terms of accessibility, language, topic matter, and source title. The remainder of the paper will be arranged as follows. Part (2) will offer the methods for bibliometric analysis, while Part (4) will present the results and conclusion.

2. Methodology

The analysis will be carried out using the bibliometric toolkit. The toolkit includes two methods: the primary and enrichment techniques. The technique consists of two important components: performance analysis (A) and science mapping (B). Although the primary approaches may be used for a wide range of investigations, this research study will concentrate on a few of them. Two pieces of software, R and VOSViewer, helped with the bibliometric. Bibliometric analysis is a quantitative examination of a large collection of data, with results provided as themes, networks, research elements, and descriptive analysis. The evolution and thematic structure of a certain area may be analyzed using this bibliometric approach, which "was also attempted by Badenes-Rocha *et al*., [4]". Furthermore, this study is devoid of subjective bias. Nasir *et al*., [23] also analyzed the bibliographic data used in this work." Science mapping and performance analysis were utilized to determine trends and research directions. Performance analysis is a tool for evaluating the contributions of research

participants, such as authors, counties, publishers, publications, and institutions in the topic region. Science mapping aims to connect research components. As "also conducted by other studies [4], [23]," combining scientific mapping and enrichment methodologies provides us with the conceptual framework of a study area and the essential subjects of the issue, building a link between different research portions.

2.1 Bibliometric Search

Scopus data is used to create a bibliometric analysis database. The Scopus database, which "was also undertaken by Jakhar *et al*., [13]" is considered the most scientific and systematic database for bibliometric analysis. Scopus has been acknowledged as the greatest database for bibliometric analysis, in addition to the aforementioned remark that "previous studies [4], [23]" As a result, it can be said that Scopus is the most comprehensive database that contains a wide range of information about publications, and that papers must fulfill tight requirements to be included in this database.

To choose the optimal search, several keywords are found, including "taxicabs," "e-hailing," and "ride-hailing." The most appropriate keyword was "e-hailing". This article will discuss e-hailing. A search on the Scopus database for the keyword "e-hailing" yielded 208 publications.

2.2 Filtration

Only English-language articles were selected using the first filter, the language filter. The selected articles were then published in journals. There were 208 final papers selected for examination. Because further filtration may reduce the number of articles and alter the bibliometric analysis, just these two sorting criteria were utilized.

3. Results

3.1 Total Publication and Number of Active Years of Publication

The entire publication is a performance analysis approach. The total number of publications on the subject issue is taken into consideration. The 208 findings from publications published each year are included in the annual scientific production. The articles were organized into categories according to the year they were published in the journals. Figure (1) shows that e-hailing research grows on a yearly basis. Only one publication was made in 2013, but by 2018, there were 19 publications in total, with 22 and 28 in 2023 and 2024, respectively. 21 documents are counted till August 2025. The phrase "active years of publishing" refers to the number of years that research has been done in the field to examine the phenomena. Groundbreaking research is still being conducted, and the active year begins in 2013. Given the pattern shown in Figures (1) and (2), there are still comparatively fewer studies conducted annually; as a result, there is need for further study on this subject.

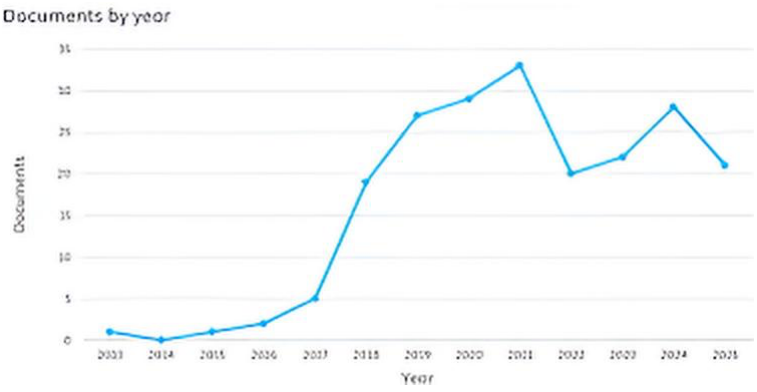

Fig. 1. Shows year-to-year publications from 2013 to 2025

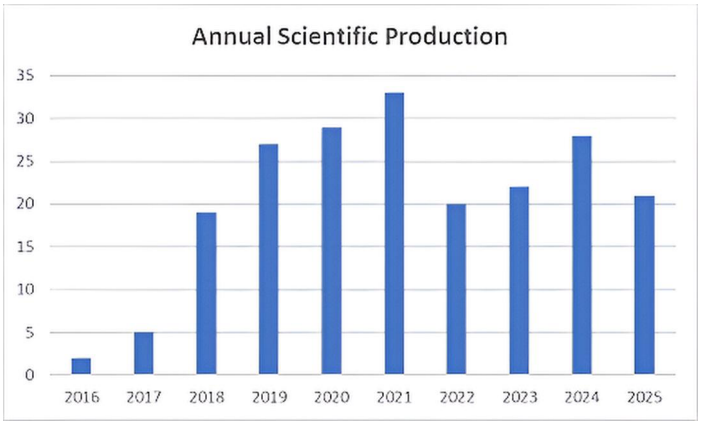

Fig. 2. Shows year-to-year publications from 2016 to 2025

3.2 Most Promising Journals

Promising journals are those that publish the highest number of papers on a certain field. In order to find prospective publications, we used R software to apply Bradford's rule. Table (1) displays the most promising papers from the top ten journals in the e-hailing field. The Transportation Research Part C: Emerging Technologies publication stands out from the others with fourteen papers devoted to the topic of e-hailing. Among other journals, Transportation Research Part B: Methodological has an edge in the e-hailing field because to eight articles that placed second. Compared to other publications, Lecture Notes in Computer Science stands out with seven papers covering the e-hailing industry. Publishing works that had potential led to the selection of Bradford's legislation for scrutiny. The outcome was a graph showing the number of articles published by a journal together with the name of the source. The graph was then transformed into a table, as seen in Table (1). Scholars will be able to quickly find and choose a handful of journals that will assist their study of e-hailing and future research thanks to Bradford's legal analysis, which identifies the most relevant journals that are leading the way in providing material relating to e-hailing. The more articles a journal publishes on a certain subject, the more of an influence it may have on subsequent researchers in that area.

Table 1
Shows the name of the journal along with the number of a paper published

No.	Name of journals	No. of published
1.	Transportation Research Part C: Emerging Technologies	14
2.	Transportation Research Part B: Methodological	8
3.	Lecture Notes in Computer Science	7
4.	Transportation Research Part E: Logistics And Transportation Review	6
5.	Transportation Research Record	5
6.	Iop Conference Series: Earth and Environmental Science	3
7.	Plos One	3
8.	Sustainability (Switzerland)	3
9.	Transportation Research Part A: Policy and Practice	3
10.	Travel Behaviour and Society	3

3.3 Dominant Countries

Countries that rank first in the area of research in terms of both published papers and citations are considered to be leaders in the subject. The analytical job involves examining the database using R software. To determine which countries, dominate the e-hailing market, we analyse the data according to citations and scientific output. To find out which countries are dominating, we look at both the number of articles and the number of citations. For this reason, we will be looking at the top 10 countries from both perspectives. While Singapore has the highest average article citations (211.00), China has more documents than any other country (61). This information may be derived by looking at numbers (2) and (3), which reveal the leading nation. To everyone's astonishment, the US comes second for average document citations with just 38 articles. Colombia was behind several other countries in terms of citations, even though it had more published papers than them. These countries included Brazil, Australia, and others. The scenario in Malaysia is quite similar. This country's American counterpart submitted more articles with less citations. To make the study easier to understand, the data from figures (3) and (4) were translated into a tabular format in Table (2). It follows that China and Singapore are leading the pack when it comes to studying e-hailing. This area is dominated by four countries: Colombia, the US, the UK, and Australia.

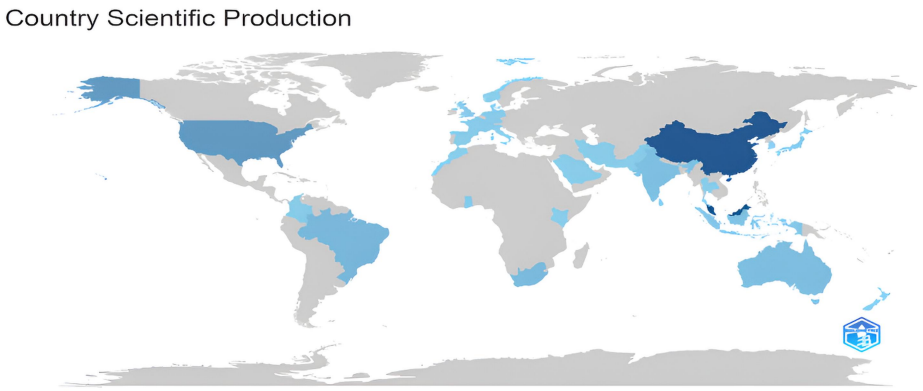

Fig. 3. Shows a world map depicting the number of documents published by each country

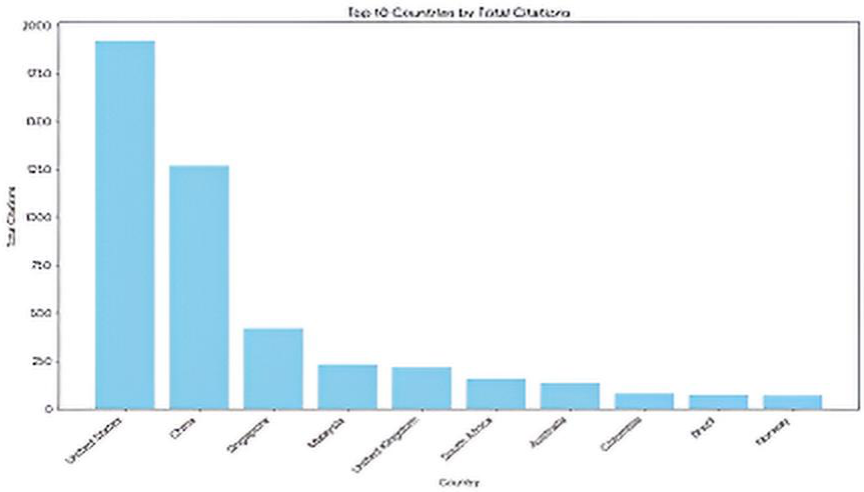

Fig. 4. shows the number of citations received by each country's documents.

Table 2
Shows the countries' names, the number of documents published and the number of citations received

Rank	Country	Documents	Rank	Country	Average Article Citations
1	China	61	1	Singapore	211.00
2	Malaysia	53	2	United States	50.61
3	United States	38	3	Colombia	39.50
4	South Africa	15	4	Norway	35.50
5	Australia	10	5	United Kingdom	31.14
6	Brazil	9	6	China	20.80
7	United Kingdom	7	7	Australia	13.70
8	Colombia	2	8	South Africa	10.60
9	Norway	2	9	Brazil	8.33
10	Singapore	2	10	Malaysia	4.42

3.4 Most Relevant Authors

To find the most relevant authors, look at their publication rates. The R software then determined it by tally of all the papers they had produced about e-hailing. A higher number of publications authored by an author is associated with a greater level of relevance, according to the statistics. Figure 5 displays the 10 authors who are most relevant (5). The evidence clearly shows that Ramezani possessed eight documents each. Readers may have a better understanding of the work of the top 10 authors listed and identify areas that need more attention. Wang and Xing have both contributed significantly with their five papers.

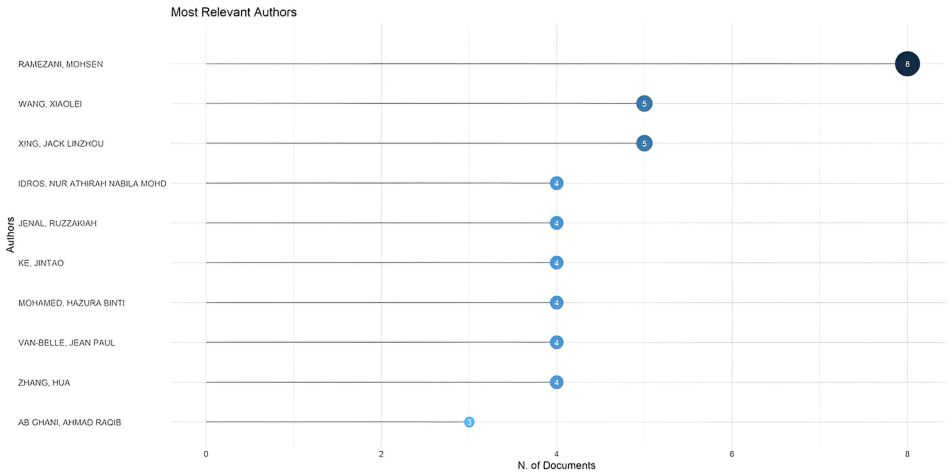

Fig. 5. Shows the authors' names and the number of papers published by them

3.5 Influential Authors

In every given topic, the most cited writers are those who have garnered the most number of scholarly articles. All that is required are the citations. Thus, writers were ranked according to the total number of documents they received. on terms of the number of papers on an author's account, the most well-known writers will have the most, whilst the least-known writers would have the fewest. It is evident that authors like He Fang (496 total papers) and Yang Hai (648 total documents) are at the top of the list. On the other hand, Wang Xiaolei and Wang Hai are ranked third and fourth, respectively, among the writers. In figure (6), you can see the remaining writers.

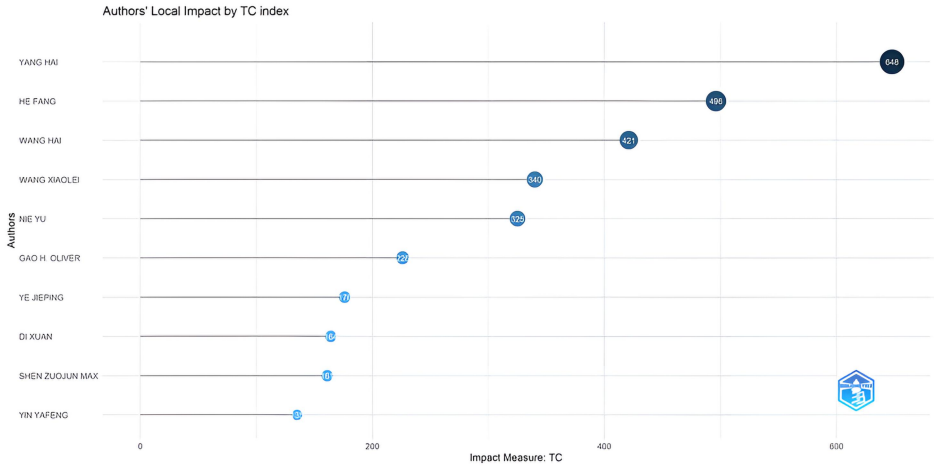

Fig. 6. Shows authors' names and numbers of total document

3.6 Citation Analysis

Citation analysis is a scientific mapping approach. When a publication is referenced by another publication, it links the publication. This "was also done by *Jakhar et al.,* [13]". Two criteria are used for citation analysis: (1) global citation and (2) local citation. The quantity of citations an article obtains from readers may be used to gauge its impact in citation analysis.

3.6.1 Most global cited documents

Publications that get the highest number of citations outside of any kind of filtering including subject domain are called the most globally referenced literature. According to Jakhar *et al*., [13], this study was also conducted. A publication is considered to have received global citations if and only if it has been referenced both inside and outside of its subject area. It is arguable that the ten most cited publications in the world significantly influence the choice of citation style used by subsequent authors. References to these sources are made in both publications that address and those that do not address e-HAILING. Figure (7) shows the top 10 papers, and table (3) provides an analysis of them. Table (3) includes the names of the top ten most referenced publications on a worldwide scale, along with the number of citations, authors, and articles for each. This data was derived from Figure (7).

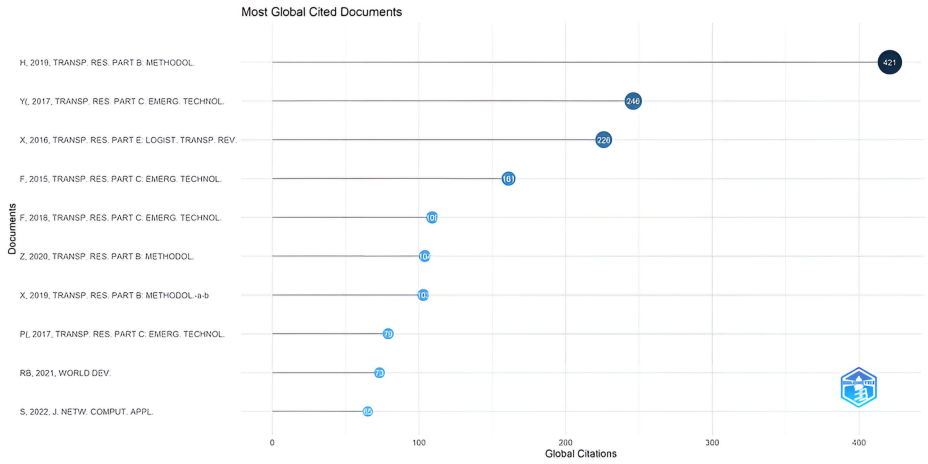

Fig. 7. Shows the most influential papers in terms of global citation

Table 3
Shows the article name, authors' name, and citations of the top 10 globally cited documents

No.	Article Title	Authors	Global citation
1	Ridesourcing systems: A framework and review	Wang, H., & Yang, H. (2019)	421
2	How can the taxi industry survive the tide of ridesourcing? Evidence from Shenzhen, China	Nie, Y. M. (2017)	246
3	Pricing strategies for a taxi-hailing platform	Wang, X., He, F., Yang, H., & Gao, H. O. (2016)	226
4	Modeling taxi services with smartphone-based e-hailing applications	He, F., & Shen, Z. J. M. (2015)	161
5	Pricing and penalty/compensation strategies of a taxi-hailing platform	He, F., Wang, X., Lin, X., & Tang, X. (2018)	109
6	On the supply curve of ride-hailing systems	Xu, Z., Yin, Y., & Ye, J. (2020)	104
7	A Markov decision process approach to vacant taxi routing with e-hailing	Yu, X., Gao, S., Hu, X., & Park, H. (2019)	103
8	Connecting e-hailing to mass transit platform: Analysis of relative spatial position	Chen, P. W., & Nie, Y. M. (2017)	79
9	Digital platforms and institutional voids in developing countries: The case of ride-hailing markets	Heeks, R., Gomez-Morantes, J. E., Graham,	73

		M., Howson, K., Mungai, P., Nicholson, B., & Van Belle, J. P. (2021)	
10	Towards blockchain-IoT based shared mobility: Car-sharing and leasing as a case study	Auer, S., Nagler, S., Mazumdar, S., & Mukkamala, R. R. (2022)	65

3.6.2 Most local cited documents

Articles that "was also undertaken by Jakhar *et al*., [13]" reference other articles in the same field since they are considered local cited papers because they are discussed within the topic domain. Local citations, otherwise stated, are ones that are unique to the subject area of the resources. One study on e-hailing cites another paper on the same topic as an example. Consequently, most articles that are cited locally focus on works that are often discussed or referred to in the field. To learn more about the subject, look at the documents shown in figure (8). In the realm of e-hailing, these papers are particularly relevant and may be seen as reliable sources for obtaining initial documentation. For the reasons laid forth in their description, it is important to note that local citations will never exceed global citations. Table (4) concludes the study of Figure (8).

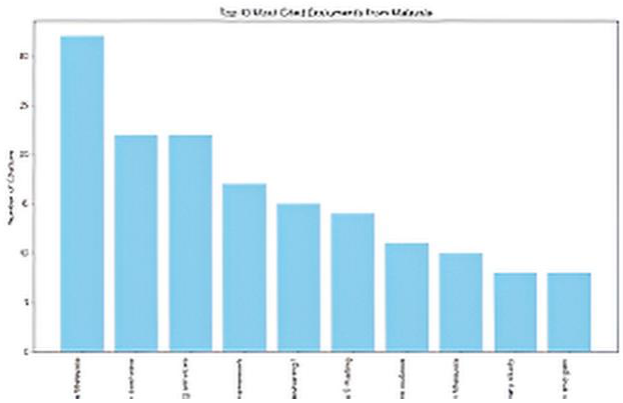

Fig. 8. Shows documents receiving a total number of local citations

Table 4
Shows the article name, authors' name, and citations of the top 10 locally cited documents

No.	Article Title	Authors	Local citation
1	Gig Workers, Social Protection and Labour Market Inequality: Lessons from Malaysia; Pekerja Gig, Perlindungan Sosial dan Ketidaksamaan Pasaran Buruh: Pengajaran daripada Malaysia	Uchiyama, Y., Furuoka, F., Akhir, M. N. M., & MN, M. (2022)	32
2	Cyber-physical-social systems: An overview	Reine, R., Juwono, F. H., Sim, Z. A., & Wong, W. K. (2021)	22
3	To grab or not to grab?: Passenger ride intention towards e-hailing services	Teo, B. C., Mustaffa, M. A., & Rozi, A. M. (2018)	22
4	Service Quality of Bus Performance in Asia: A Systematic Literature Review and Conceptual Framework	Bakar, M. F. A., Norhisham, S., Katman, H. Y., Fai, C. M., Azlan, N. N. I. M., & Samsudin, N. S. S. (2022)	17

5	Ride or not to ride: Does the customer deviate toward ridesharing?	Shamim, A., Khan, A. A., Qureshi, M. A., Rafique, H., & Akhunzada, A. (2021)	15
6	The use of expert review in component development for customer satisfaction towards E-hailing	Idros, N. A. N. M., Mohamed, H., & Jenal, R. (2020)	14
7	E-hailing services in Malaysia: Current practices and future outlook	Jais, A. S., & Marzuki, A. (2020)	11
8	A review and conceptual development of the factors influencing consumer intention towards E-hailing service in Malaysia	Arumugam, V., Ismail, M. R., & Joeharee, M. (2020)	10
9	Determinant factors of customer satisfaction for e-hailing service: A preliminary study	Mohd Idros, N. A. N., Mohamed, H., & Jenal, R. (2018)	8
10	Is the well-being of gig workers in Malaysia better? The reality of pain and gain	Abd Samad, K., Abd Rahman, N. H., Ismail, S., & Marmaya, N. H. (2023)	8

3.7 Co-citation Analysis

Collaborative citation analysis is one way to map scientific literature. It is considered that two references are connected or have a similar content structure when they are discussed together in a third work. Co-citation analysis, which "was also undertaken by Jakhar *et al*., [13]," is a tool for revealing the theoretical underpinnings of a certain profession. This method also helps us find the most significant articles by using the clusters we generated. A specific basis serves as the basis for each cluster, which all have a common subject. Once the documents have been clustered, the most relevant articles for each topic may be found using the co-citation analysis. This analysis allows researchers to get additional knowledge about the article according to their interests. Furthermore, academics of the future may compile works on a certain subject by perusing the relevant journals. When doing the analysis, the VOSViewer application makes use of a co-citation strategy. We choose just those books and journals that have received at least five citations in other published works. Out of 520, just 23 make it to the citation limit. We looked at Figure 9 by giving the linkages some weight.

Fig. 9. Shows a map of co-citation analysis based on the authors' name

It produces a total of five clusters. To demonstrate the extent to which other publications are connected to those in the reference list, you might give more weight to the relationships. A higher number of links indicates that the work is more suited for study.

Table 5
Shows the interpretation of the co-citation map

Colour of cluster	Author name	Citation
Red	Anderson	12
Green	Cramer	8
Bule	Arnott	13
Gold	Agatz	9
Purple	Acheampong	7

This bar chart, titled "Document by author," in Figure (10) illustrates the number of documents published by a selection of authors. The y-axis represents the number of documents, while the x-axis lists the authors. Ramezani, M. is the most prolific author, having published 8 documents. This is significantly more than the other authors. There's a tie for second place between Wang, X. and Xing, J.L., who have both published 5 documents. The next group of authors, Jenal, R., Ke, J., and Mohamed, H., are tied at 4 documents each. The remaining authors, Ambak, K., Di, X., Fang, Z., and Haddad, E.A., have all published the same number of documents, with each contributing 3. The chart visually represents the publication output, showing a sharp drop from the leading author to the rest of the group and then a more gradual decline.

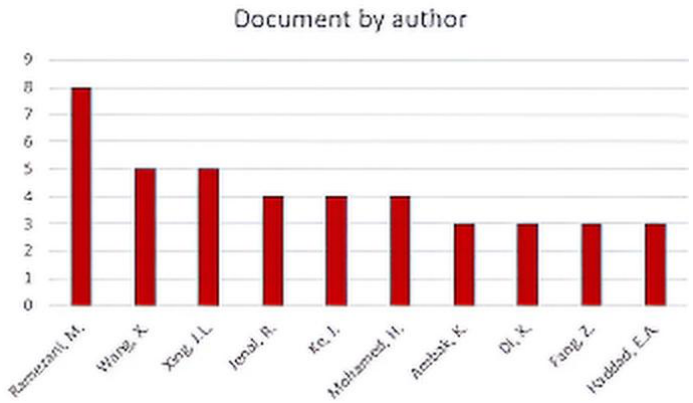

Fig. 10. Shows of highest document from authors' name

This Table 6. shows the author pair of the collaborations," lists the top 10 author pairs based on the number of collaborations they've had. The table has three columns: No. (ranking), Author Pair, and Collaborations (the number of joint publications). The top three author pairs Stoeger Heidrun and Ziegler Albert, JN Stinson Jennifer N and Lindsay Sally, and CB Muller Carol Blue and PB Single Peg Boyle are tied for the highest number of collaborations, with 5 each. The next five pairs, including FJ García Peñalvo Francisco José and Tinoco Giraldo Harold, Cagliostro Elaine and Lindsay Sally, JD Leck Joanne D and JN Stinson Jennifer N, JD Leck Joanne D and Lindsay Sally, and PB Single Peg Boyle and RM Single Richard M, have all collaborated 4 times. Finally, the last two pairs on the list, DK Levine Deb K and MR Kaufman Michelle R and MR Kaufman Michelle R and Wright Kate, have each collaborated 3 times. This table effectively ranks the most frequent author pairs, with the highest frequency being 5 collaborations.

Table 6
Shows the author pair of the collaborations

No.	Author Pair	Collaborations
1.	Idros, Nur Athirah Nabila Mohd and Jenal, Ruzzakiah	4
2.	Idros, Nur Athirah Nabila Mohd and Mohamed, Hazura Binti	4
3.	Jenal, Ruzzakiah and Mohamed, Hazura Binti	4
4.	Md Lazam, Nor Azlinah and Qureshi, Mohammed Naeem	3
5.	Jiao, Guipeng and Ramezani, Mohsen	3
6.	Su, Hang and Wang, Xiaolei	3
7.	Su, Hang and Xu, Min	3
8.	Su, Hang and Zhang, Xiaoning	3
9.	Wang, Xiaolei and Xu, Min	3
10.	Wang, Xiaolei and Zhang, Xiaoning	3

3.8 Co-occurrence Analysis

Using "author keywords" is also used in co-occurrence analysis, another scientific mapping approach. The study includes the author's chosen keywords as it is focused on the author's selected research approach. Similar to what "was also undertaken by Jakhar *et al*., [13]," co-word analysis groups words that appear together into themes or clusters. Since we are only interested in those specific keywords, we restrict our research to those that occur in five or more publications.

Which are typically utilised by numerous authors to check how a subject of research is running, and only strong words may be investigated. There are 79 words that meet the requirement. The co-occurrence analysis, which made use of Figure (11) and Table (7), was used to construct five categories. The phrase "taxicab" has appeared 38 times and "e-hailing" 54 times; the term's strength is proportional to its circle size. Among the red-highlighted words in cluster (1), "taxicabs" appeared 38 times, "taxi transport" 20 times, and "China" 13 times. Among the green phrases found in cluster (2) are "commerce" (14), "transport network," and "transport network" (13). Concentrated in a blue cluster (3) are phrases like "e-hailing" (54), "ride-hailing" (12), and "Malaysia" (11). In cluster four, which was gold in colour, were the following terms: "traffic congestion," "transport system," and "travel behaviour" (13). The purple fifth cluster contains the following terms: public transportation (10), e-hailing service (10), and urban transportation (3).

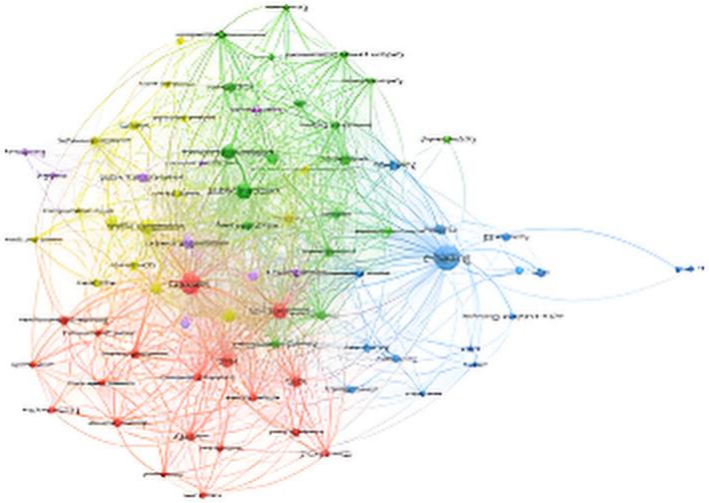

Fig. 11. Shows a map of the co-occurrence of keywords

Table 7
Shows various keywords formulated through co-occurrence analysis

Colour of cluster	Keywords	Link	Total link strength	Times appeared
Red	taxicabs	67	237	38
	taxi transport	63	172	20
	China	45	77	13
Green	commerce	45	98	14
	transportation network	52	131	13
	on demands	42	90	12
Blue	e-hailing	71	158	54
	ride-hailing	39	58	12
	Malaysia	13	18	11
Gold	traffic congestion	55	121	20
	transportation system	62	128	15
	travel behavior	46	87	13
Purple	urban transportation	51	80	13
	e-hailing service	28	36	10
	public transportation	29	38	10

3.8.1 Thematic analysis

As seen in Figure (12), theme clusters were created using co-occurrence analysis. Another group that did this was Jakhar *et al*., [13] Clusters of related subjects are generated by the scientific mapping method known as co-occurrence analysis, which groups together concepts that occur together often. A wide variety of topics evolved, and each phrase was selected accordingly. The reason for this is because all keywords paint a more realistic picture for theme development, which takes into account the words used in the abstract, title, and keywords. Thematic analysis only included terms that appeared in papers 10 times or more, so the total keyword coverage exceeded the author's keyword coverage. Keywords with a higher document frequency were also taken into account. Due to the fact that a keyword's field significance increases with each subsequent appearance in a paper, we must assign it a weight of 10 before it occurs in any papers. Second, several weights were tested using a hit-and-miss method; conclusions were clear and illuminating when the weight was ten times. The baseline, which gave importance to cases of keywords, was met by a total of twenty-four terms. A total of four clusters were produced. Theme 1 talks about the role of transportation systems and their operational aspects. The terms "fleet operations," "mobility," and "on-demands" point to the practical management and dynamic nature of modern transport. The inclusion of "public transport," "public transportation," "transportation network," "transportation system," and "urban transport" highlights a strong emphasis on large-scale, structured, and city-centric transport solutions. The presence of "ride-hailing" suggests that this cluster also considers new, technology-driven forms of urban mobility alongside traditional systems. Theme 2 aims to 7 items, this cluster addresses the economic and behavioral dimensions of the transportation topic. The terms "costs" and "commerce" directly relate to the financial side of transportation. "Competition" indicates an analysis of market dynamics within the sector. The items "China," "taxi transport," and "taxicabs" seem to ground these economic and competitive factors in a specific geographic context and a particular mode of transport. The inclusion of "travel behavior" shows an interest in how individuals interact with and make decisions about these systems. Theme 3 is all about the highly specific and appears to be centered on the e-hailing industry and its local context. The terms "e-hailing" and "e-hailing service" are the

core of this group, indicating a direct focus on this specific type of service. The term "Malaysia" provides a clear geographical context, suggesting the study is localized to this country. The presence of "motor transportation" links e-hailing to the broader category of transport, while "surveys" suggests a methodology used to gather data, likely related to user behavior or market insights within this context. Theme 4 is all the advanced or technical concepts. "Reinforcement learning" is a term from artificial intelligence and machine learning, which indicates that your analysis may touch on how these technologies are used to optimize transportation systems, such as for fleet management or traffic flow. "Traffic congestion" is a major problem in urban transport and is a key issue that advanced technologies are often used to solve. This cluster likely represents a more specialized or forward-looking aspect of your research. Here, analysis follows the same principle as cooccurrence: the bigger the visible circle, the more weight a word is assigned.

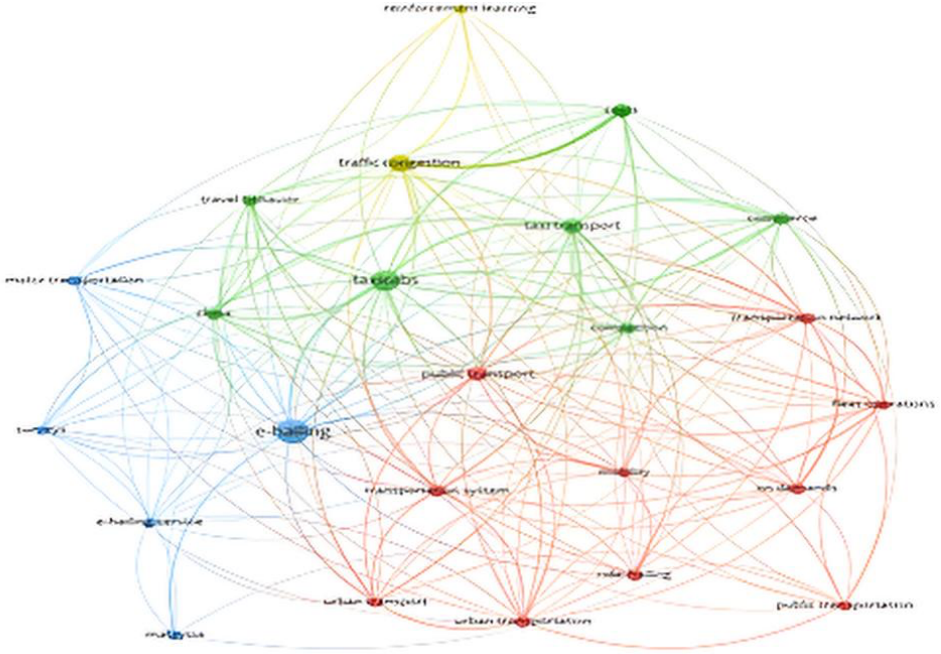

Fig. 12. Shows a map of co-occurrence analysis to form themes through all keywords

3.9 Thematic Evolution

Thematic evolution is used to determine the direction of the trend, the diversification of the subject throughout time, and the paradigm change. Time is broken down into groups in theme progression in order to examine changes across time. Based on the Figure (13), analysis of publication trends and key research topics, the thematic evolution of e-hailing has progressed through distinct phases. The thematic evolution of e-hailing research over the past decade reflects the dynamic and rapidly changing nature of urban mobility, technological adoption, and transportation systems. As illustrated in the frequency of the top fifteen keywords across the years, scholarly attention toward e-hailing began to gain momentum around 2016 but surged significantly after 2018. Early studies between 2013 and 2016 were relatively limited, with sporadic appearances of keywords such as public transport, transportation system, and behavioral research. These initial discussions often revolved around integrating e-hailing into existing mobility frameworks and understanding the implications of ride-hailing services on traditional transport modes. The year 2018 marks the turning point in thematic growth, coinciding with the global rise of platforms such as Uber, Didi, and Grab, which reshaped mobility patterns in both developed and developing contexts. During this period, the keyword China emerged strongly, reflecting the country's central role in both the rapid adoption of

e-hailing technologies and the regulatory challenges that accompanied their expansion. The steep rise of keywords such as competition and traffic congestion after 2018 further demonstrates scholarly interest in the socio-economic and infrastructural impacts of e-hailing. These topics highlighted concerns regarding the disruption of taxi industries, price competition, and the worsening of congestion in urban centers due to the proliferation of ride-hailing vehicles. By 2019 and 2020, the frequency of certain keywords such as behavioral research and e-hailing reached their peak. This reflects an intensified focus on understanding consumer adoption, preferences, and travel behaviors. The dominance of behavioral research during this period also indicates the growing need to analyze not only technological adoption but also how users make decisions between e-hailing and other transport modes. Simultaneously, fleet operations and logistics gained scholarly traction, suggesting an expanding discourse on operational efficiency, sustainability, and the optimization of e-hailing platforms. These themes were likely amplified by the increasing reliance on digital platforms during the COVID-19 pandemic, when mobility restrictions forced both users and companies to rethink traditional mobility and logistics models. After 2021, thematic diversity increased as multiple keywords maintained relatively balanced frequencies rather than a single dominant theme. This indicates a maturing field of study where researchers explored broader perspectives rather than focusing solely on adoption or competition. Keywords such as traffic congestion, transportation network, and public transport appeared more frequently, showing a shift toward evaluating systemic impacts and integration of e-hailing within multimodal transport networks. At the same time, sustained attention to sustainability and electric transport signaled a pivot to addressing environmental concerns, especially as governments began emphasizing decarbonization of transport systems. The discussions on environmental sustainability also reflect the growing awareness of e-hailing's role in contributing to emissions and the potential for mitigation through fleet electrification. In recent years, especially from 2022 onward, the thematic landscape appears more fragmented yet comprehensive. Rather than a singular dominant keyword, research themes spread across user behavior, traffic impacts, operational efficiency, and system-wide integration. This suggests that e-hailing research has evolved from exploratory adoption studies into a multifaceted field engaging with complex issues such as sustainability, congestion management, and the future of transport systems. Overall, the thematic evolution underscores a trajectory from initial curiosity and adoption, through phases of disruption and critical examination, to current discussions of long-term sustainability and systemic integration in global transportation networks.

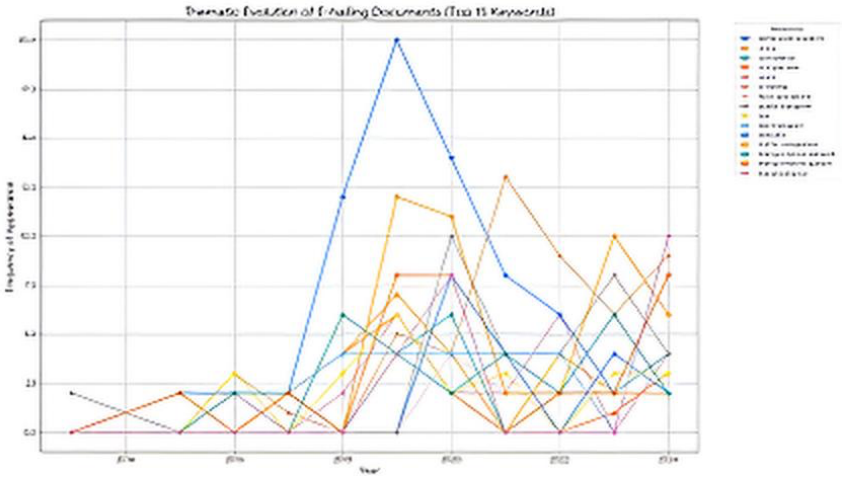

Fig. 13. Showcases thematic evolution

3.10 Discussion

Through offering a thorough bibliometric analysis of e-hailing research, which providing a thorough and objective examination of the e-hailing research sector. The main advantage of the study is that it provides an extensive bibliometric analysis, a quantitative evaluation of a large amount of data, of e-hailing research. The study is thought to be devoid of subjective bias, and this approach aids in characterizing publishing trends. It makes use of two crucial bibliometric toolbox techniques. scientific mapping and performance analysis. While scientific mapping identifies links between various research components, performance analysis looks at the contributions of authors, nations, publishers, and organizations. Scholars and researchers benefit from the study's comprehensive summary of the state of the field. An examination of publishing trends over time reveals that research on e-hailing is expanding yearly, with a notable surge in publications since 2013. This suggests that further research is necessary because the area is still in its infancy. Anyone wishing to enter the area or identify a research gap to fill will find this to be a useful insight. Another important advantage is the examination of interesting articles. The study determines which leading journals, including Transportation Research Part C: Emerging Technologies and Transportation Research Part B: Methodological, often publish articles on e-hailing using Bradford's law. This increases the likelihood that researchers will be published in high-impact, pertinent journals by enabling them to swiftly find and select those that will support their study and future research. The more papers a journal publishes in a certain discipline, the more it can impact future researchers in that field.

Furthermore, leading nations in the study of e-hailing. China has the most documents, while Singapore has the greatest average number of article citations, according to an analysis of both publication and citation counts. Despite producing fewer publications than some other nations, the US also has a high citation count. Understanding which regions are leading the subject might be helpful for international partnerships and determining regional research goals, according to this geographical distribution analysis. Most significant and pertinent writers. Leading contributors like Ramezani, who has eight documents, and Yang Hai, who has 648 total documents, are highlighted by rating writers according to their publication volume and overall citation count. To identify important specialists whose work is highly acclaimed and widely mentioned, as well as to comprehend the fundamental work in the subject, this knowledge is essential for novice researchers. Citation and co-citation analysis are two of the study's main advantages. The study finds the most significant publications both inside and outside the e-hailing industry by distinguishing between global and local citations. For example, Wang and Yang's "Ridesourcing systems: A framework and review" has 421 worldwide citations. By clustering linked publications into groups that each reflect a distinct subject, the co-citation analysis further reveals the field's conceptual structure. This makes it easier for scholars to locate relevant material and comprehend the fundamental subjects. This is further supported by co-occurrence analysis, which highlights significant terms like "taxicabs," "e-hailing," "traffic congestion," and "public transit" by forming thematic clusters based on author-used keywords. The structure and historical development of the area are clearly depicted by this thorough thematic mapping.

4. Conclusions

To better comprehend the realm of e-hailing, the major objective of the article was to do a bibliometric study of the gathered data. This analysis focused on the direction of research, the formulation and evolution of themes, network analysis, and trends in E-hailing. The bibliometric analysis helped collect vital information about the e-hailing and to uncover the topic's various

taxicabs, e-hailing, and ride-hailing and more. A thorough bibliometric analysis of e-hailing research has been presented in this paper, together with a concise synopsis of its evolution, key figures, and developing themes. The investigation, which looked at 208 papers from the Scopus database, showed that scholarly interest has been steadily increasing since 2013, with a notable spike in publications following 2018. The analysis identified the most internationally and locally cited papers, as well as the most prolific nations, journals, and authors. A transition from early studies on adoption and regulation to more contemporary concerns about sustainability, congestion management, and technology integration was also depicted in the thematic progression of research. Overall, the results show that e-hailing is a quickly growing field of study that is relevant to both academia and real-world applications, although it is still fragmented and developing.

The findings of this study have significant implications for academia, policymakers, and industry stakeholders. For researchers, the bibliometric mapping consolidates fragmented knowledge and highlights underexplored areas such as gig workers' welfare, environmental sustainability, and the integration of e-hailing with public transport systems. For policymakers, the results provide evidence-based insights into the global and regional development of e-hailing, helping to design regulations that balance innovation, public safety, labor rights, and environmental objectives. For industry practitioners, the identification of leading journals, authors, and thematic trends offers guidance for strategic decision-making and collaborative opportunities. In particular, the emphasis on Malaysia and Southeast Asia contributes a valuable localized perspective to global debates often dominated by developed countries.

There are limits to the current study. First, the findings of this study could not be generalized because it only looked at articles in the Scopus database. Thus, future research can use more comprehensive databases, such as Google Scholar or Web of Science, to gather fascinating insights. This limitation narrows the scope of insights and may overlook influential contributions in the E-hailing domain published outside Scopus. Therefore, future research can expand the bibliometric mapping by incorporating multiple databases, which would allow for more holistic coverage, stronger cross-validation of findings, and broader generalizability across disciplines. Second, the study focuses only on English-language publications, potentially overlooking valuable research published in other languages; expanding the language scope would provide a more global picture. Third, bibliometric analysis emphasizes quantitative measures such as publication counts and citations, which may not fully capture the depth or quality of contributions; combining bibliometric analysis with systematic literature reviews could enrich the insights. Finally, the study does not account for the most recent real-time industry developments that may not yet appear in academic databases; future research could bridge this gap by integrating policy reports, industry white papers, and real-world case studies alongside academic data.

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