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Taxi and urban mobility studies: A bibliometric analysis

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ABSTRACT

In the context of increasing globalization and global competition, urban mobility in terms of different private Taxi transport projects is gaining relevance. In the last decade, interest in studying the impact of Taxi options on changes in urban mobility and consumer preferences has increased. The most important recent line of study is the development of the dimensions of urban mobility and the possible incorporation of new ones and the Taxi option is one of the most important dimensions in urban mobility dynamism. Therefore, it becomes a necessary task to measure the amount and level of academic work that has been carried out on urban mobility, its dimensions, and the effect that Taxi options may have. So, the main objective of this paper is to examine the current state of urban mobility, carrying out a bibliometric analysis. 6687 research papers published between 1967 and 2021 have been analysed based on the results of the Web of Science Core Collection (WoS), identifying publications and co-authorship among the most recognized authors, the countries with the highest percentage of scientific production, the most prominent citations, the most influential journals, and the co-occurrence of keywords. In summary, the most recurring topics that show the academic development of urban mobility have been identified, guiding on future topics to be incorporated into the study and measurement of urban mobility options, such as Taxi, ride-sourcing, ride-pooling, ride-sharing and others.

1. Introduction

Taxi has been a means of urban transport widely used by the whole society for many years. In ancient times, transport services for goods and people were already offered within the same population to facilitate and speed up the movement of the population (Recasens-Alsina, 2020; Astroza et al., 2020). Currently, the urban mobility sector has expanded, there is no longer a single means or service, but different means of urban transport coexist, such as metro, bus, Taxi and ridesourcing services (In Spain these services are known as transport vehicle with driver (VTC)), among others (Ollmedo-Peralta, 2017; De Miguel-Molina et al., 2021). During all these years the sector has evolved and advanced to offer a better service to customers. Mobility, urban transport, and Taxis have been the subject of study by many authors for many years. We can find academic papers that refer to the Taxi sector dating back over two centuries to papers published just a few days ago. Issues such as consumption habits, working conditions, cost factors, organization, logistics, legal, followed by a long etcetera have been studied (Mahmassani, 1990; Lizárraga-Mollindeo, 2006; Yu et al., 2022).

At present, urban mobility, more specifically the transport sector with tourist vehicles, is undergoing many changes derived from the legal regulations to which they are subject (Canitez, 2019; Moscholidou and Pangbourne, 2020). In the last years, the existing competition between Taxis and ridesourcing services has triggered an increase in regulation by public administrations to try to resolve differences and satisfy equality in competition in the sector (Zha et al., 2016; Zhang and Nie, 2021). For this and at this point, it has been considered appropriate to study the relevance of urban transport and the Taxi sector within the academic world (Gomez et al., 2021). In Spain, as in other countries, the relationship between the Taxi sector and ridesourcing services has been regulated by the Government. In 2018, Royal Decree-Law 13/2018 was approved, which sets the operating conditions and regulations applicable to the transport of vehicles with a driver, whether they are Taxis or VTC. This Decree transferred the powers to regulate ridesourcing licenses to regional and local governments, establishing a four-year moratorium to compensate them for the severe restrictions imposed on the development of their activity. This period has just ended on September 30, 2022 and it is now when the great differences between

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the approved regulations can be observed since, for example, Madrid has a regulation favourable to competition between services, Catalonia has very restrictive regulations that require prior reservation of the ride-sourcing service at least 2 h in advance, while other autonomous communities have not yet published legislation in this regard.

Taxi and urban mobility have an impact factor of 13,846 papers, taking into account the main journals on transport and mobility that are included in the Web of Science Core Collection. This document will attempt to analyse and highlight the main factors that have been studied in the academic literature on these subjects. With all this, we will be able to identify the main lines of research carried out by the predecessor authors in the field of mobility and passenger transport in urban areas (Merigó et al., 2016). To carry out this study, a set of quantitative and qualitative papers have been analysed, using different methodologies and bibliometric tools. Bibliometric techniques have two main characteristics: on the one hand, a performance analysis of the different papers is carried out; on the other hand, schemes and maps of the different factors and scientific actors related to the object of the study carried out are developed (Noyons et al., 1999). Therefore, different aspects are studied to assess the impact of citations in scientific publications through the different related factors. With all this, it will be possible to establish all those aspects that have already been widely studied by the scientific community and identify which factors have not been addressed so exhaustively. Since scientific mapping and analysis of the actors are complementary studies, they will be used together to approximate all these lines of study in the most precise way. It can be revealed that this study allows us to reliably observe all the most notable scientific aspects and actors that have helped to explore the transport and mobility market in the Taxi sector (Van Eck and Waltman, 2007; Chen et al., 2017).

Different academic journals have produced additional editions, special papers, and letters to highlight an event related to the journal itself or its field of study (Baier-Fuentes et al., 2021). Bibliometric analyses are highly noteworthy at these key moments as they allow us to make a framework that encompasses everything that happened in that space of time on the different aspects of the study. In this case, the proximity of the end of the transitional period marks a line between the present of urban mobility and the future that lies ahead, so that we find ourselves at a turning point, where there is room for reflection and retrospection in its study. As we propose, we find different examples of papers carried out by other high-impact journals like this one.

The rest of the paper is structured as follows. Section 2 shows the different topics that we used in our bibliometric research. Section 3 deals with the formal aspects of the methodology used to prepare this paper, Section 3 explains the formal aspects of the methodology used to prepare this work, with special focus on the execution of the analysis. Section 4 presents the main results of the factor performance analysis and scientific mapping of the literature published in recent years on urban mobility and the Taxi sector. Finally, we will find Section 5, where a description of the most noteworthy aspects of the study and the conclusions of the analysis carried out will be made.

2. Topic review

In this section, we briefly establish the definitions related to the different concepts that we are going to use for our bibliometric research, such as urban mobility, Taxi, ridesharing, ride-sourcing, ride-pooling and ridesplitting.

2.1. Urban mobility

Urban mobility is one of the major challenges facing authorities at the moment. Facilitating the circulation of vehicles in cities, coexistence between people and vehicles, as well as reducing pollution levels are priority objectives (Mirzaee and Wang, 2020; Schipper et al., 2020).

The current design of cities is oriented towards the importance that private vehicles have had to date, so their transformation must be oriented towards a more sustainable model where public transport becomes more relevant. For this reason, public administrations at a European level are developing new policies aimed at implementing the necessary changes to leave private vehicles aside, removing those vehicles of a more polluting nature from circulation, and also trying to regulate urban transport.

2.2. Taxi

The need for urban and interurban travel by citizens led to the creation of the Taxi service. This private transport service has been widely accepted and developed in our cities for many years. In order to facilitate its development, it has been heavily regulated by different administrations, which have established the need for drivers to acquire licenses to carry out their activity (Li and Szeto, 2021). On the other hand, the price of the service is also determined by the authorities of each area.

The emergence of new forms of transport in tourist vehicles with drivers has boosted the sector, increasing its competitiveness.

2.3. Ride-sharing

With the development of smartphone apps, ride-sharing information is becoming more accessible (Pan et al., 2022; Yan et al., 2019). Ride-sharing technology has made great progress.

For the most congested cities, shared rides are very convenient as they offer advantages over public transport for users, such as convenience, and for society it means less pollution and more available parking spaces (Ma and Zhang, 2017).

2.3.1. Ride-sourcing

Ride-sourcing is one of the services that have fostered the development of the sharing economy and that has had a greater growth in a large number of countries (Rizki, M. et al., 2021). These services are intended to put travellers who wish to travel from point A to point B in contact, through an application installed on the users' mobile phone, such as UBER, with an available driver who is willing to meet that demand in real time.

Users of these services have identified various benefits that have helped their rapid growth, among which we can highlight the agility in hiring, the increase in available vehicles, the awareness of the price at the time of hiring and the possibility of arranging the pick-up time.

Due to the observed growth, the authorities in most countries have proceeded to regulate the service in order to protect users and other existing means of transport such as Taxis.

2.3.2. Ride-pooling

The new economy has provided a solution to the high number of private vehicles that circulate in cities. We find that on many occasions, most vehicles are occupied by a single passenger, which hinders the flow of traffic. For this reason, in many cities the ride-pooling service is offered, in which several users with similar itineraries share the same vehicle during part of their trip. On the one hand, greater vehicle occupancy is achieved and, on the other, an improvement in the environmental cost of the journey (Wilkes et al., 2021). In 2022, the number of trips made using this mode of shared trips is still quite low compared to the use of private vehicles.

2.3.3. Ride-splitting

Ride-splitting is similar to public transport, although it has advantages that increase the degree of user satisfaction, such as the door-to-door transport service, the absence of passenger crowds and the pre-booking of the service.

Ride-splitting is defined as a form of ride-sourcing by which unacquainted passengers with similar origins and destinations use the same vehicle traveling together, which implies a significant reduction in

economic and environmental costs for each of them (Cahyo and Burhan, 2019).

3. Methodology

For this paper, a bibliometric analysis has been carried out to collect the quantitative values, breaking down the existing literature in the different indexed reference sources. In this case, we have used the academic papers provided by Web of Science (WoS) (Durán-Sanchez et al., 2017). The WoS, currently owned by Clarivate Analytics, is the most widely used and authoritative database of research publications and citations, which allows us to obtain more truthful and contrasted information. Web of Science Core Collection contains, among others, these citation indexes: Science Citation Index Expanded (SCIE), which indexes the most prestigious science and technology publications and journals; Social Science Citation Index (SSCI), a multidisciplinary index to the journal literature of the social sciences and Emerging Source Citation Index (ESCI), which includes journals and papers on science and technology and social sciences with a projection to enter the category of Journal Citation Reports (JCR) (Wang and Chen, 2010; Gaviria-Marin et al., 2019). As already mentioned, WoS has been used to carry out this paper since it is the source with the largest number of high-impact journals: however, it should be noted that there are also other databases such as Google Scholar, Emerald Insight and Scopus, among others (Bakkalbasi et al., 2006; Adriaanse and Rensleigh, 2013).

The following keywords were used during October 2022 to retrieve the papers: ("urban mobility" OR "Taxi" OR "ride-sourcing" OR "ride-pooling" OR "ride-splitting" OR "ride-sharing"). The use of these keywords allows the selection of papers dealing with the main urban mobility topics (UMT) analysed in the body of literature. We only considered papers published in English and restricted the bibliographic search to the time period between 1967 and 2021. In addition, we used papers, review papers, letters and notes. Subsequently, we trimmed the initial sample by eliminating irrelevant papers that do not contribute significantly to the literature on urban mobility.

In the same way, since there are many categories, a limitation has been established to be able to focus the study on the field of urban mobility, economy and legislation. For this purpose, the papers that belong to at least one of the following categories are shown: Transportation OR Engineering OR Environmental Sciences Ecology OR Computer Science OR Business Economics OR Science Technology Other Topics OR Public Environmental Occupational Health OR Telecommunications OR Geography OR Operations Research Management Science OR Urban Studies OR Mathematics OR Social Sciences Other Topics OR Physical Geography OR Government Law. As a result, 6687 papers including reviews and full papers written in English and published up to 2021 were retrieved. Finally, sample papers were analysed using two bibliometric procedures: performance analysis and science mapping.

The main techniques proposed for carrying out bibliometric studies are several and diverse according to the different authors (Cobo et al., 2015; Merigó et al., 2018; Donthu et al., 2021). Some of these authors propose the use of quantitative analysis for the study of literature, although in recent years there is a growing trend towards the use of scientific mapping for bibliometric study. Therefore, the use of the two proposed techniques provides us with greater rigor and precision when analysing the different aspects of study in this paper (Waltman et al., 2010; Cobo et al., 2012).

Different indicators have been used to carry out this study and undertake the performance analysis in the most precise way. The number of total publications (TP), the number of total citations (TC) received by these publications and total citations per year (C/Y) are the main and best-known information factors, but much more information is also extracted from databases (Kong et al., 2020; Standing et al., 2021). Through the databases, indices have been generated to measure the influence of citations in academic papers published by an author; for example, we find the h-index (H), one of the main indicators used in the academic environment to assess the influence of the papers from a citation threshold h. No other benchmarks have been used, for example, i10-index and g-index (Bornmann et al., 2009; Norris and Oppenheim, 2010). The influence of different authors, journals and universities, and populations (POP) has been studied. In the case of universities, two rankings have been used to measure the category of the university, that is, the Academic Ranking of World Universities (ARWU) and the Quacquarelli Symonds World University Ranking (QS) (Baier-Fuentes et al., 2021).

To more precisely observe the entire bibliographic structure of the papers and the topics mentioned, scientific mapping has been used, with which we will be able to observe the different connections existing in the study environment of science (Cobo et al., 2014; López-Belmonte et al., 2020). We can observe how the different factors that act within this line of academic research evolve and act (Van Raan, 2014). There are different software programs that allows us to carry out bibliometric studies. In this case, the VOSviewer tool has been used for the creation of science mapping (Van Eck and Waltman, 2010; Purwayadi, 2020).

Since the study is obtained through previous publications, the data used in this work may undergo small modifications that alter the result over time. Especially for those papers that have been recently published.

4. Results

4.1. Bibliometric performance analysis

4.1.1. Publications and citation structure

The first papers on UMT were published in the late 1960s. During the last decade of the 20th century, only 185 papers were published, while in the first decade of the 21st century the number of papers on the subject doubled. Since then we find a growing production of academic papers on this topic, with this trend continuing to date. Fig. 1 shows the increase in research on UMT over the years.

Through the figure we can see that the turning point began in 2012, coinciding with the entry into the Taxi and mobility sector of the company UBER. The production of academic papers on urban mobility and the Taxi sector is a line of research that has not stopped growing since then. In 2018, the preparation and production of academic papers on urban mobility and the Taxi sector was relaunched, thus becoming a growing line of research. Regarding the number of citations that these papers obtain, we observe that the first papers from the late 90s did not have a great impact on the scientific community in view of the little continuity that this line of research had at that time and the low publication of papers on the matter. On the other hand, papers produced in 2003 have been better accepted by the scientific community, with this being the only year in the first half of the decade that was highly efficient. As of 2007, papers with a greater flow of citations were produced. For instance, in 2008 Geroliminis, N. and Daganzo, C.F. published a paper that currently has a total of 774 citations. As of 2011, papers with a greater impact began to be produced, accumulating values of over hundreds of citations, which may be related to the increasing publication of academic papers on these topics. All this can be seen more clearly in Table 1, which contains the data collection. However, data from the beginning of 2020 onwards still do not reflect their full potential due to the short period of time that has elapsed, although a growing evolution of the line of research is already observed.

4.1.2. Influential papers

As seen above, there are many papers that refer to the concepts studied; papers that have been cited by different authors in different Business and Management and Mobility and Transportation journals. It is very important to find out which are the most relevant papers on this subject in order to advance in the line of research following the dynamics set by the authors. Table 2 shows the 50 most cited papers collected by the Web of Science Core Collection. The table includes the title of the publication, the authors, the year of publication, the total

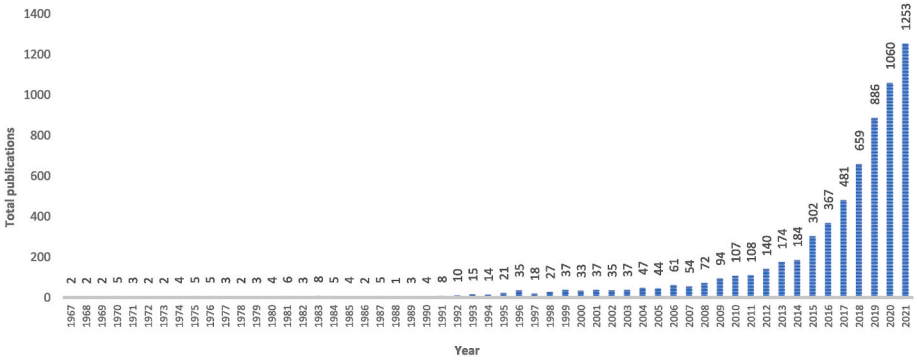

Fig. 1. Number of papers published per year.

citations (TC) and the average number of citations per year (C/Y).

"Existence of urban-scale macroscopic fundamental diagrams: Some experimental findings" is one of the most cited papers to date, accumulating a total of 755 citations. This paper was one of the precursors of the macroscopic fundamental diagram analysis model, for which data from GPS-equipped Taxis was used to measure the density and flow of vehicles and roads in urban mobility, thus being a paper of great value for the scientific community. However, the most cited paper is "Navigation-related structural change in the hippocampi of Taxi drivers" carried out among Taxi drivers to study the relevance of mapping to develop cognitive perception and larger posterior hippocampus. This clinical paper has received 1730 citations since its publication in 2000. Years later, Alonso-Mora, J. et al. developed a paper of great academic value for the study of carpooling in the on-demand service, which has 474 citations. It is important to point out that both the topics and the authors as well as the journals where they were published are still prominent in the field today. Finally, it should also be noted that these are the papers with the highest citation rate per year, which shows that they are still of great value to the scientific community and are a reference for lines of research related to mobility and transport. Aloi, A. et al. published a paper in 2020 on the automation of mobility through autonomous vehicles, which currently has a rate of approximately 90 citations per year. However, this index is expected to grow as technological advances are developed and applied.

4.1.3. Leading authors on the topic

Below, Table 3 shows the 25 main authors with publications in the field of urban mobility and the Taxi sector. In the table we can see the name of the authors and the organizations they represent, as well as the total papers (TP) only on these topics, the total citations (TC) of these papers, the h-index calculated for those publications and the ratio of citations per paper. The organization shown is the last reported to be published in the Web of Science Core Collection database.

It should be noted that Yang, H. is the author of 60 published papers and the one with the highest number of citations overall, with a h-index of 28, followed by Liu, Y., who has 54 published papers with a h-index of 21. Zhang, D.Q., with only 17 papers, has the highest citation rate, with 70,88 citations per paper. On the other hand, it is noteworthy that all authors have a minimum of 7 citations per paper, with a minimum of 180 citations in total. Although the organizations that these authors investigate are diverse in nature, it can be seen that most of them are based in China.

4.1.4. The most productive and influential institutions

Institutions from all over the world collaborate and study on the subject of mobility; this is an important line of research that is present in many disciplines; for this reason, in Table 3 below, institutions from all over the world are represented. The table shows the ranking of the 30 institutions that have made the greatest number of contributions to these disciplines in recent years. This table contains different indicators: total papers (TP), total citations (TC), the institution's h-index (H) and the ratio of total citations per total papers (TC/TP). A counter has also been provided to show the number of papers with over 100, 50 or 10 citations. Finally, the ranking of the institutions has been taken according to prestigious international rankings of institutions, the first being the Academic Ranking of World Universities (ARWU) and the second one Quacquarelli Symonds World University Ranking (QS). In this way, it will be possible to see if the most prestigious institutions dedicate time and effort to carry out research in this field.

Tsinghua University, with a total of 122 published papers and over 3000 citations, followed by Massachusetts Institute of Technology (MIT), with 121 papers and over 4000 citations, are the two main institutions and the ones that have contributed the most literature in this field. Then, we find a group of universities located in Asia that have carried out various studies of great value such as Tongji University, with 95 papers and a h-index of 24, and Hong Kong Polytechnic University, with 89 papers and 2355 citations. University of California, Berkeley, is also one of the leading institutions, with 74 papers, a h-index of 26, and a citation ratio of 62.30. University College London is another of the main institutions in this field, not only because of the number of papers published, which amounts to 62, but also because of their importance, since it has a ratio of 57.47 citations per paper.

Within the top 30, the fact that 46.67% of the listed institutions are based in China stands out, which reflects the importance and complexity of mobility in these urban areas. The other 33.33% is made up of universities located in the United States as well as institutions from different European countries and Hong Kong.

According to the Academic Ranking of World Universities, the list includes 17 institutions in the top 100, with 12 of them ranked within the top 50 in the world, which reflects the importance and relevance of the topics we are dealing with. On the other hand, the ranking provided by Quacquarelli Symonds World University Ranking references 16 of these institutions within the top 100 in the world. It should be noted that the Massachusetts Institute of Technology (MIT) is ranked as the 4th top institution in the world by ARWU and that it is rated first in the QS World University Ranking. In the list we can also find Harvard University, which is ranked first in the world by ARWU and 5th by QS. These data are very remarkable given that these are the institutions with the highest number of publications and citations within this line of research.

4.1.5. The most productive and influential countries

Now we are going to deal with the 25 most influential countries, those from which the greatest number of contributions have been made. It should be noted that papers on this subject have been published in many other countries, which is indicative of the national and international relevance of these issues. Here, the country of production is the one from which the different authors of the paper worked. In this table, different indicators have been used in the same way as in Table 4, to which new indicators have been added, such as the total population of the country, according to data from the World Bank Group, and a ratio of

Table 1
Annual citation structure on Taxi and Urban Mobility topics.

Year	TP	TC	≥200	≥150	≥100	≥50	≥20	≥10	≥5	≥1
1967	2	2	0	0	0	0	0	0	0	2
1968	2	3	0	0	0	0	0	0	0	2
1969	2	4	0	0	0	0	0	0	0	4
1970	5	1	0	0	0	0	0	0	0	1
1971	3	2	0	0	0	0	0	0	0	2
1972	2	3	0	0	0	0	0	0	0	3
1973	2	7	0	0	0	0	0	0	0	5
1974	4	3	0	0	0	0	0	0	0	2
1975	5	2	0	0	0	0	0	0	0	2
1976	5	10	0	0	0	0	0	0	0	6
1977	3	7	0	0	0	0	0	0	0	5
1978	2	4	0	0	0	0	0	0	0	4
1979	3	10	0	0	0	0	0	0	1	3
1980	4	3	0	0	0	0	0	0	0	3
1981	6	5	0	0	0	0	0	0	0	3
1982	3	7	0	0	0	0	0	0	0	4
1983	8	10	0	0	0	0	0	0	0	8
1984	5	7	0	0	0	0	0	0	0	4
1985	4	9	0	0	0	0	0	0	0	8
1986	2	10	0	0	0	0	0	0	0	9
1987	5	8	0	0	0	0	0	0	0	7
1988	1	7	0	0	0	0	0	0	0	6
1989	3	7	0	0	0	0	0	0	0	5
1990	4	7	0	0	0	0	0	0	0	6
1991	8	12	0	0	0	0	0	0	0	12
1992	10	18	0	0	0	0	0	0	0	12
1993	15	34	0	0	0	0	0	1	1	14
1994	14	53	0	0	0	0	0	1	1	18
1995	21	61	0	0	0	0	0	1	2	31
1996	35	94	0	0	0	0	0	1	4	34
1997	18	125	0	0	0	0	0	1	4	53
1998	27	179	0	0	0	0	0	3	9	53
1999	37	200	0	0	0	0	0	3	10	62
2000	33	216	0	0	0	0	0	2	8	73
2001	37	260	0	0	0	0	1	0	8	107
2002	35	333	0	0	0	0	1	3	11	108
2003	37	409	0	0	0	0	1	3	14	128
2004	47	467	0	0	0	0	2	2	27	122
2005	44	649	0	0	0	1	0	5	28	170
2006	61	707	0	0	0	0	2	9	25	198
2007	54	845	0	0	0	1	0	12	40	206
2008	72	1019	0	0	0	1	3	14	46	230
2009	94	1141	0	0	0	1	4	13	46	274
2010	107	1340	0	0	0	1	4	10	63	321
2011	108	1581	0	0	0	1	5	15	71	393
2012	140	1794	0	0	1	0	5	23	80	424
2013	174	2246	0	0	1	1	7	21	89	536
2014	184	2874	0	0	1	0	9	41	133	587
2015	302	3684	0	0	0	3	16	54	155	703
2016	367	4753	0	0	0	2	27	79	182	908
2017	481	6563	0	0	1	4	36	112	263	1045
2018	659	9283	0	0	1	6	58	157	379	1317
2019	886	14734	0	0	2	18	107	270	540	1670
2020	1060	19952	0	1	3	22	144	369	694	2206
2021	1253	27688	0	0	3	33	227	544	924	2647
2022	172	21928	0	0	0	12	127	411	921	2976
Total	**6677**	**125395**	**0**	**1**	**13**	**107**	**786**	**2180**	**4779**	**17742**
Percentage	**99,85%**		**0,00%**	**0,00%**	**0,05%**	**0,42%**	**3,07%**	**8,51%**	**18,66%**	**69,26%**

Total Papers to the Population (TP/POP) and Total Citations to the Population (TC/POP).

The results in Table 5 show the great diversity of countries that are making publications in this line of research, although the total number of countries that publish on these topics covers 109 countries from the 5 continents. The United States is the country with the highest production of papers, with a total of 1849 papers and a h-index of 96, followed by China, with 1811 papers, 35,953 citations and a h-index of 85. These two countries top the list by far, as the next country is England with a total production of 471 papers and a h-index of 56. If we consider publication efficiency measured in citations, we find that Switzerland, with 92 publications, has a citation ratio of 29.54 citations per paper, which is a very high value. England is the next country with the highest ratio, with 28.59 citations per paper. Taking publications per inhabitant as a reference, we observe that countries with smaller populations have a better ratio of total publications per person. Singapore, with 120 papers, stands out for its production of papers per inhabitant. On the other hand, Greece, with 85 papers and a h index of 20, stands out in terms of the ratio of citations per population.

Table 6 shows a comparison by continents. As expected, Asia, with a total of 2743 papers and a h-index of 89, is the continent with the highest production of papers, followed by North America, with 2123 papers, the latter being the one with the highest number of citations with a total of 53,048. Oceania is the continent with the lowest number of publications but, in contrast, the one with the highest proportion of papers per inhabitant.

Table 2
Top 50 most cited papers on urban mobility and Taxi topics.

Rank	Title	Author/s	Year	TC	C/Y
1	Navigation-related structural change in the hippocampi of taxi drivers	Maguire, E.A.; Gadian, D.G.; Johnsrude, I.S.; Good, C.D.; Ashburner, J.; Frackowiak, R.S.J.; Frith, C.D.	2000	1730	78,64
2	Existence of urban-scale macroscopic fundamental diagrams: Some experimental findings	Geroliminis, N.; Daganzo, C. F.	2008	774	55,29
3	Urban gridlock: Macroscopic modeling and mitigation approaches	Daganzo, C. F.	2007	550	36,67
4	Just a better taxi? A survey-based comparison of taxis, transit, and ridesourcing services in San Francisco	Rayle, L.; Dai, D.; Chan, N.; Cervero, R.; Shaheen, S.	2016	543	90,50
5	More Electric Aircraft: Review, Challenges, and Opportunities for Commercial Transport Aircraft	Sarlioglu, B.; Morris, C. T.	2015	516	73,71
6	Ride On! Mobility Business Models for the Sharing Economy	Cohen, B.; Kietzmann, J.	2014	491	61,38
7	Ridesharing: The state-of-the-art and future directions	Furuhata, M.; Dessouky, M.; Ordonez, F.; Brunet, M.E.; Wang, X.; Koenig, S.	2013	480	53,33
8	On-demand high-capacity ride-sharing via dynamic trip-vehicle assignment	Alonso-Mora, J.; Samaranayake, S.a; Wallar, A.; Frazzoli, E.; Rus, D.	2017	474	94,80
9	Aggregation, blowup, and collapse: The ABC's of taxis in reinforced random walks	Othmer, H.G; Stevens, A.	1997	468	18,72
10	Real-Time Urban Monitoring Using Cell Phones: A Case Study in Rome	Calabrese, F.; Colonna, M.; Lovisolo, P.; Parata, D.; Ratti, C.	2011	384	34,91
11	A Tale of Many Cities: Universal Patterns in Human Urban Mobility	Noulas, A.; Scellato, S.; Lambiotte, R.; Pontil, M.; Mascolo, C.	2012	380	38,00
12	Disruptive Change in the Taxi Business: The Case of Uber	Cramer, J.; Krueger, A. B.	2016	372	62,00
13	Predicting Taxi-Passenger Demand Using Streaming Data	Moreira-Matias, L.; Gama, J.; Ferreira, M.; Mendes-Moreira, J.; Damas, L.	2013	363	40,33
14	Quantifying the benefits of vehicle pooling with shareability networks	Santi, P.; Resta, G.; Szell, M.; Sobolevsky, S.; Strogatz, Steven H.; Ratti, C.	2014	358	44,75
15	Urban mobility and urban form: the social and environmental costs of different patterns of urban expansion	Camagni, R.; Gibelli, M.C.; Rigamonti, P.	2002	360	18,00
16	Ridesharing in North America: Past, Present, and Future	Chan, N. D.; Shaheen, S. A.	2012	345	34,50
17	Short-term forecasting of passenger demand under on-demand ride services: A spatio-temporal deep learning approach	Ke, J.; Zheng, H.; Yang, H.; Chen, X.	2017	326	65,20
18	Visual Exploration of Big Spatio-Temporal Urban Data: A Study of New York City Taxi Trips	Ferreira, N.; Poco, J.; Vo, H. T.; Freire, J.; Silva, C. T.	2013	317	35,22
19	Socioeconomics of urban travel: Evidence from the 2001 NHTS	Pucher, J.; Renne, J. L	2003	316	16,63
20	Fine particulate matter and carbon monoxide exposure concentrations in urban street transport microenvironments	Kaur, S.; Nieuwenhuijsen, M. J.; Colvile, R. N.	2007	304	20,27
21	Fine particle (PM2.5) personal exposure levels in transport microenvironments, London, UK	Adams, H.S.; Nieuwenhuijsen, M. J.; Colvile, R.N.; McMullen, M.A.S.; Khandelwal, P.	2001	289	13,76
22	Urban land uses and traffic 'source-sink areas': Evidence from GPS-enabled taxi data in Shanghai	Liu, Y.; Wang, F.; Xiao, Y.; Gao, S.	2012	283	28,30
23	T-Finder: A Recommender System for Finding Passengers and Vacant Taxis	Yuan, N. J.; Zheng, Y.; Zhang, L.; Xie, X.	2013	274	30,44
24	Savings Constraints and Microenterprise Development: Evidence from a Field Experiment in Kenya	Dupas, P.; Robinson, J.	2013	268	29,78
25	T-Drive: Enhancing Driving Directions with Taxi Drivers' Intelligence	Yuan, J.; Zheng, Y.; Xie, X.; Sun, G.	2013	246	27,33
26	On the spatial partitioning of urban transportation networks	Ji, Y.; Geroliminis, N.	2012	240	24,00
27	Offloading in Internet of Vehicles: A Fog-Enabled Real-Time Traffic Management System	Wang, X.; Ning, Z.; Wang, L.	2018	238	59,50
28	Revealing travel patterns and city structure with taxi trip data	Liu, X.; Gong, L.; Gong, Y.; Liu, Y.	2015	238	34,00
29	Relationships between young drivers' personality characteristics, risk perceptions, and driving behaviour	Machin, M. A.; Sankey, K. S.	2008	238	17,00
30	The collaborative economy and tourism: Critical perspectives, questionable claims and silenced voices	Dredge, D.; Gyimothy, S.	2015	233	33,29
31	Macroscopic relations of urban traffic variables: Bifurcations, multivaluedness and instability	Daganzo, C. F.; Gayah, V. V.; Gonzales, E. J.	2011	225	20,45
32	Cost-based analysis of autonomous mobility services	Boesch, P. M.; Becker, F.; Becker, H.; Axhausen, K. W.	2018	222	55,50
33		Ricci, M.	2015	221	31,57

(*continued on next page*)

Table 2 (*continued*)

Rank	Title	Author/s	Year	TC	C/Y
	Bike sharing: A review of evidence on impacts and processes of implementation and operation				
34	Understanding intra-urban trip patterns from taxi trajectory data	Liu, Y.; Kang, C.; Gao, S.; Xiao, Y.; Tian, Y.	2012	219	21,90
35	Non-parametric estimation of route travel time distributions from low-frequency floating car data	Shi, Q.; Abdel-Aty, M.	2015	215	30,71
36	Visual Traffic Jam Analysis Based on Trajectory Data	Wang, Z.; Lu, M.; Yuan, X.; Zhang, J.; van de Wetering, H.	2013	211	23,44
37	Prediction of urban human mobility using large-scale taxi traces and its applications	Li, X.; Pan, G.; Wu, Z.; Qi, G.; Li, S.; Zhang, D.; Zhang, W.; Wang, Z.	2012	206	20,60
38	Dynamic ride-sharing and fleet sizing for a system of shared autonomous vehicles in Austin, Texas	Fagnant, D. J.; Kockelman, K. M.	2018	202	50,50
39	Autonomous taxis could greatly reduce greenhouse-gas emissions of US light-duty vehicles	Greenblatt, J. B.; Saxena, S.	2015	201	28,71
40	What influences travelers to use Uber? Exploring the factors affecting the adoption of on-demand ride services in California	Alemi, F.; Circella, G.; Handy, S.; Mokhtarian, P.	2018	197	49,25
41	A behavioral choice model of the use of car-sharing and ride-sourcing services	Dias, F. F.; Lavieri, P. S.; Garikapati, V. M.; Astroza, S.; Pendyala, R. M.; Bhat, C. R.	2017	197	39,40
42	Is Uber a substitute or complement for public transit?	Hall, J. D.; Palsson, C.; Price, J.	2018	195	48,75
43	Land-Use Classification Using Taxi GPS Traces	Pan, G.; Qi, G.; Wu, Z.i; Zhang, D.; Li, S.	2013	194	21,56
44	Flows of Meaning, Cultures of Movements - Urban Mobility as Meaningful Everyday Life Practice	Jensen, O. B.	2009	192	14,77
45	Real-Time City-Scale Taxi Ridesharing	Ma, S.; Zheng, Y.; Wolfson, O.	2015	189	27,00
46	Particle and trace gas emission factors under urban driving conditions in Copenhagen based on street and roof-level observations	Ketzel, M; Wahlin, P; Berkowicz, R; Palmgren, F	2003	186	9,79
47	China's Hangzhou Public Bicycle Understanding Early Adoption and Behavioral Response to Bikesharing	Shaheen, S. A.; Zhang, H.; Martin, E.; Guzman, S.	2011	186	16,91
48	An Analysis of the Labor Market for Uber's Driver-Partners in the United States	Hall, Jonathan V.; Krueger, Alan B.	2018	185	46,25
49	Effects of the COVID-19 Lockdown on Urban Mobility: Empirical Evidence from the City of Santander (Spain)	Aloi, A.; Alonso, B.; Benavente, J.; Cordera, R.; Echaniz, E.; Gonzalez, F.e; Ladisa, C.; Lezama-Romanelli, R.; Lopez-Parra, A.; Mazzei, V.; Perrucci, L.; Prieto-Quintana, D.; Rodriguez, A.; Sanudo, R.	2020	184	92,00
50	A Survey on Vehicular Social Networks	Vegni, A. M.; Loscri, Valeria	2015	178	25,43

4.2. Science mapping

Science mapping, which allows us to graphically observe the connections between the different actors of scientific publications, is currently the most widely used methodology for bibliometric analysis. In this way, we can complement the analytical performances with a structured, visual and dynamic methodological model. Below we show the different bibliometric mappings carried out with the actors that have been worked on in the previous sections, the connections between the different authors, the main academic journals, the countries that have carried out the most studies in these lines of research and the keywords most used. As mentioned in the methodology section, VOSviewer program has been used to develop the charts presented below. This tool allows us to create analyses by citations, co-citations, co-occurrences, and bibliographic coupling. Citations and co-citations allow us to see the relationship between the different papers shown. The relationships establish the duality of citations within the same paper, each of them belonging to different journals. Therefore, in the mapping only the data of the two cited papers will be shown and not those of the paper cited. The graphical representation of co-citation will show the most cited papers and the connections between them. Finally, the co-occurrence map shows all those terms that are closest in a sentence or text, which will allow us to visualize which descriptors are repeated and what are the connections between them.

In the first place, the most co-cited authors are shown, which will allow us to see who are the academics that appear more times repeated and the connections they have with the rest of the experts in the field. For this, it has been established that they must have at least 20 citations and the 100 most representative authors have been taken. In Fig. 2 we can see that two large groups of authors coexist. Specifically, we can see that authors from Chinese universities are together in a red block while top authors from other regions, mainly the United States, are on the other side, in the green and blue parts of the chart.

Proximity between the sources denotes a greater relationship between authors and sources. Yang, H. from the Hong Kong University of Science & Technology stands out for being the author with the highest number of citations while in the centre of the purple block, on the other hand, we find Liu, Yu, a professor at Peking University. To better understand these connections, Fig. 3 shows a bibliographic coupling of institutions, where the main relationships between institutions are represented, so that we can detect if there is a connection between the authors and the institutions. It has been established that to represent the institutions they must have carried out at least 10 papers in common and only the 200 most representative institutions will be represented. If we focus on the figure, we see that the universities do work together with those that are closest geographically to them. In the same way, it can be seen that the connections are quite weak, which indicates that there are few inter-institutional works. In Fig. 4, a bibliographic coupling by country has been made, where the 75 regions with the most connections are shown. China and the United States are the most closely connected countries, which seems logical since they are the two countries in which the most papers have been published and with institutions with the greatest number of connections between them. In the same way, it can

Table 3
Top 25 Leading authors in urban mobility and Taxi.

Rank	Authors	Organization	TP	TC	H	TC/TP	≥100	≥50	≥10
1	Yang, H.	Hong Kong University of Science & Technology	60	2585	28	43,08	8	8	27
2	Liu, Y.	Peking University	54	1964	21	36,37	5	5	25
3	Wong, S.C.	University of Hong Kong	36	1642	23	45,61	4	8	21
4	Li, Y.	Delft University of Technology	35	777	13	22,20	0	6	13
5	Zhang, Y.	University of South Florida	32	227	8	7,09	0	0	7
6	Chen, C.	Dalian University of Technology	31	1188	15	38,32	6	3	7
7	Zhang, L.	University of Maryland College Park	29	408	11	14,07	0	2	10
8	Wang, Y.	University of Science & Technology of China	29	405	9	13,97	1	1	6
9	Ratti, C.	Massachusetts Institute of Technology	27	1524	15	56,44	4	2	11
10	Wang, J.	Southeast University - China	25	352	11	14,08	0	1	12
11	Li, Q.	Nanjing University of Information Science & Technology	22	711	13	32,32	1	3	10
12	Chen, X.	Zhejiang University	22	627	10	28,50	1	1	8
13	Ukkusuri, S.	Purdue University	21	810	13	38,57	2	5	9
14	Winkler, M.	University of Paderborn	21	411	11	19,57	0	2	9
15	Chen, J.	Queen Mary University London	21	230	10	10,95	0	0	10
16	Zhang, F.	Massachusetts Institute of Technology	19	371	10	19,53	1	1	8
17	Santi, P.	Massachusetts Institute of Technology	18	763	9	42,39	2	1	5
18	Szeto, W. Y.	University of Hong Kong	18	358	10	19,89	0	2	8
19	Zhang, D. Q.	East China University of Science & Technology	17	1205	13	70,88	6	2	6
20	Wang, X.	University of Science & Technology of China	17	196	9	11,53	0	0	9
21	Gao, S.	University of Wisconsin System	16	911	10	56,94	3	1	6
22	Ke, J.	University of Hong Kong	16	700	10	43,75	1	2	8
23	Zhu, Y.	Shanghai Jiao Tong University	16	440	10	27,50	1	1	8
24	Li, L.	Tsinghua University	16	249	7	15,56	0	1	6
25	Yang, Y. J.	Jilin University	16	180	6	11,25	0	1	4

Table 4
The most productive and influential institutions.

Rank	Organization	Country	TP	TC	H	TC/TP	≥100	≥50	≥10	ARWU	QS
1	Tsinghua University	China	122	3124	33	25,61	2	19	57	52	42
2	Massachusetts Institute of Technology	United States	121	4297	32	35,51	10	11	45	4	1
3	Tongji University	China	95	1892	24	19,92	2	11	38	151–200	212
4	Hong Kong Polytechnic University	Hong Kong	89	2355	25	26,46	5	9	39	151–200	65
5	Wuhan University	China	86	1669	24	19,41	1	8	33	151–200	194
6	Zhejiang University	China	81	2612	26	32,25	8	6	32	52	42
7	Shanghai Jiao Tong University	China	77	2214	25	28,75	4	8	38	59	46
8	University of California, Berkeley	United States	74	4610	26	62,30	9	9	24	5	27
9	Southeast University	China	73	1019	18	13,96	1	3	27	151–200	461
10	Beihang University	China	69	1587	23	23,00	3	7	23	201–300	443
11	Beijing Jiaotong University	China	64	949	18	14,83	0	5	27	401–500	801–1000
12	University of Michigan	United States	64	1676	25	26,19	3	5	30	26	25
13	Central South University	China	64	1125	19	17,58	0	5	28	151–200	499
14	Peking University	China	62	2704	26	43,61	9	8	30	45	12
15	University College London	United Kingdom	62	3563	21	57,47	7	3	21	17	8
16	Purdue University	United States	61	1561	21	25,59	3	8	21	86	129
17	Delft University of Technology	Netherlands	60	1544	19	25,73	1	7	20	151–200	61
18	Chang'an University	China	59	437	11	7,41	0	2	13	801–900	>1000
19	Cornell University	United States	51	1773	19	34,76	4	2	17	12	20
20	New York University	United States	51	921	20	18,06	0	4	22	27	39
21	Universidade de São Paulo	Brasil	51	809	15	15,86	1	5	13	101–150	115
22	University of Washington	United States	48	1251	20	26,06	2	6	23	19	80
23	Harvard University	United States	47	1908	20	40,60	3	9	14	1	5
24	Sun Yat-sen University	China	46	1063	17	23,11	1	6	17	89	267
25	University of North Carolina	United States	46	1261	19	27,41	2	8	13	29	102
26	Harbin Institute of Technology	China	45	998	17	22,18	1	4	19	151–200	217
27	Johns Hopkins University	United States	45	716	14	15,91	0	3	21	16	24
28	University of Lisbon	Portugal	45	475	13	10,56	0	1	15	201–300	335
29	ETH Zurich	Switzerland	44	1474	20	33,50	4	6	17	21	9
30	Dalian University of Technology	China	43	1633	17	37,98	5	8	5	301–400	561–570

be seen that Western countries are more oriented towards relations with the United States while Eastern countries are more related to China.

Another very important factor is the observation of co-cited journals, which allows us to see which are the main sources of information for the papers and where we can find the most outstanding ones; therefore, the most important journals in this matter, a co-citation mapping for the top 1000 journals with more than 20 citations. As can be seen in Fig. 5, we also find journals of great value and high quality, such as Transport Policy, Journal of Transport Geography, the journals of the Transportation Research group, IEEE Transactions on Intelligent Transportation Systems, Computers, Environment, and Urban Systems, among others. The inclusion in the figure of Atmospheric Environment journal should be highlighted, which shows the importance of this matter within transport, urban mobility and the Taxi sector.

Finally, in Fig. 6 we can see which are the most related keywords, thus identifying which are the most widely covered topics in the framework of urban mobility and the Taxi sector and also which are the lines of research that have not yet been fully addressed. For this, a co-

Table 5
The most productive and influential countries.

Rank	Country	TP	TC	H	TC/TP	≥100	≥50	≥10	Population	TP/POP	TC/POP
1	United States	1849	48477	96	26,22	88	161	786	331.893,74	5.571,06	146.061,81
2	China	1811	35953	85	19,85	57	129	652	1.412.360,00	1.282,25	25.455,97
3	England	471	13466	56	28,59	23	44	193	55.997,20	8.411,13	240.476,31
4	Germany	331	6152	42	18,59	8	26	100	83.129,29	3.981,75	74.005,20
5	Brazil	320	2426	27	7,58	1	10	54	51.744,88	6.184,19	46.883,87
6	Italy	299	6417	40	21,46	8	24	105	59.066,22	5.062,12	108.640,78
7	Spain	275	3910	33	14,22	4	13	91	47.326,69	5.810,67	82.617,23
8	Australia	273	5903	42	21,62	8	23	124	25.739,26	10.606,37	229.338,37
9	Canada	272	6288	42	23,12	11	18	97	38.246,11	7.111,83	164.408,88
10	France	227	4697	35	20,69	11	16	71	67.499,34	3.363,00	69.585,87
11	Netherlands	181	4249	36	23,48	4	19	68	17.533,40	10.323,15	242.337,48
12	Japan	170	3010	30	17,71	4	7	64	125.681,59	1.352,62	23.949,41
13	South korea	148	2110	24	14,26	3	7	45	213.993,44	691,61	9.860,12
14	India	139	1160	17	8,35	1	2	30	1.393.409,03	99,76	832,49
15	Singapore	120	2399	27	19,99	4	9	44	5.453,57	22.003,94	439.895,33
16	Sweden	119	2807	31	23,59	2	14	48	33.359,42	3.567,21	84.144,15
17	Portugal	102	1698	22	16,65	1	4	40	10.299,42	9.903,47	164.863,65
18	Switzerland	92	2718	27	29,54	6	11	39	8.697,72	10.577,48	312.495,69
19	Taiwan	91	1841	25	20,23	2	8	38	23.570,00	3.860,84	78.107,76
20	Iran	90	761	15	8,46	0	2	18	85.028,76	1.058,47	8.949,91
21	Greece	85	1783	20	20,98	4	6	20	5.408,32	15.716,53	329.677,24
22	South Africa	74	934	17	12,62	1	2	17	60.042,00	1.232,47	15.555,78
23	Poland	72	805	14	11,18	1	4	14	5.122,60	14.055,36	157.146,76
24	Scotland	71	1618	23	22,79	4	3	31	5.454,24	13.017,40	296.649,95
25	Turkey	68	1302	20	19,15	2	4	21	111.046,91	612,35	11.724,77

Table 6
Publications classified by continents.

Rank	Supraregions	TP	TC	H	TC/TP	Population	TP/POP	TC/POP
1	Asia	2743	48372	89	17,63	3.699.168,19	741,52	13.076,45
2	North America	2123	53048	99	24,99	380.804,42	5.575,04	139.305,11
3	Europa	2348	47504	89	20,23	1.431.604,96	1.640,12	33.182,34
4	Latin America	482	5920	37	12,28	303.725,03	1.586,96	19.491,31
6	Africa	223	2436	24	10,92	368.836,58	604,60	6.604,55
5	Oceania	307	6317	43	20,58	25.739,26	11.927,30	245.422,75

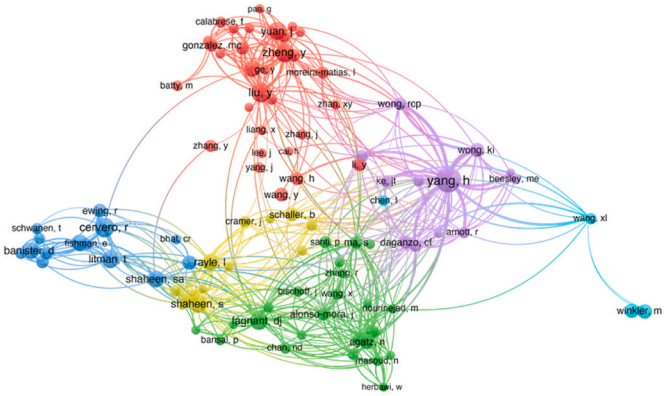

Fig. 2. Co-citations of authors cited on Urban Mobility and Taxi topics.

occurrence map of the 300 most repeated keywords has been made, with a minimum of 20 occurrences. In this way, all the keywords shown can be defined as valid, used and significant. Naturally, the main keywords used are Taxi, Urban Mobility and Model. The first two are representative of the subject of study itself, while model, as can be seen in the figure, is related to studies dealing with Taxi growth, boundedness, diffusion, aggregation, dynamics, etc. Then we can see that different thematic blocks have not yet been exploited: in blue we find sharing economy, very close and related to shared mobility, technology, future and also electric vehicles. In yellow we find another factor that is a little more represented, but with a lot of room for study, such as sustainability

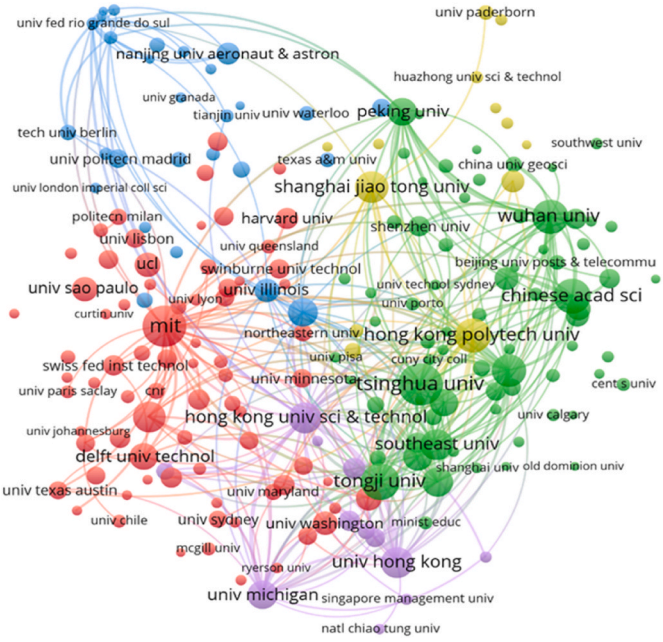

Fig. 3. Bibliographic Coupling of Institutions publishing.

in mobility, also related to urban mobility, climate change, as well as the keyword "China", surely due to the growing interest of Chinese culture in improving the sustainability and mobility of its crowded cities. It is

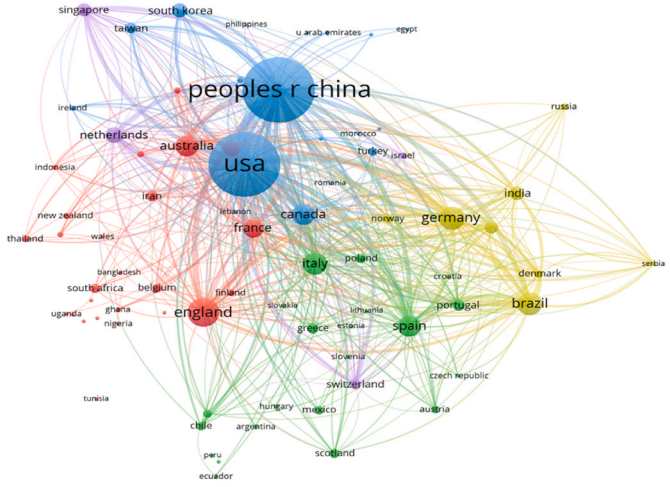

Fig. 4. Bibliographic Coupling of Countries publishing.

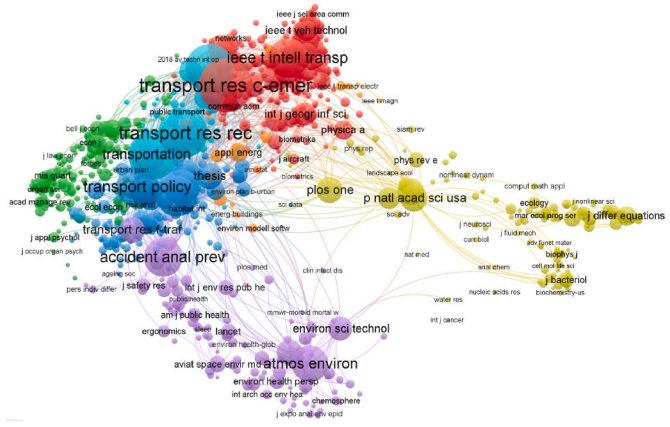

Fig. 5. Co-citation of journals.

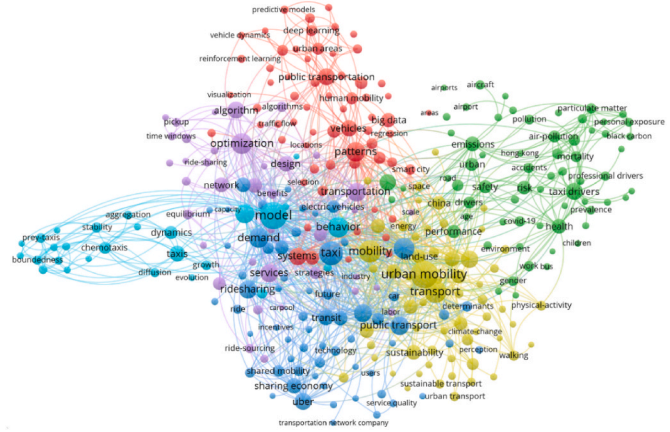

Fig. 6. Co-Occurrence of keywords.

worth noting the inclusion of big data in the red cluster, which, which despite being a line of study that is beginning to be developed more widely, there are still many studies to be carried out and many connections to be made. This keyword is related to other very technological ones such as now, regression, patterns, deep learning, vehicle dynamics and smart cities, very close to the purple section which deals with optimization, transportation, algorithm, network … Finally, in the green part we find the relevance of emissions, accidents safety, mortality, health and personal exposure.

5. Conclusions

Urban mobility is a key factor for society and represents numerous lines of research that are currently not only in full development but also growing exponentially. In recent years the number of publications on the subject has increased, with this being a topic of interest for the most prestigious journals. The transport sector is a widely used study tool to understand transport and urban mobility, which is reflected in the number of publications and citations it receives. That is why it is so important to carry out a bibliometric analysis through performance analysis and scientific mapping. It allows us to observe the literature and the different lines of research that this topic offers us. Likewise, it allows us to observe which authors are the most influential and which journals are the most relevant in this field. For this, data from the Web of Science Core Collection database have been used. This study thus confirms the high potential of this line of research and the great interest it should generate for the most prestigious journals.

The main results obtained show us the growing trend in the production of papers on this topic and the great acceptance of them in the academic environment, in view of the high number of citations. We found papers on the subject published in more than 100 countries, which indicates the level of globalization reached in this field of research. Mobility is a relevant issue for all countries and cities on the planet. In addition, we find a large number of authors who write papers on these topics. The main countries from which these papers have been produced are those with the largest population and greatest confluence of mobility, as is the case of China and the United States, although there are also other countries with large production or high value papers such as England, Brazil or Spain. The scientific mapping of the publications has provided us with important advances to develop new lines of research. In this research work, the VOS Viewer program has been used and the most cited and outstanding authors on paper on the subject have been identified, among whom we find highly prestigious academics such as Gai Yang and Yu Liu, both with extensive academic careers on the topic under study. It has also been possible to identify the major journals that are sources of information on this topic, such as Transport Policy, Journal of Transport Geography, Sustainability and Atmospheric Environment, among others.

5.1. Policy strategies

In recent years, urban mobility has become a particularly relevant issue for political decision-makers and planners who consider the different alternatives that citizens have to move around cities. In the main European cities, measures are being taken in order to expel private vehicles from the centre. In the first place, mobility limitations are applied to vehicles considered to be the most polluting and, secondly, regulations are beginning to be developed with the aim of removing combustion cars in the near future to make room for those vehicles with a lower environmental impact such as electric or hydrogen-fueled vehicles.

On the other hand, the development of technological applications due to technological disruption has caused an exponential growth of mobility solutions.

In several cities such as Barcelona (Spain), local authorities have taken measures to protect protect the most traditional sectors such as Taxi. For this reason, they have implemented regulations that seriously hinder the use of applications for shared ride services such as UBER.

On the other hand, the shared use of vehicles such as cars, motorcycles and bicycles provide additional solutions for residents who do not have their own vehicle. For this reason, it is important that policy makers and planners consider developing alternative strategies to increase the effectiveness of the decisions they make to promote mobility within cities and towns. It should be noted that in different European

cities public bicycle services have been implemented and competition between companies of the new economy that offer rental by the minute and hour of vehicles such as cars and motorcycles has been encouraged. The entry of carsharing companies has also been favored, thus facilitating a more rational shared use of vehicles, which also means a reduction in the costs associated with the use of the means of transport available to users.

5.2. Future lines of research

The greatest advance that this work contributes is the proposal and praise of future lines of research related to this matter. The existence of a line of research related to the study of electric and autonomous vehicles, sustainable development and optimization of urban mobility has been observed. Likewise, there are also strong incentives to propose studies related to technology such as Big data, GPS, Smart Cities, and the optimization of resources, sustainability and urban mobility. Finally, the development of research on shared mobility, shared economy, shared vehicle transport companies, sustainability, consumer preferences and legislative regulations for Taxi and ridesourcing services for urban mobility is proposed.

Author statement

Emili Vizuete-Luciano: Conceptualization, Methodology, Validation, Supervision. **Miguel Guillén-Pujadas**: Methodology, Software, Writing-Original Draft, Data Curation. **David Alaminos**: Resources, Writing-Review & Editing Visualization, Supervision. **Jose María Merigó-Lindahl**: Conceptualization, Writing-Review & Editing Visualization, Supervision.

Data availability

Data will be made available on request.

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