Jomat

Journal of multidisciplinary academic tourism
*2024, 9 (2): 113-126*
*https://doi.org/10.31822/jomat.2024-9-2-113*

ISSN: 2645-9078

# Bibliometric analysis of carsharing and car rental research in the field of urban transportation and tourism transportation

***Bayram Akay***

***Keywords:***
*Bibliometric analysis,*
*Carsharing,*
*Car rental,*
*Urban transportation,*
*Tourism transportation.*

***ABSTRACT***

*This paper reviews recent carsharing and car rental research bibliometrically. The study examines the evolution, structure, and boundaries of Web of Science-reviewed carsharing and car rental research. VOSviewer and SPSS 22 evaluated 204 vehicle rental and 574 carsharing articles in the WOS core collection. A gradual rise in car rental and carsharing studies is shown. China and the US produce the most carsharing and rental publications, respectively. China is the most productive country for carsharing publications and the United States for car rental publications. While China and the United States cooperate on carsharing, the United States cooperates with other countries (Canada, Germany, England, France, Australia, Portugal, Taiwan, Israel) on car rental. Co-occurrence network analysis shows that carsharing has five main themes: sharing economy, electric vehicles, transportation, shared mobility, and mobility as a service, while car rental research has four main themes: revenue management, transportation, quality service, and e-commerce. Carsharing and car rental studies share transportation themes. Carsharing subjects include transportation, engineering, business economics, environmental science ecology, science technology, and computer science, while car rental subjects include management, operations research, economics, transportation, business, transportation science technology, business finance, engineering, tourism, and environmental science. Car rental concerns vary by management, tourism, and finance. Tourism literature neglects car hire. This study thoroughly reviews 26 years of automobile rental and 22 years of carsharing literature. Thus, it can help academics comprehend automobile rental and carsharing studies and direct future research.*

***Article History:***
*Submitted: 19.04.2023*
*Revised:23.08.2023*
*Accepted: 13.11.2023*
*Published Online: 14.11.2023*

## 1. Introduction

The car rental industry in the world originated in the United States in the twentieth century (Zhang *et al*., 2014). This branch of activity started as a simple business with car rental agencies renting cars to customers for a fee (Carroll and Grimes, 1995, p. 84). The car rental industry has grown over time by providing supporting services to the transportation sector, including airlines, highways, railways and cruise ship lines (Maximiliano, 2011, p. 272). This sector is broadly divided into three market segments (Tourism + Business + Local Market): travel, leasing and substitute vehicle market (Geraghty and Johnson, 1997). It is divided into short-term car rental services and long-term (fleet, operational) car rental services as well (Tang and Deo, 2006, p. 806). These services include the rental of minibuses, cars, motorcycles, bicycles, trucks and vans for several purposes (Datamonitor Firm, 2006, p. 7). Large car rental companies have become global companies, operating almost all over the world through their franchise networks (Beech *et al*., 2006, p. 448). For example, Europcar International operates in 170 countries, Avis in 161 countries, Hertz in 150 countries, Sixt in 110 countries, National in 83 countries, Budget in 128 countries and Advantage in 33 countries (Akay, 2021).

Research on carsharing does not have a long history compared to car rental research. Robeson (1952) introduced car rental services for the transportation of public health nurses to rural areas in the USA, and Hyatt (1953) introduced Hertz, Avis and National car rental businesses as road transportation. Although carsharing has existed in Switzerland since 1948 (Li, Zeng & Wang, 2021), the first academic studies are on the past, present and future of carsharing in Europe and North America, as well as the introduction of carsharing and partnership management (Orski, 2001; Shaheen *et al*., 1999; Shaheen *et al*., 1998). In recent years, research on carsharing has increased in various fields such as transportation, business, management, environment and energy (Nansubuga and Kowalkowski, 2021, p. 56). These studies are based on vehicle emissions (Chapman *et al*., 2020), global warming (Ding *et al*., 2019), low cost and green development (Dong *et al*., 2020), urban sustainability (Roblek *et al*., 2021),

***Research Paper***

***Bayram Akay:*** *Assoc. Prof., Burdur Mehmet Akif Ersoy University, Burdur, Türkiye, Email: bakay@mehmetakif.edu.tr, Orcid Id: 0000-0003-4658-6994*

traffic congestion, parking problems (Ke *et al*., 2019), air pollution (Nijland & Meerkerk, 2017) and business models (Meijer *et al*., 2019; Sarasini & Langeland, 2021). Car rental research focused on travel, quality of service (Zhang *et al*., 2014), mobility, sustainability, competition, pricing (Wei-Chiang *et al*., 2007), income management (Beatriz *et al*., 2017;Geraghty & Johnson, 1997), demand forecasting (Menezes & Uzagalieva, 2013; Zhu, 2006), logistics management (Fink & Reiners, 2006; Haensel *et al*., 2012) and fleet planning (Pachon *et al*., 2006). While carsharing and car rental are common practices in the transportation and tourism transportation, a synthesis of information on this topic has not yet been presented. In this study, the articles in the WOS database were analyzed by bibliometric analysis to determine the evolution and structure of the carsharing and car rental literature with different dynamics and to figure out the limit reached by the literature worldwide.

## 2. Literatur Rewiev

### *Car rental and carsharing*

In 1908, the Ford Motor Company produced the low-priced Ford Model T, opening up travel to middle-class Americans. In 1918, Walter L. Jacobs founded the first car rental company, Rent-A-Ford-Car Company (Zhang *et al*., 2014). Avis E. Warren, an automobile dealer, pioneered the car rental service at the Florida Airport in 1946 (Craig *et al*., 2008, p. 40). In the 1970s, enterprises added car types, insurance, pick-up and delivery options to their products (Carroll and Grimes, 1995). In 1978, deregulation of the airline industry led to an increase in the number of airline passengers with discounted airfares. In that period when tourism developed as well, tourists helped to develop not only the airline sector but also the car rental sector (Singh and Zhu, 2007, p. 16). By the 1990s, organizations started to use methods (computerized reservation systems and revenue management) to control their pricing strategies and management systems (Carroll & Grimes, 1995, p. 84). The increasing use of the internet for online booking, check-in and global distribution systems (GDS) became a viable business model for both tourists and car rental businesses (Car Rental Business Global Strategic Business Report, 2008, p. 3).

Car rental has become an increasingly preferred mode of transportation for both travel and tourism purposes (Sun *et al*., 2021). Lazov (2017) defines car rental services as “services for renting cars to corporate and leisure travelers and receiving lease payments. According to Narsaria *et al.* (2020), it is "a set of car rental services for a certain period of time (daily, weekly, monthly, yearly) and for a fee". Carsharing is a type of car rental service where consumers rent a car for various travel purposes (professional, leisure or shopping) for short periods of time, usually charged by the hour (Liu *et al*., 2018; Ouahmed *et al*., 2018). Carsharing is a car rental system where members can access a fleet of vehicles in a relatively short time by booking online or by mobile phone and operating the vehicle with an electronic key card or mobile app (Cisterna *et al*., 2019; H. Kim *et al*., 2017). Carsharing refers to a subscription fee, payments linked to the duration of the reservation, the kilometers traveled and the right to temporary use of a vehicle without responsibility for ownership (Eckhardt *et al*., 2019). Unlike traditional car rental, carsharing relies on platform mediation to identify suitable matches between provider resources and users and facilitate exchange. While car rental requires a contractual agreement every time a car is rented, carsharing usually requires a membership and subscription (Nansubuga & Kowalkowski, 2021). Carsharing differs from its counterparts such as Enterprise, Hertz and Avis in that there are no branches where the vehicles are rented, and all transactions are completed through the network (Skift, 2012).

Carsharing has been available in Switzerland since 1948, but has become a popular mobility solution globally in the last 20 years ((Li, Zeng & Wang, 2021; Ouahmed *et al*., 2018). It has been popularized for offering sustainable solutions to urban mobility problems, especially those related to traffic congestion, air pollution and parking space scarcity (Curtale *et al*., 2021; Wang *et al*., 2020). The ridesharing market is divided into three categories: carsharing, ridesharing, and on-demand ride services (Acheampong & Siiba, 2020). There are also a variety of ride-sharing strategies, such as business-to-consumer (B2C), peer-to-peer (P2P), two-way round-trips, one-way trips, and free-floating strategies (Seo & Lee, 2021, p. 876). Around the world, carsharing is in use in almost all European countries, the United States, Japan, South Korea, Singapore, Malaysia, India, China and Australia. It is estimated to reach around 12 million people by 2020 and revenues are projected to reach $6.5 billion in 2024 (Hjorteset & Böcker, 2020; Mattia *et al*., 2019).

### *Overview of carsharing and car rental bibliometric studies*

Despite the growing number of studies on carsharing and car rental, there are almost no studies on bibliometrics. Roblek *et al.* (2021) conducted a content analysis of 314 carsharing articles published in peer-reviewed journals from the Scopus database using Leximancer. It has identified a total of seven themes: sharing, economy, model, systems, electric vehicle sharing, politics and travel. Nansubuga and Kowalkowski (2021), conducted a systematic analysis of 279 carsharing articles published between 1996 and 2020. As a result of the literature review (customer behavior, drivers and barriers, vehicle balancing, and business models), four basic themes were identified. Anthopoulos and Tzimos (2021) have made a bibliometric analysis of the publications of carpooling platforms as Smart City Projects. Researchers have identified the USA, China, Italy and Spain as the countries with the most publications. The most published journals are Transportation Research Record, Lecture Notes in

Computer Science, Transportation Research Part C: Emerging Technologies, Transport Reviews, Transportation Research Part A: Policy and Practice. Carpooling, smart city, smart mobility, smart transportation, business models and internet of things themes have emerged. However, there has been no bibliometric research focusing on the maturity level of the car rental literature. For this reason, bibliometric studies of car rental research are needed.

## 3. Materials and Methods

### *Data collection and analysis*

Today, data mining has become one of the most important data sources due to the rapid development of the internet and social media usage. Online comments, forums, databases, travel blogs and social media sites are common data collection methods for researchers (Bayram *et al*., 2017; Doğan *et al*., 2016; W. G. Kim *et al*., 2016; Zhou, 2014). The Web of Science (WoS), Scopus and Google Scholar databases are globally accepted for bibliometric analysis. The WOS database was preferred because multiple databases would result in duplication (Liao *et al*., 2018) and the WOS core collection is the most commonly used database (Storme *et al*., 2021; Yu & Liao, 2016). In order to determine the evolution and structure of the concepts of car rental and carsharing and the limit reached by the literature in the world, a bibliometric analysis of the articles on the subject was conducted. To obtain the needed information, answers were sought for the following questions:

- What is the global trend in scientific publications about carsharing and car rental?
- How is research organized in terms of co-authorship by country or region?
- What is the distribution of the studies according to their subjects?
- What are the themes of the studies according to the keywords?
- What are the similar and different aspects of carsharing and car rental related scientific publications?
- How is the common citation status of research according to journals?
- What are the future directions of research in this area?

In the research, the WOS database encodes articles according to criteria such as publication type, article title, source title, authors, keywords, abstract, affiliates, WoS categories, language, cited reference, publication year, volume and issue. In order to ensure the validity of the research, it was decided whether the articles focused directly on car sharing or car rental. The WOS database was used to prevent duplication. Thus, 272 articles (research articles and review articles) related to car rental, rent a car and vehicle rental (1995–2021) were obtained from the WOS Core Collection. After excluding 68 articles on carsharing that contained irrelevant topics and only article tags, 204 articles were finally analyzed for visual analysis. 622 articles (research articles and review articles) related to carsharing (1999-2021) were found. Excluding 48 articles on car rental, rent a car, vehicle rental and irrelevant topics, 574 articles were analyzed. VOSviewer is a creation, visualization and exploration bibliometric tool based on network data. It can be used to create networks of co-authorship, citation, co-occurrence, bibliographic aggregation or co-citation links (Guan & Huang, 2022; Van Eck & Waltman, 2010). In the research, the studies on https://www.webofscience.com were exported and saved as a study file according to the criteria in Table 1. Coauthorship, co-occurrence keywords and co-citation sources were analyzed via the VOSviewer analysis program. Bar chart, pie chart and line chart graphs were created and interpreted with the SPSS program.

**Table 1. Studies search information**

| Criterion | Contain |
|---|---|
| Database | WOS database |
| WOS core search terms | TS = (“car rental”, “rent a car”, “vehicle rental”).TS= (“carsharing”). |
| Language | All language |
| Document types | Article, review article. |
| Timespan | Car rental 1995–2021, carsharing 1999-2021 |

Source: Author

## 4. Results and Discussion

Basic features analysis of publications carsharing

Publication years and productive countries. As shown in Figure 1, there were 574 publications on carsharing between 1999 and 2021, with a gradual increase in the number of publications after 2010. In particular, carsharing publications reached 28 in 2015 and 143 in 2021, a 20-fold increase compared to the number of publications in 2010. This is due to the emergence of carsharing as a new transportation option to solve urban transportation problems in cities such as traffic congestion, parking problems, air pollution, sustainability, and CO2 emissions (Ke *et al*., 2019; Nijland & Meerkerk, 2017).

Figure 2 shows the number of publications in different countries from 1999 to 2021. China contributed to the majority (115) of publications related to carsharing. Being the most populous country in the world (population: 1 billion, 426 million) and having the world's most populous cities such as Beijing, Shanghai, Chongqing, Tianjin, Guangzhou, and Shenzhen, the world's most populous cities seem to be focused on solving traffic problems. The USA and Germany rank second and third, respectively, as the most developed countries in the world. Carsharing research has been hastened in developed countries such as the England, Italy, Netherlands and Canada. Another reason for the increase in carsharing research is the growth of the sharing economy around the world (Roblek *et al*., 2021).

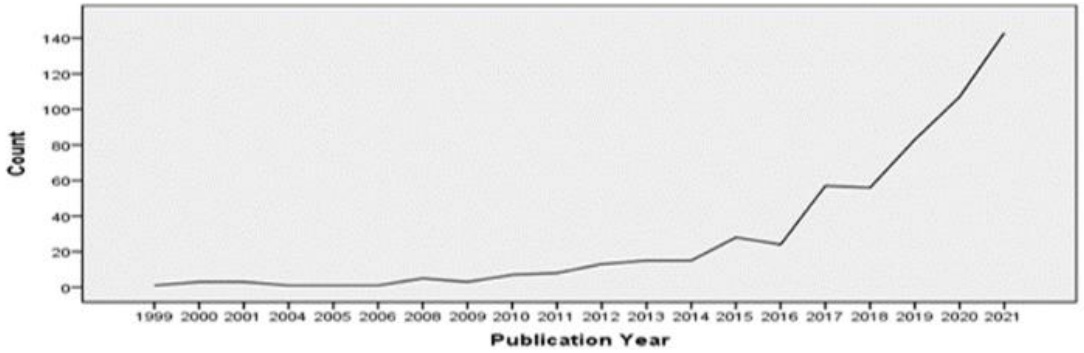


**Figure 1. Year-wise publications in carsharing research**

*Source: Author*

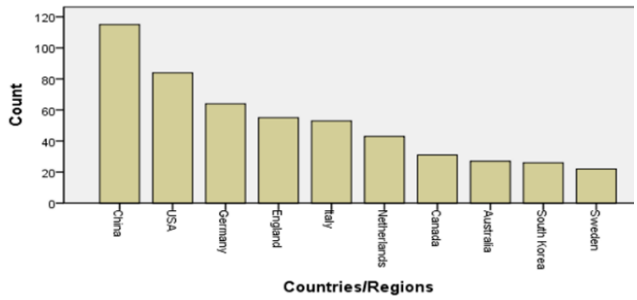


**Figure 2. Top 10 most productive countries with carsharing publications**

*Source: Author*

Co-authorship and core authors. Country co-authorship analysis (co-authorship region/country analysis) is an important form of co-authorship analysis. It might reflect the degree of communication between countries and the influential countries in this field (Liao *et al*., 2018). The country co-authorship network of carsharing-related publications is shown in Figure 4. There are many colors on the map, showing the diversity of research directions. The big gradients stand for influential countries. The links between the gradients stand for the cooperative relationships between the institutes. The distance between gradients and the thickness of the links stand for the level of cooperation between countries. The thicker the line, the closer the cooperation (Perianes-Rodriguez *et al*., 2016). When the threshold was set to 4 in the analysis, 32 out of 65 countries were confirmed to have met this requirement. VOSviewer created six clusters: Austria, Finland, France, Greece, the Netherlands, Portugal, Spain and Switzerland; Canada, Japan, Luxembourg, Singapore, the United Arab Emirates and the United States; China, India, Poland, South Korea and Taiwan; Germany, Israel, Norway, Scotland and Sweden; Australia, Denmark, England and Hungary; and Belgium, Brazil, Ireland and Italy. Figure 3 shows that the centers of research in carsharing are China in Asia and the United States in the Americas. The link strength between China and the United States is 17, between China and the UK is 9, between China and the Netherlands is 7 and between the United States and Germany is 6. This suggests that geographical advantage is not the primary factor influencing the cooperation relationship.

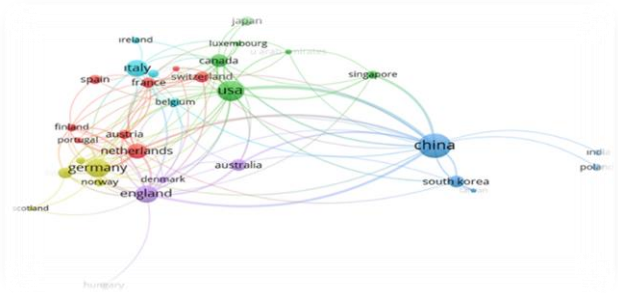


**Figure 3. Country/Region co-authorship network map**

*Source: Author*

As shown in Table 2, Axhausen, K. W., from the University of ETH Zurich, Switzerland, is ranked first with 10 published papers, mainly focusing on modeling free-floating carsharing, comparing carsharing, carsharing systems and mobility. Among the most productive authors, Diana, M., is from Italy; Timmermans, H., from the

**Table 2. Most productive authors in carsharing research**

| Author | YFP | Publications | Total Citation | TC/P | Institution | Countries |
|---|---|---|---|---|---|---|
| Axhausen, Kay W. | 2015 | 10 | 543 | 54,3 | ETH Zurich | Switzerland |
| Diana, Marco | 2018 | 8 | 102 | 12,7 | Polytechnic University of Turin | Italy |
| Timmermans, Harry | 2017 | 6 | 149 | 24,8 | Eindhoven University of Tech. | Netherlands |
| Ciari, Francesco | 2015 | 6 | 549 | 91,6 | Polytechnique Montreal | Canada |
| Liao, Feixiong | 2018 | 5 | 90 | 18 | Eindhoven University of Tech. | Netherlands |
| Becker, Henrik | 2017 | 5 | 322 | 64,4 | ETH Zurich | Switzerland |
| Kent, Jennifer Lee | 2015 | 5 | 132 | 26,4 | University of Sydney | Australia |

Note: YFP: year of first publication

*Source: Author*

Netherlands; and Ciari, F., from Canada. Becker, H. with Axhausen, K. W. all 5 articles of and Becker, H. and Ciari, F. with Axhausen, K. W. 3 articles of are collective. The number of citations is one of the most important criteria used to measure the impact of articles (Kızılöz, 2020). Regarding the most citations per publication, Polytechnique University of Montreal in Canada, and ETH Zurich University in Switzerland have a relatively high number of cited articles. The fact that researchers from the most productive countries in the carsharing research field (China, the United States, Germany, and England) are not among the most productive authors demonstrates that it is a research topic.

Subject categories and keywords co-occurrence. The topic category aims to identify the history (1999–2021) of research topics on carsharing. Figure 4 presents the first category, which includes many disciplines such as transportation, engineering, business economics, environmental science, science technology and computer science. This shows that research on carsharing is multidisciplinary.

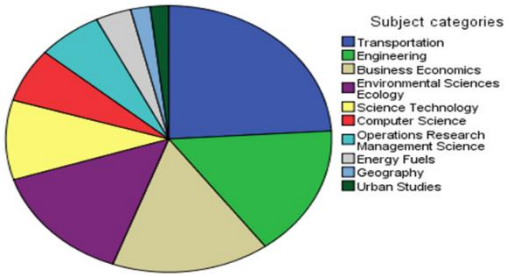


**Figure 4. Top ten subject categories with carsharing publications**

*Source: Author*

Keywords co-occurrence can effectively reflect the research hotspots in the discipline fields, providing auxiliary support for scientific research (Liao *et al*., 2018). Keywords can reflect trends in a particular subject area over a specific period (Guan & Huang, 2022; Yang and Meng, 2019). Low frequency keywords have minimal impact and high frequency keywords have high impact (Xue *et al*., 2020). Figure 5 shows the co-occurrence visualization map of keywords in references related to carsharing in the period 1999–2021. A co-occurrence keyword analysis was conducted using Vosviewer for 1,692 keywords and five word frequency thresholds. The analysis revealed five clusters (carsharing, electric vehicles, transportation, shared mobility and mobility as a service) under five different themes.

The first cluster (in green) identifies empirical research that analyzes the role of ridesharing and the sharing economy on various outcomes such as sustainable mobility, collaborative consumption, attitudes, Uber and mode choice. This research has focused on the role of attitude in sharing (Acheampong & Siiba, 2020), facilitating collaborative consumption (Tan *et al*., 2017), transitioning to sustainable mobility (Terama *et al*., 2018), understanding the sharing economy and becoming an Uber driver (Valente *et al*., 2019) and carsharing preferences (Carrone *et al*., 2020).

The second cluster (in purple) is formed by various empirical studies focusing on carsharing systems for electric vehicles, scheduling, autonomous vehicle and shared autonomous vehicles (Huang *et al*., 2020; Li, Long & Yu, 2021; Luo *et al*., 2021; Smet, 2021; Zhao *et al*., 2021). In particular, the studies in this cluster have focused on vehicle relocation and substitution in carsharing systems, online scheduling, the design problem of autonomous vehicle systems, and infrastructure planning for electric autonomous carsharing.

The third cluster (in red) consists of automobiles, public transportation, smart city, urban mobility, electric

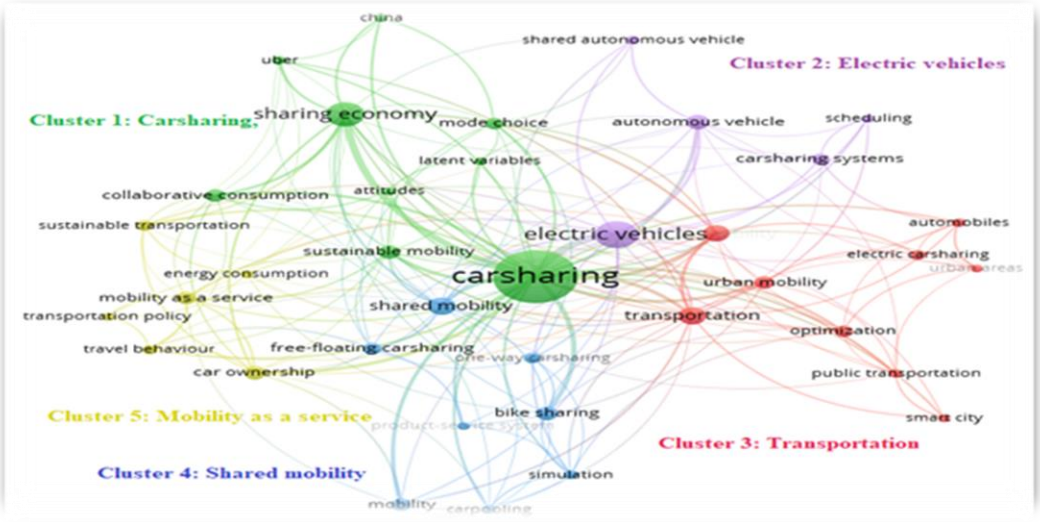


**Figure 5. Keyword co-occurrence network map**

*Source: Author*

carsharing and sustainability studies related to transportation (Bardhi and Eckhardt, 2012; Dias *et al*., 2017; Firnkorn & Müller, 2011). For example, Choi and Yoon (2017) study examines carsharing and public transportation, Tao *et al*.'s (2021) study examines carsharing under smart city conditions, and Awasthi *et al*.'s (2018) study examines the sustainability of urban mobility projects.

The fourth cluster (in blue) consists of carsharing types, including shared mobility, bike sharing, free floating, one-way carsharing, carpooling and simulation. Most of the articles focus on shared mobility as a driving force, factors affecting shared mobility, the welfare impact of shared mobility, the sustainability of shared mobility and shared mobility on urban traffic congestion to solve urban mobility and traffic problems (Akyelken *et al*., 2018; Becker *et al*., 2020; Giovanni *et al*., 2019; Jiachen *et al*., 2021; Jie *et al*., 2021; Li & Kamargianni, 2020).

Finally, the fifth cluster (in yellow) reflected a few mixed papers, but holistically they examined travel behavior, transportation policy, sustainable transport, energy consumption and car ownership under mobility as a service (Becker *et al*., 2018; Dowling & Kent, 2015; Yinghui *et al*., 2011). Some articles focused on car ownership, consumer awareness and carsharing intention as well (Burlando *et al*., 2019; Ikezoe *et al*., 2020).

Co-citation source analysis. Journal co-citation analysis is not only an effective way to study the structure and characteristics of a subject but also reveals the overall structure of the subject and the characteristics of a journal (Hu *et al*., 2011). Figure 6 shows the 157-gradient journal co-citation network from the VOSviewer co-citation sources analysis. The size of the gradient stands for the activity of the journal and the number of articles published. The distance between two gradients is also particularly important. In general, the smaller the distance between two gradients, the higher the attribution frequency. As shown in the visualization in Figure 6, each cluster has a color showing the group to which it is assigned. It is seen that all these journals are categorized into five clusters.

The red cluster includes the Journal of Cleaner Production, the Journal of Business Research and the Journal of Consumer Research. The red cluster stands for clean production, business and consumer research. The yellow cluster includes the Journal of Transportation Research Record, the Journal of Transportation Research Part A: Policy and Practice, etc. The green cluster includes Journal of Transportation Research Part B: Methodological; Journal of Transportation Research Part C: Emerging Technologies, Journal of Transportation Research Part E: Logistics and Transportation Review, etc. Journal of Transportation Research Part D: Transport and Environment and Journal of Energy Policy are included in the blue cluster. The small purple cluster includes Transportation Letters and Innovative Mobility Research (IMR) journals. The last four clusters cover policy, methodology, technology, logistics, environment, and energy under the overall theme of transportation. Carsharing research is interdisciplinary with different disciplines.

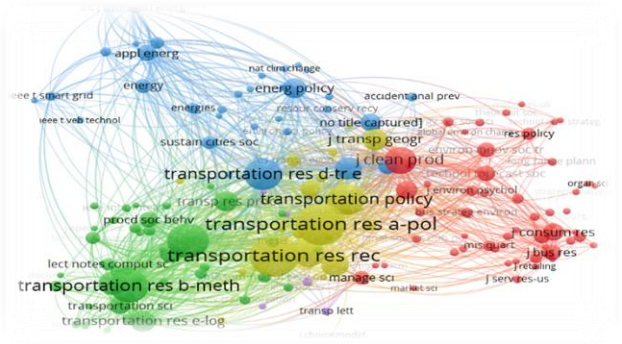


**Figure 6. The journal co-citation network of carsharing related publications**

*Source: Author*

## *Basic Features Analysis of Publications Car Rental*

Publication time and productive countries. 221 publications on car rental, rent a car and vehicle rental were made between 1995 and 2021, and 204 publications were evaluated by removing 17 publications from the carsharing list, the focus of which was not on car rental (Figure 7). While the number of articles initially fluctuated, it gradually increased after 2015. Publications are on travel (tourism transportation, service quality, mobility, sustainability, tourist satisfaction and loyalty, competition, pricing, travel product, market segmentation), leasing (fleet size and planning, revenue management, demand forecasting) and mathematical modeling (social networks, algorithm, TOPSIS, Neural Networks, vector model) (Alberto *et al*., 2014; Beatriz *et al*., 2017; Haensel *et al*., 2012; Menezes & Uzagalieva, 2013; Netessine *et al*., 2002; Pachon *et al*., 2006; Wei-Chiang *et al*., 2007; Yang *et al*., 2009; Zhang *et al*., 2014). In terms of the number of publications, it can be said that there is a need for car rental studies, which is a part of tourism transportation. Hence, Maximiliano (2011) notes that while much attention has been paid in the literature to hotels, tour operators, railways, airlines, food and beverage or gastronomy, destination management, etc., rent-a-car has received almost no attention.

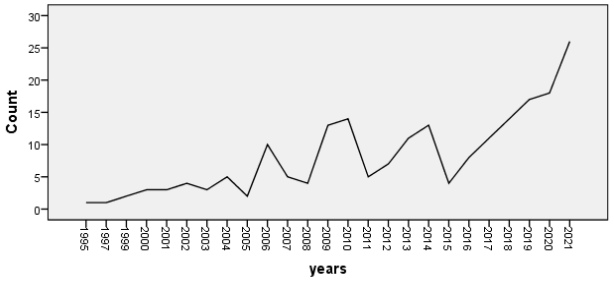


**Figure 7. Year-wise publications in car rental research**

*Source: Author*

Figure 8 shows the leading countries in the car rental literature according to the number of publications. It shows the top 10 countries contributing to nine or more publications. The most productive country was the USA with 66 broadcasts, followed by China in second place with 24 broadcasts, England in third place with 15 broadcasts and the Spain in fourth place with 12 broadcasts. Consequently, the USA dominates the car rental literature, contributing around 32% of all publications. It is because the sector spreads from here and because it is the most developed location. In the USA, an average of 1.98 million cars are in service at 17,676 different locations in 2020 (Auto Rental News Firm, 2022).

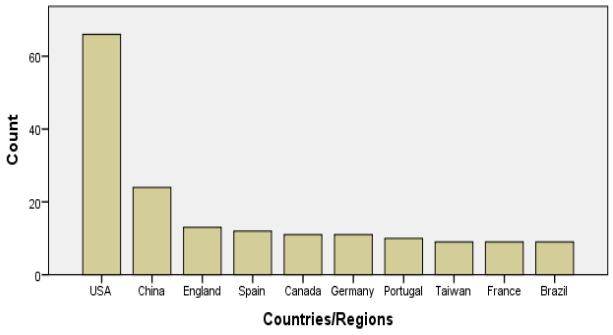


**Figure 8. Top 10 most productive countries with car rental publications**

*Source: Author*

Co-authorship and core authors. To better understand the development of car rental research cooperation between countries, a co-author network map of research countries was used between 1995 and 2021 (Figure 9). When the threshold was set to 2 in the Vosviewer analysis, 29 out of 52 countries were confirmed to have met this requirement. VOSviewer created six clusters: Australia, Brazil, England, Finland, France, Italy and Portugal; Canada, Israel, China, Singapore and the United States; Austria, Germany, Scotland and the Netherlands; India, Japan and South Korea; Belgium and Sweden; and Taiwan and Turkey. The United States and England are research centers in the field of car rental. The link strength between the United States and China is 5, between the United States and Canada is 3, between the United States and England is 3, between China and Singapore is 3 and between China and England is 3. This suggests that geographical advantage is not the primary factor affecting the cooperation relationship. While China's cooperation with other countries is leading in carsharing, the United States' cooperation with other countries is leading in car rental.

The number of citations is the main factor to reflect the quality of a paper (Liao *et al*., 2018). According to the citation analysis 204 documents included in the scope of the research received a total of 3908 citations. The citation value per article is 19.16. The citation value per author is 2.30 (3908÷1702). George and Xia (2011) study has 149 citations, Bertsimas and Popescu (2003) study has 130 citations, Geraghty and Johnson (1997) study has 114 citations, Netessine *et al*., (2002) study has 94 citations and Carroll and Grimes (1995) study has 85 citations. (Figure 10). Car rental research has received fewer citations, according to carsharing research.

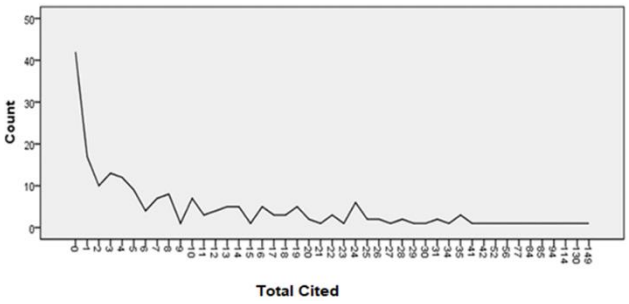


**Figure 10. Number of citations to car rental publications**

*Source: Author*

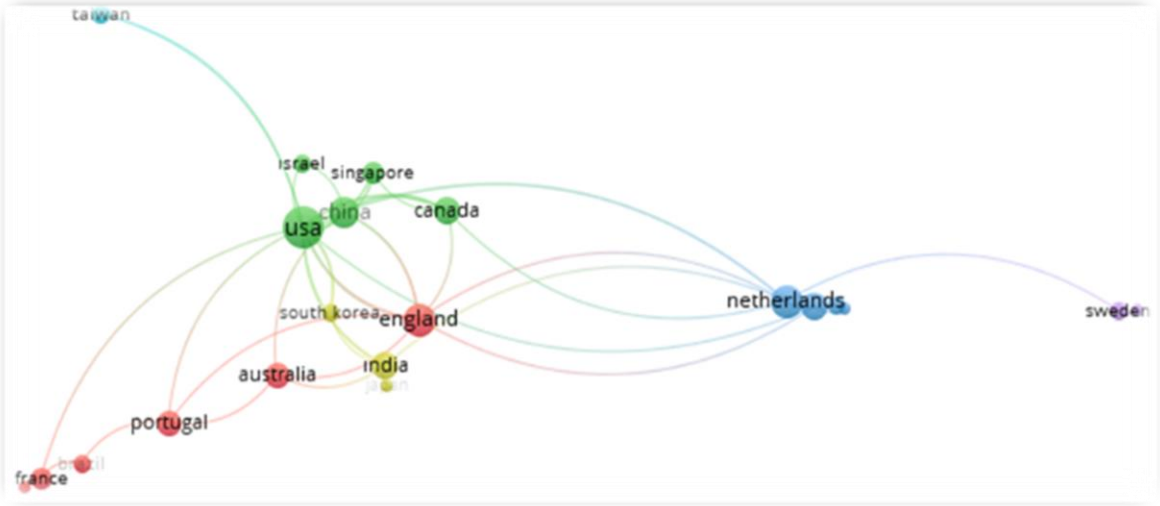


**Figure 9. Country/Region co-authorship network map**

*Source: Author*

Subject categories and co-occurrence analysis. The topic category (Figure 11) aims to name the history (1995–2021) of research topics on car rental, vehicle rental and rent a car. This field of study is multidisciplinary, with areas such as management, operations research, economics, transportation, business, transportation science technology, business finance, engineering, tourism and environmental science. A comparison of carsharing subject categories with car rental subject categories shows differences in areas such as management, tourism and business finance. Car rental topics are more focused on management, economics, business and tourism.

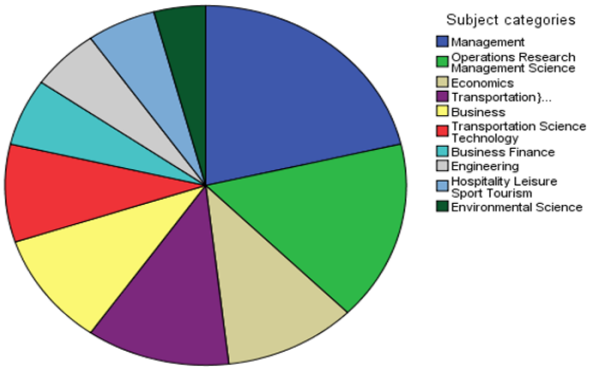


**Figure 11. Top ten subject categories with car rental publications**

*Source: Author*

Using Vosviewer, 676 keywords (word frequency threshold 2) from articles on car rental, rent a car and vehicle rental were grouped into four different themes (Figure 12). These themes (revenue management, transportation, quality service and e-commerce) reflect the research focus of car rental research.

The first cluster (in dark blue, bottom center) focuses on revenue management practices in car rental businesses, clarifying pricing, capacity control and the use of electric vehicles (Anderson & Carroll, 2007; Bertsimas & Popescu, 2003; Haensel *et al*., 2012; Li & Pang, 2017; Oliveira *et al*., 2017). The contexts of research with a greater focus on this cluster include the integration of pricing and capacity utilization in car rental (Oliveira *et al*., 2017), the pricing and capacity utilization problem (Queirós & Oliveira, 2021), an integrated revenue management approach to capacity control (Steinhardt & Gönsch, 2012), multi-electric vehicle allocation, charging, EV leasing and EV adoption (He *et al*., 2020; Langbroek *et al*., 2019; Sun *et al*., 2021).

The second cluster (in yellow, bottom right) consists of articles on the e-commerce practices of car rental businesses in the online world. Scientists have focused on online travel transactions, online purchasing and how it affects purchase decisions (Marcus & Anderson, 2006; Venkateshwara & Smith, 2006; Yinghui *et al*., 2011). Researchers have also examined scheduling issues in car rental operations (pick-up and delivery and working hours of staff) (Ernst *et al*., 2010; Kulkarni *et al*., 2018).

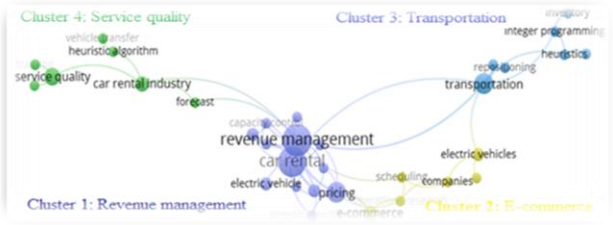


**Figure 12. Keyword co-occurrence network map**

*Source: Author*

The third cluster (in blue, top right), contains research documents focusing on the role of car rental enterprises in tourism transportation. The majority of the articles in that cluster include the use of integer-linear programming techniques to solve problems in tourist mobility, car rental systems, relocation strategies and fleet assignment (Conejero *et al*., 2016; George & Xia, 2011; Martin *et al*., 2019; Roy *et al*., 2014).

Lastly, the fourth cluster (in green, top left) consists of empirical research on service quality in the car rental industry (Ekiz *et al*., 2009; Hashem, 2015; Shah & Shah, 2022) and seeks to explore customer satisfaction and loyalty (Şimşek & Yarımoğlu, 2019; Zhang *et al*., 2014). Service quality consists of six dimensions as comfort, delivery, safety, handing over, ergonomics and accessibility and has an impact on customer satisfaction and loyalty. The authors also examined demand forecasting, revenue forecasting and dynamic forecasting techniques in car rental enterprises (Guillen *et al*., 2019; Hong *et al*., 2007; Shah, & Shah, 2022; Zhu, 2006). Transportation is a common cluster of carsharing and car rental. The car rental clusters are revenue management, service quality and e-commerce, while the carsharing clusters are sharing economy, electric vehicles, shared mobility and mobility as a service (MAAS). Therefore, these two concepts, which are fundamentally similar but have different dynamics, have been analyzed separately.

Co-citation source analysis. The Figure 13 shows that 39-gradient journals are divided into three clusters according to co-citations source analysis. The red cluster includes the European Journal of Operational Research (EJOR), Journal of Operational Research and the Journal of Computers & Operations Research. The red cluster stands for computers and operations research. The green cluster includes Journal of Transportation Research Record, Journal of Tourism Management, Journal of Transport Policy. The green cluster focuses on tourism and transportation management. The blue cluster, on the other hand, includes the Journal of Management, Journal of Marketing and Journal of Business Research. The blue cluster publishes on management, marketing and business issues. Carsharing research is mostly published in transportation, cleaner production and consumer research journals, whereas car rental research is published in management, marketing, business and, to a lesser extent, tourism journals.

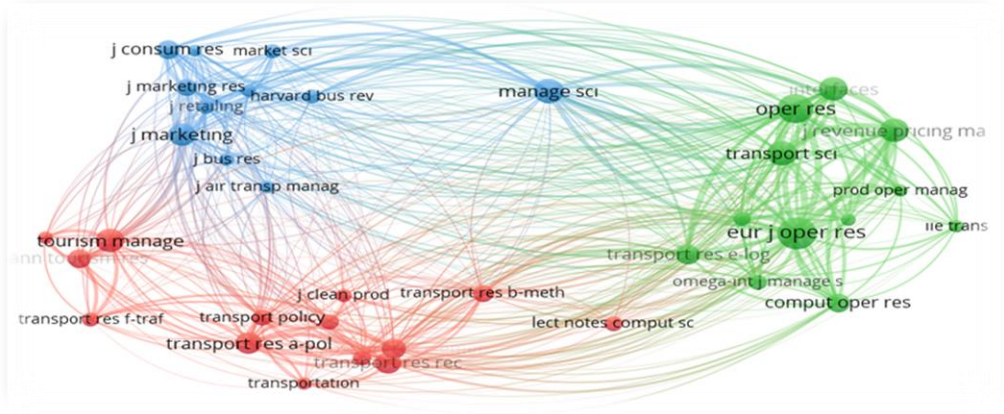


**Figure 13. The journal co-citation network of car rental related publications**

*Source: Author*

## 5. Discussion and Conclusions

In this study, bibliometric analysis and visualization were applied to publications related to carsharing and car rental. By data mining the articles from the WOS database, the overview and evolution of the car rental literature were evaluated between 1995 and 2021 and the carsharing literature between 1999 and 2021. Performance analysis (productive countries, co-authorship and core authors), co-occurrence analysis and co-citation analysis were applied in order to achieve the objective of this study. This is the first attempt for mapping an organized conceptual and intellectual structure by applying bibliometric techniques (Öztürk & Dil, 2022).

The world car rental industry originated in America in the twentieth century (Zhang *et al*., 2014). Carsharing beginning of the in the 21st century emerged as a business model that is the evolution of classic car rental especially in big cities with traffic, parking, environmental, GHG emissions and energy problems (Cocca *et al*., 2020). Today, tourists travel to the destination by using transportation vehicles from their region. They rent a car on part or all of their trips within the destination. In the same way, city residents generally prefer hourly car sharing for professional, leisure or shopping. City residents prevent negative environmental impacts such as less emissions, less fuel, less parking, less traffic by choosing car sharing instead of car ownership.

The results for the quantitative data set show that the carsharing literature dates back to the 1999s, and the field has been maturing in recent years (107 articles in 2020 and 143 articles in 2021). The car rental literature, which generally provides services for tourism transportation, indicates that the field has not matured (18 articles in 2020 and 26 articles in 2021) and the number of articles has fluctuated over the past years. China is the most productive country in carsharing (114 articles), while the United States is the most productive country in car rental with 65 publications. The solution to traffic problems (traffic congestion, emissions, noise, parking, etc.) in China's crowded cities has been addressed by researchers (Chen & Kockelman, 2016; Cheng *et al*., 2021; Jian *et al*., 2020; Lee *et al*., 2014). The United States has consolidated its leadership in car rental (global reach, advanced service network, etc).

In carsharing research, China collaborates with the United States, the UK, the Netherlands, South Korea, India and Poland, while the United States collaborates with Canada, England, Singapore and Israel on car rental. This suggests, contrary to Fengand Cui (2021), that geographical location does not affect collaboration between researchers in different countries. Carsharing research is mostly published in transportation, cleaner production, and consumer research journals, while car rental research is published in management, marketing, business and, to a lesser extent, tourism journals. More research on car rental enterprises, which constitute an important branch of tourism transportation (Dănilă & Gaceu, 2009), might be published in tourism journals. Hattingh (2022) argues that given the size of the car rental market within the tourism sector, it has received surprisingly little attention from researchers.

In the carsharing research, five themes were identified, namely carsharing, electric vehicles, transportation, shared mobility and mobility as a service. Roblek *et al.* (2021) identified seven similar themes, namely sharing, economics, modeling, systems, electric carsharing, policy and travel. In the car rental research, four themes were identified: revenue management, transportation, quality service and e-commerce. Transportation is a common cluster of carsharing and car rental. This situation reveals that although the two concepts have similar characteristics, they have different dynamics and are worthy of further research.

Although this research provides important new insights into carsharing and car rental research, it, like all research, has limitations. At the beginning, the data set was prepared by extracting articles from the journals indexed in the Web of Science database. Although this database has a large

portfolio of journals (Yu & Liao, 2016), a couple of research might have been missed. Second, it only considers journal articles as opposed to other relevant published works (book, chapter, proceeding paper).Thirdly, very few publications in other languages (Turkish, Polish, Spanish, French and Portuguese) with abstracts and keywords in English were analyzed. Fourthly, co-authorship/countries, co-citation/cited sources and co-occurrence/keyword analyses were conducted as per the total word count limitation of the article. However, further analysis such as co-authorship/author/organizations, co-citation/cited references/cited authors and citation/document, authors/organizations/countries may help to find out various aspects. Finally, using visualization analysis, this research helps researchers understand the evolution, structure and reach of carsharing and car rental research. Future research may include such as rental behavior, innovation, entrepreneurship, agglomeration, customer loyalty, company profitability and performance.

## References

Acheampong, R. A., & Siiba, A. (2020). Modelling the determinants of carsharing adoption intentions among young adults: the role of attitude, perceived benefits, travel expectations and socio-demographic factors, Transportation, 47(5), 2557-2580, https://doi.org/10.1007/s11116-019-10029-3

Akay, B. (2021). Socio-Economic Effects and Recovery Efforts for the Rental Industry: Post-COVID-19 Strategies: In M. Kortanje (Ed.), Renting Cars and Trucks (p. 93–110), IGI Global International Academic Publisher.

Akyelken, N., Banister, D., & Givoni, M. (2018). The Sustainability of Shared Mobility in London: The Dilemma for Governance. Sustainability, 10(2), 420. https://doi.org/10.3390/su10020420

Alberto, C. J., Cristina, J., & Esther, S. C. (2014). An Iterative Algorithm for the Management of an Electric Car-Rental Service, Journal of Applied Mathematics, 8(3), 1-11 https://doi.org/10.1155/2014/483734

Anderson, C. K., & Carroll, B. (2007). Demand management: Beyond revenue management. Journal of Revenue and Pricing Management, 6(4), 260-263. https://doi.org/10.1057/palgrave.rpm.5160092

Anthopoulos, L. G., & Tzimos, D. N. (2021). Carpooling Platforms as Smart City Projects: A Bibliometric Analysis and Systematic Literature Review. Sustainability, 13, 10680. https://doi.org/10.3390/su131910680

Auto Rental News Firm (2022). https://www.autorentalnews.com/10132672/u-s-car-rental-revenue-dives-27-4-in-2020.

Awasthi, A., Omrani, H., & Gerber, P. (2018). Investigating ideal-solution based multicriteria decision making techniques for sustainability evaluation of urban mobility projects, Transp. Res. Pt. A-Policy Pract, 116, 247-259. https://doi.org/10.1016/j.tra.2018.06.007

Bardhi, F., & Eckhardt, G. M. (2012). Access-Based Consumption: The Case of Car Sharing, Journal of consumer research, 39 (4), 881–898. https://doi.org/10.1086/666376

Bayram, M., Bayram, Ü., & Kara, M. (2017). Evaluatıon of the Kyrgyzstan online destination image. 3rd International Symposium of the Turkish World, 20-22 April 2017, Kyrgyzstan, p. 476-485.

Beatriz, B. O., Maria, A. C., & José, F. O. (2017). Fleet and revenue management in car rental companies: A literature review and an integrated conceptual framework, Omega, 71, 11-26. https://doi.org/10.1016/j.omega

Becker, H., Balac, M. Ciari, F., & Axhausen, K. W. (2020). Assessing the welfare impacts of Shared Mobility and Mobility as a Service (MaaS), Transportation Research Part A: Policy and Practice, 131, 228-243. https://doi.org/10.1016/j.tra.2019.09.027.

Becker, H., Ciari, F., & Axhausen, K. W. (2018). Measuring the car ownership impact of free-floating carsharing - A case study in Basel, Switzerland, Transportation Research Part D: Transport and Environment, 65, 51-62. https://doi.org/10.1016/j.trd.2018.08.003

Beech, J. G., Beech, J., & Chadwick, S. (2006). The Business of Tourism Management, Financial Times/Prentice Hall, England

Bertsimas, D., & Popescu, I. (2003). Revenue management in a dynamic network environment. Transportation Science, 37(3), 257-277. https://doi.org/10.1287/trsc.37.3.257.16047

Burlando, C., Ivaldi, E., Saiani, P. P., & Penco, L. (2019). To own or not to own? Car ownership and consumer awareness: Evidence from an Italian survey, Research in Transportation Business & Management, 33. https://doi.org/10.1016/j.rtbm.2020.100435

Car Rental Business Global Strategic Business Report (2008). Global strategic business report global industry analysts, https://www.researchandmarkets.com/reports/338373/car_rental_business_global_strategic_business.

Carroll, W., & Grimes, R. (1995). Evolutionary change in product management: experiences in the car rental industry, Interfaces, 25(5):84-104. https://doi.org/10.1287/inte.25.5.84

Carrone, P., Andrea, H., Valerie, M. J., Anders F. M., Stefan, E., & Rich, J. (2020). Understanding car sharing preferences and mode substitution patterns: A stated preference experiment, Transport Policy, 98, 139-147. https://doi.org/10.1016/j.tranpol.2020.03.010

Chapman, D. A., Eyckmans, J., & Van Acker, K. (2020). Does Car-Sharing Reduce Car-Use? An Impact Evaluation of Car-Sharing in Flanders, Belgium. Sustainability, 12, 8155. https://doi.org/10.3390/su12198155

Chen, T. D., & Kockelman, K. M. (2016). Carsharing's life-cycle impacts on energy use and greenhouse gas emissions, Transportation Research Part D: Transport and Environment, 47, 276-284. https://doi.org/10.1016/j.trd

Cheng, J., Chen, X., Ye, J., & Shan, X. (2021). Flow-based unit is better: exploring factors affecting mid-term OD

demand of station-based one-way electric carsharing, Transportation Research Part D: Transport and Environment, 98. https://doi.org/10.1016/j.trd.2021.102954.

Choi, J., & Yoon, J. (2017). Utilizing Spatial Big Data platform in evaluating correlations between rental housing car sharing and public transportation. Spat. Inf. Res., 25, 555–564. https://doi.org/10.1007/s41324-017-0122-6

Conejero, J. A., Jordán, C., & Sanabria-Codesal, E. (2016). An algorithm for self-organizationof driverless vehicles of a car-rental service. Nonlinear Dyn. 84, 107–114. https://doi.org/10.1007/s11071-015-2237-4

Craig, S., Phil, M., & Meerman, S. D. (2008). Tuned In: Uncover the Extraordinary Opportunities That Lead to Business Breakthroughs, Hoboken, John Wiley Inc.

Cisterna, C., Giorgione, G., Cipriani, D., & Viti, F. (2019). Supply characteristics and membership choice in round-trip and free-floating carsharing systems, 5-7 Jun 2019, 6th International Conference on Models and Technologies for Intelligent, Krakow, Poland.

Cocca, M., Teixeira, M., Vassio, L., Mellia, M., Almeida, M. J., & Silva, A. P. C. (2020). On Car-Sharing Usage Prediction with Open Socio-Demographic Data, Electronics 9(72), 1-20, doi:10.3390/electronics9010072.

Curtale, R., Liao, F., & Waerden, P. (2021). User acceptance of electric car-sharing services: The case of the Netherlands, Transportation Research Part A: Policy and Practice, 149, 266-282. https://doi.org/10.1016/j.tra.2021.05.006

Dănilă, D. M., & Gaceu, L. (2009). Online evaluation method for assessing the variation of the tourist number interested in car rental. In: Bulletin of the Transilvania University of Braşov, Series II, 2(51), 75-78.

Datamonitor Firm (2006). Global Car Rental Industry Profile, Reference Code: 0199-0031. www.datamonitor.com.

Dias, F. F., Lavieri, P. S., & Garikapati, V. M. (2017). A behavioral choice model of the use of car-sharing and ride-sourcing services. Transportation, 44, 1307–1323. https://doi.org/10.1007/s11116-017-9797-8

Ding, N., Pana, J., Zhang, Z., & Yang, J. (2019). Life cycle assessment of car sharing models and the effect on GWP of urban transportation: A case study of Beijing, Science of The Total Environment, 688, 1137-1144. https://doi.org/10.1016/j.scitotenv.2019.06.111

Doğan, S., Güngör, M. Y., & Tanrıverdi, A. (2016). Content analysis of online consumer reviews: a case study on food & beverage enterprises in Kuşadası. International Refereed Journal of Marketing and Market Researches, 9, 1-22. Doi: 10.17369/UHPAD.2016923643.

Dong, X., Cai, Y., Cheng, J., Hu, B., & Sun, H. (2020). Understanding the Competitive Advantages of Car Sharing from the Travel-Cost Perspective. Int. J. Environ. Res. Public Health, 17, 4666. https://doi.org/10.3390/ijerph1713466

Dowling, R., & Kent, J. (2015). Practice and public–private partnerships in sustainable transport governance: The case of car sharing in Sydney, Australia, Transport Policy, 40, 58-64. https://doi.org/10.1016/j.tranpol.

Eckhardt, G. M., Houston, M. B., Jiang, B., Lamberton, C., Rindfleisch, A., & Zervas, G. (2019). Marketing in the sharing economy, Journal of Marketing, 83(5), 5-27. https://doi.org/10.1177/0022242919861929

Ekiz, E. H., Bavik, A., & Arasli, H. (2009). RENTQUAL: A new measurement scale for car rental services. Tourism: An international Interdisciplinary Journal, 57, 135-153.

Ernst, A. T., Horn, M., Kilby, P., & Krishnamoorthy, M. (2010). Dynamic scheduling of recreational rental vehicles with revenue management extensions, Journal of the Operational Research Society, 61(7), 1133-1143. https://doi.org/10.1057/jors.2009.78

Feng, Y., & Cui, S. (2021). A review of emergency response in disasters: present and future perspectives, Journal of Natural Hazards, 105(1), 1109-1138. https://doi.org/10.1007/s11069-020-04297-x

Fink, A., & Reiners, T. (2006). Modeling and solving the short-term car rental logistics problem, Transportation Research Part E Logistics and Transportation Review, 42(4), 272-292. https://doi.org/10.1016/j.tre.2004.10.003

Firnkorn, J., & Müller, M. (2011). What will be the environmental effects of new free-floating car-sharing systems? Ecological Economics, 70(8), 1519-1528. https://doi.org/10.1016/j.ecolecon.2011.03.014

George, D. K., & Xia, C. H. (2011). Fleet-sizing and service availability for a vehicle rental system via closed queueing networks, European Journal of Operational Research, 21(1), 198-207. https://doi.org/10.1016/j.ejor.2010.12.015

Geraghty, M., & Johnson, E. (1997). Revenue Management Saves National Car Rental, INFORMS, 27(1), 107-127.

Giovanni, M., Roberta G. M., & Ludovica, P. (2019). Shared mobility as a driver for sustainable consumptions: The intention to re-use free-floating car sharing, Journal of Cleaner Production, 237, 124-140. https://doi.org/10.1016/j.jclepro.2019.06.235

Guan, H., & Huang, T. Z. (2022). Rural tourism experience research: a bibliometric visualization review (1996-2021), Tourism Review. https://doi.org/10.1108/TR-03-2022-0147

Guillen, J., Ruiz, P., Dellepiane, U., Maccarrone, L., Maccioni, R., Pinzuti, A., & Procacci, E. (2019). Europcar Integrates Forecasting, Simulation, and Optimization Techniques in a Capacity and Revenue Management System. INFORMS Journal on Applied Analytics, 49(1):40-51. https://doi.org/10.1287/inte.2018.0970

Haensel, A., Mederer, M., & Schmidt, H. (2012). Revenue management in the car rental industry: A stochastic programming approach. J Revenue Pricing Management, 11, 99–108. https://doi.org/10.1057/rpm.2010.52.

Hashem, D. N. (2015). The impact of quality of services in the car rental companies on customer satisfaction. Economy & Business Journal, 9, 494-502.

Hattingh, L. (2022). Going Out-There: A Literature Review on Drive Tourism Within the South African Context. African Journal of Hospitality, Tourism and Leisure, 11(SE1):595-616. https://doi.org/10.46222/ajhtl.19770720.245

He, L., Ma, G., Wei, Q., & Xin, W. (2020). Charging an electric vehicle-sharing fleet. Manufacturing & Service Operations Management 23(2), 471-487. https://doi.org/10.1287/msom.2019.0851.

Hjorteset, M. A., & Böcker, L. (2020). Car sharing in Norwegian urban areas: Examining interest, intention and the decision to enroll, Transportation Research Part D: Transport and Environment, 84, 1-15. https://doi.org/10.1016/j.trd.2020.102322.

Hong, W. C., Lai, Y. J., Pai, P. F., & Yang, S. L. (2007). An improved support vector model in car-rental revenue forecast, Journal of Statistics and Management Systems, 10:3, 427-437. https://doi.org/10.1080/09720510.2007.10701263

Huang, A. K., Rich, J., & Ma, W. J. (2020). Vehicle relocation in one-way station -based electric carsharing systems: A comparative study of operator -based and user-based methods, Transportation research part e-logıstics and transportation review, 12(3). https://doi.org/10.1016/j.tre.2020.102081.

Hu, C. P., Hu, J. M., Gao, Y., & Zhang, Y. K. A. (2011). Journal co-citation analysis of library and information science in China. Scientometrics, 86, 657–670. https://doi.org/10.1007/s11192-010-0313-6

Hyatt, M. R. (1953). There's a Car in The Picture, Challenge, 1 (9), 55-58.

Ikezoe, K., Kiriyama, E., & Fujimura, S. (2020). Car-sharing intention analysis in Japan by comparing the utility of car ownership for car-owners and non-car owners, Transport Policy, 96, 1-14. https://doi.org/10.1016/j.tranpol.2020.05.018

Jiachen, L., Ma, M., Xia, X., & Ren, W. (2021). The spatial effect of shared mobility on urban traffic congestion: evidence from Chinese Cities, Sustainability, 13(24), 13-24. https://doi.org/10.3390/su132414065

Jian, S., Liu, W., Wang, X., Yang, H. S., & Waller, T. (2020). On integrating carsharing and parking sharing services, Transportation Research Part B: Methodological, 142, 19-44. https://doi.org/10.1016/j.trb.2020.09.013

Jie, F., Standing, C., Biermann, S., Standing, S., & Le, T. (2021). Factors affecting the adoption of shared mobility systems: Evidence from Australia, Research in Transportation Business & Management, 41. https://doi.org/10.1016/j.rtbm.2021.100651

Ke, H., Chai, S., & Cheng, R. (2019). Does car sharing help reduce the total number of vehicles? Soft Computer 23, 12461–12474. https://doi.org/10.1007/s00500-019

Kızılöz, H. E. (2020). Citation count prediction of academic papers. European journal of science and technology, 370-375. https://doi.org/10.31590/ejosat.araconf48

Kim, H., Chio, H. K., Kim, K. J., & Park, E. (2017). From owning to sharing: understanding the emergence of social sharing services, Program: electronic library and information systems, 51(2), 102-115.

Kim, W. G., Li, J. J., & Brymer, R. A. (2016). The impact of social media rewievs on restaurand performance: the moderating role of excellence certificate. International Journal of Hospitality Management, 55, 41-51.

Kulkarni, S., Patil, R., Krishnamoorthy, M., Ernst, A., & Ranade, A. (2018). A new two-stage heuristic for the recreational vehicle scheduling problem, Computers & Operations Research, 91, 59-78. https://doi.org/10.1016/j.cor.2017.11.004

Lazov, I. (2017). Profit management of car rental companies, European Journal of Operational Research, 258(1), 307-314. https://doi.org/10.1016/j.ejor.2016.08.064

Li, Y., Long, J. C., & Yu, M. (2021). A time-dependent shared autonomous vehicle system design problem, Transportation Research Part C: Emerging Technologies,124,11-26. https://doi.org/10.1016/j.trc.2020.102956

Li, M., Zeng, Z., & Wang, Y. (2021). An innovative car sharing technological paradigm towards sustainable mobility, Journal of Cleaner Production, 288, https://doi.org/10.1016/j.jclepro.2020.125626

Li, W., & Kamargianni, M. (2020). An ıntegrated choice and latent variable model to explore the ınfluence of attitudinal and perceptual factors on shared mobility choices and their value of time estimation. Transportation Science, 54(1), 62-83. https://doi.org/10.1287/trsc.2019.0933

Li, D., & Pang, Z. (2017). Dynamic booking control for car rental revenue management: A decomposition approach, European Journal of Operational Research, 256(3), 850-867. https://doi.org/10.1016/j.ejor.2016.06.044.

Liao, H., Tang, M., Luo, L., Li, C., Chiclana, F., & Zeng, X. J. (2018). A bibliometric analysis and visualization of medical big data research, Sustainability, 10(2), 1-18.

Liu, Z., Jia, Y., & Zhu, X. (2018). Deployment Strategy for Car-Sharing Depots by Clustering Urban Traffic Big Data Based on Affinity Propagation, Scientific Programming, 1-9, https://doi.org/10.1155/2018/3907513

Lee, J. B., Byun, V., Lee, S. H., & Do, V. (2014). Correlation between optimal carsharing locations and carbon dioxide emissions in urban areas, Int. J. Environ. Sci. Technol. 11, 2319–2328. https://doi.org/10.1007/s13762-014-0640-x

Langbroek, J. H. M., Cebecauer, M., Malmsten, J., Franklin, J. P., Susilo, Y O., & Georén, P. (2019). Electric vehicle rental and electric vehicle adoption, Research in Transportation Economics, 73(C), 72-82. https://doi.org/10.1016/j.retrec.2019.02.002

Luo, K. L., Xu, Y. F., & Liu, H. D. (2021). Online scheduling of car-sharing request pairs between two locations, Journal of Combinatorial Optimization 43(5), 1240-1263. https://doi.org/10.1007/s10878-020-00635-8

Marcus, B., & Anderson, C. K. (2006). Online Low-Price Guarantees—A Real Options Analysis. Operations Research, 54(6), 1041-1050. https://doi.org/10.1287/opre.1060.0333.

Martin, J. M., Guaita, M. J. M., Molina, M. V., & Sartal, R. A. (2019). An Analysis of the Tourist Mobility in the Island of Lanzarote: Car Rental Versus More Sustainable Transportation Alternatives. Sustainability, 11(3):739. https://doi.org/10.3390/su11030739

Mattia, G., Mugion, R. G., & Principato, L. (2019). Shared mobility as a driver for sustainable consumptions: The intention to re-use free-floating car sharing, Journal of Cleaner Production, 237. https://doi.org/10.1016/j.jclepro.2019.06.235

Maximiliano, K. (2011). Rent-a-car industry: a case study in Argentina tourismos: an international multidisciplinary, Journal of Tourism, 6(1), 271-280.

Meijer, L. L. J., Schipper, F., & Huijben, J. C. C. M. (2019). Align, adapt or amplify: Upscaling strategies for car sharing business models in Sydney, Australia, Environmental Innovation and Societal Transitions, 33, 215-230. https://doi.org/10.1016/j.eist.2019.06.003

Menezes, A., & Uzagalieva, A. (2013). The Demand of Car Rentals: a Microeconometric Approach with Count Models and Survey Data, Review of economic analysis, 5(1), 25-41.

Nansubuga, B., & Kowalkowski, C. (2021). Carsharing: a systematic literature review and research agenda, Journal of Service Management, 32(6), 55-91. https://doi.org/10.1108/JOSM-10-2020-0344

Narsaria, I., Verma, M., & Verma, A. (2020). Measuring satisfaction of rental car services in India for policy lessons, Case Studies on Transport Policy, 8(3), 832-838.

Netessine, S., Dobson, G., & Shumsky, R. A. (2002). Flexible Service Capacity: Optimal Investment and the Impact of Demand Correlation. Operations Research, 50(2),375-388. https://doi.org/10.1287/opre.50.2.375.428

Nijland, H., & Meerkerk, J. (2017). Mobility and environmental impacts of car sharing in the Netherlands, Environmental İnnovation and Societal Transitions, 23, 84- 91, https://doi.org/10.1016/j.eist.2017.02.001

Oliveira, B. B., Carravilla, M. A., & Oliveira, J. F. (2017). Fleet and revenue management in car rental companies: A literature review and an integrated conceptual framework, Omega-Int. J. Management, 71, 11-26. https://doi.org/10.1016/j.omega.2016.08.011

Pachon, J., Iakovou, E., & Chi, I. (2006). Vehicle fleet planning in the car rental industry. Journal Revenue Pricing Management, 5, 221–236. https://doi.org/10.1057/palgrave.rpm.5160041

Perianes-Rodriguez, A., Waltman, L., & Van Eck, N. J. (2016). Constructing bibliometric networks: A comparison between full and fractional counting. Journal of Informetrics, 10(4), 1178–1195.

Queirós, F., & Oliveira, B. B. (2021). Impact of environmental concerns on the capacity-pricing problem in the car rental business, Journal of Cleaner Production, 322. https://doi.org/10.1016/j.jclepro.2021.129044

Robeson, K. A. (1952). Car rental for public health nurses in rural areas. Public health nursing, 44 (3), 132-133.

Roblek, V., Meško, M., & Podbregar, I. (2021). Impact of Car Sharing on Urban Sustainability. Sustainability, 13, 1-19. https://doi.org/10.3390/su13020905

Roy, D., Pazour, J. A., & Koster, R. (2014). A novel approach for designing rental vehicle repositioning strategies, IIE Transactions, 46(9), 948-967. https://doi.org/10.1080/0740817X.2013.876129.

Seo, J., & Lee, S. (2021). Who gives up a private car for a car-sharing service? An empirical case study of Incheon City, South Korea, International Journal of Sustainable Transportation. https://doi.org/10.1080/15568318.2021.1949077

Shah, R. T., & Shah, T. T. (2022). Innovative m-car rental service quality in India, International Journal of Innovation Science, 14 (3/4), http://doi,org/10.1108/IJIS

Shaheen, S., Sperling, D., & Wagner, C. (1999). Carsharing and partnership management: An international perspective, Transportation Research Record, 1666, 118 – 124.

Shaheen, S., Sperling, D., & Wagner, C. (1998). Carsharing in Europe and North America: Past, present, and future, Transportation Quarterly, 52(3), 35 – 52.

Sarasini, S., & Langeland, O. (2021). Business model innovation as a process for transforming user mobility practices, Environmental Innovation and Societal Transitions, 39, 229-248, https://doi.org/10.1016/j.eist.2021.04.005

Singh, V., & Zhu, T. (2007). Pricing and Market Concentration in Oligopoly Markets, Marketing Science, 27(6), 1020-1035. https://doi.org/10.1287/mksc.1070.0357.

Skift, D. S. (2012). Hertz's acquisition of Dollar Thrifty. https://skift.com/2012/08/27/hertz-to-acquire-dollar-thrifty-much-competition.

Smet, P. (2021). Vehicle substitution in heterogeneous round-trip carsharing systems, Computers & Industrial Engineering, 162, 20-41. https://doi.org/10.1016/j.cie.2021.107703

Steinhardt, C., & Gönsch, J. (2012). Integrated Revenue Management Approaches for Capacity Control with Planned Upgrades, European Journal of Operational Research, 223, 380-391. http://dx.doi.org/10.2139/ssrn.1515865.

Storme, T., Casier, C., Azadi, H., & Witlox, F. (2021). Impact Assessments of New Mobility Services: A Critical Review. Sustainability. 13(6), 3074. https://doi.org/10.3390/su13063074

Sun, M. D., Shao, C. F., Zhuge, C. X., Wang, P. X., Yang, X., & Wang, S. Q. (2021). Exploring the potential of rental electric vehicles for vehicle-to-grid: A data-driven approach, Conservation and Recycling, 175. https://doi.org/10.1016/j.resconrec.2021.105841

Şimşek, M., & Yarımoğlu, E. (2019). Service Quality, Satisfaction, and Loyalty Relations in the Car Rental Industry, Ege Academic Review, 19(1), 89-101. https://doi.org/10.21121/eab.2019148777

Tan, F. T. C., Cahalane, M., Tan, B., & Englert, J. (2017). How go get car share's product-service system is facilitating collaborative consumption, MIS Quarterly

Executive, 16(4). https://aisel.aisnet.org/misqe/vol16/iss4/5

Tang, C., & Deo, S. (2006). Rental price and rental duration under retail competition, European Journal of Operational Research, 23(11), 806-828. https://doi.org/10.1016/j.ejor.2006.03.061

Tao, Z., Nie, O., & Zhang, W. (2021). Research on travel behavior with car sharing under smart city conditions, Journal of Advanced Transportation, 13, 138-152. https://doi.org/10.1155/2021/8879908

Terama, E., Peltomaa, J., Rolim, C., & Baptista, P. (2018). The Contribution of Car Sharing to the Sustainable Mobility Transition, journal of mobility studies, 8(2), 113-121. https://doi.org/10.3167/TRANS.2018.080207

Orski, C. K. (2001). Car sharing, Transportation Quarterly, 55(4), 13-15.

Ouahmed, A., Josselin, J., & Zhou, F. (2018). Relocation optimization of electric cars in one-way car-sharing systems: modeling, exact solving and heuristics algorithms, International Journal of Geographical Information Science, 32:2, 367-398. https://doi.org/10.1080/13658816.2017.1372762.

Öztürk, O., & Dil, E. (2022). Bibliometric Analysis of Organizational Ecology Theory (OET): To Review Past for Directing the Future of the Field, Ege Academic Review, 22(2), 195-212. https://doi.org/10.21121/eab.980638

Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics, 84(2), 523–538.

Valente, E., Patrus, R., & Córdova, G. R. (2019). Sharing economy: becoming an Uber driver in a developing country, Revista de Gestão, 26(2), 143-160. https://doi.org/10.1108/REGE-08-2018-0088

Wang, N., Guo, J., Liu, X., & Fang, T. (2020). A service demand forecasting model for one-way electric car-sharing systems combining long short-term memory networks with Granger causality test, Journal of Cleaner Production, 244. https://doi.org/10.1016/j.jclepro.2019.118812

Wei-Chiang, H., Young-Jou, L., Ping-Feng, P., & Shun-Lin, Y. (2007) An improved support vector model in car-rental revenue forecast, Journal of Statistics and Management Systems, 10:3,427-437. https://doi.org/10.1080/09720510.2007.10701263

Venkateshwara, R. B., & Smith, B. (2006). Decision support in online travel retailing. Journal Revenue Pricing Management, 5, 72–80. https://doi.org/10.1057/palgrave.rpm.5160012

Xue, W., Li, H., Ali, R., & Rehman, R. U. (2020), Knowledge mapping of corporate financial performance research: A visual analysis using cite space and ucinet. Sustainability, 12(9):3554. https://doi.org/10.3390/su12093554

Yang, Y. Z., Jin, W. Z., & Hao, X. N. (2009). Dynamic Pool Segmentation Model and Algorithm in the Car Rental Industry, journal of computers, 4(12), 1202-1208. https://doi.org/10.4304/jcp.4.12.1202-1208.

Yang, Y. & Meng, G. F. (2019). A bibliometric analysis of comparative research on the evolution of international and Chinese ecological footprint research hotspots and frontiers since 2000, Ecological Indicators, 102, 650-665.

Yinghui, Y., Hongyan, L., & Yuanjue, C. (2011). Discovery of Online Shopping Patterns Across Websites. INFORMS Journal on Computing, 25(1), 161-176. https://doi.org/10.1287/ijoc.1110.0484

Yu, D. J., & Liao, H. C. (2016). Visualization and quantitative research on intuitionistic fuzzy studies. J. Intell. Fuzzy Syst. 30, 3653–3663. https://doi.org/10.3233/IFS.

Zhang, M., Xie, Y., Huang, L., & He, Z. (2014). Service quality evaluation of car rental industry in China, International Journal of Quality & Reliability Management, 31(1), 82-102. https://doi.org/10.1108/IJQRM-11-2012-0146

Zhao, D. F., Li, X. P., & Cui, J. X. (2021). A simulation-based optimization model for infrastructure planning for electric autonomous vehicle sharing, Comput.-Aided Civil Infrastruct. Eng. 36(7), 858-876. https://doi.org/10.1111/mice.12506

Zhou, L. (2014). Online rural destination images: Tourism and rurality. Journal of Destination Marketing & Management, 3(2), 227–240.

Zhu, J. (2006). Using turndowns to estimate the latent demand in a car rental unconstrained demand forecast. Journal Revenue Pricing Management, 4, 344–353. https://doi.org/10.1057/palgrave.rpm.5170157

Jomat

**Journal of multidisciplinary academic tourism**

ISSN: 2645-9078

2024, 9 (2): 113-126

*https://doi.org/10.31822/jomat.2024-9-2-113*

# INFO PAGE

# Bibliometric analysis of carsharing and car rental research in the field of urban transportation and tourism transportation

## Abstract

*This paper reviews recent carsharing and car rental research bibliometrically. The study examines the evolution, structure, and boundaries of Web of Science-reviewed carsharing and car rental research. VOSviewer and SPSS 22 evaluated 204 vehicle rental and 574 carsharing articles in the WOS core collection. A gradual rise in car rental and carsharing studies is shown. China and the US produce the most carsharing and rental publications, respectively. China is the most productive country for carsharing publications and the United States for car rental publications. While China and the United States cooperate on carsharing, the United States cooperates with other countries (Canada, Germany, England, France, Australia, Portugal, Taiwan, Israel) on car rental. Co-occurrence network analysis shows that carsharing has five main themes: sharing economy, electric vehicles, transportation, shared mobility, and mobility as a service, while car rental research has four main themes: revenue management, transportation, quality service, and e-commerce. Carsharing and car rental studies share transportation themes. Carsharing subjects include transportation, engineering, business economics, environmental science ecology, science technology, and computer science, while car rental subjects include management, operations research, economics, transportation, business, transportation science technology, business finance, engineering, tourism, and environmental science. Car rental concerns vary by management, tourism, and finance. Tourism literature neglects car hire. This study thoroughly reviews 26 years of automobile rental and 22 years of carsharing literature. Thus, it can help academics comprehend automobile rental and carsharing studies and direct future research.*

**Keywords:** *Bibliometric analysis, Carsharing, Car rental, Urban transportation, Tourism transportation.*

## Authors



| Full Name | Author contribution roles | Contribution rate |
|---|---|---|
| ***Bayram Akay:*** | *Conceptualism, Methodology, Software, Validation, Formal Analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision, Project administration, Funding acquisition* | *100%* |



***Author statement:*** *Author(s) declare(s) that All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.* ***Declaration of Conflicting Interests:*** *The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article*

**This paper does not required ethics committee report**

**Justification: The methodology of this study does not require an ethics committee report.**