




“Sustainable development and sharing economy: A bibliometric analysis”

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SUSTAINABLE DEVELOPMENT AND SHARING ECONOMY: A BIBLIOMETRIC ANALYSIS

Abstract

Sustainability promotes a feasible strategy to achieve a continuous development of the economy, society, and environment. This study aims to analyze the growing efforts on researches made by academic communities in exploring the sharing economy as a potential approach to promote sustainable development. A bibliometric approach with VOSviewer and COOC analysis was applied. A total number of 975 published articles were analyzed in this study. As a result, it was found that few studies have shed light on collaborative and sustainable consumption, climate change, and bioeconomy in the sharing economy by country, such as renewable resources and business models, circular economy in China, and life cycle assessment, particularly taking evidence from the urban mobility services in China. It was also revealed that there is a new interdisciplinary research trend in the field of sustainable development such as sustainable business models, game theory, blue economy, peer-to-peer accommodation, smart grids, and electric vehicles. Other trend concentrates on technological advancements and policies to promote sustainable development in the sharing economy.

Keywords

sustainability, sharing, circular economy, collaborative
consumption, urban mobility, innovation, China

JEL Classification

A12, Q01, Q20

INTRODUCTION

As an everlasting topic in the economic and social progress of human beings, sustainable development can be dated back to the 1960s when environmental consciousness emerged in the society as economic development was obtained at the cost of environmental degradation (Cao et al., 2019). It refers to the “development that meets the needs of current generations without compromising the ability of future generations to meet their needs and aspirations” (Steurer et al., 2005), which is also defined as the strategy of maximizing the net gains of economic growth while preserving natural resources and providing quality goods and services (Barbier, 1989). The essence of the concept of sustainable development is to balance the three central pillars, i.e., environmental sustainability, social sustainability, and economic sustainability (Klarin, 2018). The introduction of sustainability provides new approaches for dealing with complex and interconnected economic, environmental, and social developments. After years of practice, it has been made due to contribution in generating environmental consideration in policy-making, promoting environmental management in business, and improving citizens’ environmental awareness.

Despite the achievements of sustainability initiatives, the overall development patterns are still on an unsustainable track that results in resource exhaustion (Ahamad & Ariffin, 2018; Torras, 2000), biodiversity decline (Brito et al., 2018; Chaudhary & Kastner, 2016; Crenna et al., 2019), habitat loss (Giam et al., 2010; Wilkie et al., 2019), climate change (Ayers & Dodman, 2010; Holden, 2019), and environmental

degradation (Notarnicola et al., 2017; Olanipekun et al., 2019). As a result, there is an urgent need to develop new approaches to achieve the sound and lasting growth of the economy, society, and environment. In this regard, the sharing economy will probably provide a new way for sustainable development (Heinrichs, 2013). It is vigorously promoted both in the academic community to explore its feasibility in consumption reduction and resource conservation (Ala-Mantila et al., 2016; Chen et al., 2019; Gerwe & Silva, 2020) and in the society by industries, businesses, and policy-makers for its potential in sustainability (Asian et al., 2019; Curtis & Lehner, 2019). However, a bibliometric analysis of the academic literature related to sustainable development in the sharing economy is rarely seen, particularly in terms of urban mobility services in China like bike-sharing (Lan et al., 2017; Yin et al., 2019) and car-sharing (Ding et al., 2019). This study investigates the knowledge landscape related to sustainability in the sharing economy from 2010 to 2020. Bibliometric methods such as frequency, authorship, co-authorship, citation, co-citation, co-reference, and co-occurrence of the extracted academic articles were used to explore the influential articles, major researchers, prolific countries/regions, contributing journals, co-operating organizations, hot topics, and research trends.

1. DATA SOURCE AND ANALYSIS TOOLS

1.1. Data source and retrieval strategy

The bibliographic data to be analyzed were obtained from the Science Citation Index Expanded (SCI-E) and Social Sciences Citation Index (SSCI) in the Core Collection of Web of Science, which is referred to as the most important and influential database to retrieve academic records and conduct bibliometric analysis because it lists over 12,400 prestigious academic journals (Zhao et al., 2020) and is updated continuously (Azer & Azer, 2019). The keyword combinations that were searched on November 30, 2020 in the Web of Science Core Collection are 'Sustainable Development' and 'Sharing Economy', and 'Sustainability' and 'Sharing Economy'. Documents are articles in the English language from 2010 to 2020. 977 articles were obtained, and the total publications were reduced to 975 because there were two repeated articles.

1.2. Analysis tools

This study utilizes Co-Occurrence 6.7 (COOC 6.7) to count the frequency and draw the wind rose diagram of productive authors and word cloud map and weighted time-zone map of keywords (Xueshudiandi, 2020). It also uses VOSviewer 1.6.13 to visualize the collaboration network be-

tween countries/regions, organizations and journals, and co-occurrence network of keywords. Developed by Leiden University in the Netherlands, VOSviewer can create various graphs for different disciplines based on the algorithm of co-citation, co-authorship, and coupling of bibliographic references (Van Eck & Waltman, 2010). It has been widely used in bibliometric mapping (Williams, 2020) to construct networks to reveal collaboration and research trends.

2. RESULTS

2.1. Publication output

As shown in Figure 1, the number of publications related to sustainable development in the sharing economy has been rising per year since the beginning of the study period. The number of published documents was only 17 in 2010, which reached 274 in the single year of 2020, six times more than the number in the starting year of this analysis. The total amount reached 975 in 2020, marking that the publications of academic papers in this research field increased by 57 times in the past decade. Sustainability in the sharing economy proves to be a research hotspot that is constantly drawing attention from the academic circle.

975 papers identified in this review were cited 9,425 times according to the number of citations from the Web of Science Core Collection. Table 1 lists the top 16 papers that have been cited over

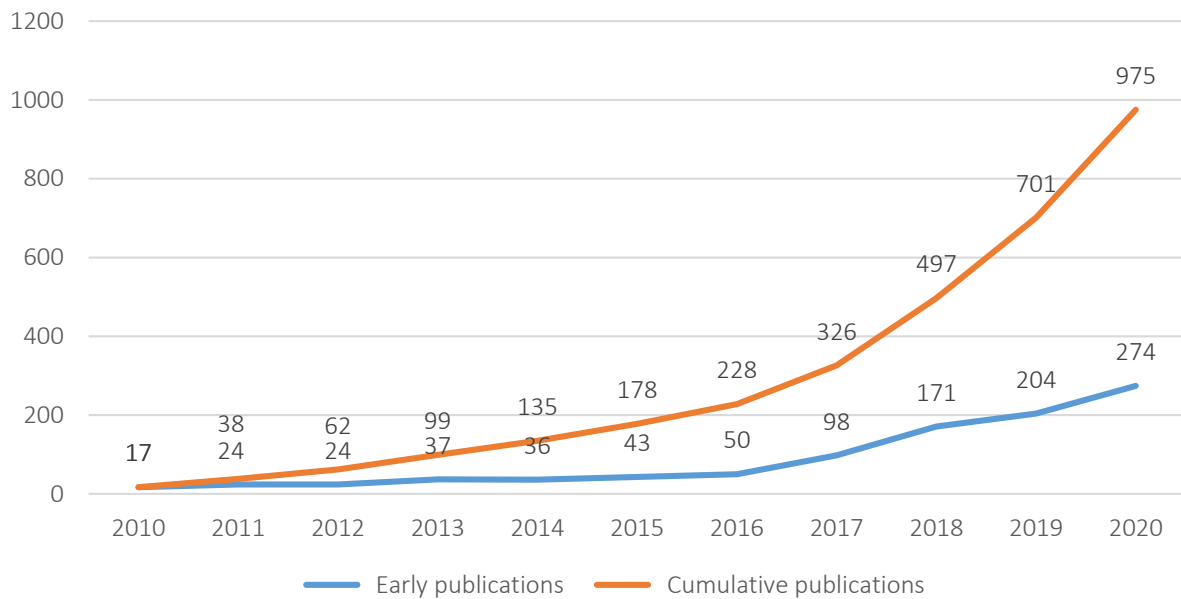


Figure 1. Number of published documents on sustainable development in the sharing economy from 2010 to 2020

100 times. The article by Hamari et al. (2016) is cited 784 times, which doubles the cited times of the paper at the second place and implies its weight in this research topic. It shows that people's motivations to engage in collaborative/sustainable consumption are multifaceted, such as concerns for sustainability, enjoyment of activities, and economic benefits. Sustainability is not directly related to participation unless it is also related to positive attitudes towards collaborative consumption.

The second most frequently cited paper (388 times) by Martin (2016) frames the sharing economy as an opportunity for economic growth, an approach of more sustainable utilization of resources, and the creation of unregulated markets, strengthening the neoliberal paradigm and a disconnected form of innovation. It was suggested that the sharing economy will be unable to transit into a sustainable economy if it chooses the path of corporate co-option.

Cohen and Kietzmann (2014) (cited 320 times) analyzed the current shared mobility business models for sustainability in shared mobility services based on agency theory to reveal the best relation between service providers and local governments. The results showed that confrontations were prevalent in private or public mod-

els while the merit model is most feasible for mobility service providers and local governments.

Frenken and Schor (2017) developed a conceptual framework to define the associated forms of sharing economy and to comprehend its abrupt emergence in terms of economic history. After evaluating the platforms of sharing economy from the perspective of the influences on the economy, society, and environment, the existing supervision and later substitutable platforms were discussed and future researchers were invited to pay attention to the platforms' management, scalability and effects.

Heinrich (2013) introduced the conceptual perspectives of the sharing economy through the lens of sustainable development, including the relation between materialist and post-materialist values, the impact of environmentalism and sustainability, new ideas towards material well-being, and living quality, etc. Sharing economy can be used as an umbrella concept that contains a vision to help comprehend novel inventions, emerging economic activities, and social interactions. Given its potential contribution to economic and social sustainability, interdisciplinary and cross-disciplinary studies on sustainable development should be distributed to the research on the sharing economy in a systematic way.

Table 1. 16 most highly cited academic articles on sustainable development in the sharing economy from 2010 to 2020

Ranking	Year	Cited (times)	Journal	Academic articles
1	2016	784	Journal of The Association for Information Science and Technology	Hamari et al. (2016)
2	2016	388	Ecological Economics	Martin (2016)
3	2014	320	Organization & Environment	Cohen and Kietzmann (2014)
4	2017	269	Environmental Innovation and Societal Transitions	Frenken and Schor (2017)
5	2013	233	Gaia-Ecological Perspectives for Science and Society	Heinrichs (2013)
6	2013	176	Geoforum	Bassett and Fogelman (2013)
7	2010	172	Journal of Construction Engineering and Management	Chan et al. (2010)
8	2011	170	Energy Economics	Lin and Jiang (2011)
9	2017	139	Environmental Innovation and Societal Transitions	Bocker and Meelen (2017)
10	2014	137	Global Environmental Change-Human and Policy Dimensions	Schaffartzik et al. (2014)
11	2011	136	Landscape Ecology	Cumming (2011)
12	2011	128	Energy	Zhang et al. (2011)
13	2010	113	Journal of Cleaner Production	Coenen et al. (2010)
14	2010	106	Journal of Peasant Studies	Dauvergne and Neville (2010)
15	2016	103	Technological Forecasting and Social Change	Barnes and Mattsson (2016)
16	2018	103	Current Issues in Tourism	Tussyadiah and Pesonen (2018)

2.2. Authors

975 articles retrieved in this study are composed of 3,132 authors. Figure 2 presents the researchers who contributed more than four papers. The most prolific authors are Mangalagiu and Thornton who contributed 7 publications in the studied period (Figure 2). Being cited 152 times in total, these seven articles were all co-authored by them between 2017 and 2020, which implies their major research interest in sharing economy, sustainable development, collaborative governance, Shanghai, value co-creation, urban mobility, and social innovation. Based on a case study with quantitative and qualitative approaches on Mobike, a bike-sharing platform in China, they identified the major contributing factors in the sharing economy that enable people from passive recipients to active creators in the process of consumption and designed a framework that integrates social learning and social innovation of the realization of sustainable development to create values by both users and platforms (Lan et al., 2017). Through three cases of sharing cars, electric vehicles, and bicycles of Shanghai, China, they found that there was a robust co-evolutionary framework between the sustainable development of cities and innovations in the business ecosystem in the direction of environment-friendly mobility (Ma et al., 2018b). As the dramatic growth of shared bicycles damaged social and environmental sustainability and

put pressure on city administration, they suggested a feasible collaborative governance model that cultivates and incorporates social actors to achieve sustainable urban development (Ma et al., 2018a). From the case studies on Mobike and EVCARD (an electric-vehicle-sharing platform), they developed a conceptual framework to underline the significance of co-creating values between governments, sharing platforms, and users in the emergent sharing economy (Ma et al., 2019). Sharing systems can achieve win-win results by reducing perceived scarcity and reciprocity risks and affect users' intentions and ability to substitute collaborative consumption for private possessions (Lan et al., 2020). After comparing the mobility sharing sector in Shanghai and the energy efficiency of the building industry in Istanbul, they found that providing a properly conducive environment for the destabilization of the regime and joint efforts from various parties can ensure the transformation of urban sustainability and move forward in achieving the goals of sustainable growth (Yazar et al., 2020). In a comparative case study of Mobike in Shanghai, Som Energia in Girona (a clean energy cooperative), an urban agri-food supplier in Venice, and energy-efficient construction start-ups in Istanbul, they proposed a theoretical model to facilitate the sustainable transformation including cocreation, coevolution, and co-governance between the city, the environment-friendly businesses and the society (Ma et al., 2020).

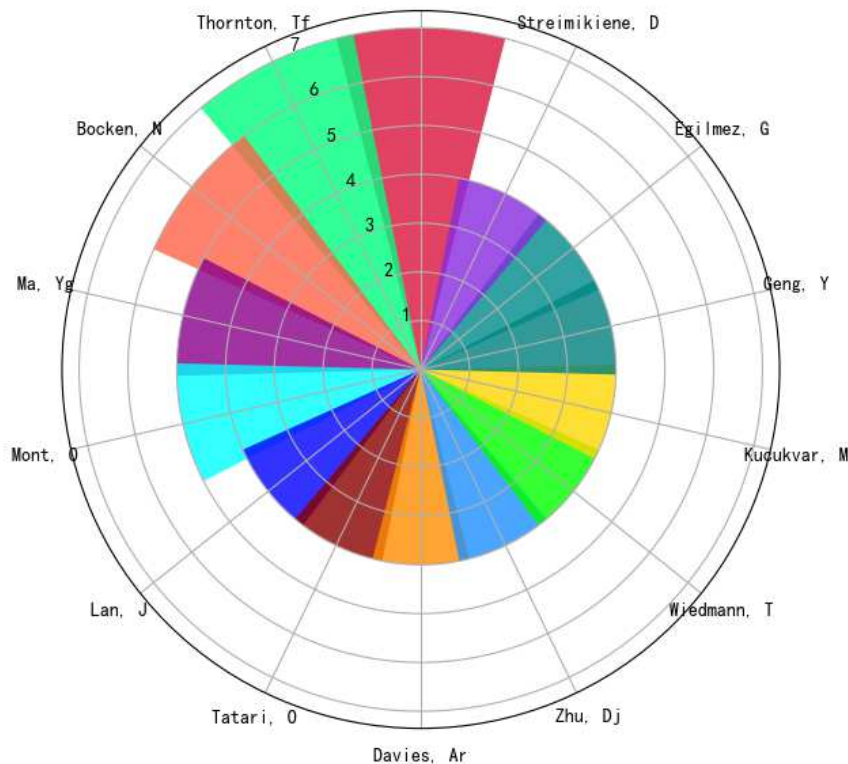


Figure 2. Wind rose diagram of the top 14 most productive authors on sustainable development in the sharing economy from 2010 to 2020

Contributing six articles with 98 cited times in the retrieved references, Bocken's main research focuses are sustainable business models, circular economy, sharing cities, ecosystems, and urban environmentalism. Based on the review of the scattered academic literature on sharing models of supplies, Boons and Bocken (2018) used ecosystem thinking to conceptualize the transition process to a sharing economy and proposed a method to evaluate the impact of sharing business modes on the environment that considers the system context. Through six case studies of emerging circular cities, leadership, adjustable visions for the future, experimental methods, background knowledge about utilization of resources, and interacting with stakeholders were identified as prominent policy strategies for developing circular cities (Prendeville et al., 2018). Based on the case studies of four cities in Sweden, Palm et al. (2019) developed a framework to understand the diversified roles city governments play in the sharing economy, and identified three major governance models, including governance by supply and authority, by collaboration and empowerment and through voluntary service. Since few studies have investigated the ecologies of var-

ious business models to comprehend and improve their impacts on sustainability, Bocken et al. (2019) proposed a new framework to achieve a systematic form of innovation and experimentation of sustainable business models based on the understanding of clarity of construct, setting of boundary and uncertainty of results. Later, after surveying the car-sharing business in four cities in Sweden from the perspective of "ecologies of business models", Bocken et al. (2020) found that car-sharing is a supplement to car use in the current society rather than a substitute for mobility mode. Paths for local policymakers were proposed to achieve greater sustainable development such as offering financial support, providing incentives, and increasing publicity. Since circular economy makes full use of resources and diminishes climate change, resource exhaustion, environmental pollution, etc., a series of principles including collaboration (interaction with other stakeholders to achieve circular innovation), experimentation (structured trial and error system to carry out circular economic initiatives) and platformization (network platforms to attain circularity) were proposed to innovate the circular ecosystem (Konietzko et al., 2020).

2.3. Countries/regions

975 retrieved articles are contributed by 98 countries/regions. The top 19 most prolific countries/territories that published more than twenty articles in the studied period are listed in Table 2. Contributing more than 100 publications, the top 3 most productive countries/regions are all from the developed world except for the People's Republic of China, which implies the importance China has attached to the sustainable development in the sharing economy. Figure 3 shows that only 4 papers were published by Chinese researchers in 2010, while the yearly publications increased to 65 in 2020 alone. The total amount of papers reached

194 in 2020, 48.5 times more than that in 2010, which clearly demonstrates the growing popularity of the research on sustainability and sharing economy in the People's Republic of China.

VOSviewer groups the countries/regions with more than ten publications into five clusters (Figure 4). Countries/regions with higher co-occurrence are identified with the same color in the same clusters (Chen et al., 2020). Each cluster refers to a group of cooperative countries/regions that have a common research interest. The major contributors of each cluster can be identified by the size of the node. The major contributors of cluster 1 are England, Spain, Switzerland,

Table 2. Top 19 most contributing countries/regions on sustainable development in the sharing economy from 2010 to 2020

Ranking	Country or territory	Publications	Citation Count
1	People's Republic of China	194	2,099
2	USA	182	2,884
3	England	127	2,227
4	Italy	66	689
5	Germany	66	928
6	Australia	63	577
7	Netherlands	61	1,106
8	Sweden	57	757
9	Spain	57	646
10	Austria	37	725
11	France	35	393
12	Canada	31	815
13	Denmark	27	1,203
14	Romania	27	117
15	Poland	26	117
16	India	26	145
17	Finland	25	1,214
18	Japan	21	407
19	Switzerland	20	265

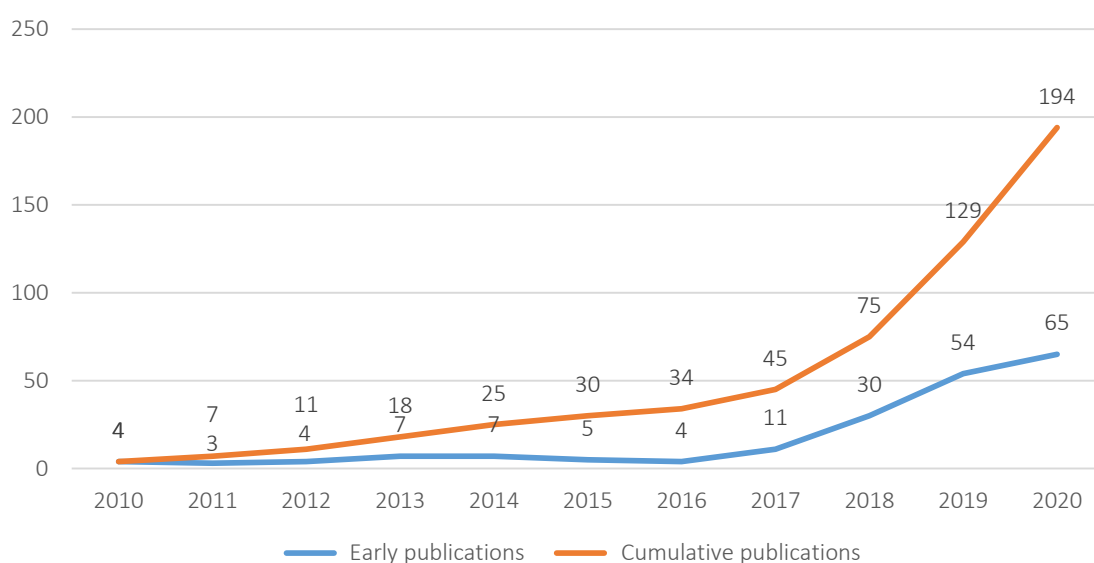


Figure 3. Number of published articles on sustainable development in the sharing economy by researchers from the People's Republic of China (2010–2020)



Figure 4. Cluster map of countries/regions on sustainable development in the sharing economy from 2010 to 2020

Romania, and Poland, whose research focuses are circular economy, collaborative consumption, renewable energy, overtourism, governance, Airbnb, European Union, bioeconomy, and sustainability transitions. The major contributors of cluster 2 are the People's Republic of China, Australia, Taiwan, and South Korea, whose research interests are China, collaborative consumption, game theory, energy consumption, economic growth, life cycle assessment, and environmental sustainability. The major contributors of cluster 3 are the USA, France, Denmark, Canada, and India, whose research focuses are circular economy, collaborative consumption, climate change, China, system dynamics, shared mobility, economic growth, renewable energy, and governance. The major contributors of cluster 4 are Sweden, Finland, and Norway that concentrate on circular economy, collaborative consumption, sustainable consumption, innovation, and sustainable business models. The major contributors of cluster 5 are Italy, Germany, Scotland, Portugal, and Brazil that prioritize collaborative consumption, circular economy, industrial symbiosis, sustainable consumption, access-based consumption, smart cities, and social innovation.

2.4. Journals

Table 3 lists the most prolific academic journals with more than ten publications on sustainability in the sharing economy. *Sustainability* is definitely the leading player in the research on this topic with 165 papers, twice more than the journal in the second place and eight times more than the one in the third place. Its Journal Impact Factor in 2019 is 2.576, ranking Q3 in Green & Sustainable Science & Technology. *Journal of Cleaner Production*, the second most productive journal, ranks Q3 in Green & Sustainable Science & Technology with Journal Impact Factor at 7.246 in 2019. *Resources Conservation and Recycling*, in the third place, ranks Q1 in Environmental Sciences with Journal Impact Factor at 8.086 in 2019.

The co-cited journals in the retrieved references are grouped into four clusters (Figure 5) and the major contributor in each cluster is from the top 5 most productive journals. The size of a nod signifies how many times the academic journal has been cited (Chen & Liu, 2020). The biggest nod in cluster 1 in yellow is *the Journal of Cleaner Production*, ranking second in Table 3. The major contributor

Table 3. Top 9 most constructive academic journals related to this study (2010–2020)

Ranking	Journal	Publications	Citation Count
1	Sustainability	165	800
2	Journal of Cleaner Production	88	1,297
3	Resources Conservation and Recycling	24	358
4	Ecological Economics	21	802
5	Energy Policy	14	182
6	Energies	13	82
7	Technological Forecasting and Social Change	11	382
8	Science of The Total Environment	10	149
9	Environmental Innovation and Societal Transitions	10	565

of cluster 2 in blue is Ecological Economics, at the fourth place in Table 3. The main contributor of cluster 3 in red is *Sustainability-Basel* (abbreviated for Sustainability by JCR), the first place in Table 3. The leading contributor of cluster 4 in green is *Energy Policy*, at the fifth place in Table 3.

2.5. Organizations

The top 14 most prolific organizations with more than 8 publications on sustainability in the sharing economy are listed in Table 4. Two of the top five institutions are from China: the Chinese Academy of Sciences with 23 publications and the University of Chinese Academy of Sciences with 13 papers respectively. Other major contributing universities include Lund University (22 publications) from Sweden, Utrecht University (14 publications) from the Netherlands, the University of Manchester (12 publications) from the UK, and Tsinghua University (12 publications) from China.

The six major clusters of collaboration networks between the institutions with more than five publications are presented in Figure 6. Cluster 1 has 13 institutions, among which Tsinghua University has the highest total link strength at 16. Cluster 2 includes 9 universities, among which Beijing University of Technology has the greatest total link strength at 6. Cluster 3 has 7 organizations, among which Delft University of Technology has the largest total link strength at 8. Cluster 4 includes 6 items, among which the University of Manchester has the highest total link strength at 9. Cluster 5 has 5 contributors, among which the Chinese Academy of Sciences has the strongest collaboration with other institutions, with a total link strength of 19. Cluster 6 also includes 6 universities, among which the University of Sydney, Deakin University, and the University of New South Wales all have the same total link strength at 14.

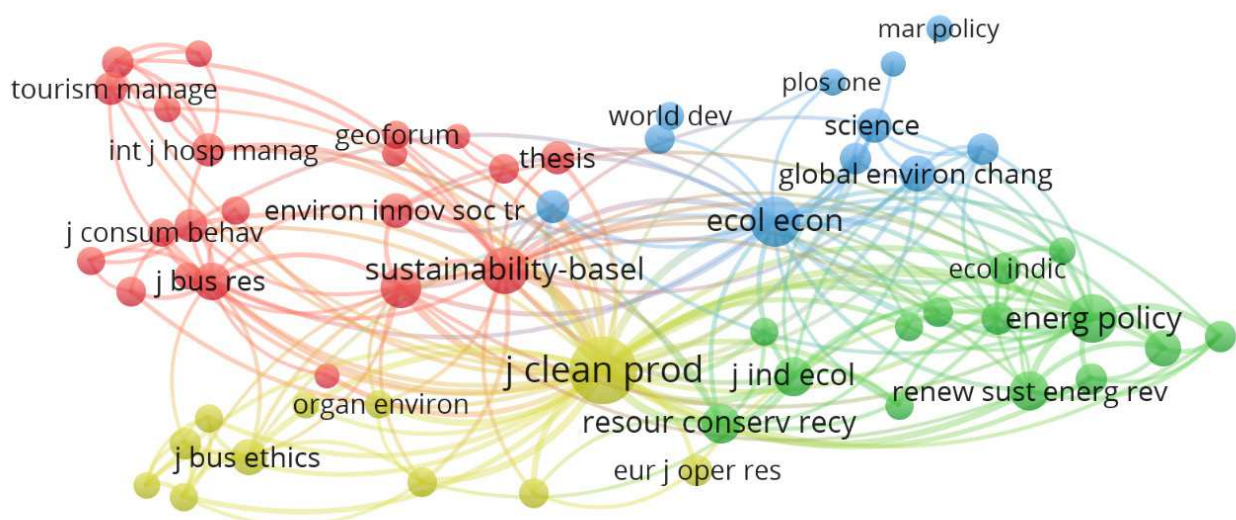
**Figure 5.** Co-citation map of academic journals related to this study (2010–2020)

Table 4. Top 14 most contributing organizations on sustainable development in the sharing economy (2010–2020)

Ranking	Name of Institutions	Location	Publications
1	Chinese Academy of Sciences	China	23
2	Lund University	Sweden	22
3	Utrecht University	Netherlands	14
4	University of Chinese Academy of Sciences	China	13
5	The University of Manchester	UK	12
6	Tsinghua University	China	12
7	University of Oxford	UK	11
8	Tongji University	China	10
9	Delft University of Technology	Netherlands	9
10	Bucharest University of Economic Studies	Romania	9
11	Shanghai Jiao Tong University	China	8
12	University of Leeds	UK	8
13	University of Southampton	UK	8
14	The Australian National University	Australia	8

2.6. Keywords

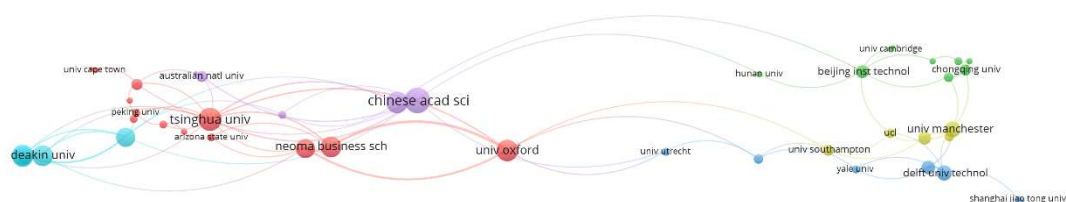
Keywords can reveal the primary message of the corresponding paper. The top 22 keywords that have appeared more than ten times are listed in Table 5. In addition to the topic words “Sustainable Development” and “Sharing Economy”, other most frequent keywords are “Circular Economy”, “Collaborative Consumption”, “Climate Change”, “China”, “Renewable Resource”, and “Business Models” (Figure 7).

2.7. Research related to sustainable development in the sharing economy from the perspective of urban mobility services in China

Although there has been a large number of academic articles focusing on sustainable development in the sharing economy, only seven papers can be retrieved by narrowing down the keywords to “sustainable development”, “sharing economy”, “mobility”, and “China” in the Web of Science

Table 5. High-frequency keywords on sustainable development in the sharing economy from 2010 to 2020

Ranking	Keyword	Frequency	Ranking	Keyword	Frequency
1	Sustainable Development	236	12	Tourism	13
2	Sharing Economy	157	13	Innovation	13
3	Circular Economy	70	14	Economic Growth	13
4	Collaborative Consumption	39	15	Life Cycle Assessment	13
5	Climate Change	24	16	Sustainable Consumption	12
6	China	22	17	Sustainable Development Goals	11
7	Renewable Energy	22	18	Energy Efficiency	11
8	Business Models	21	19	Environmental Sustainability	10
9	Sharing	16	20	Bioeconomy	10
10	Governance	14	21	Industrial Symbiosis	10
11	Airbnb	14	22	System Dynamics	10

**Figure 6.** Cluster map of organizations researching this field from 2010 to 2020



et al., 2019), social network analysis (Zhang et al., 2019), sharing system (Lee et al., 2020; Wang et al., 2019), system dynamics (Xue et al., 2020) and legalization (Lee et al., 2020). It is clear that several research hot spots identified in the above bibliometric analysis of sustainable development in the sharing economy have yet been applied in the studies on urban mobility sharing in China.

3. DISCUSSION

The co-occurrence map of the high-frequency keywords (see Figure 8) highlights 24 nodes that are clustered into four main groups. Each cluster reveals a research hotspot in the domain of sustainable development in the sharing economy through the past decade.

Table 6. Articles retrieved by the keywords “sustainable development”, “sharing economy”, “mobility”, and “China”

Publication Year	Reference	Article Title	Journal
2014	Wang et al. (2014)	Changing Urban Form and Transport CO ₂ Emissions: An Empirical Analysis of Beijing, China	Sustainability
2018	Ma et al. (2018)	Co-evolution between urban sustainability and business ecosystem innovation: Evidence from the sharing mobility sector in Shanghai	Journal of Cleaner Production
2019	Zhang et al. (2019)	China's Sharing Economy of Mobility Industry: From Perspective of Industrial Ecosystem	Sustainability
2019	Wang et al. (2019)	Rethinking the Utility of Public Bicycles: The Development and Challenges of Station-Less Bike Sharing in China	Sustainability
2019	Ma et al. (2019)	Value Co-creation for sustainable consumption and production in the sharing economy in China	Journal of Cleaner Production
2020	Lee et al. (2020)	Sustainability of ride-hailing services in China's mobility market: A simulation model of socio-technical system transition	Telematics and Informatics
2020	Xue et al. (2020)	System Dynamics Analysis of the Relationship between Transit Metropolis Construction and Sustainable Development of Urban Transportation-Case Study of Nanchang City, China	Sustainability

(1) *Sharing economy from the perspective of collaborative and sustainable consumption*

Cluster 1 includes 7 items and mainly devolves into the sharing economy from the perspective of collaborative and sustainable consumption. Sustainable consumption mainly involves changing consumers' behaviors and intentions to increase their sustainable awareness, purchase more sustainable goods/services, and reduce consumption of resources (O'Rourke & Lollo, 2015). Collaborative consumption is a peer-to-peer consuming mode that allows customers to acquire and share the ownership of possessions via online platforms (Hamari et al., 2016) which has turned into a salient constituent of the sharing economy (Lindblom & Lindblom, 2017). As emerging sharing initiatives that advocate resource conservation, reduce environmental pollution and increase consumers' awareness of sustainability (Prieto et al., 2017; Zamani et al., 2017), they have been increasingly popular in the past few years and become efficient facilitators for promoting sustainable development (Prothero et al., 2011; Tsou et al., 2019). Collaborative/sustainable consumption has been practiced in businesses such as consumer goods, hospitality, transportation, etc. (Park & Armstrong, 2017) Although enjoyment, sustainability, social, diversity-seeking, reputation, and financial interests are identified as significant factors in predicting the willingness to be involved in collaborative/sustainable consumption activ-

ities (Kim & Jin, 2020), personal satisfaction, an internal motivator, has the highest degree of motivation, followed by concern-for-sustainability and finally economic benefits (Alzamora-Ruiz et al., 2020). Reputation and economic benefits have a positive and significant impact on attitudes towards collaborative/ sustainable consumption, while reputation rather than economic benefits have a significant effect on behavioral intentions (Ianole-Calin et al., 2020).

(2) *Sustainable development from climate change and bioeconomy perspective*

Cluster 2 comprises 5 items and mainly studies sustainable development from climate change and bioeconomy perspective. The influence, fragility, and risk of climate change are subject to both climatic conditions and socio-economic context that including economy, policy, population and technological advancement (Arnell et al., 2011). Shared Socio-economic Pathways (SSPs) were put forward to propose a feasible framework for research on climatic adaptation and vulnerability and local sustainable development (Frame et al., 2018; Nilsson et al., 2017). Climate change policy-makers should take socio-economic conditions into account to evaluate the contributions of population, climate, economy, and land use as in SSPs to future impacts of changing climate (Chae et al., 2020). At the same time, bioeconomy refers to the practices of generating energy and producing con-

sumer goods in economic activities (Guo & Song, 2019), whose key feature is the use of green biological resources in place of unrenovable energy as raw materials in economic activities (McCormick & Kautto, 2013). As a result, it improves economic resilience, energy security, and sustainable environment (Bórawski et al., 2019).

(3) *Renewable resources and business models*

5 items in cluster 3 shed light on renewable resources and business models. Countries rich in hydrocarbons have been accused of emitting most greenhouse gases and other pollutants because of the massive use of fossil fuels (Jianzhong et al., 2018). The international community is working hard to innovate and consume renewable energy to make contributions to sustainable development (Venkatraja, 2020) because renewable resources can bring a variety of benefits such as a better environment, diversified fuels, energy security, economic stability, and social productivity (Benli, 2013). The market situation and the growing demand for renewable energy indicate that the production of ethanol and vegetable oil esters will step up by 2030, which will stimulate the growth of the green energy business (Bórawski et al., 2019).

(4) *Circular economy in China and life cycle assessment*

Cluster 4 includes 4 items and mainly discusses circular economy in China and life cycle assessment. Circular economy is a way to enhance the recycling utilization of resources to disconnect economic advancement from the consumption of natural resources (Pauliuk, 2018). Indicators of the circular economy are mostly centralized on the conservation of materials as well as recycling approaches without considering Life Cycle Thinking strategies. There are no available indicators to evaluate the preservation of functions such as multifunctionality or sharing platforms (Moraga et al., 2019). While in China, the scarcity of resources and the efficiency of resource utilization both pose challenges to its economic growth and sustainable development. Therefore, circular economy has become one of the important parts of its national development strategies. However, the main obstacles to the development of China's circular economy are weak public consciousness and insufficient financial support,

and there is a gap between making policies and taking actions (Xue et al., 2010).

4.1. Research trends

The Cumulative Timezone view of the Top 10 keywords from 2010 to 2020 (Figure 9) reveals that "Sustainable Development" first appeared in 2010 and "Sharing Economy" first showed up in 2013, which kept on growing in the retrieved articles and became the biggest nodes on the graph. The growing keywords that emerged in 2019 are sustainable business models, game theory, and blue economy. People's increasing environmental awareness has given birth to novel sustainable business models, thereby building a more sustainable society (Cosenz et al., 2020). Sustainable business models respond to unsustainable challenges through innovations that create social benefits, economic value, and environmental improvement (Muñoz & Cohen, 2018). Based on the combination of game theory and agent-oriented models, the leading enterprises in the sharing economy can improve the performance of cooperation among organization members with a revenue distribution method that integrates fixed revenue and revenue-sharing (Meng et al., 2020). Meanwhile, blue economy is a model of sustainable development that seeks new economic opportunities from the ocean to reduce poverty, enhance food security and diminish environmental degradation (Voyer et al., 2020). Although it has gained increasing interest and become an influential notion, various interpretations of blue economy have led to different policies and practices adopted by countries and regions in the world (Hassanali, 2020).

The top three weighted keywords in 2020 are peer-to-peer accommodation, smart grids, and electric vehicles. Peer-to-peer accommodation initiatives have reshaped the traditional balance of the hospitality industry (Liu et al., 2019; Sainaghi & Baggio, 2020). Social interaction and respect, whether in combination with each other or part with economic interests, are identified as the major driving factors for the behavioral intention to use peer-to-peer accommodation, while sustainability is supplementary in influencing consumers' intention because it needs to work together with other motivators (De Canio et al., 2020). Smart grid technologies of cluster energy can significantly improve energy man-

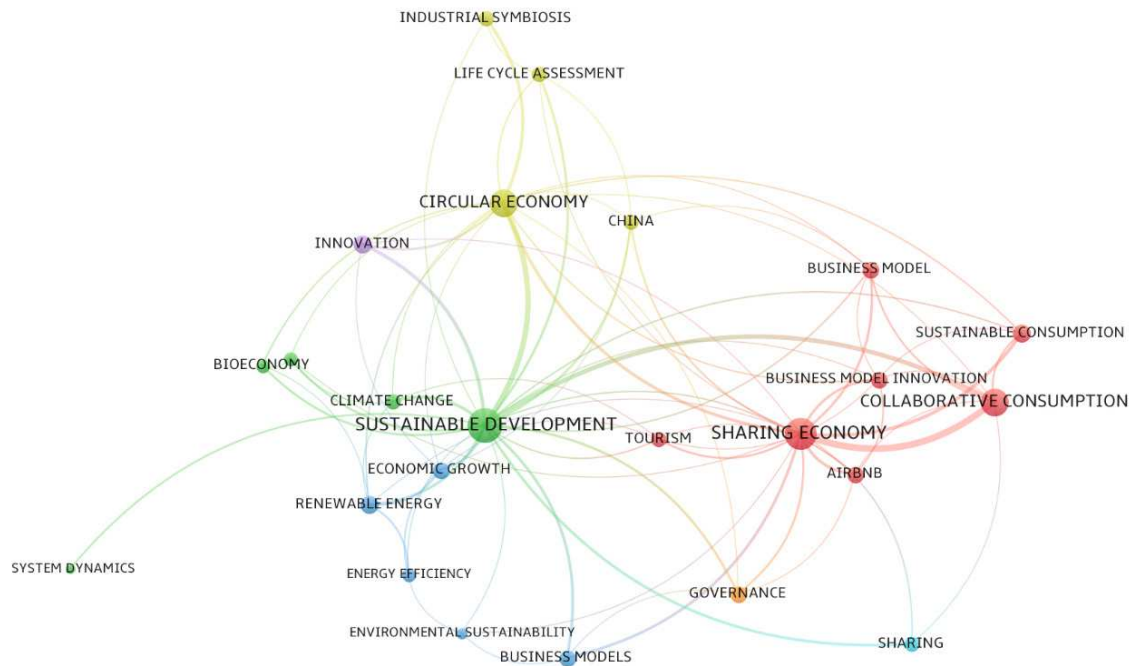


Figure 8. Co-occurrence map of the high-frequency keywords of the retrieved documents from 2010 to 2020



Figure 9. Cumulative Timezone view of the top 10 keywords on sustainable development in the sharing economy in each year from 2010 to 2020

agement and the generation mix of clean energy resources. Peer-to-peer networks can be used as a fundamental mechanism to support distributed energy resources and motivate individual users to engage in the energy market in the booming sharing economy (Petri et al., 2020). In the meanwhile, innovations of sustainable electric vehicles provide a hopeful alternative to the continued dependence

on limited fossil fuels and relieve the growing social concerns associated with climatic change (Reinhardt et al., 2020). Businesses in sharing electric vehicles bring direct and indirect advantages to urban mobility and accelerate the adoption of electric vehicles (Luna et al., 2020), which can reduce the mounting pressure on the environment and energy (Loeb & Kockelman, 2019).

CONCLUSION

The paper reveals that sustainable development in the sharing economy remains a research hotspot with growing popularity through the bibliometric and visual analysis of the academic references obtained from the Web of Science Core Collection during 2010–2020. It aimed to identify the research hotspots and trends in this field by analyzing the major authors, productive countries/regions, contributing academic journals, prolific organizations, collaboration, and co-occurrence.

The results show that there are four main research hotspots: (1) sharing economy in terms of collaborative and sustainable consumption, (2) sustainable development from climate change and bioeconomy perspective, (3) renewable resources and business models, (4) circular economy in China and life cycle assessment. The study also implies the potential research trends in sustainable business models, game theory, blue economy, peer-to-peer accommodation, smart grids, and electric vehicles. At the same time, the People's Republic of China witnessed an exponential increase in publications on sustainable development in the sharing economy from 4 papers in 2010 to 65 in 2020 alone.

As global economy is undergoing dramatic changes due to geopolitics and technological advancements, in particular, more academic efforts are needed in proving how different approaches of the sharing economy affect the sustainability of the environment, society, and economy, especially taking evidence from the urban mobility services in China who has seventeen cities with a population of more than ten million respectively (Tencent, 2020) and booming mobility-sharing businesses nationwide.

Although valuable information and meaningful findings have been obtained, it is worth noting that there are certain limitations. First, the academic articles related to sustainability in the sharing economy in this study are not exhaustive and some potentially valuable references from the journals that are not listed in the Web of Science Core Collection may have been excluded. Second, there might be an inevitable linguistic bias since all the articles retrieved are written in English.

AUTHOR CONTRIBUTIONS

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