

Reference:

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Analysis of the evolution of the Sharing Economy towards sustainability. Trends and transformations of the concept

Abstract

The Sharing Economy has been emerged in recent years as a trend with high growth potential by showing itself to be an innovative model for creating products, services and relationships based on sustainable consumption. The Sharing Economy has emerged as a multidimensional and multidisciplinary concept, which initially only covered areas of the economy and social sciences and which later experienced growth in business, urban planning, tourism, information technology and digital science (industry 4.0) or engineering. This has transformed its development from an economic opportunity to a form of decentralised, equitable and sustainable economy with the creation of new initiatives and companies that have reduced environmental impact by decreasing the use of natural resources. The present study aims to evaluate the evolution of the discourse and the way research has progressed in this incipient sphere of collaborative consumption up to the present day by means of an in-depth analysis of scientific production through bibliometrics and network analysis techniques with the VOSviewer© software and the complete database of publications obtained from the Web Of Science (2152 publications). It also includes the detailed examination of the most relevant bibliographic reviews on Sharing Economics, as well as the main publications on bibliometric analysis. The article evaluates key words, sources, authors, citations, organizations, categories, and countries using various bibliometric techniques. Finally, in the results 5 clusters of thematic categories are obtained where a change in the trend of publications towards the field of

clean and green technology is reflected, forming in recent years an agglutinating nucleus of all the disciplines in which "sustainability" acts as the backbone of scientific production. This is a positive development in cleaner production, where institutions and authors from the USA and Europe have risen to the top of the ranking of publications and impact. At a global level, the current commitment to research for the development of accessible, equitable and sustainable products and services is reflected.

Keywords: Sharing Economy; Collaborative Consumption; Collaborative Economy; Bibliometric Analysis; Sustainable Consumption; Sustainability.

1. Introduction

Sharing Economy (SE) phenomenon has proved to be more than a fragile and temporary trend, capable of reversing competition around the world. Within the wide variety of organizations that have been born based on the concept of "sharing" assets (services or products), those companies based on digitized platforms have been prospering in many different industrial sectors and at an international level (Belk, 2014a). Linked to this new digital phenomenon, the SE has gained a strong foothold in the discourse among policymakers, companies and academics because it is presented as a new innovative business model that is an alternative to existing consumption and production practices (Acquier et al., 2017).

This is an emerging field of research development, which has grown in less than a decade with more than 2000 papers published on the most representative terms such as Collaborative Consumption, CC (Ranjbari et al., 2018); Collaborative Economy, CE (Frenken and Schor, 2017a) and Peer Economy, PE (Benjaafar et al., 2019), all related to sustainable consumption and manufacturing, one of the Sustainable Development Goals (SDGs) (Sullivan et al., 2018).

However, research in the field of SE remains blurred (Ertz and Leblanc-Proulx, 2018) due to the breadth of topics covered as well as the different sectors it has impacted. Among the most studied topics are research oriented to conceptual and theoretical foundations (Belk, 2014a; Frenken and Schor, 2017a; Laurenti et al., 2019), to digitized platforms and their security (Mantymaki et al., 2019; Shao and Yin, 2019), to the new role that the consumer-prosumer acquires (Filipovic et al., 2019; Ritzer et al., 2012), to sustainable tourism (Jeong et al., 2014), to government and regulations (Berkowitz and Souchaud, 2019; Garcia-Teruel, 2019; Mutiarin et al., 2019), to social benefits (Böcker and Meelen, 2017; Laurenti et al., 2019; Riesgo Gomez, 2020) or to environmental aspects (Hobson et al., 2018; Meng et al., 2020). As for the sectors active in this new phenomenon, the list has increased exponentially in recent years with work oriented towards tourism and accommodation (Ginindza and Tichaawa, 2019; Wisker et al., 2019), transport (Jaremen et al., 2019; Mohamed et al., 2019), manufacturing (Jiang and Li, 2020; Xiao et al., 2019), politics (Garcia-Teruel, 2019; Mutiarin et al., 2019), sociology and behavioural approaches (Baumber et al., 2019; Cui and Aziz, 2019; Gazzola et al., 2019; Hamari et al., 2016), economics and markets (G. Li et al., 2019; Xia et al., 2019), games (Boron et al., 2020; Choi et al., 2020) or digital technologies (D. Li et al., 2019; Light and Miskelly, 2019).

Each published study has contributed to the development of an additional vision to the field of SE from a variety of perspectives, methodologies, theoretical framework, technique proposals, research paradigms and disciplines. The boom in work over the last 5 years has produced a result that is rich in content, but not organized, and has begun to fragment into several sub-areas that must be treated with attention because of their diversity. There are some works that tried to make sense of this situation, but reaching results of complexity and exposing the future of reorganization as a common objective

(Agarwal and Steinmetz, 2019; Ertz et al., 2016; Slee, 2017). Since this is a complex issue, although the knowledge and conclusions provided by these approaches are important for the reorganization of the large amount of information, work and research in the area of SE, it is proposed to carry out an additional analysis of the literature using objective bibliometrics, cluster analysis and network analysis that provide a better understanding of the evolution of the publications as well as the identification of new areas of work and the relationships between them.

This analysis is based on several previous research on this topic using some bibliometric techniques that will be extensively detailed in the next section, the background. Although these are works that contribute to the literature on SE by presenting a comprehensive review of the literature, there are analyses that present restrictions and do not cover all the available knowledge (Ertz and Leblanc-Proulx, 2018; Fahimnia et al., 2015; Lima and Carlos Filho, 2019; Shin and Perdue, 2019a).

As the theory is a reflection of a knowledge production system (Suddaby, 2014), this paper also aims to contribute to the theory by identifying the evolution of publications dealing with SE by analysing the degree of attention paid by experts around the world to its development and, in particular, by listing the areas of application as well as the emerging relationship with clean production and the new challenges of SDGs.

This article contributes to the improvement in the exponentially growing research field of SE by carrying out a detailed examination of the available literature since the first appearances of the term in section 2. Specifically, this innovative study aims to analyse the characteristics, relationships, affected sectors and repercussions through the citations that are given in all the available literature through a method of network analysis that allows for the complexity of the term to be addressed. Section 3 sets out the methodology with the phases of analysis through which the 2152 existing publications in the Web Of

Science (WOS) database have passed. Section 4 develops the results and the discussion that intends to present the complete analysis of the networks, where 5 main clusters are obtained that classify the works in all the existing research sectors. Likewise, an analysis of the sources (journals, books, proceedings, among others) is carried out, as well as the networks among authors where co-authorship, citation, and co-citation of documents from the bibliographic sample can be discovered. The study yields important results that help in the thematic classification of the works, possible schools of thought, international multidisciplinary research groups, as well as the possibility of obtaining a holistic vision of the incision of the innovative concept of SE in all sectors and models of business, consumption and production. Finally, the conclusions expose the limitations and provides potential for future research.

2. Background

The popularized term SE is often used to describe different organizations that connect users/tenants and owners/suppliers through Consumer-to-Consumer (C2C) (e.g. Uber, Airbnb) or Business-to-Consumer (B2C) platforms (e.g. Zipcar, WeWork) based on the exchange, sharing, rental of goods, resources or services, usually between strangers seeking to meet latent needs (Belk, 2014b).

Likewise, increased consumer awareness of environmental sustainability, and the economic recession that has led to higher unemployment rates, have attracted people to want to develop transactions that allow them to more comfortably access and benefit from underutilized assets (Frenken and Schor, 2017a; Sundararajan, 2016). Users get involved in the SE movement mainly to avoid ownership obligations and take advantage of the lower costs involved (Bardhi and Eckhardt, 2012; Godelnik, 2017).

This is an innovative model that has been able to be extrapolated to many areas of consumption with very diverse services and products due to the scope provided by the main axis of development: Industry 4.0 and the digital revolution, where all agents in the value chain of the product or service are connected and with the option of sharing data at any time (De Las Heras García De Vinuesa et al., 2018; Pham et al., 2019).

The successes of SE models such as Airbnb (hospitality) and Uber (transport), which originated in Silicon Valley, have led the SE discourse and its apparent economic opportunity with the development of a more equitable and responsible form of consumption involving the media, established industries, entrepreneurs and base activists (Martin, 2016). However, as Martin describes (Martin, 2016), this new form of economy can lead to contradictory forms, ranging from a possible path to sustainability to a nightmarish form of neoliberalism (Martin, 2016). Therefore, it is necessary to observe and analyse the evolution from the formulation of the SE's niche as well as the successful reformulation of economic opportunity and the resulting sustainable footprint. This double track, has been treated in recent years with followers and retractors where to defend if it is a momentum for the transition to sustainability (Geels, 2014; Smith and Raven, 2012; Viitanen and Kingston, 2014).

SE has experienced strong growth in the development and publication of studies and research over the past 5 years (Barbosa and Fonseca, 2019; Belarmino and Koh, 2020; Cherry and Pidgeon, 2018; Leung et al., 2019; Puschmann and Alt, 2016; Thierer et al., 2015). However, emerging research on SE has generally taken a broader approach by also challenging the use of the word "sharing" and introducing general and complementary terms such as "access economy," "collaborative consumption," and "on-demand services" (Bardhi and Eckhardt, 2012; Belk, 2014a; Botsman and Rogers, 2011). This fact has led to an increase in the number and diversity of sectors opting for this new trend: transport,

urban planning, accommodation, catering, politics and government, tourism, consumption of goods, product design, manufacturing or entrepreneurship, among others.

A bibliometric review investigates the formal properties of knowledge domains using mathematical and statistical methods by examining what network is created around the most representative keywords and how citations, authors, organizations, countries and sources can be indicative of impact and importance in the research field (Mora et al., 2017).

Fahimnia (Fahimnia et al., 2015) develops a work of bibliometric analysis of more than 1000 studies retrieved from the Scopus database using the criteria of author, title and abstract using only the term "sharing economy". Subsequently, a selection of works of proven influence is made. The work carries out a joint citation analysis that identifies the most striking authors, as well as the way they relate to each other, in addition to a study of the citations to identify the strength of the interrelations between the publications. Derived from this methodological structure, emerging research groups, key research topics, and interrelationships and patterns of collaboration are identified. This study has two main limitations: the first is the exclusive use of the Scopus database in the year 2015 when the number of publications was still growing, and the amplitude of the database is lower in high impact journals. On the other hand, the second limitation is the non-inclusion of the keyword study that can provide an analysis of sectors and grouping of research areas in which the SE is fragmented.

Ertz and Leblanc-Proulx (Ertz and Leblanc-Proulx, 2018) develop work related to the environmental field, using as a basis the work done by Fahimnia to guide its methodological structure. In this case, they include the Scopus and WOS databases, filtering by title, abstract and authors, although in this case they also include the subject field which broadens the exploration. Their search terms are: "sharing economy",

"collaborative economy" or "collaborative consumption", with the particularity that they include the word "sustainability" and "environment" accompanied by the Boolean operator AND to filter exclusively by works of the environmental dimension. The analysis was on 729 publications in English with filtering in the type: journal articles, conference papers, books, editorials and book chapters. In this case the results were a step forward by analysing the top 10 publishing journals, the most important organizations and the 20 most used words in the titles of the publications in the form of a ranking table. Regarding network analysis, they analysed the main network of authors obtaining 5 clusters, as well as the author density network and the author co-citation clusters. The limitations of this study lie in the filters used for the search, focusing only on the environmental dimension, as well as in the depth of the analysis of the networks, which is related to the fact that the information of each publication only includes the title, abstract, authors and subject. Some of the positive aspects are related to the conclusions from the geographical point of view that show possible relationships between research groups, as well as in the sample of the density of publications between the years 2000 and 2017, leaving evidence of the dynamism of this area of research. This work is a reference point where sustainability is suggested as an emerging focus in SE (Frenken and Schor, 2017b).

Lima and Filho (Lima and Carlos Filho, 2019) carry out an analysis where the keywords used are "Collaborative consumption", "Collaborative Economy", "Sharing Economy" without including a subject filter and only in the Scopus database. On the other hand, they do include the restriction of publications in the form of articles and reviews and in the English language, as well as only those that have gone through a peer-review process and are available in Full-text available. They obtain 95 documents from which the results are analysed in tables of the main journals, authors, and the works with the greatest impact.

From the point of view of the networks, they obtain the co-authoring network with results from very dispersed clusters, publication co-citation network with 4 main clusters and, as a more innovative but limited result in terms of content, the realization of a keyword co-occurrence network where 3 clusters related to "sharing and Exchange", "sustainability and circular economy" and "sharing economy in the tourism industry" are observed as main areas. As for the limitations of this study, it is shown that the filters used in the search are restrictive, since many papers presented at conferences, published in books or in journals of origin are left out, representing a lost field with a multitude of potentialities in the analysis of academic evolution. Likewise, by limiting the search to works only in English and with peer review process, the impact of the publications is increased, but the global evolution of the concept is lost. The study shows a dispersion of authors where, being a very recent emerging topic with the limitations imposed in the study, it is not possible to analyse in depth the foundations completely established in a research roadmap.

Finally, the work done by Shin and Perdue (Shin and Perdue, 2019a), which focus on the bibliometric analysis of publications related to a specific area of the SE, self-service technology (SST) in hospitality. They analyse 199 journal articles published between 2000 and 2017 on SST. As for the results, they examine the network of key SST research topics where 3 main clusters are revealed and, in another network, the trends in the co-creation of value for the client through the analysis of co-citation of publications. The limitation of this study is the in-depth exploration of only one area of the SE as well as the exclusion of all types of publications other than research articles. However, the results obtained in the analysis of networks through foundational articles, turning point articles, and article clusters, provide a list of key topics for future research on hospitality SST.

Together, they have developed comprehensive reviews of recent SE-related publications (Agarwal and Steinmetz, 2019; Cheng, 2016; Muñoz and Cohen, 2017; Ranjbari et al., 2018; Sutherland and Jarrahi, 2018; ter Huurne et al., 2017). The main objective of these papers is to significantly organize the past work, proposing future research agenda, identifying multifaceted discourses, applications of literature and a mapping of the SE. However, although Cheng (Cheng, 2016) makes an approach to possible literature connections through clustering related to keywords in SE research, in this type of work the literature links through criteria such as topics, affiliation, place, or authors are not analysed, losing the potential for extraction of relevant information. Furthermore, the scarcity of a complete analysis of the network of works in this typology of past works means that it is not possible to make a research roadmap and identify the impact of the subject matter, as well as the segregation of developmental areas within the overall concept. Obtaining a network and being able to analyse it offers a rigorous and robust analysis that makes an enormous contribution to the literature. In this case, the value of mapping the scope and structure of the discipline is appreciated, identifying more outstanding and cited research, as well as the discovery of key research groups (Fahimnia et al., 2015).

3. Methodology

Being aware of the multidimensionality that the field of shared economy has acquired in recent years and avoiding the tendency to fractionate this transversal concept into a specific area of knowledge, the objective of working with the most complete possible sample of scientific production has been pursued in the present manuscript. To this end, the WOS database has been selected as the ideal database because of its high scientific impact, the diversity of databases that make it up and the thematic versatility and formats or types of documents that it supports, ranging from scientific articles, books and book

chapters to presentations at conferences or bibliographical reviews. There are numerous works that use the WOS as a source of information (Zamora-Polo et al., 2019).

The methodological structure is based on Zhao and Strotmann's proposal (Zhao and Strotmann, 2015) which is divided into these stages: definition of search keywords and the database, data cleaning and formatting, initial data analysis and in-depth analysis (networks and results).

A review has been carried out on "shared economy" in the WOS Main Collection, applying as search terms "sharing economy", "collaborative economy", "collaborative consumption" and "peer economy", these being the main terms on which the conceptualization of shared economy revolves and on which there is a greater scientific consensus to define its concept (Ertz and Leblanc-Proulx, 2018; Guttentag, 2019; Kim, 2019; Lima and Carlos Filho, 2019; Ma et al., 2019; Plewnia and Guenther, 2018).

More specifically, the syntax of the search criteria carried out corresponds to the following terms: "sharing economy" OR "collaborative economy" OR "collaborative consumption" OR "peer economy". The search has been carried out on the field "Topic" being the widest offered by the database that searches for these terms in the Title, Abstract, Authors keywords and KeyWords Plus®. No filters have been applied either by date or by type of document, thus including in the database all the bibliographic references available in the WOS in relation to the term.

The result of this search generated a base of 2,152 documents that will be the final sample with which the bibliometric analysis is operated. This documentary collection includes scientific articles, books and book chapters, reviews, etc. from 1978, when the first publication was registered, to April 15, 2020.

In order to contextualize the data obtained, a descriptive study of the sample has been carried out, through the results analysis tool offered by the WOS where results have been obtained about the frequency of thematic categories, year of publication of references and type of document.

The next step has been to refine the data, since some of the fields are not standardized and could affect the reliability of the analyses since the variation in the nomenclature of an author, for example, would be interpreted as two independent authors. Given the volume of the sample, it has been necessary to carry out the data refinement with the support of the open source software OpenRefine©, version 3.3, through which the author and organization variables have been standardized (De Las Heras et al., 2020).

After refining the data, the analysis carried out has a double objective, firstly to carry out a descriptive study of the sample, which includes the historical evolution of scientific production in the field of "sharing economy", as well as the typology of records and distribution by thematic categories of the WOS. Secondly, to carry out a bibliometric analysis that allows us to know the incidence and established networks of key words, authors and their reference organizations, sources, and countries.

The data processing has been done through the VOSviewer© software (van Eck and Waltman, 2013), version 1.6.14. This software, focused on the analysis of bibliometric and sociometric networks, allows the analysis of co-authorship of the sample based on authors, organizations or countries, co-occurrence of key words, bibliographic coupling, citation and co-citation of documents, sources, authors, organizations or countries, mapping of co-authorship networks, co-citation, bibliographic coupling and co-occurrence of key words of the selected bibliographic sample (De Las Heras et al., 2020).

The visualization of bibliometric and sociometric networks is often done using one of three basic approaches: distance-based, graphical and time-based approaches (van Eck and Waltman, 2014). The VOSviewer© tool uses the distance and force of association approach, approximating those nodes that are closer, i.e. those with a smaller geodetic distance (van Eck and Waltman, 2010). In general, the shorter the distance between two nodes, the greater their relationship, i.e., their similarity. For the calculation of the network, the input is a normalized co-occurrence matrix, on which the association force index or proximity index is calculated based on the co-occurrence variables between the nodes or references and the expected number of co-occurrences, understanding that these are independent variables (van Eck et al., 2010). Thus, the S_{ij} similarity between two nodes i and j is calculated as follows (Eq.1)

$$S_{ij} = \frac{C_{ij}}{W_i W_j}$$

Eq. 1. Similarity between two nodes

Where C_{ij} is the number of co-occurrences of nodes i and j and where W_j is the total of the number of occurrences of nodes i and j or the total of co-occurrence numbers of these nodes.

More specifically, the following analyses are carried out (Donner et al., 2020; van Eck and Waltman, 2013):

Co-occurrence analysis: used to measure the co-occurrence of *keyword authors*, it bases its analysis on determining the number of documents in which they appear together.

Bibliographic coupling analysis: this type of analysis has been applied to the *authors* of the publications. The relationship between authors is measured according to the number of bibliographic references they share among their publications.

Co-authorship analysis: this analysis measures the relationship of the items based on the number of co-authorships of the documents. This type of analysis has been applied to the reference *organisations of the authors* of the publications analysed.

Citation analysis: this analysis, carried out for the *source* variable, i.e., journals and publishers in which the documents are published, determines the relationship based on the number of times they are cited.

Co-citation analysis: applied to the *sources*, this analysis explains the relationships according to the number of times the sources are cited together

The result of this analytical process shows a complete map of scientific production related to the SE. Given the extension of the sample analysed, the graphics resulting from the analyses carried out do not allow the structure of the maps to be displayed correctly due to the large number of nodes present. To avoid this, the most relevant nodes have been filtered, using the volume of occurrences of each node as a screening criterion. This allows us to select the nodes with more occurrences in the corresponding analysis, determining the optimal volume of occurrences to adjust the most information possible with the correct visualization of the map.

4. Results and Discussion

Firstly, based on the database obtained, it can be seen that, as mentioned above, the term "sharing economy" is a multidisciplinary term that covers a wide range of thematic categories. Thus, the bibliographic records selected cover a total of 120 WOS subject categories, with a high degree of representativeness in the distribution, since none of the categories concentrates more than 17% of the 2,152 references that make up the study. However, Figure 1 shows the main categories where most of the records are concentrated,

in which "business" stands out with 361 references in this category (16.78%), "management" with 324 (15.01%) and "hospitality leisure sport tourism" with 302 (14.03%).

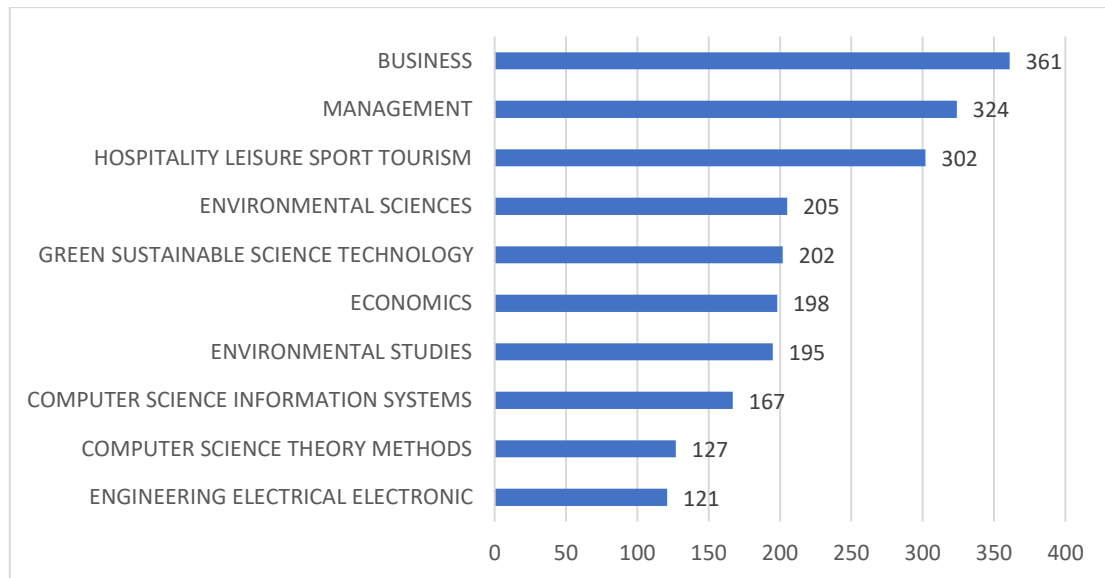


Figure 1. Frequency analysis of thematic categories. Total number of publications.

Source: Web Of Science. Own elaboration

In terms of the type of publication, the format of the scientific article has a notable predominance over other types of document, accounting for 66.10% of the total number of documents (1,552 references), followed by "proceedings papers", which account for 19.17%. The rest of the publications, as shown in Figure 2, remain in a range of less than 4%.

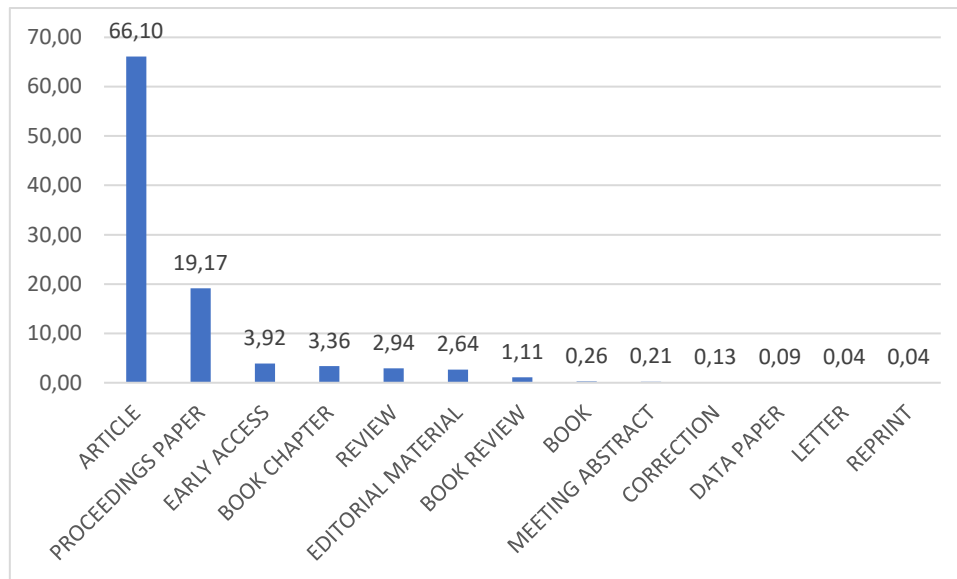


Figure 2. Percentage of records by type of publication Source: Web Of Science. Own elaboration

At a descriptive level, another of the results shown is the evolution of the scientific interest in the SE, for which a historical description of two parameters is made: the volume of registered publications and the number of citations of these publications. As shown in Figure 3, scientific interest has increased exponentially in the last 5 years, producing an escalation of data both in the number of documents published and the number of citations in the WOS.

The year 2020 follows the same increasing trend with a total of 150 publications and 2,408 citations up to 15 April this year, although this fact has not been included in the graph as the data for the whole year are not available.

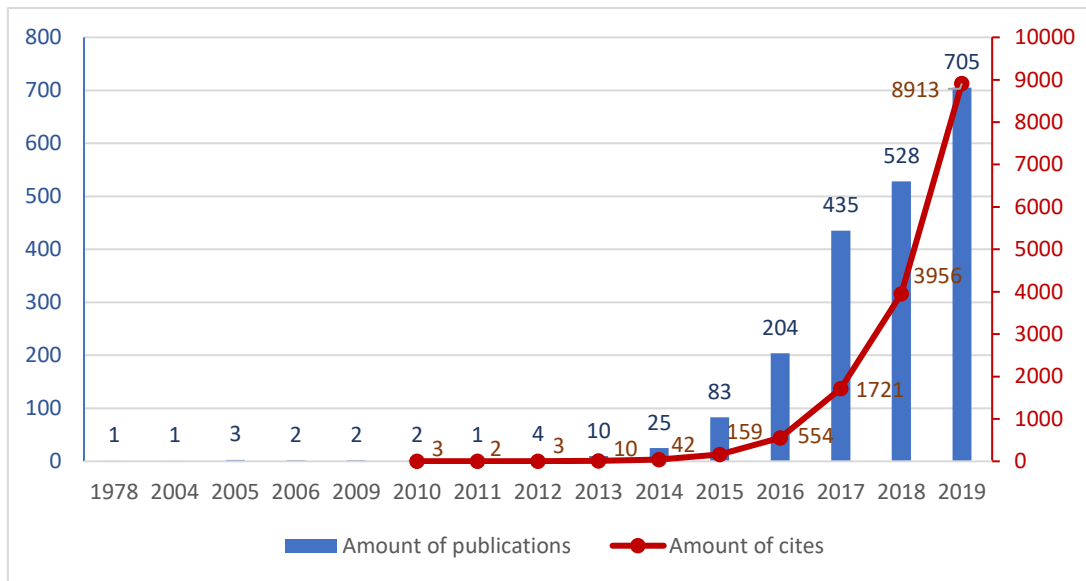


Figure 3. Historical evolution of publications and citations Source: Web Of Science.

Own elaboration

After the descriptive analysis, we move on to the analysis using the VOSviewer© software to meet the second objective described in the methodology. The main results of the analysis are presented below.

4.1. Analysis of keywords and subject categories

Co-occurrence analysis of "authors keywords" allows us to know which words are more repeated in scientific publications related to the ES and which of them have a greater linking force.

Figure 4 shows the co-occurrence map of the keywords contributed by the authors in each of the publications that make up the database analysed. The reference sample identifies a total of 4,806 "author keywords". In order to be able to visualize them correctly, a filtering of the keywords has been carried out to select the most relevant ones. To do this, it has been considered that at least 5 keywords occur, that is, that at least 5 documents in the database have the same "author keyword". This filtering process results in 179 nodes on which the co-occurrence analysis has been performed.

fourth place with a greater distance because it is a term more linked to economy and its use with "collaborative consumption" has been generalized in more areas of research. Finally, he highlights "sustainability", which is the key word that is appearing most in the literature in recent years and which reinforces the subsequent analysis of the WOS categories where it can be seen that sustainability is in the most central position, which, seeing that it has more linking force, means that these will be very important and determining terms in SE research.

Table 1. Classification of occurrence of "author keyword"

Position	Keyword	Occurrences	Total link strength
1	sharing economy	1.040	1606
2	Airbnb	259	503
3	Collaborative consumption	220	459
4	Collaborative economy	99	183
5	Sustainability	83	188
6	Business model	69	140
7	Trust	61	137
8	Uber	58	156
9	Sharing	53	115
10	tourism	52	127
11	Peer-to-peer	50	108
12	Peer-to-peer accomodation	50	102
13	Carsharing	40	82
14	Circular economy	38	76
15	Blockchain	35	71

Source: own elaboration.

The next step in evaluating the results of this network is cluster analysis, which is a multivariate statistical technique that seeks to group elements (or variables) together in an attempt to achieve maximum homogeneity in each group and the greatest difference between groups (Everitt et al., 2011). In this case, by default, the VOSviewer© software identifies 15 clusters for a resolution of value 1, being the minimum of 1 node for the configuration of a cluster. However, due to the high number of nodes and the large sample size, clusters are not representative as the bond strength of many of the sample nodes is low.

Cluster 3 (dark blue)	Collaborative ways in the community	collaborative consumption; collaborative economy; community; sharing; tourism
Cluster 4 (yellow)	Digitalization	digital platform; gig economy; platform economy; ridesharing; uber
Cluster 5 (purple)	Hospitality	airbnb; peer-to-peer accommodation; short-term-rental; trust
Cluster 6 (light blue)	Collaborative behaviour	carsharing; consumer behaviour; peer-to-peer

Source: own elaboration.

From the cluster analysis, the importance of the SE as the core of multiple disciplines or knowledge areas such as sustainability and environment, tourism and hospitality, economy and entrepreneurship, digital and participatory development can be seen (Cheng, 2016). Likewise, it can be seen how there are connections between clusters 3, 4, 5 and 6, since they are new business models, mostly present in tourism ("tourism" cluster 3), hospitality ("airbnb" and "peer-to-peer accommodation", cluster 5) and transport ("carsharing" cluster 6), which have their main communication and service channel, as well as their economic management (remuneration) through digital platforms ("digital platform" cluster 4).

In the sense of the disintegration into different fields or areas of knowledge within the SE, an in-depth analysis of the multidisciplinary nature of the concept has been carried out by means of an innovative study of the standardized thematic categories offered by the WOS, which will make it possible to ascertain, on the one hand, the profusion of the SE according to these categories and, on the other, the evolution in each of the disciplines (Leydesdorff et al., 2013).

In the reference database, a total of 120 thematic categories are identified, from which 12 are excluded for the study since they are not related to any other because they appear in documents in an isolated manner and are not very representative at the level of occurrence. Thus, a total of 108 categories have been selected for analysis.

First, the analysis of the reiteration of the categories represented in Table 3 is visualized, where the prevalence of the nodes is shown in a quantitative way, where the most representative areas are “business”, “management”, “hospitality, leisure, sport & technology”, “environmental sciences”, “Green, sustainable sciences & technology”.

Table 3. Occurrences of thematic WOS "categories"

Position	Thematic categories	Ocurrences
1	Business	360
2	Management	324
3	Hospitality, leisure, sport & technology	302
4	Environmental sciences	203
5	Green & sustainable science & technology	200
6	Economics	198
7	Environmental studies	193
8	Computer science, information systems	166
9	Computer science, theory and methods	125
10	Engineering, electrical & electronic	121
11	Law	92
12	Computer science, interdisciplinary applications	82
13	sociology	74
14	Operations research & management science	72
15	Engineering, environmental	71

Source: own elaboration.

The first conclusions about the analysis of SE areas through the WOS categories offer the beginning of the hypothesis of the disintegration in different areas due to the inclusion and diffusion of digitalization in many sectors as a distribution channel of collaborative consumption and its new conception of the prosumer (Ritzer et al., 2012).

In Figure 6, this analysis has been represented in an item density graph with the results of the 108 categories. The occurrence is represented by colours, with the colder colours being those categories with fewer occurrences and the warmer colours being the nodes with a greater presence in the literature base (results from table 3).

Secondly, the position of the nodes is another element of analysis that can be seen in this graph of item density, where the closest nodes are those that have a greater relationship. Thus, "islands" or thematic nuclei can be observed, where categories are grouped together

close to each other and where a main group composed of "management", "business", "economy", hospitality, "leisure, sport & tourism" can be distinguished as the densest, presenting a strong connection between them and also keeping a certain association with the sphere of social and human sciences.

In another disconnected "island" appear the environmental sciences, computer and information sciences. Adjacent to this nucleus, and with less representation, are the areas of geography and urban and development studies.

There is a third core of medium size, but with a growing density where the category "Green & sustainable & technology" is positioned in the centre, and that is connected to "engineering", close to "transport" and this to "energy". This core, as will be analysed in the following graph, is positioned as an emerging area in SE's research.

Isolated and of smaller size, we can see the last nuclei composed by the classical sciences such as mathematics, physics and chemistry, and the one related to the communication sciences.

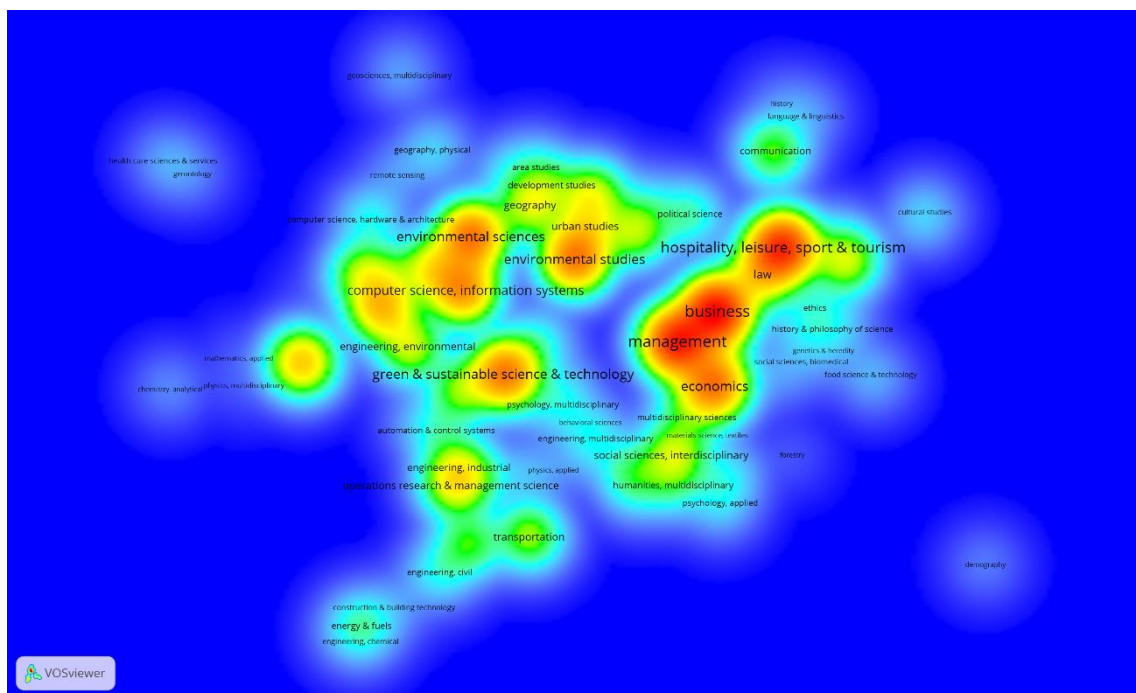


Figure 6. Publication density analysis in WOS “categories”. Source: VOSviewer©

If we focus on positioning, although the graph shows a lack of flow between different areas, possibly due to the recent scientific interest of the SE, it seems that the Green & sustainable & technology field is the one that tends to bring together the rest of the fields and stands as a strategic area in the development of the SE.

Another interesting analysis is the historical evolution of the thematic categories. Even though the SE is a term that has been relevant in scientific production relatively recently, as shown in Figure 3, there is a notable historical evolution with differences according to the thematic areas.

Figure 7 shows the network of the 63 thematic categories with the most occurrences, at least 5 reiterations in the bibliographical base of reference, discerning by colour the year of publication. 2014 has been taken into account as the starting year, which is when scientific production in SE begins to take off. Thus, at first, it seems that the area of social sciences was the first to study and research about SE, followed by human sciences and psychology, all of them in blue. Around 2017, the yellow colour, scientific production in SE shot up in the areas of economics, business, urban studies, geography, tourism and computer sciences, engineering coinciding with the growing use and inclusion of industry 4.0 in all areas (Kamble et al., 2018; Luque et al., 2017; Shrouf et al., 2014). However, in the last two years it seems fundamental to shift the bibliographic production in SE towards the field of engineering, environmental sciences and studies in the field of ethics. Therefore, together with the central position of the category "Green & sustainable & technology" observed in the previous graph, this is the current strategic line, coinciding with the exponential growth of studies related to sustainable manufacturing and in accordance with objective 12 of the Sustainable Development Goals, which combines *responsible consumption and production* (Sullivan et al., 2018).

Figure 8 shows the network obtained, where, according to the legend provided by the software, it goes from the coldest colours (blue) to indicate the least number of quotations received, to the warmest colours for those with the most. This legend is normalized from 0 to 30 offering an average of quotations received by the publications of each author to homogenize the distances between all the authors and can be represented in the same magnitude, since there are authors with very high values of quotations with respect to others. This is the case of the main author Belk Russell (852 citations) who, with her publication *You are what you can access: Sharing and collaborative consumption* (Belk, 2014a) with 751 citations, considered the reference in the inclusion of the aspects of sustainability and the analysis of society's response to this approach to collaborative consumption. As can be seen in table 4, there is a leap in the number of citations with the following authors, although this does not mean that the studies by Byod Cohen (418 citations), who takes the initiative in analyzing the transport and mobility sector (Cohen and Kietzmann, 2014), by Chris J., should not be highlighted. Martin (401 citations), which analyzes the evolution of the SE's discourse in publications until 2015, its main characteristics and potential, as well as a critique of *the pathway of corporate co-option*, situating the SE as a mere economic opportunity far from the transition to sustainability (Martin, 2016) and Iis Tussyadiah (367 citations), who analyzes the impact of shared accommodation on the development of tourism (Tussyadiah and Pesonen, 2016) and the experiences of shared tourism through multimedia material (Tussyadiah and Fesenmaier, 2009).

Table 4. "Author" Analysis

Position	Authors	Citations
1	Belk, Russell	852
2	Hamari, Juho	751
3	Cohen, Byod	418
4	Martin, Chris J.	401
5	Tussyadiah, Iis P.	367

6	Proserpio, Davide	357
7	Zervas, Georgios	312
8	Cheng, Mingming	307
9	Ert, Eyal	282
10	Fleischer, Aliza	282
11	Frenken, Koen	235
12	Gretzel, Ulrike	183
13	Rosenblat, Alex	180
14	Yeubnet, Timm	176
15	Law, Rob	176

Source: own elaboration.

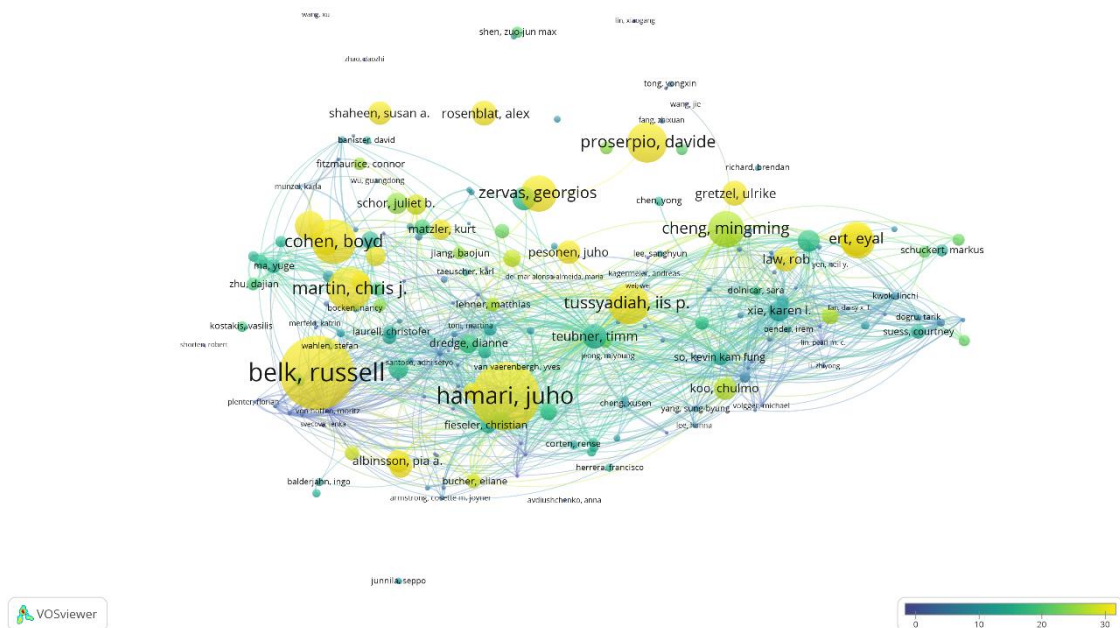


Figure 8. Bibliographic coupling analysis of “authors”. Source: VOSviewer©

4.3. Organizations co-authorship analysis

Next, an analysis of the organizations that carry out the published research on SE is made. As can be seen in Figure 6, an analysis is made of the co-authors of the organizations to which the authors of the publications analysed are attached. A total of 1,746 organizations have been identified in the sample carried out. The evaluation carried out has focused on those organisations with a minimum volume of occurrence of 5, where the result is refined in a total of 177 organisations, of which 22 organisations have been suppressed because

they are not related to any other. The result shown therefore includes the analysis of the 155 most representative organisations.

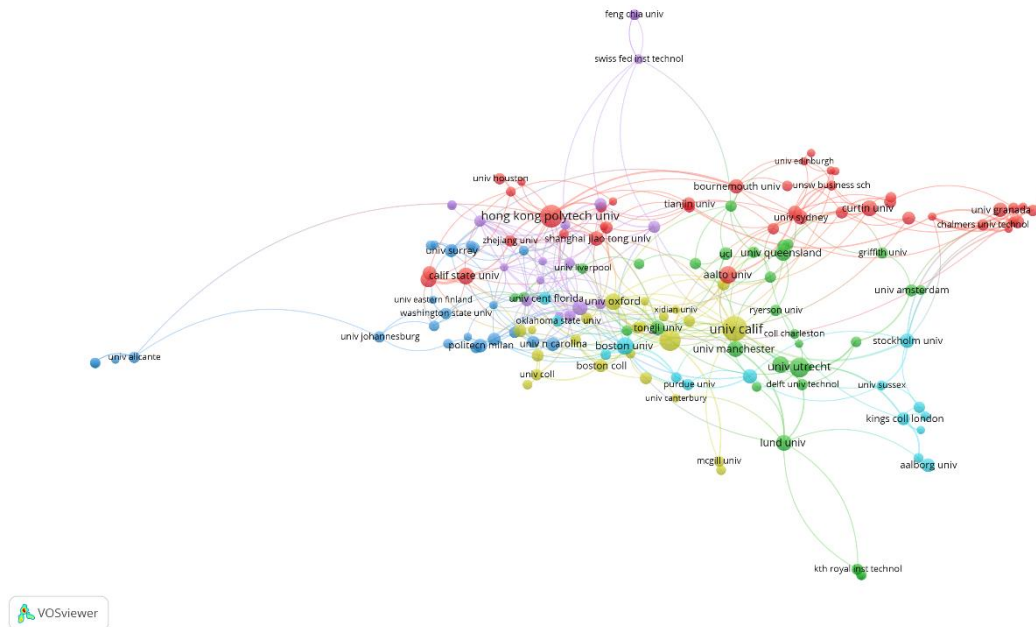


Figure 9. Network of co-authoring “organizations”. Source: VOSviewer©

There are a total of 6 clusters, differentiated by colour (Figure 9), led by Boston University, Hong Kong Polytechnic University, University of Minnesota and the University of California, with 27, 26, 24 and 23 points of association strength respectively. Table 4 shows the most representative organizations by number of occurrences, citations and bonding strength. By number of occurrences, the University of California System, Hong Kong Polytechnic University and Tsinghua University stand out. If we look at the number of citations, York University is in first place with a wide margin over Aalto University with 761 citations, also with a wide margin over Boston University in third place. Finally, the link strength is analysed and, in this case, Boston University climbs to first place, followed by Hong Kong Polytechnic University and the University of Minnesota System.

Table 5. Organisations' position on documents, quotations and networking strength

Pos	Documents		Citations		Total Link Strenght	
	Organization	Value	Organization	Value	Organization	Value
1	University Of California System	40	York University	876	Boston University	27
2	Hong Kong Polytechnic University	33	Aalto University	761	Hong Kong Polytechnic University	26
3	Tsinghua University	28	Boston University	665	University Of Minnesota System	24
4	Utrecht University	24	Copenhagen Business School	657	University Of California System	23
5	Boston University	20	University Of California System	553	University Of Oxford	21
6	Aalto University	19	Utrecht University	448	Tsinghua University	21
7	University Of Oxford	18	University Of Southern California	402	California State University System	19
8	California State University System	18	Hong Kong Polytechnic University	398	Chalmers University Of Technology	19
9	Beijing Jiaotong University	18	Washington State University	360	Harvard University	18
10	University Of Manchester	17	University Of Manchester	352	University Of Denver	18
11	University Of Denver	16	Boston College	332	Hong Kong Univ	17
12	Curtin University	16	University Of Leeds	275	Tongji University	16
13	Lund University	16	University Of Oxford	273	Ratio Inst	16
14	University Of Queensland	16	University Of Technology Sydney	270	Peking University	16

Source: own elaboration.

Directly related to the organizations is the analysis of scientific production by country. As can be seen in the table above, American and Asian organizations take the first positions, followed by British organizations. In these same terms the data referred to countries are developed. The analysis of co-authorship by countries reveals the participation of a total of 80 countries, where those that contribute more documents are the USA with 457 documents, China with 375 and the United Kingdom with 219, followed by Spain (165), Germany (146) and Australia (142). Regarding citations, the main countries are from the Anglo-Saxon area, with the USA taking first place with 5,395 citations, the United Kingdom with 2,444 and Canada with 1,749, followed by China, Germany and Finland with 1,502, 1,482 and 1,279 citations respectively. Although it is

observed that in terms of volume of publications, China is in the first positions, it is European and American publications that have a greater volume of impact at present (Battino and Lampreu, 2019; Peña-Vinces et al., 2020; Saviolidis et al., 2020) .

4.4.Source citation and co-citation analysis

Another element of analysis that is the subject of this article is the analysis of sources. These are mainly (92%) scientific journals, although we also include editorials and proceedings from different international conferences with an impact on the field of the ES.

A total of 1071 sources have been identified. As in the previous cases, a filtering process has been carried out, selecting those sources cited in at least 5 documents from the database analysed, with a total of 75 sources meeting this requirement. Finally, an analysis of 73 sources has been carried out, given that 2 of the 75 sources selected have not been cited by any other source (co-citation).

To interpret the results obtained with respect to the multidisciplinary nature of the sources and to be able to relate the citation, co-citation and documents, table 5 is presented. In this table, the sources have been ordered with respect to the relationship between the number of documents and the number of citations (column "Citations and Documents Relation" = "Documents" / "Citations") adding the information of the WOS category in which the source is found, as well as the Journal Citation Report (JCR) ranking of the last year that data exist (2018).

This shows once again the diversity of the themes of the sources observed in the different analyses: business, ecology, environmental sciences, hospitality, computer sciences and tourism among others. This fact is related to the progress of research in the different areas of the SE and how in each of them publications that are classified as influential stand out,

leading the sources to position themselves as potential references in the area of WOS and having an influence on the impact index of the source.

Table 6. Citations and Documents Relation of “sources”

Source	Category Analysis				Doc.	Citations	Citations and Documents Relation
	WOS Category 1	JCR Rank	WOS Category 2	JCR Rank			
1	Business	Q1	---	---	12	934	77,83
2	Ecology	Q1	Environmental Sciences	Q1	7	383	54,71
3	Environmental Sciences	Q1	---	---	10	408	40,8
4	Business	Q3	---	---	11	446	40,55
5	Environmental Studies	Q1	Hospitality, Leisure, Sport & Tourism	Q1	17	673	39,59
6	Business	Q2	Computer Science, Information Systems	Q2	9	269	29,89
7	Geography	Q1	---	---	7	190	27,14
8	Hospitality, Leisure, Sport & Tourism	Q1	Sociology	Q1	16	417	26,06
9	Business	Q1	Regional & Urban Planning	Q1	25	538	21,52
10	Hospitality, Leisure, Sport & Tourism	Q1	---	---	42	842	20,05
11	Hospitality, Leisure, Sport & Tourism	Q1	Management	Q1	32	552	17,25
12	Hospitality, Leisure, Sport & Tourism	Q1	---	---	13	218	16,77
13	Green & Sustainable Science & Technology	Q1	Engineering, Environmental	Q1	57	828	14,53
14	Hospitality, Leisure, Sport & Tourism	Q1	---	---	13	176	13,54
15	Hospitality, Leisure, Sport & Tourism	Q1	---	---	26	190	7,31
16	Business	Q1	Computer Science, Information Systems	Q1	11	40	3,64
17	Green & Sustainable	Q2	Environmental Sciences	Q2	91	278	3,05

	Science & Technology						
18	Hospitality, Leisure, Sport & Tourism	Q2	Management	Q2	20	51	2,55
19	Computer Science, Information Systems	Q1	Engineering, Electrical & Electronics	Q1	16	34	2,13
20	Green & Sustainable Science & Technology	Q2	Hospitality, Leisure, Sport & Tourism	Q1	13	18	1,38

Source: own elaboration.

As can be seen, all the sources are in the first positions of the JCR ranking (Q1 or Q2) where the most influential authors publish their works and, analysing their research in depth, we can see how sustainability issues are addressed in their works such as the reduction of carbon emissions or the reduction of waste and pollution (Belk, 2014a; Cheng, 2016; Ertz and Leblanc-Proulx, 2018; Guo et al., 2019; Laurenti et al., 2019; Netter et al., 2019), increasingly oriented towards these WOS categories. The SE stimulates alternative consumer behaviour and business models, which can contribute to make a relevant difference to the environment by emphasizing the link between the SE and sustainability (Klößner, 2013).

In the case of sources, co-citation analysis is particularly relevant since the repetition of joint citations favours the consolidation of association in clusters or areas of study that are closer to each other.

The co-citation analysis of sources reports a total of 32,006 sources, which are the sources present in the bibliographic citations cited for each of the 2,152 documents in the bibliographic reference base. To extract the most representative clusters, the sample has been filtered by selecting those sources that have been cited at least 25 times, with 479 sources meeting the requirement. Of these, only those clusters containing at least 5

sources have been extracted. The result is a total of 479 sources distributed in 5 clusters as shown in Figure 10.

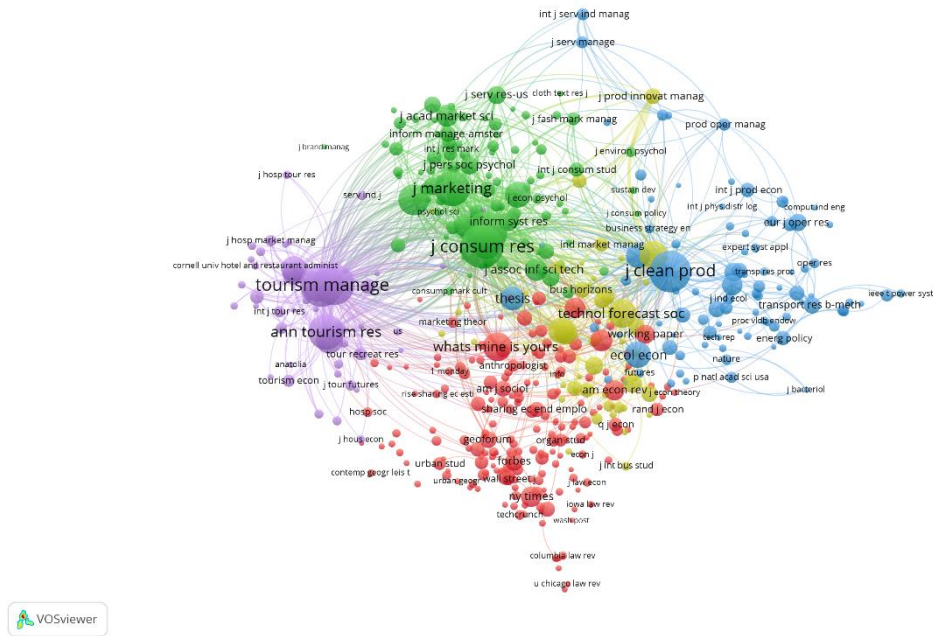


Figure 10. “Source” co-citation analysis. Source: VOSviewer©

As shown in Figure 10, the clusters distributed by colour correspond to the following thematic areas (Table 7).

Table 7. Clusters for thematic areas of the “sources”

Clusters	Colour	Area
Cluster 1	Purple	Tourism
Cluster 2	Green	Marketing, Consumption
Cluster 3	Blue	Engineering, Transport and Energy, Production and Environmental Sustainability
Cluster 4	Red	Social sciences and economics
Cluster 5	Yellow	Technology and Innovation

Source: own elaboration.

In the spatial distribution it is observed that clusters 1, 2 and 3 remain more spatially concentrated than clusters 4 and 5, this is due to the fact that the areas of the first ones

more co-cites in sources of the same thematic area, while clusters 4 and 5 seem to be more transversal disciplines (Böcker and Meelen, 2017; Chen et al., 2019; Cherry and Pidgeon, 2018; Dudin et al., 2019; Gazzola et al., n.d.; Javaid et al., 2019; Kim et al., 2019; Mittendorf et al., 2019; Peterson et al., 2019; Philip et al., 2019; Ye et al., 2019; Zhang, 2019) co-citing with each other but also linking with other knowledge disciplines such as tourism (cluster 1), marketing and consumption (cluster 2) and engineering, transport and clean production (cluster 3).

According to Ertz and Leblanc-Proulx, cluster 3 (in their study it was the emerging cluster 4), which deals with sustainability related to engineering, production and energy consumption, is the most dispersed and related to the other clusters, forming an increasingly consolidated core and with the prospect of climbing to the top positions due to the link with the SDGs (Gusmão Caiado et al., 2018; Rosati and Faria, 2019).

5. Discussion

5.1. Key research topics

The key research themes in the field of SE have evolved chronologically. Initially, however, the theoretical and basic studies that serve as a stimulus for research interest in this field are positioned and occupy preferably economic and social categories (Cluster 4) (Belarmino and Koh, 2020; Botsman and i Rogers, 2010; Botsman and Rogers, 2011; Heinrichs, 2013). Subsequently, there are four research development clusters, where a chronology can be observed between them, since, firstly, studies are developed referring to cluster 1 and 2, with publications in the urban studies, tourism or business categories (Acquier et al., 2017; Cesarani and Nechita, 2017; Godelnik, 2017; Lan et al., 2017;

Tussyadiah and Sigala, 2018) based on empirical studies of redistribution and mutualisation of tangible goods and services. This is followed by cluster 5 on innovation and engineering publications, which provide more applied problem-solving and a focused approach to specific aspects of collaboration through technology development (Dabbous and Tarhini, 2019; Geissinger et al., 2019b; Huang and Zhao, 2019; Jiang and Li, 2020). Finally, cluster 5 is still temporarily present, although with a clear focus on green systems and sustainable manufacturing by measuring the potential of this emerging area (cluster 3) (Du et al., 2019; Geissinger et al., 2019a; Guo et al., 2019; Jaremen et al., 2019).

5.2. The focus on sustainability

SE-based models have not always been recognised as a means of achieving sustainability as only economic benefits were addressed in the first instance (Heinrichs, 2013; Munzel et al., 2019; Piscicelli et al., 2015). However, inherent in the definition of the SE concept developed by Belk (Belk, 2014a), it includes the improvements and advantages in terms of resource optimisation, lower material consumption and cleaner production derived from all collaborative strategies (Agarwal and Steinmetz, 2019; Slee, 2017; Suchanek and Szmelter-Jarosz, 2019).

Likewise, given the controversy that the postulation of this concept has entailed between economics and sustainability, there are authors who criticise this sustainable orientation (Frenken and Schor, 2017a; Schor et al., 2016), although these were only publications of a conceptual nature (Böcker and Meelen, 2017; Falk et al., 2019; Ravenelle, 2017).

Ertz and Leblanc-Proulx (Ertz and Leblanc-Proulx, 2018) indicates that, apart from some company-sponsored studies, there was a lack of sustainability-oriented work, but it is interesting to note that, with the emerging new category (Green, sustainable sciences & technology) which has brought together work on SE in recent years, it can now be said

that a new line of applied work has been established in leading journals focusing on case studies and SE methodologies as a significant contribution to sustainability (Guo et al., 2019; Lin et al., 2019; Pham et al., 2019; Wagner et al., 2019) .

6. Conclusions

The aim of this study was to carry out as complete an analysis as possible of the scientific production on the SE, thus achieving the central objective of the research. To this end, it has focused on the WOS, as it is the most complete scientific database with the greatest impact. The filters have been reduced to a minimum to be able to reach the totality of available publications on the subject and the search has been carried out by the "topic" field which is the one that offers a greater range of exploration. This holistic approach has made it possible to complement the results obtained by previous literature reviews (Battino and Lampreu, 2019; Chen et al., 2014; Ertz and Leblanc-Proulx, 2018; Lima and Carlos Filho, 2019; Shin and Perdue, 2019b), based on the analysis of a broader document base on SE.

This study combines two consolidated methodologies in the bibliographic review according to their capacity of structuring and representing the data: the bibliometric study and the analysis of networks. The co-authorship, co-occurrence, citation, bibliographic coupling and co-citation analyses used allow the measurement and graphic representation of the most used keyword networks, the most influential authors, the most outstanding sources, as well as offering a mapping of the historical-temporal evolution of the research fields and analysing the trends with respect to the new research fields.

In addition, the keyword network analysis carried out, which has required a prior computerised refinement process, gives conclusive results related to the analysis of the WOS categories, an innovative element in bibliometric evaluation. This extensive

analysis allows the results to be placed as a starting point for the achievement of strategies linked to sustainability and clean technologies in the fields of action of the SE, since it is considered to be the category of greatest interest for the scientific community at present.

The results of the analysis show that the US and China are the leaders in terms of volume of publications. This suggests a change of trend over the past three years in the most influential countries in SE scientific production, as Ertz and Leblanc-Proulx (Ertz and Leblanc-Proulx, 2018) argued in their analysis that Europe was the leader in terms of productivity. However, if we focus on the interest aroused by publications in the scientific community, based on citation analysis, China is relegated to a more discreet level, with the US and Europe emerging as the main powers in this field. The same results are obtained in the analysis of the relationship between authors, which evaluates the number of bibliographical references they share among their publications. The American Russell Belk continues to be the most influential author because his work is suggested as the starting point of the SE (Belk, 2014a). He is somewhat removed from the Finnish Juho Hamari who focuses his work on the analysis of society's response to this collaborative consumption approach (Hamari et al., 2016). Behind them, we find Cohen, Martin, Tussyadiah, Proserpio and Zervas, not finding until the eighth position of influence Asian authors (Cheng, Ertz y Fleischer) in spite of having an important volume of publications.

A total of 120 thematic categories out of the 236 existing in the WOS have been identified in the documents of the bibliographic base analysed. This wide representation confirms that the ES is a multidimensional and multidisciplinary concept, applied and researched by many different areas of knowledge. This can be seen from the study, taking into account two aspects.

Firstly, the analysis of the reiteration of the categories (occurrence), where it was obtained that the most representative areas are "business", "management", "hospitality, leisure,

sport & technology", "environmental sciences" and "Green, sustainable sciences & technology". This situation is supported by the analysis of co-citation of sources from which 5 main clusters are obtained, such as *Tourism; Marketing and Consumption; Engineering, Transport and Energy, Production and Environmental Sustainability; Social Sciences and Economy; and Technology and Innovation.*

Secondly, the spatial distribution of the categories, where nuclei are shown scattered according to the different disciplines involved. However, despite the disconnection between the nuclei, probably due to the recent take-off of scientific production in SE, a trend can be observed in which the category "Green & sustainable & technology" is positioned at the centre, acting as a nucleus which brings together the other disciplines, i.e. "sustainability" is positioned as the backbone of scientific production in SE.

Regarding the limitations presented in the document, the first of these is the one relating to the selected database. Only the WOS has been chosen, but it is possible to consider for the future the inclusion in the study of other databases (Scopus or Google Scholar) where publications with less impact and of another nature are found (trade publications or patents, for example).

The bibliometric analysis with VOSviewer© has been carried out using the full counting method, where each quotation, document or co-quotation has been counted as a whole number, regardless of the number of authors in the work. There is the possibility of performing a fractional counting, where each author of the publication obtains a number between 0 and 1 depending on the number of authors in the work. This limitation suggests that the study carried out could give more representation to publications with more authors.

It should also be mentioned that there is another limitation to the analysis carried out in the selection of keywords. The four most representative ones which are positioned in the general literature as key concepts in the SE have been selected. Likewise, terms such as "sustainable consumption", "gig economy", or "sharing platform" could be included.

Finally, another limitation of the study is related to the exponential increase in recent years where Price's law of logarithmic growth is represented (Price, 1965). The incorporation of new disciplines or scientific areas in the last 2 or 3 years to the field of SE, such as engineering, environmental sciences and studies in the field of ethics, have a very low impact on publications, as well as on citations, since these are emerging fields where publications are in very primary stages. However, far from being a problematic constraint, it emerges as a starting point for future research that can serve as a basis for proposing a broader framework for responsible production and consumption in line with GDS objective 12.

Suggested guidelines for future research can be directed towards the following inputs. Firstly, subsequent literature reviews could be carried out after 2020 to better assess the productivity and influence of authors, organisations and the media by taking the results of this study as a reference point and adding the vision of how COVID-19 has influenced research as this pandemic, due to its characteristics and configuration of social relations, is a head-on collision with the SE (Kupriyanovsky et al., 2020).

Secondly, it is possible to carry out an analysis by including new keywords that have been generated in the development of this concept which, at present, may not seem to have a high impact, but which, nevertheless, can be found in the central axes of the studies (for example, social, model, or sharing manufacturing). In this way, it is integrated into the Framework for Strategic Sustainability Development (Missimer et al., 2017).

Next, future research could determine the evolution of the one we have identified in this study, for its validation. It is interesting to analyse whether the structure of the 5 category clusters is maintained over the years, that is, whether they are fragmented into sub-areas of research more focused on sustainability, whether they disappear or whether, on the contrary, they are consolidated as transversal axes of research.

The knowledge developed so far and the opportunity of sustainable development as the backbone of research in any field, means the potential for developing alternative production models that can help make a relevant difference to the environment by opening up new opportunities for clean manufacturing. We suggest case studies applied to industries where the philosophy of the SE and its environmental and social advantages are incorporated, where a lower consumption of resources, energy and goods between different industries (industrial eco-parks (Ghisellini et al., 2016; Martín et al., 2018)), consumers and customers, would emerge a considerable environmental improvement.

7. Acknowledgements

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