Comparative Analysis of the Scientific Production in Sustainable Supply Chain

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Abstract : This study examines global scientific production on the sustainable supply chain based on bibliometric indicators such as the scientific production, percentage change in production, average citations per document for the period 2007-2018. The analysis was carried out by country, by year of publication, by language used for publication, using the Histcite database of scientific literature. The results show that total world production has varied over the period, and that this topic has attracted great scientific interest. Two groups of high-production countries are distinguished, one of which has a highly specialized thematic focus.

Keywords : Sustainable supply chain, management, bibliometric, score citation.

1. Introduction

Supply chain sustainability is a business problem that affects an organization's supply chain or logistics network in terms of environmental, risk and waste costs. There is a growing need to integrate environmentally sound options into supply chain management[1,2]. Sustainability in the supply chain is increasingly seen by senior executives as essential to generating profitability and has replaced cost, value and speed of money as the dominant topic of discussion among purchasing and supply professionals. A sustainable supply chain takes advantage of opportunities for value creation and offers significant competitive advantages for first adopters and process innovators[3], But growing demand for and consumption of products has put pressure on industrial production and supply chains, which has had negative effects on the environment and society[4,5]. The world has needed to include new methods to meet its operational needs, with minimal negative impact[6].

Maintaining measures of profitability while conducting business through environmentally and socially sustainable operations is a challenge of optimization for organizations globally and for our society. It is therefore essential to create new methods and tools to take into account the three pillars of sustainability –

economic, environmental and social - in a multi-stakeholder chain[7]. Unfortunately, there is a lack of guidelines to support a comprehensive analysis, especially with regard to the evaluation of the environmental and social performance of decision alternatives. This hinders progress in corporate sustainability. Questions arise about how to measure and balance the respective indicators with traditional economic objectives[8,9].

There have been few bibliometric studies of the results of research in this area, however, there is a great need to review this research to identify important actors in this area[10]. The last decade has been characterized by the greatest growth in the research effort to obtain a sustainable supply chain and, therefore, to advance in the use of new methods of sustainable development[11,12]. China, one of the most polluted countries due to its massive production of products for the whole world[13], does not yet appear as a leading researcher on this subject, but as the sustainability of the supply chain becomes more difficult, the concept of circular economy needs to be integrated into supply chain management to achieve an optimal balance of benefits[14,15].

In this regard, the work of the research groups in the field of sustainable development was evaluated, considering areas outside the US and the European economic community, with the aim of comparing the research results and priorities of 10 countries in this source of sustainable supply chains between 2007 and 2018, using as a measure the number of publications, their increase and the factors affecting the development of a more efficient method[16,17]. It is also important to highlight the academic capacity of some researchers and specialised centres to generate a worldwide impact on the development of scientific potential, based on the premise that man plays a fundamental role in the knowledge-producing society, and that there is therefore a close relationship between the progress of scientific research and the volume of research results published[18]. Therefore, a comparative analysis of the differences between researchers from the European Union and the changes observed in the field of sustainable supply chains was carried out, so that the implementation of related measures made it possible to assess the situation in a given country in relation to all other countries[19,20].

The main contribution of this work is a bibliometric study of the scientific production in the field of sustainable supply chains, taking into account the volume of research results in the periods 2007-2018, with the aim of analysing the evolution of trends in this area and identifying the relevant factors that have predominated in this area.

2. Materials and Methods

The bibliometric analysis developed in this work is a systematic approach that allows the user to quickly and quantitatively analyze scientific publications, to obtain as a result the milestones in certain research topics. This analysis allows for a much clearer visualization of scientific development and behavior in a given topic, facilitating the identification of significant contributions to that topic or field.

Local and global citation rates were used as bibliometric indicators. The information used to generate the reports was obtained from the Web of Science (WoS), which provides an important source of data for the development of any bibliometric analysis to be performed as it allows users to access more consistent and standardized records compared to other databases such as Scopus.

Two other indicators were also used: production in different languages and relative production, with population data from European and other continents, allowing important conclusions to be drawn about the situation in the world for sustainable supply chains and the environmental impact of not taking into account the traceability of a friendly supply method.

3. Results and Discussion

The main countries in the world with the highest production of scientific papers in the field of sustainable supply chains were analysed, focusing mainly on those with a production of at least 50 papers published in the most productive journals and institutions in this category.

Table 1 presents in an objective, clear and efficient manner the results distributed by years of publication, with their respective bibliometric indicators of local and global citation.

Table 1. Countries, publications, number of publications in local (TLCS) and number of global (TGCS).

Country	Publications	TLCS	TGCS
USA	99	773	4514
UK	86	273	1477
China	63	75	494
India	41	65	312
Germany	39	549	2853
Canada	31	612	2840
Iran	29	75	402
Italy	29	68	413
Netherlands	24	36	439
France	22	72	618

Table 1 shows how the USA concentrates a visible effort in the research development of sustainable supply chains, with 19.7% of the total publications in the world. Followed closely by the UK with 17.1% and China with 12.5%. It is important to bear in mind that these three countries are first world countries with a large number of inhabitants who need sustainable development options to increase the efficiency of their processes. Not only the number of inhabitants of a country is important, but also the economic growth in the last decade experienced by these countries, which have committed themselves to a model of sustainable development in their countries. Figure 1 shows how the USA has the most citations on the Hitscite platform. Germany and Canada closely follow with a number of similar citations, countries like China and the UK that share with the USA the podium of the three countries with the most research interest in the field of sustainable supply chains, do not always have the highest number of TGCS.
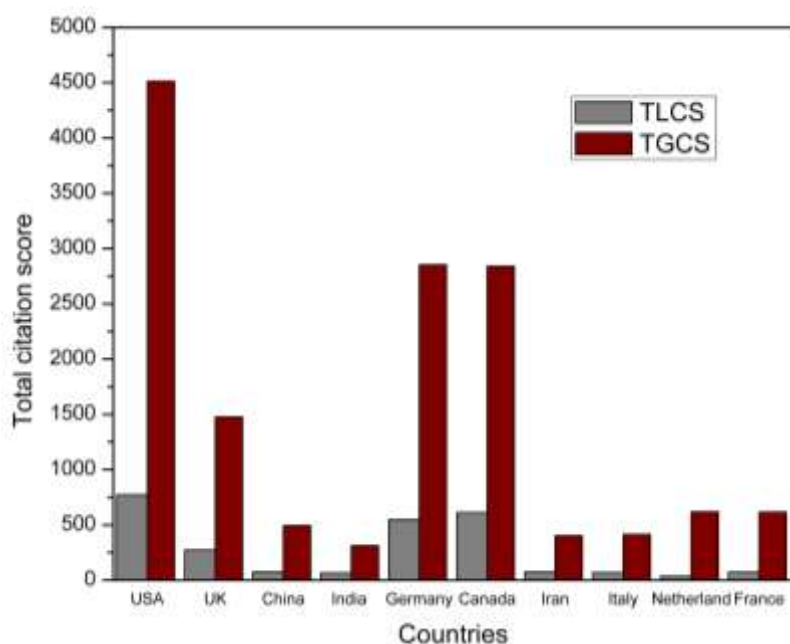
Figure 1. Countries, number of publications in local (LCS) and number of global (GCS) citations.
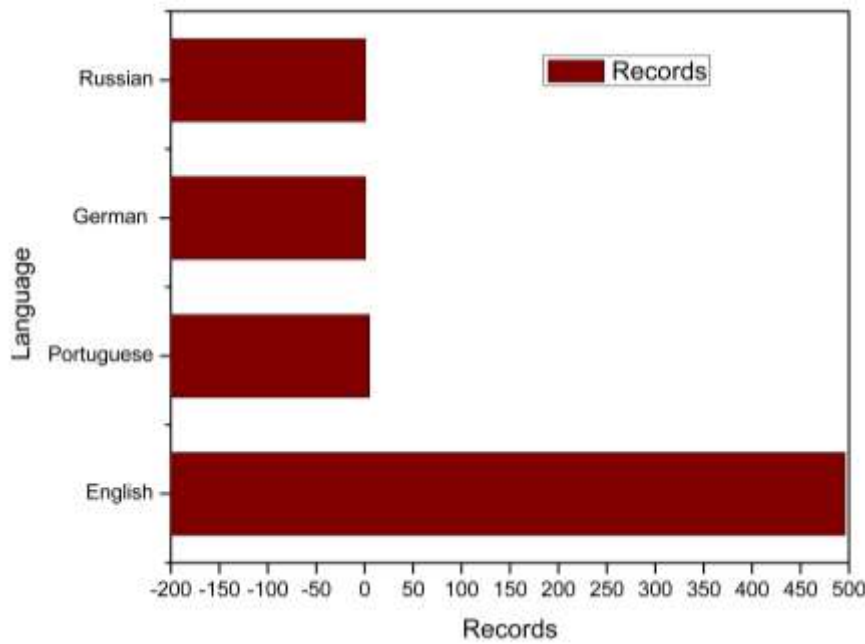
Figure 2. Publications in other languages.

It is usually believed that only the most developed countries with a high birth rate and large populations linked to vast territories where supply is difficult, sustainable techniques are needed. Figure 2 shows the superiority in which most of the articles in the Hitscite database are researched and published.

Due to the increase in population experienced on the planet with a growth of 10% within a decade, it is compared to the need of man to research in sustainable supply chains that adapt to the continuous change in social, environmental and operational requirements in each country. As shown in Figure 3, the USA maintained slow growth until 2014, when it had a production rate that was twice as high as in previous years, and then declined, but in 2017 it showed a considerable increase as the largest provider of updated information in the field of sustainable development. Countries such as the UK and China have growth over the years where growth is seen in the years 2014 and 2017. Countries such as India, Canada and Iran have a growth that increases over the course of the decade although all show a decline in the year 2017. The research interest of the Netherlands and Italy remains almost constant during the range studied for the analysis, this can be explained by the fact that they are small first world countries where they have a simplified operational functioning due to the conditions they face.
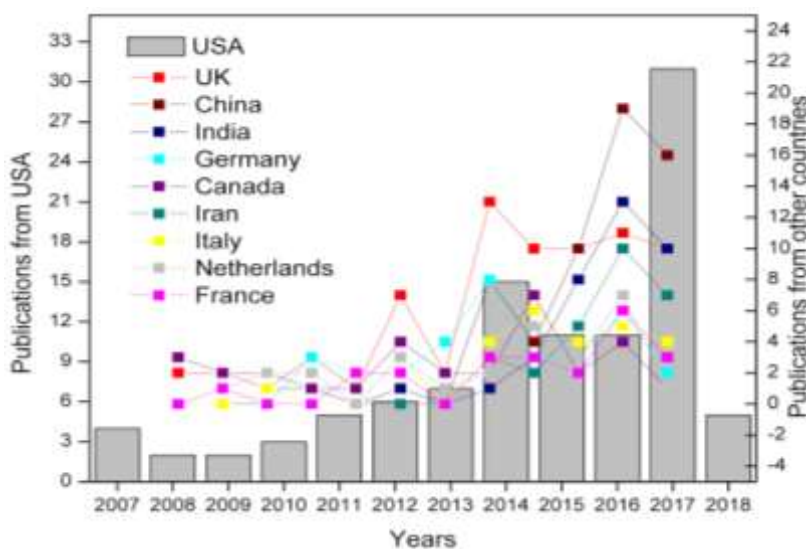

Figure 3. Year of publication in each country.

Within the context of publications, important factors must be taken into account, what is necessary will always be to have the greatest possible impact and to reach the greatest number of people directly affected, but nevertheless there are ways of estimating the scope of the new information, the H index compared to the number of publications that each journal has and the total number of citations, both local and global. The Journal of cleaner production has the largest number of publications and the second H index in the ranking of table 2, in the case of Sustainability revista de corto alcance and International journal of production economics it is observed that it has a number of similar publications, but only the second one has an important impact within the field of sustainable supply chains.

Table 2. Journals, records, total local citation score (TLCS), total global citation score (TGCS) and H index.

Journal	Records	TLCS	TGCS	H index
Journal of cleaner production	67	368	2214	132
Sustainability	33	13	132	12
International journal of production economics	32	325	1629	141
Supply chain management-an international journal	17	170	754	11
Business strategy and the environment	13	53	268	75
International journal of physical distribution & logistics management	12	290	1464	85

For each research topic there are references who are at the forefront and serve as a guide for those who arouse interest in new sustainable supply techniques. Figure 4 shows Stefan Seuring, a German who has contributed during his professional career the most important advances for supply chains in countries with a large territory that must be supplied under any climatic condition, publishing each year in this field of research, in 2013 and 2014 he doubles his production, definitely a reference that created the bases on which the new ideologies are based in terms of sustainability. It is important to highlight Mark Pagell and Zhaohui Wu, two professors who throughout their careers have taken as their main focus the safe operational effectiveness and how the logistics of a process affects relationships within the chain. Finally, it is important to mention Cory Searcy who goes into the concept of what makes a chain sustainable and environmental studies to optimize supply management routes. Since 2012, she has contributed seven studies that set a precedent in a research field that needs to be updated due to the rapid change of our planet.
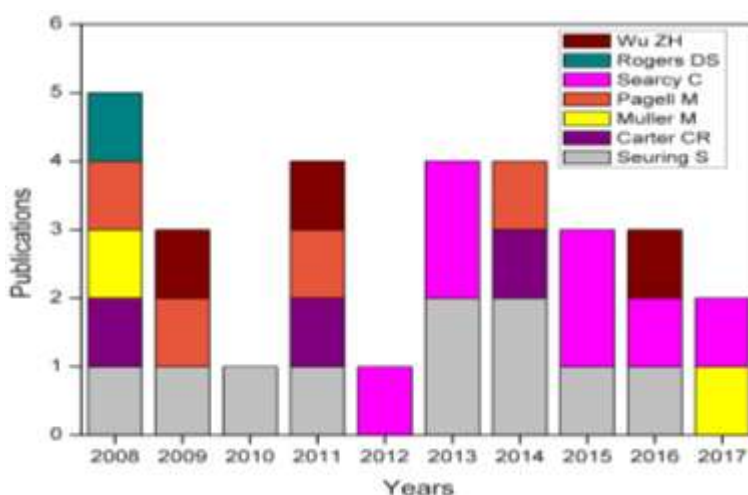

Figure 4. Top 7 authors with most number of publications.

4. Conclusions

Analyses show that total production has increased over the course of our study period (2007-2018), and that developing countries stand out in the world because of the variables studied.

During this period the USA, China, United Kingdom and India were the countries with the highest production of articles and also the most cited worldwide. Canada, Iran and Germany are making a major research effort in the area of sustainable supply chains. The country with the greatest impact has been the USA, which has provided a high research capacity to decant operational management and coordination of supplies as an example of a sustainable and clean region. Countries like France, due to its small territory, are relegated to the bottom of the list, their production in this field has been precarious, something very rare because it is an area with a strong economy that could find in this type of research methods that lead them to become world powers in sustainable techniques.

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