

Scientific Prospecting on Sustainable Development: A Bibliometric Analysis

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Abstract—This study aimed to map a scientific production on Sustainable Development through a bibliometric analysis. The methodological procedures were delineated by a quantitative approach, the research involved data taken from Scopus scientific database. For the searches in this database, the keywords “sustainable development” and “sustainable development” were used within a period of 10 years, from 2009 to 2018. The searches identified 7,841 publications related to the theme, an average of 784 articles published per year. The year with the largest number of publications was 2018, with 1279 publications. The author with the largest number of publications was researcher Razman, M. R., with 17 articles published. Regarding the areas of publication of articles, the ones that stood out in relation to the number of articles published were: Social Sciences, Environmental Science, Energy, Business, Management and Accounting and Engineering, with respectively 3,844, 3,051, 1,551, 1,398 and 1,093 articles. published. Among the journals, the ones with the highest number of publications were: Sustainability Switzerland, Journal of Cleaner Production, Sustainable Development, with respectively 391, 186 and 145 publications. Regarding educational institutions, the highlights regarding the number of articles published were for the Chinese Academy of Sciences, The Bucharest University of Economic Studies and University Kebangsaan Malaysia. The country with the largest number of publications in the area - United States, with 850 publications. Note that most of the publications were written in English, with a total of 7,091 publications in English.

Keywords—Bibliometrics, Scientific Production, Sustainable Development.

I. INTRODUCTION

Growing concern about excessive resource consumption, environmental degradation and social inequality has resulted in calls for a transition to a more sustainable society and economy. It was in the subsequent work of the World Commission on Environment and Development Brundtland Report (Brundtland, 1987) that the concept of development being one that meets the needs of the present without compromising the ability of future generations to meet their own needs, becoming a conventional concept for literature (ADAMS et al., 2016).

Since the mid-twentieth century, numerous environmental, social and economic crises on a global scale have significantly affected our societies. (TRINDADE et al., 2017). The concept Sustainable Development is increasingly in the political debate, academic discussions

and practically all layers of society (STOFFEL; COLOGNESE, 2015).

Therefore, this research aimed to analyze the academic scientific production related to the area of Sustainable Development in the last 10 years (from 2009 to 2018), providing researchers and the academic community with an overview of scientific and technological studies and advances in this area. over that period.

This article is divided into five sections. The first section provides an introduction to the topics covered in this research. The second section presents a brief review of the literature related to bibliometrics and sustainable development. The third section shows the methodology used in the development of this research. The fourth section presents the analysis of the data obtained in the

research. The fifth section brings the final considerations on the research.

II. REVIEW OF LITERATURE

Sustainable Development

Sustainable Development has become an ideal, a new paradigm for today's society and its concept has spread throughout society (STOFFEL; COLOGNESE, 2015). This concept emerged from a process of critical reevaluation of the relationship between the economy, society and the environment (RODRIGUES; RIPPEL, 2015).

According to Sheng (2001), to achieve Sustainable Development, it is necessary to move towards a comprehensive conception, understanding the very concept of the term and, at the same time, extending this understanding to the agents and actors involved in society in a clearer way. According to Weil (2002), individuals will be able to discern their true responsibilities if they reflect on problems that have made critical the natural processes of the earth such as: excessive consumption, abuse of the environment, aggression among people, for example.

For Oliveira and Santos (2015), sustainable development is a variable in the process of approximation of the long-term sustainability condition. Costa (2015) believes that sustainable development includes social justice, income distribution, full employment, security and health in the workplace, environmental protection and socioeconomic well-being.

Thus, development must be understood as "a complex process of economic, political and, mainly, human and social changes and transformations" (OLIVEIRA, 2002, p. 40). The concept of sustainable development has undergone several transformations: perception of environmental degradation, environmental problems understood as a general phenomenon without territorial limits of National States, degradation as a planetary problem that harms everyone, and is linked to the type of development practiced (BARBIERI, 2000).

For this work, sustainable development is understood to be that definition of the report of the World Commission on Environment and Development Brundtland (Brundtland, 1987): "one that meets present needs without compromising the ability of future generations to meet their own needs".

Bibliometrics

According to Silva et al. [14] "The term bibliometric is derived from the fusion of the suffix "metric" with bibliography, information, science and library respectively,

are analogous or very close in nature, objectives and applications."

Bibliometrics as a method has the advantage of softening the elements of judgment and generating quantitative results that tend to be the sum of many small judgments and judgments made by several people (SANTOS; RAUSCH, 2009). Bibliometric studies serve to evaluate the productivity and research quality of scientists by measuring based on the number of publications and citations of various researchers (VANTI, 2002).

Bibliometric research allows the identification and description of a series of patterns in the production of scientific knowledge. In addition, it serves to estimate with quality and quantity, the production of scientific articles published on a particular theme, highlighting the main authors (researchers and institutions) involved in this process, which contribute to the enhancement of science (BASTOS; HEIN; FERNANDES, 2006).

Traditionally, bibliometric studies are developed from information obtained from large databases, such as: Web of Science, Scopus, Scielo, ACM, IEEE, among others.

III. METHODOLOGY

The methodology used in this research had a quantitative and descriptive character, which initially had a bibliographic survey on the themes bibliometrics and Sustainable Development, conducted through research in scientific articles, dissertations, theses, seminars and periodicals in the area.

According to Cervo, Bervian and Silva (2007), the method is concretized as a set of several steps or steps that must be followed to perform a research and that configure the techniques.

Then, bibliometric researches were performed in the Scopus scientific production database, based on articles published in indexed congress journals and annals, related to the theme sustainable development. The time frame used in this research comprised the period from 2009 to 2018.

Bibliometric research is widely used to quantify the processes of written communication related to a particular theme (SAES, 2000).

The quantitative technique seeks the theoretical basis in the bibliometric laws and principles, detailing and outlining the paths that must be crossed to map the scientific production (VIEIRA; HORI; GUERREIRO, 2008). Filho, Junior and Siqueira (2007), state that the principle of bibliometrics is to analyze scientific activity through the quantitative study of publications.

Bibliometric studies also allow the measurement of the content of theses, articles published in annals and journals,

among others, through analyzes referring to the authors, citations and methodology (BARBOSA et al., 2008). The bibliometric research developed in this work had the following process steps: definition of the research theme; choice of database; elaboration of search criteria; data collection and analysis of search results.

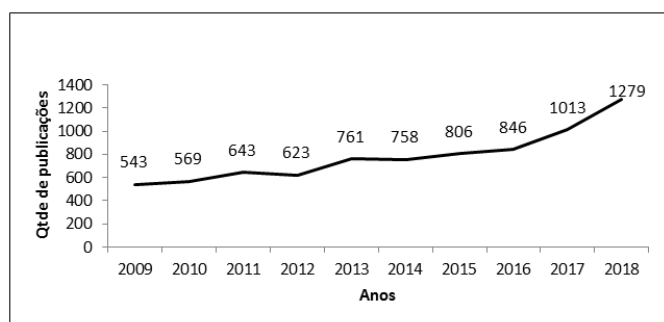
Regarding the search criteria used in the academic production databases, keywords entered in the "title" field of the database cited were used, obeying the time interval established by the research, from 2009 to 2018. The keywords used in the survey were: "sustainable development" and "sustainable development".

After collection, the data were transported to a spreadsheet, where they were processed, organized and tabulated, generating statistical graphs referring to bibliometric indicators related to the theme addressed in this research.

IV. DATA ANALYSIS

Graph 1 shows the volume of articles involving the theme "sustainable development" published in the Scopus platform database, from 2009 to 2018.

According to the collected data, 7,841 publications were identified over the analyzed period (10 years). This is equivalent to an average 784 articles published per year. These numbers show that studies in this area have grown over the years, arousing the interest of researchers and institutions on the subject.



Graphic. 1: Number of publications entitled Sustainable Development in the Scopus database. Prepared by the authors (2019).

Table 1 shows the authors with the highest indexes of publications related to the theme sustainable development in the Scopus database within the analyzed period.

Table. 1: Authors with the highest index of publications on the theme "sustainable development" in the Scopus database. Prepared by the authors (2019).

AUTHORS THAT PUBLISHED MORE	NUMBER OF PUBLICATIONS
RAZMAN, M.R.	17
ARIFIN, K.	12

KOPNINA, H.	12
TVARONAVIČIENE, M.	10
RAMLI, Z.	9
BERAWI, M.A.	8
GERICKE, N.	8
HUANG, G.H.	8
DUDIN, M.N.	7
HAPPAERTS, S.	7

The highlight regarding the amount of articles published is for the researcher Razman, M.R., with 17 articles published.

Table 2 shows the most comprehensive areas of articles published on the theme sustainable development in the Scopus database. The number of publications stood out in the areas of Social Sciences, Environmental Science, Energy, Business, Management and Accounting and Engineering.

Table. 2: Areas with the most publications on sustainable development in the Scopus database. Prepared by the authors (2019).

AREA	NUMBER OF PUBLICATIONS
Social Sciences	3844
Environmental Science	3051
Energy	1551
Business, Management and Accounting	1398
Engineering	1093
Economics, Econometrics and Finance	927
Agricultural and Biological Sciences	643
Earth and Planetary Sciences	427
Arts and Humanities	320
Medicina	313

Table 3 shows the journals that had the largest number of articles published on the theme sustainable development in the Scopus database. Highlights regarding the number of articles published were for the journals: Sustainability Switzerland, Journal of Cleaner Production, Sustainable Development.

Table. 3: Journals with the largest number of publications on the theme “sustainable development” in the Scopus database. Prepared by the authors (2019).

PERIODICS / MAGAZINES	NUMBER OF PUBLICATIONS
SustainabilitySwitzerland	391
Journal of Cleaner Production	186
Sustainable Development	145
ProblemyEkorożwoju	134
Quality Access to Success	116
Wit Transactions on Ecology and the Environment	94
International Journal of Sustainability in Higher Education	71
Journal of Security and Sustainability Issues	71
Business Strategy and the Environment	58
International Journal of Sustainable Development and World Ecology	54

Table 4 shows the educational institutions that stood out in relation to the volume of articles published in the area of sustainable development.

The highlight of the number of publications was the Chinese Academy of Sciences, The Bucharest University of Economic Studies, Universiti Kebangsaan Malaysia.

Table. 4: Educational institutions with the largest number of publications on the theme “sustainable development” in the Scopus database. Prepared by the authors (2019).

INSTITUTIONS	NUMBER OF PUBLICATIONS
ChineseAcademyofSciences	105
Academy of Economic Studies, Bucharest	58
The Bucharest University of Economic Studies	57
UniversitiKebangsaanMalaysia	55
WageningenUniversityandResearch Centre	48
VilniusGediminoTechnikosUniversitetas	44
Utrecht University	39
Kazan Federal University	38
CNRS Centre National de laRechercheScientifique	35
Tsinghua University	34

Table 5 shows the countries that had the largest number of publications on sustainable development in the Scopus database. The ranking of the five countries with the highest number of publications is led by the United States, followed by China, the United Kingdom, India and Germany.

Table. 5: Countries with the most publications on sustainable development in the Scopus database. Prepared by the authors (2019).

COUNTRIES THAT PUBLISHED MORE	NUMBER OF PUBLICATIONS
United States	850
China	800
United Kingdom	641
India	364
Germany	361
Russia Federation	355
Australia	344
France	316
Romania	306
Poland	288

Regarding the language of publications, Table 6 shows that the highlight is the English language, given the universality of this language. In addition to publications in the English language, there are also publications in several languages, which shows that the theme sustainable development has a worldwide reach, arousing the interest of researchers worldwide.

Table. 6: Languages with the largest number of publications on the theme “sustainable development” in the Scopus database. Prepared by the authors (2019).

LANGUAGE MOST USED	NUMBER OF PUBLICATIONS
English	7091
French	178
Spanish	134
Chinese	130
Russian	118
Polish	102
German	98
Portuguese	85
Ukrainian	36
Lithuanian	28

Figure 1 was produced from the use of CiteSpace software, which allows the visualization of patterns of relationship

between topics, enabling the identification of moments of themes explosion and the evolution of research fronts. Figure 1 illustrates the most frequent keywords in the title and summaries of scientific productions related to the theme sustainable development.



Fig.1: Top Keywords in Sustainable Development Publications " in the Scopus database. Prepared by the authors (2019).

V. CONCLUSION

This research shows a study of the scientific productions related to the theme sustainable development in the scientific database Scopus, in the time frame of 10 years (2009 to 2018).

The bibliometric study serves as an important scientific research mechanism that shows the evolution of this technology in the world over the period investigated.

Measurement of scientific production through bibliometrics allows the performance of researchers, institutions, countries and journals to be evaluated through mapping scientific articles and other scientific productions, taking into account quantitative and qualitative metrics.

All articles identified in this research were analyzed according to the following criteria: authors, areas of knowledge, journals in which they were published, authoring institutions, countries that had published the articles and languages that were written.

Through this study, it is expected to have contributed to the evolution of the researched theme, and that the results of this research may benefit researchers and scholars in the area, arousing interest in new studies in this technological area.

For future work, this study proposes the use of other scientific research databases and the use of new keywords related to the theme.

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