



SDGs Prevalence in Higher Education. a Bibliometric Analysis

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SDGs prevalence in higher education.

A bibliometric analysis

Abstract. This bibliometric analysis investigates the prevalence and trends of Sustainable Development Goals (SDGs) within the realm of higher education research. As global imperatives, the SDGs provide a comprehensive framework for addressing social, economic, and environmental challenges. This study employs bibliometric techniques to systematically analyze a dataset of scholarly publications related to higher education and SDGs. VOSviewer and RStudio were used to conduct the bibliometric analysis with the use of the Web of Science core collection citation database. By mapping the landscape of SDGs research within higher education, this study aims to identify key areas of focus, emerging trends, and gaps in knowledge. The findings will contribute to a better understanding of the academic discourse surrounding SDGs in higher education, providing insights for researchers, policymakers, and practitioners working towards sustainable development objectives.

Keywords: sustainability, university, SDG.

1 Introduction

The concerns emphasized in the last centuries worldwide, probably also in the future ones, are the environmental problems we are facing. In this sense, in 2015 the UN elaborated and adopted the 17 Sustainable Development Goals with 169 targets and they aim to reduce the negative impact that the population has on the environment.

In 1990, at the Talloires Conference in France, university leaders from around the world adopted and elaborated the Talloires Declaration [1]. This document outlines a set of 10 principles and commitments for promoting sustainability in higher education institutions. Currently, over 500 universities from over 50 countries have signed this declaration [2].

The purpose of this paper is to examine the research that analyzes the SDGs in relation with higher education, especially since one of these objectives is specifically dedicated to education, namely SDG4 - quality education.

The analysis encompasses a range of indicators, including publication trends over time, prolific authors and institutions, prevalent themes, and the interdisciplinary nature of research around this topic.

2 Literature review

The subject of sustainable development was first introduced and used in 1972. A few years later, in 1978, The Brundtland Commission [3] defined sustainable development

as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

Teaching, research, and social contributions have traditionally been three roles played by higher education institutions [4]. The social contributions are constantly changing as a result of the events and periods we live in. For each of the 17 SDGs, universities can play one or more roles.

Teaching was, is and will remain the main role of universities, but the way this process is carried out has been adapted and improved over the time. Regarding the SDGs assumed by the UN member countries through the 2030 Agenda, the role of universities is to actively promote and underpinning these objectives [4, 5, 6], to inform and pass on to awareness the new reality we live and what we can do individually so as to reach these goals. This can be achieved either by including in the students' curricula an optional subject for sustainable development, or by introducing a chapter related to some SDGs in these fields to each subject. There are definitely targets that can be identified for any field out of the 169 adopted targets.

The social contribution of universities in the SDG context requires the adoption of concrete measures at the institutional level. Starting with 2017, a GUIDE FOR UNIVERSITIES accessible to any university was drafted [7]. This guide presents examples of good practice and tools that can support universities in their commitment to achieving the SDGs. Three years later this guide was updated, and the universities that implemented the most innovative and effective measures were invited to present them as case studies as examples of good practice [7]. Adopting a strategy for a green university or capturing some indicators related to those targets in the institutional strategies can significantly contribute to the final purpose of the Agenda 2030. All this approach requires a large internal organizational transformation, this being one of the barriers [9]. At the same time, the material bases that universities own consume energy and resources and generate impressive amounts of waste [6], and embracing sustainability requires their transformation. However, educational institutions must be an example for society. All the more so as they prepare the future leaders of the community. Therefore, universities should set a precedent by approving a development model that aligns with the principles of environmental protection and intra- and intergenerational equity, supporting the basic concept of sustainable development [6].

The biggest implication that universities have regarding the SDGs is the research part. Moreover, at the global level there are two international rankings for sustainability, namely:

The Times Higher Education Impact Rankings - was the first international ranking that evaluated the activities of higher education institutions in relation with SDGs. The 4 areas of interest for this ranking are: research, stewardship, outreach and teaching. 1705 universities from 115 countries and regions participated in the 5th edition in 2023. Australia's Western Sydney University came out on top for the second consecutive year, the UK's University of Manchester follows in second place, while Canada's Queen's University takes third place. Among the countries that are most present in the top 100 are Great Britain (26 institutions), Australia (16 institutions) and Canada (15 institutions).

QS World University Rankings: Sustainability 2023 – appeared in 2023 and includes indicators which are categorized into measures of environmental sustainability, encompassing sustainable institutions, sustainable education, and sustainable research. Additionally, there are measures related to social impact, covering aspects such as equality, knowledge exchange, educational impact, employability and opportunities, and quality of life. 700 higher education institutions participated in the first edition of this ranking, and the University of California, Berkeley (UCB) took first place.

Analyzing the frequency of SDGs according to THE Impact Ranking in 2023, the first top 5 universities paid the most attention to SDG 17 – Partnerships for the Goals and SDG 15 – Life on land. This aspect once again proves the social role that universities have, being a link between various parties. Moreover, they represent a neutral point of discussion and debate between civil society, the economic-social environment and the decision-making environment - governments. In this triangle, the universities, through the expertise they have and the research they do, can present an objective and reliable advisory body.

It is important to note that although one of the SDGs is specifically dedicated to education, namely SDG 4 – Quality education, this objective is not found in the previously mentioned top. In a previous study [10] it is highlighted that considerable strides have been made in the environmental and economic dimensions of sustainable development. Thus, for universities bolstering the social dimension remains an unresolved challenge.

3 Methodology

The bibliometric analysis represents a quantitative study of the bibliographic material that outlines a general picture of the academic works related to the researched field. Qualitative analysis presents the history, evolution, distribution by country/area, characteristics and other relevant information about the publications in a certain researched field [11].

Bibliometric methods can be used to assess the performance and research patterns of authors, journals, countries, and institutes, and can be used to identify and quantify patterns of cooperation among them [12]. Bibliometrics can present the latest advances, which are the main research directions and topics in a certain field [13]. Bibliometric analysis also allows the identification of current gaps in a particular research discipline, both content-wise and geographically [14]. Furthermore, bibliometrics can play a crucial role in science-related decision-making. It is widely used to rank applications for academic positions and to assess the performance of journals, countries and institutions. Bibliometric results can also be considered to support decision makers and funding agencies to allocate research funding [15].

The freely available software program VOSviewer [16] was used to analyze and visualize relationships between authors, countries, co-citations and terms. VOSviewer is a software tool for building and viewing bibliometric networks. These networks may include, for example, journals, researchers or individual publications and may be built on the basis of citation, bibliographic coupling, co-citation or co-authorship

relationships. VOSviewer also provides text mining functionality that can be used to construct and visualize co-occurrence networks of important terms extracted from a body of scientific literature.

This study used the Web of Science database to identify, retrieve, and process information. The various bibliometric indicators (the total number of publications, citations, authors, countries, research areas) create a more complex aspect of the researched field.

In total, in the Web of Science database, 1033 works were published between 1995 and 2024 related to the SDG in relation to the university. These publications cover 9582 authors, 148 countries or territories, 115 research areas. All articles with the following keywords were included in the analysis: higher education, SDG.

4 Findings

Until 2005 just two documents had been published in Web of Science. During 2006 – 2015 the scholars' interest in this topic has increased with 2400%. This number can be explained by the novelty of the concept and the concern of Higher Education Institutions for other aspects of education. The number of publications began to increase after 2015, when the 17 SDGs were adopted. The period 2021-2024 has registered an increase in publications in this field. The peak was reached in 2023 – 273 publications appeared this year.

Table 1. The number of scientific documents containing the terms "SDG, higher education" in the title, abstract or keywords of the existing documents in the Web of Science database, depending on the year of publication.

Period	Number of scientific documents identified	The increase of scientific interest from one period to another for the researched topic (%)
1995 – 2005	2	-
2006 - 2015	48	2400
2016 - 2020	290	604,16
2021 – 01.02.2024	693	238,96
Total	1033	-

Source: Own conceptualization, following data processing

The most relevant publications on this topic founded by this criteria are „SDG 4 in higher education: challenges and opportunities” by Ferguson, T and Roofoe, CG indexed in INTERNATIONAL JOURNAL OF SUSTAINABILITY IN HIGHER EDUCATION and „Sustainable Development Goal for Quality Education (SDG 4): A

study on SDG 4 to extract the pattern of association among the indicators of SDG 4 employing a genetic algorithm” by Saini, M., Sengupta, E., Singh, M., Singh, H., Singh, J. published in EDUCATION AND INFORMATION TECHNOLOGIES.

All types of research were included in the search. Among the document types, articles (86,738%) are mostly found. The other documents (review articles, proceeding paper, book chapters, editorial materials, reprints, retracted publications) being limited to less than 100. The main research areas of this topic were Science Technology Other Topics (32,623%), Environmental Sciences Ecology (30%), Education Educational Research (16,651%), etc. Thus, it can be stated that the research of SDGs among higher education is characterized by a wide variety of research topics and multidisciplinary. The most local cited sources identified are *Sustainability-Basel* and *J Clean Prod* with more than 1200 local citations each.

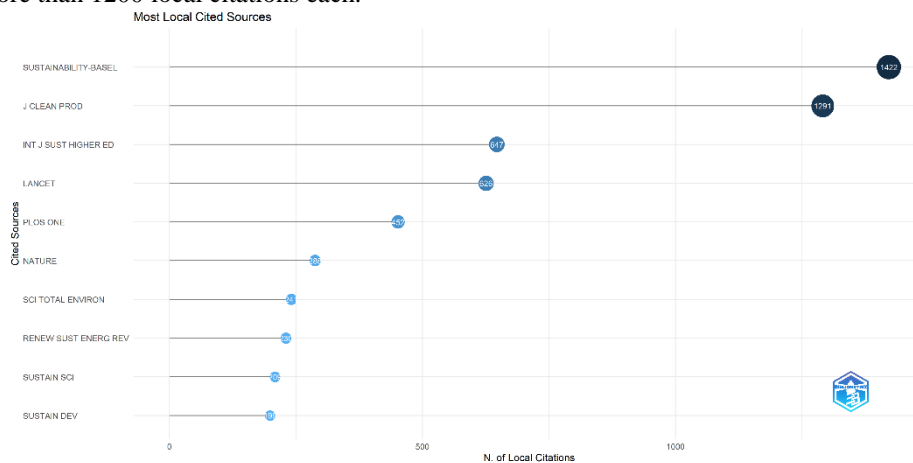


Fig. 1.: Most local cited sources

Source: Conceptualization in RStudio following data processing from the Web of Science database

Regarding the distribution of research on the world map, a distribution can be observed over a large part of its surface, more precisely in 148 countries. However, a special attention is devoted to this subject by the countries located on the territory of the European, American and Asia continent.

Most research is carried out by authors from Spain – 126 publications. In second place, with 124 publications, is China, and in third place is India, with 122 publications. The authors with the most publications are George SD, who was awarded for top reviewers for Engineering in September 2016, and Murray CJL from the USA with 739 Web of Science Core Collection publications.

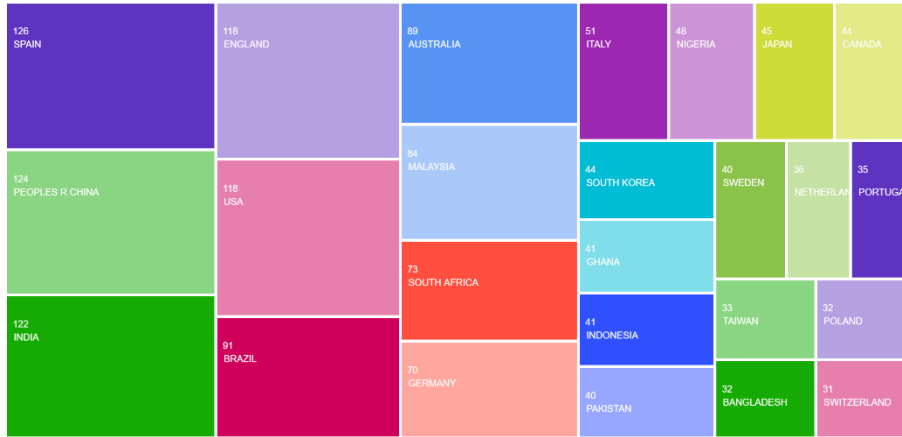


Fig. 2.: Representation of publications by country
Source: Web of Science

For the analysis of the collaboration of authors from different countries, concerned with the SDG integration in higher education, we designed the map in Fig. 2. using the following criteria:

- Unit of analysis: Countries;
- Quantification method: Counting;
- Scientific documents were ignored if they had authors from more than 25 countries;
- The minimum number of scientific documents for a country to appear on the map: minimum ten appearances.

As a result, four clusters were formed, comprising 40 items and 412 links between countries. According to the map legend, we observe that in 2020 most collaborations were made between developed or developing countries such as Japan, Spain, England, Switzerland, Germany, and China. Towards the end of 2022, collaborations extended to include countries like Russia, Malaysia, Pakistan, and Saudi Arabia. Therefore, it can be concluded that more developed countries may serve as examples of good practices for developing countries.

Moreover, the most developed countries, such as England (52 links), the USA (45), and Germany (42 links), have registered the largest number of links with other countries.

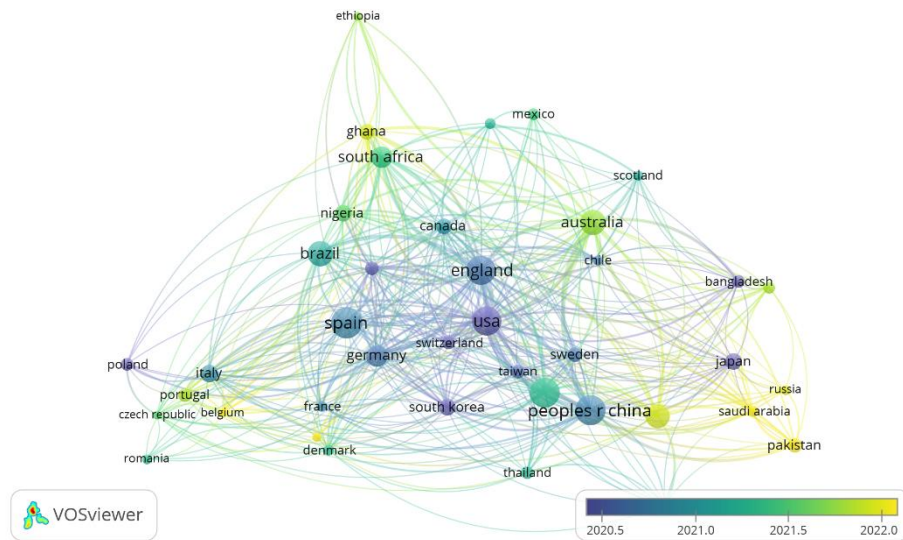


Fig. 3.: The link between scientific publications from different countries
Source: Conceptualization in VOSviewer, following data processing from the Web of Science database

Quantitative bibliometric analysis allows the creation of a map of keywords identified within the 1033 publications in the researched field. The keywords extracted from the Web of Science database were integrated into VOSviewer, resulting in the map shown in Fig. 3. This process involved selecting a minimum limit of 20 occurrences for each word. This fact led to the estimation of a number of 33 terms (which represents 0,6% of the total), 5 clusters and 375 links that met the previously mentioned condition (total number of terms identified at the time the Web of Science database query was performed: 5473).

The map below, Fig. 4., also shows the interest of the domains/keywords studied over time. Thus, around 2020, most of the research was carried out around "health, mortality, growth, gender". Around 2022, many researchers turned their attention to "universities, model, students, education for sustainable development". The subject of interest for this paper is researched around the middle of 2021, and the keywords are: higher education, SDG, sustainability, performance, challenges.

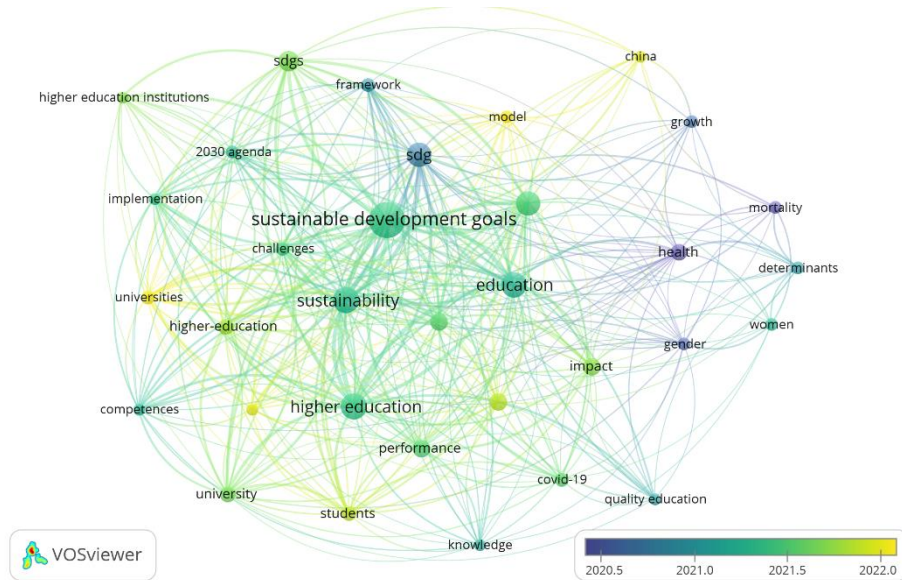


Fig. 4.: Linking keywords found in scientific documents in which the researched field is addressed

Source: Conceptualization in VOSviewer following data processing from the Web of Science database

Moreover, through RStudio we have generated a factorial analysis, using a multiple correspondence analysis, 50 terms in 5 clusters. Thus, in Fig. 5. we can see the horizontal axis (Dim 1) and the vertical axis (Dim 2) represent the two most significant dimensions extracted from the data. Dim 1 accounts for 42.84% of the inertia (variability), which is quite significant, while Dim 2 accounts for 10.35%. These two dimensions capture the major patterns of variation within the dataset.

The terms have been grouped into 5 clusters based on their proximity and similarity. The blue cluster in the upper-left quadrant, containing terms like "disease," "prevalence," "countries," "care," and "mortality," might represent research focused on global health and epidemiology. The purple cluster in the lower-right quadrant, with "energy," "consumption," "china," and "economic growth," might be related to studies on economic development and energy consumption, possibly with a focus on China. The red cluster in the center-right, with "higher education," "challenges," "management," and "innovation," could be reflecting literature on educational management and innovation in higher education. The orange "trends" term appears to be an outlier or a separate cluster, which may indicate a broad theme that doesn't fit neatly into one category or is a general term used across various fields. The green cluster in the upper-right quadrant, which includes "future," "engagement," "universities," and "implementation," might be indicative of future-oriented research themes in academia and their practical applications.

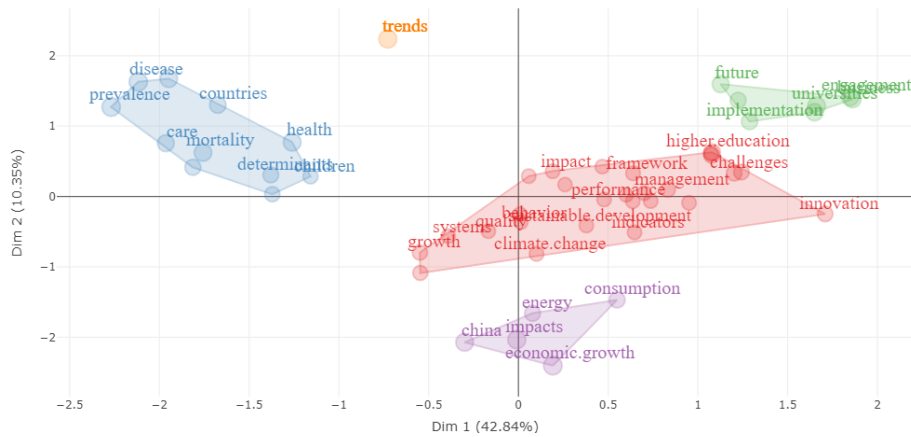


Fig. 5.: Scree plot of the main clusters based on hierarchical classification
Source: Conceptualization in RStudio following data processing from the Web of Science database

From the perspective of research specifically on the SDGs, we can note that the most interesting are SDG 3 – Good Health And Well Being and SDG 4 – Quality Education.

It is noteworthy to highlight that SDG 17, focusing on Partnerships for the Goals, is conspicuously absent from existing research. Achieving the Global Goals necessitates collective effort. International investments and assistance are essential to foster innovative technological advancements, ensure fair trade, and provide market access, particularly for developing nations. To forge a more promising world, it is imperative to embody qualities such as support, empathy, inventiveness, passion, and, most importantly, collaboration.

However, even if SDG 7 is not of interest to researchers of the chosen subject, it's worth noting the THE Impact Ranking where the most common SDG among the objectives targeted by higher education institutions is this very one - Partnerships for the Goals.

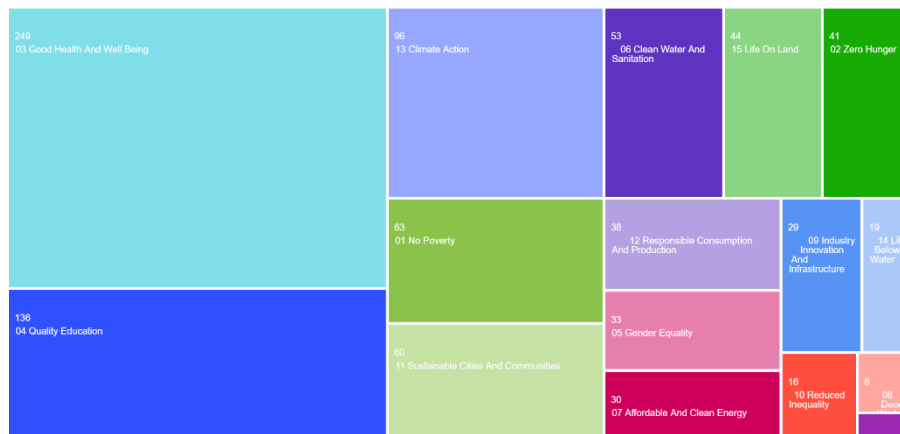


Fig. 6.: Representation of publications according to the SDGs*Source: Web of Science*

5 Conclusion

In conclusion, the first document on this topic had been published almost 30 years ago. Scholars began to focus on and research this topic the most during the period 2021 - 2024, with over 65% of the research papers published in this timeframe.

While Spain has the most articles written on this subject, the largest number of links with other countries belongs to England. Two of the most relevant articles in this field were published in 2020 and 2023 by authors from India and Jamaica, respectively, without collaborating with other countries.

After factorial analysis, two dimensions emerged, which were then grouped into five main clusters based on hierarchical classification. One of the clusters (green) is specifically dedicated to education, as indicated by keywords such as 'future, universities, implementation, engagement.' This aspect validates the prevalence of SDG in higher education. Higher education institutions play a crucial role in shaping future individuals with a sustainable vision of development in any field.

An aspect that could be thoroughly analyzed in the future is SDG4 - Quality education in relation to various fields in which research is being conducted and institutions that are involved in its realization.

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