EU Funds Sustainable Economic Development - A Bibliometric Analysis

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Abstract. *The main purpose of this paper is to conduct a bibliometric analysis on the interest of funding provided by the European Union for sustainable economic development. The research methodology is based on conducting a bibliometric analysis, which is a quantitative research method, in the form of an inventory of publishing activity in the subject area under analysis. The bibliometric analysis was carried out in two stages, the first one consisted of querying the existing database on the Core Web Of Sciences platform, and exporting the identified data. The query resulted in displaying a total of 343 documents existing in the database, while the second one involved conducting an analysis of the literature using the quantitative method of retrospective analysis of works published on the chosen subject. The results obtained from the analysis of the collected and interpreted data, based on the clusters generated by the VOSviewer software, highlight the existence of strong connections between different countries regarding the analysis and study of the EU's funding of sustainable economic development.*

Keywords: financing, economic development, bibliometric analysis, economy, VOSviewer

JEL Classification: E44; G2; O16

1. Introduction

The field of sustainable development has been one of the most debated topics in recent years, with numerous studies and research conducted on this subject. Since the emergence of the term "sustainable development" in 1972, aiming to achieve a balance between the economy and the social environment, the United Nations (UN) has attempted to bring this concept to a global level by proposing concepts for long-term development. Sustainable development and long-term sustainability are objectives that Romania, as a member state of the United Nations (UN) and the European Union (EU), must adhere to, assuming its strategy in three directions: economic, social, and environmental.

In the current economic context, Romania is compelled to identify and implement optimal strategies to contribute to the achievement of the Sustainable Development Goals it has committed to. However, for these strategies to be implemented, they must first undergo theoretical analysis, as evidenced by the scientific papers published in the field by both independent researchers and representatives of state institutions.

With the aim of assisting less developed countries in achieving these objectives, the European Union periodically provides funding. In the academic environment, research and science are essential, and in educational institutions, research and science are not only the engine of economic development but also of society, thus all research and documents obtained are part of improvement and continuous learning.

The main purpose of this paper is to document the interest in the research area of sustainable economic development. Therefore, I have proposed to conduct a

bibliometric analysis of the interest in funding provided by the European Union for sustainable economic development.

The research methodology consists of conducting a two-stage analysis. The first stage involved querying the existing database on the Core Web Of Sciences platform and exporting the identified data. The query resulted in displaying a total of 343 documents existing in the database, while the second stage involved conducting an analysis of the literature using the quantitative method of retrospective analysis of works published on the chosen subject.

Bibliometrics has a dual nature, lying at the intersection of two dimensions: that of the library and science, and that of research together with the dissemination of scientific production. Its main purpose is the statistical analysis of written publications. It is predominantly applied in the field of exact and applied sciences, but it can also be found in social or humanistic fields.

2. Theoretical aspects

Over the years, there has been remarkable confusion regarding bibliometrics, due to its use as a synonym for metric fields or for library science. By its definition, it refers to a method of quantitatively counting scientific production, ensuring the accounting and calculation of scientific publications and authors in a specific field with the aim of grouping, classifying, and ordering them into various research sectors and creating an overview for them. Bibliometrics is based on online platforms that include the most important scientific academic works, journals, or books. Bibliometric tools aim to identify the flow of publications, the pace of development, and the level of interest in the targeted field, as well as identifying authors or institutions that have made a significant contribution to scientific development.

The significant crises in recent times, such as the pandemic, wars, social divergences, and climate changes, have had a considerable negative impact on the global market and, consequently, on sustainable development. However, the Sustainable Development Goals were precisely designed for society to benefit from a higher standard of living through important aspects that have a direct effect on humanity, the environment, the economy, and the social environment.

In the 1987 Brundtland Report, the World Commission on Environment and Development defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs," with the main objective being to align economic development with the protection of the social and ecological environment.

In addition to the Millennium Development Goals (MDGs), the UN Summit adopted the 17 Sustainable Development Goals (SDGs) for the achievement of the 2030 Agenda, which was embraced by EU member states starting in 2017 through the strategy "A Sustainable Future for Europe: The EU Response to the 2030 Agenda for Sustainable Development," which focuses on citizens and future generations. For this purpose, all member countries must ensure the implementation of appropriate policies and the involvement of effective institutions to achieve the 2030 Agenda.

As a member state of both the European Union and the United Nations, Romania attaches great importance to sustainable development and the transition to a green, circular economy, and the implementation of strategies and policies is supported at both local and national levels. Romania has committed to implementing the Sustainable Development Goals and has recently revised the National Strategy for Sustainable Development by integrating these goals, with an emphasis on social issues. Through cohesion policies, Romania aims to create a fair social environment and support social inclusion by providing support to disadvantaged individuals, women,

and young people, ensuring the most beneficial employment opportunities for them, contributing to economic growth by inspiring citizens to transform the economy through innovation, optimism, and resilience, and supporting methods to raise awareness of the importance of the environment and biodiversity conservation.

In order for the proposed objectives to be implemented at the level of certain countries, the European Union provides funding to support sustainable economic development, reducing the economic burden of supporting environmental and social policies through this mechanism.

Over the years, the European Commission has launched several instruments for funding sustainable development with different forms and objectives. In 2018, the "Action Plan on Sustainable Finance and the Development of a Renewed Strategy on Sustainable Finance" was launched, focusing on three objectives: redirecting capital flows towards a more sustainable economy, integrating sustainability elements into risk management, and promoting transparency and long-term vision.

Currently, the European Fund for Sustainable Development (EFSD) combines mixed financing, through loans or grants and budget support, providing support for the establishment of international partnerships for public and private investments.

In the context of this research, data on the proposed subject of analysis, EU funding for sustainable economic development, were collected from one of the most relevant sources of scientific documents, the Web of Science database. The software used for data processing involves the mapping of a bibliometric network. The network is created by grouping articles, citations, and identified links, creating connections between different groups.

In interpreting the results, two elements can be considered: linkage and attribute. The strength of the links illustrates the number of connections between articles, and the strength of the attributes associated with them. This research tool is a valuable support for the proposed analysis in terms of content, authorship, and the spread of research worldwide.

The steps used in conducting the bibliometric analysis are:
- Identification and extraction of results generated by the database;
- Input of data into the software;
- Analysis based on multiple criteria and interpretation.

3. Results and interpretations

3.1. Keyword analysis

The keyword analysis method highlights the most persistent keywords based on their simultaneous appearance. It is important to note that only the keywords mentioned by the authors are considered in this method, aiming to highlight the terms that practically define the field of sustainable financing by the European Union.

Furthermore, only those documents in which two keywords are highlighted by different authors in each document can be considered. After analyzing the 343 documents identified and collected from the database, the VOSviewer software identified 1466 keywords.

For the analysis, the minimum number of appearances of a keyword was set to five. In this scenario, the software highlighted 54 keywords that meet this condition.

Figure 1 illustrates the most important keywords and the connections between them: the larger the keyword and node, the higher the weights; when the distance between nodes is smaller, the relationship between them is stronger. Moreover, thicker lines indicate more frequent co-appearances. Keywords with the same color indicate related keywords or a group of keywords.

As such, the software maps five clusters with the most frequent different co-appearances, represented in the adjacent figure.

Figure no. 1. Keyword co-occurrence network
Source: personal calculation via VOSWiewer

The first cluster (red), with the highest number of words, contains 18 elements and is led by the word "European Union" with 21 appearances, followed by "Structural Funds" with 19 appearances and "cohesion policy" with 16 appearances. Thus, the European Union is directly involved in implementing cohesion policies by providing structural funds to member countries in various forms.

The second cluster (green) is governed by the word "sustainability" with 18 appearances, totaling 15 items, and also contains other relevant keywords in our analysis such as "rural development" with 17 appearances and "management" with 13 appearances.

Cluster 3 (blue) includes a smaller number of items, namely 11, and the defining term for this is "sustainable development" with a total of 62 appearances, being the most impactful keyword and having fairly strong connections to other clusters. It is followed by the terms "economic growth" with 18 appearances and "renewable energy" with 11 appearances. This suggests that renewable resources play a significant role in achieving sustainable development while also contributing to economic growth through the reuse of renewable sources.

"Impact" is the term that defines cluster 4 (yellow), a relatively small cluster consisting of 23 items, focusing solely on terms that have a direct effect on the previous cluster, showing a fairly close relationship with sustainable development.

Cluster 5 (purple) includes only 4 items, and its definition is given by the 20 appearances of the terms "policy" which is contributed by "Environment" with 11 appearances and "energy" with 6 appearances.

Analyzing figure no.1 and each defining term of the cluster, we observe quite close relationships between them and direct links between clusters through them.

In the accompanying table, I presented the composition of each cluster, aiming to highlight the groups of keywords. These keywords, besides influencing the mapping, also have an impact on the policies that need to be implemented for sustainable development.

Table 1. VOSViewer identified keywords

CLUSTER 1	CLUSTER 2	CLUSTER 3	CLUSTER 4	CLUSTER 5
Cohesion policy	Biodiversity	China	Competitiveness	Energy
Convergence	Bioeconomy	Circular economy	European Union	Environment
Development	Cities	CO2 emissions	Evolution	Framework
European cohesion policy	Common Agricultural Policy (CAP)	Consumption	Impact	Policy
European funds	European funds	Countries	Productivity	
European Union	Europe	Economic growth		
Funds	Integration	Education		
Growth	Investments	Energy efficiency		
Innovation	Management	EU Structural Funds		
Knowledge	Poland	Renewable energy		
Performance	Rural area	Sustainable development		
Regional development	Rural development			
Regional policy	Sustainability			
Romania	Tourism			
Rural tourism	Biodiversity			
Strategy				
Structural funds				
Sustainable finance				

3.2. Author co-citation analysis

Regarding the analysis of author co-citation, it helps us identify those authors whose scientific works, indexed in Web of Science, are relevant and have contributed to the formation of networks among them.

Figure no. 2. Author co-citation network
Source: personal calculation via VOSWiewer

VOSviewer returned 51 authors based on the imposed filters, with at least 7 citations for each work. As mentioned earlier, the thicker the distance between two or more points, and the more pronounced the connecting line, the more stable the network, and their writings are more relevant, providing more complex information in the field of interest.

As observed from the above presentation, representative institutions of the European Union are directly interested in the topic of financing economic development. The European Commission has approximately 250 citations, followed by Eurostat with 33 citations. The World Bank, the Organisation for Economic Co-operation and Development (OECD), the Food and Agriculture Organization (FAO), and the European Free Trade Association (EFTA) have produced relevant and interesting scientific papers in this field.

Regarding the most cited authors, Andrés Rodríguez-Pose, professor of economic geography at the London School of Economics and Political Science, has made a significant contribution to the study of economic development financing with 14 citations and 109 appearances in links. John Bachtler, professor of European political studies and director of the Centre for European Policy Research, with his main research focusing on regional and industrial development in Europe, and Roberta Arbolino, professor at the University of Napoli L'Orientale (IT), studying development economics, sustainable development, regional structural policy, industrial policy, policy

evaluation, and environmental economics, are among the authors whose works have 15 citations in various studies about the subject under study in this article.

3.3. Analysis of citations by country

The citation analysis by country highlights networks and relationships formed by researchers. In the representation below, the points represent countries, and the thickness and distance of the lines outline the degree of collaboration between researchers. At this stage of the analysis, we will consider a minimum of three documents and three citations for a country.

Under these conditions, out of the 343 works, the software identified 60 countries, but only 36 countries meet the aforementioned conditions and are grouped by the relationship between 5 clusters..
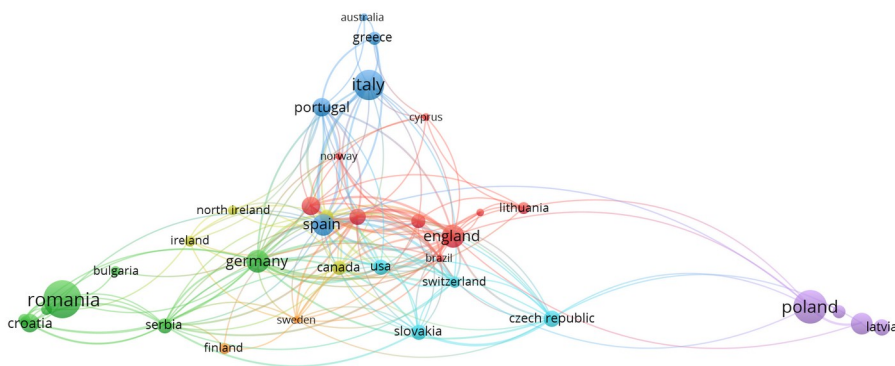
Figure no.3. Citation network by country
Source: personal calculation via VOSWiewer

The strongest link in the citation network is actually attributed to Romania, for which the software identified 60 documents and 206 citations, followed by Poland with only 46 documents and 186 citations, and England with 38 documents and 310 citations.

All three countries are found in different clusters, but the network created by them is not as tight considering the relatively large distance between the connecting lines.

Regarding Romania, it has contributed to addressing the thematic area through the 60 articles identified in the Web of Science database, and the closest connections are with countries such as Croatia, Bulgaria, and Serbia, implying that these countries are directly interested in the theoretical domain of the subject under study.

In addition to theoretical subjects, Croatia and Bulgaria are directly interested in how to obtain and efficiently use the funds provided by the European Union for growth and sustainable development, implicitly for achieving the SDGs by 2030.
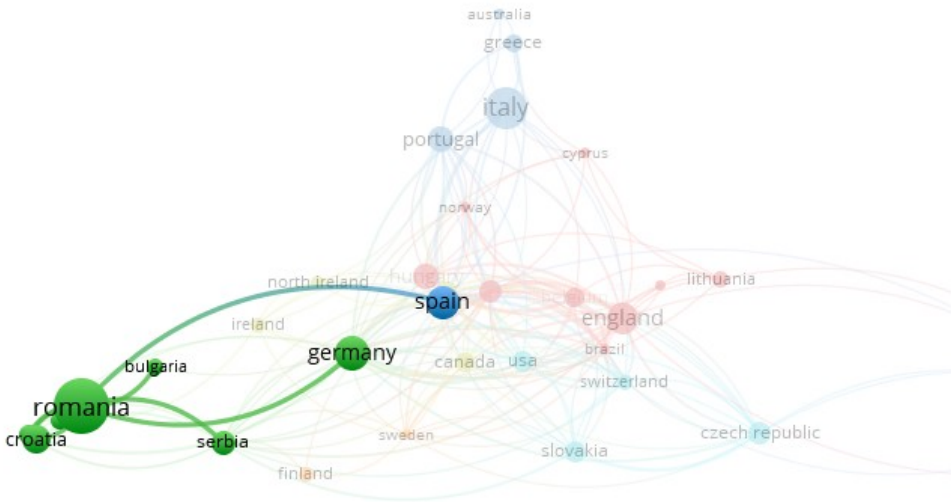
Figure no. 4. Citation network for Romania
Source: personal calculation via VOSWiewer

The interest in EU funding for sustainable economic development of countries has been captured in the accompanying table, with information from each country provided by VOSviewer as follows:

Table 2. Analysis of citations by country

No.	Country	Documents	Citations
1.	ROMANIA	60	206
2.	POLAND	46	186
3.	ITALY	38	310
4.	ENGLAND (or UNITED KINGDOM)	21	335
5.	GERMANY	21	397
6.	SPAIN	20	131
7.	UKRAINE	20	106
8.	HUNGARY	15	178
9.	PORTUGAL	14	190
10.	CROATIA	14	12
11.	NETHERLANDS	12	224
12.	CZECH REPUBLIC	12	57
13.	LATVIA	12	54
14.	UNITED STATES	10	163
15.	SERBIA	10	22
16.	SLOVAKIA	10	60

17.	BELGIUM	9	176
18.	CANADA	9	85
19.	FRANCE	8	171
20.	RUSSIA	8	8
21.	GREECE	7	47
22.	LITHUANIA	6	75
23.	SLOVENIA	6	4
24.	SWEDEN	5	103
25.	IRELAND	5	11
26.	AUSTRIA	5	5
27.	FINLAND	5	43
28.	BULGARIA	4	3
29.	BRAZIL	4	11
30.	CYPRUS	3	26
31.	NORWAY	3	23
32.	MACEDONIA	3	70
33.	CHINA	3	94
34.	AUSTRALIA	3	4
35.	ROMANIA	3	17
36.	POLAND	3	19

Countries with relatively low numbers of articles but high citation rates, compared to other more developed states in the context of our analyzed subject, include Sweden, Norway, Belgium, and France.

4. Conclusions

This study presents an analysis of the funding interest provided by the European Union for sustainable economic development, aiming to identify the importance of this subject for researchers in the field. The following conclusions have been reached:

Firstly, the analysis of keywords highlights the distribution of those key words marked by their co-appearance. Relevant keywords such as "European Union", "Structural Funds", "Cohesion Policy", "Sustainability", "Sustainable Development", "Impact", and "Policy" were identified. By analyzing these keywords, it can be concluded that sustainable development is directly impacted by the European Union through the cohesion policies implemented and funded from the available funds.

Secondly, through co-citation analysis, the most important authors in the research area were identified. Andrés Rodríguez-Pose and John Bachtler have made significant scientific contributions to the analyzed topic. Articles published by the European Commission, the Organisation for Economic Co-operation and Development (OECD), the Food and Agriculture Organization (FAO), and the European Free Trade Association (EFTA) offer the most recent regulations and cohesion policies to make sustainable development achievable.

Thirdly, the analysis of co-citations by country has highlighted 5 nodes of connection. Romania is the country with the most publications, followed by Poland and England. The results obtained from this analysis can be used by researchers and representatives of institutions interested in this field to focus more on presenting and studying in-depth the main groups of interest.

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