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Durability, circularity and sustainability in the food market – bibliometric analysis

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Abstract. *The circular economy deviates from the classical, economic, traditional, linear model, based on large amounts of materials and energy, easily accessibles Circular economy concept has become increasingly popular, gaining popularity among both researchers and practitioners.*
The transition to a circular economy is an opportunity to change the current economy and make it more sustainable, helping to achieve environmental and climate goals and principles and protecting existing resources. The aim of the paper is to highlight the importance of the concept of sustainability and circularity in the food market as well as to highlight the connection with other topics. To achieve this goal, a review of the literature was performed by querying Web of Science databases, while performing a bibliometric analysis. The results show a major interest for the sustainability and circularity concepts in the food market, due to the exponential growth of items in recent times. By searching the Web of Science database, 1793 scientific documents were found by the keyword "food sustainability", 6354 documents containing the keyword "circularity" and over 33.3 thousand documents on the topic of "sustainability". These keywords were found at least in the title, abstract, or keywords of the document.

Keywords: durability, circularity, sustainability, environment, food

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Introduction

The objectives of the European Union for the creation of a sustainable food chain concerns: reducing the ecological and climate footprint of the agri-food system, ensuring food security in the context of climate change and declining biodiversity, achieving a competitive and sustainable traceability from farm to consumer (European Commission, 2020). Also, the waste in general and food waste particularly represents real issues of great importance worldwide, with economic, social and environmental impact. According to Eurostat data, in 2018 the total waste resulting from economic activities and households at EU level was 2.3 billion tons.

The sustainability of agri-food systems is a global goal, and in order to respond to the current challenges, the food system needs to adapt. There are many studies that address this concept, for example in the paper entitled "Transition towards circular economy in the food system", Jurgilevich A. argues that the current agri-food supply chain is subject to economic, social

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and environmental problems, making it unsustainable. This paper also states that, among the possible solutions, the circular economy offers opportunities to improve and optimize production and consumption (Jurgilevich et al., 2016).

The concept of the circular economy is used and promoted by the EU in order to increase competitiveness, protect businesses from insufficient resources and help create new opportunities and innovative markets (Sousa et al., 2021).

In 2015, the European Commission adopted a circular economy action plan, which aimed to develop a resource-neutral, efficient and competitive economy. Following the successful implementation of the 2015 plan, the European Commission adopted a new Circular Economy Action Plan in March 2020, one of the main documents of the European Green Pact for sustainable growth and development. The transition of the European Union to a sustainable and circular economy will reduce the pressure on natural resources, help encourage sustainable consumption and aim to reduce waste so that the resources used are kept in the economy for as long as possible (European Commission, 2019).

Literature review

The concept of circular economy has become increasingly popular, gaining popularity among both researchers and practitioners. There are also many papers that address the circular economy topic, such as the study entitled "Conceptualizing the circular economy: An analysis of 114 definitions", in which the authors try to provide and create a transparent framework for understanding the circular economy concept. To create this framework, the authors, Julian K., Denise R. and Marko H., put together a number of 114 definitions of the circular economy concept that theyanalyzed. After analyzing the definitions, they concluded that the circular economy is most described and likened as a combination of reduction, reuse and recycling activities, while not taking into account the fact that the circular economy also needs a systemic change. Also in this paper it is argued that the main purpose of the circular economy concept refers to economic well-being, the quality of the environment but also the impact it has on society and future generations (Julian et al., 2017).

The paper "A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems" also presents the characteristics and main perspectives of the circular economy. The author notes that the circular economy aims to increase the efficiency of resource use, focusing on waste from urban and industrial areas, in order to provide a balanced balance between economy, environment and society (Patrizia et. al., 2016).

However, there are links between the circular economy and the concept of sustainable development (Julian et al., 2017). For a long time, the industrial sector has tried to implement sustainable development strategies, and the circular economy has been the latest attempt to translate the theory into concepts for incorporating economic activities and environmental welfare in a sustainable way. The authors conclude that while the circular economy focuses on a new design of all processes and the material cycle, there is a lack of sustainable development that has the effect of limiting the ethical dimension and reaching some undesirable consequences (Murray et al., 2017).

Jouni Korhonen, Antero Honkasalo and Jyri Seppälä, in the study "Circular Economy: The Concept and its Limitations" define the circular economy in terms of sustainable development but also the concept of sustainability, so "the circular economy is an economy made up of production systems and consumption, which aims to maximize the service resulting from the energy and materials used" (Jouni et al., 2018). Also in this study it is mentioned that a successful circular economy includes and participates in the development of all dimensions of sustainability, economic, environmental and social (Jouni et al., 2018).

The circular economy replaces the concept of "end of life of a product" with the restoration, aims to use renewable energy, eliminating toxic chemicals for the environment that affect and prevent reuse, while seeking to eliminate waste. For such an economy, it is assumed that there is no waste, the products are designed and generated for a cycle of reuse or even recycling. Nowadays, consumables in a circular economy are mostly made from "organic" ingredients or ingredients that are included in the "non-toxic" category and are considered to be even more beneficial for the environment (MacArthur, 2013).

Methodology

Bibliometrics is the statistical analysis of books, documents, articles or other publications. Bibliometric methods use a quantitative approach to describe, evaluate and monitor published research; this quantitative research method appeared in 1969, in a documentary note by Alan Pritchard.

Our research was conducted in the Web of Science database. The keywords "durability", "circularity" and "sustainability" were selected based on the research objectives, after which the database was queried. The search was performed by topic (Topic), because if the chosen keyword is not found in the title, abstract, or keywords of the article, it is not relevant to the search. The first search included the keyword "sustainability", where 114,413 works were found. The result obtained was much too broad, because the relationship with the food system was not specified, so articles about the construction sector were included, being outside the context of the research. The next query was based on the word structure "Food Durability" and the scope of the works was considerably reduced, thus obtaining 1,793 articles. The third query of the database was made after the keyword “circularity” and “sustainability” a number of 6354 documents was obtained respectively 33343 documents. The extracted data was then processed via VoSviewer and maps were generated based on the links between the keywords used in certain years and the links in the co-authoring countries.

Results and discussion

By searching the Web of Science database, 1793 scientific documents were found by the keyword "food sustainability", 6354 documents containing the keyword "circularity" and over 33.3 thousand documents on the topic of "sustainability". These keywords were found at least in the title, abstract, or keywords of the document.

Table 1. Number of scientific papers containing the term "durability", "circularity" and "sustainability" existing in the Scopus database

Year	No. articles ”durability”	%	No. articles ”circularity”	%	No. articles ”sustenability”	%
1975-1985	3	0.20%	62	1.00%	1	0,01%
1986-1996	37	2.10%	293	4.60%	217	0,65%
1997-2007	202	11.40%	806	12.70%	1611	4,83%
2008-2018	876	49.20%	2899	45.60%	15286	45,84%
2019-2021	661	37.20%	2294	36.10%	16228	48,67%
Total	1 793	100%	6354	100.00%	33343	100,00%

Source: Own representation based on data extracted from the Web of Science.

According to Table 1, in the period 1975-1985 only 3 papers were published, representing 0.2% of the total papers containing the keyword “food sustainability”, and in the following period,

the number of documents will increase to 2.1% (37 documents). In the case of documents related to "circularity", the same trend is maintained. Between 1975 and 1985, only 62 articles were published, representing 1% of the total. This indicates that issues of "sustainability and circularity" were not a concern until the early 1997's.

Most scientific articles found under the keywords "food sustainability" and "circularity" were published in the period 2008-2018 (49.2% and 45.6% respectively). This indicates the growing trend of interest in the two concepts, which continued throughout the period 2008-2018 (Table 1).

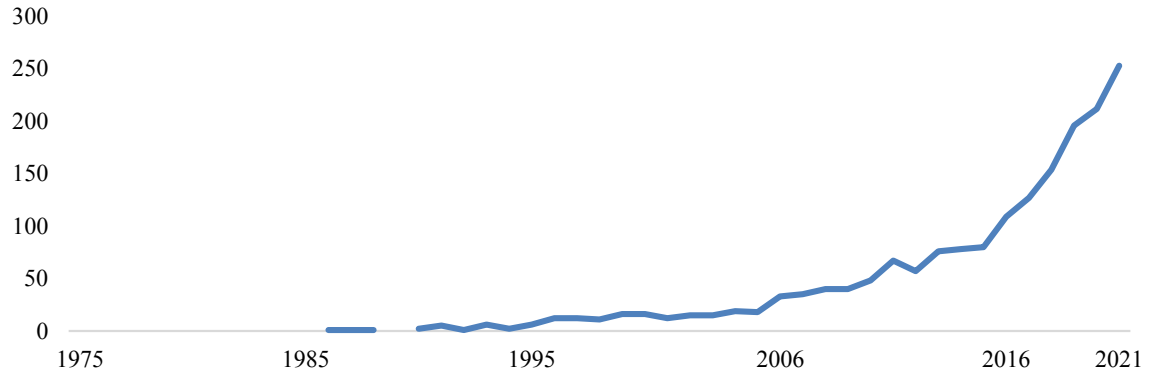

Figure 1. Number of scientific papers related to the concept of "sustainability" published by year

Source: Own graphical representation based on data extracted from the Web of Science.

For the concept of "Sustainability" the situation is different, being found in the Web of Science database 33343 works. The term sustainability has expanded since 2016 when more than 3,000 studies were published. In the period 2008-2018, over 45.8% of the total studies found in the database were published, while in just 3 years (2019-2021) approximately 49% of the total were published. This shows the great interest given to the concept of sustainability, both globally and nationally.

Another significant increase in research interest on the topics of "food sustainability" and "circularity" is observed in the period 2019-2021, in just 3 years, being published 661 scientific papers and 2294 respectively (Figure 1, Figure 2).

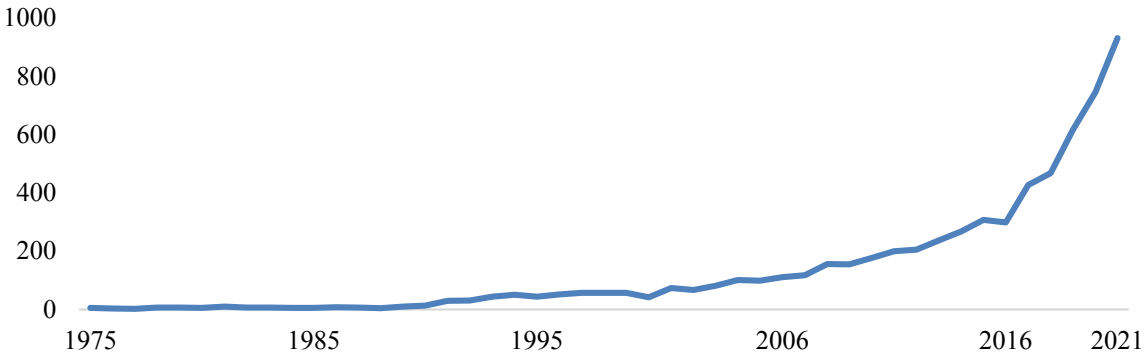

Figure 2. Number of scientific papers related to the concept of "circularity" published by year

Source: Own graphical representation based on data extracted from the Web of Science.

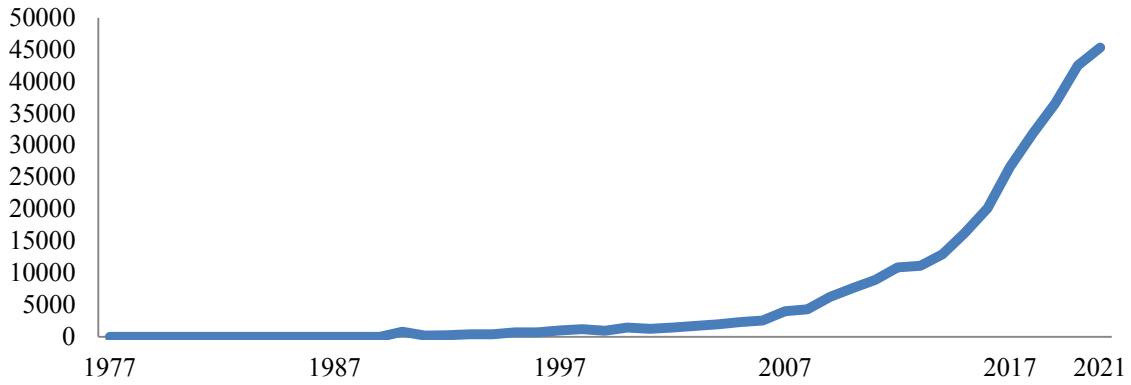

Figure 3. Number of scientific papers related to the concept of "sustainability" published by year
Source: Own graphical representation based on data extracted from the Web of Science.

With the help of the Vos Viewer program, the data extracted from the Web of Science database in the form of a text were processed and a map of the keywords was found, which can be found in the 1793 scientific documents on the concept of "food durability".

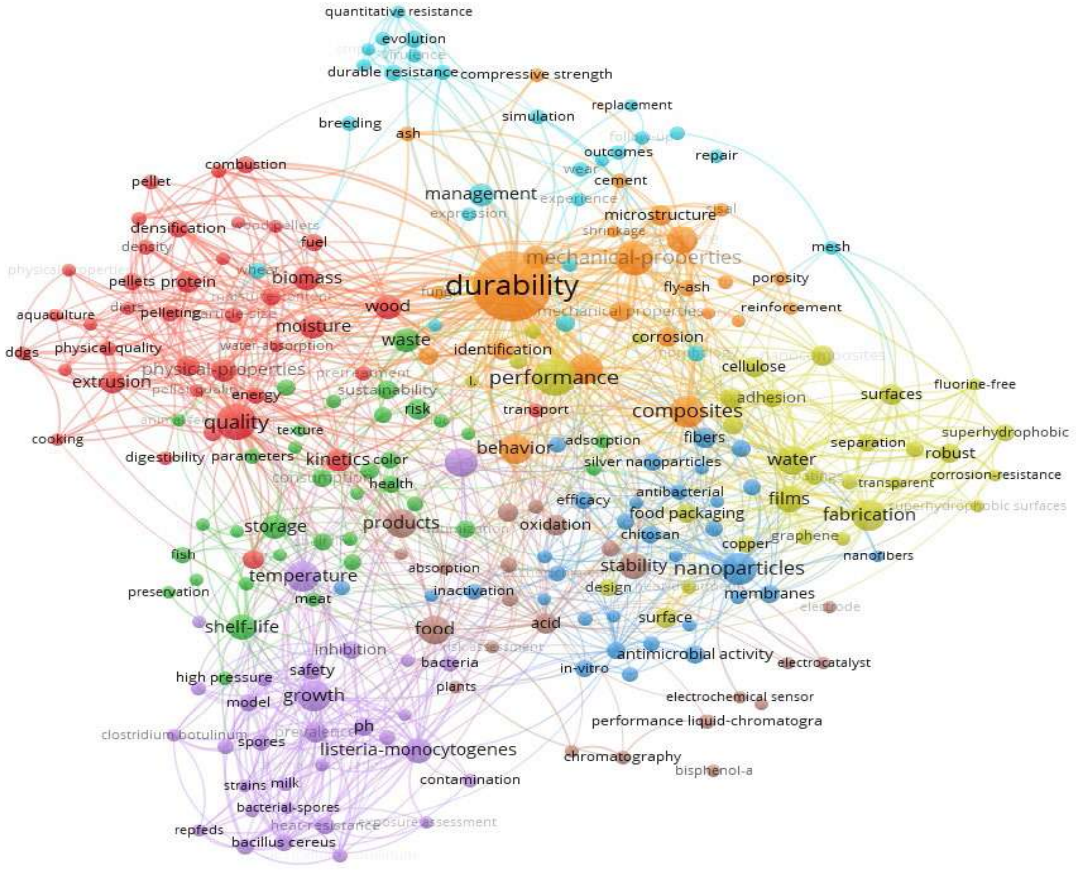

Figure 4. The link between the keywords
Source: Own graphical representation based on data extracted from the Web of Science.

Figure 4 shows a map with the links between the most common keywords, giving an overview of the main topics and research trends. Circle size shows how many times the keyword appears in the found documents. The lines represent the connections between these words, 242 words were identified and the result obtained shows only the related articles in the network. The node of the network is represented by the word "sustainability". Thus, the key words that are of major importance for the topic of "sustainability" in the analyzed articles are: performance, behavior, behavior, quality temperature (temperature), food (food) etc.

Also, for the quantitative bibliometric analysis, the situation of cooperation between authors from different countries on the topic of "food sustainability" was studied (Figure 5).

The map generated by the VoSviewer program was used to interpret the data. The map was made based on the following criteria:

• Unit of analysis: Countries

• Counting method: complete counting

• Scientific papers with authors from over 25 countries were ignored when generating the map.

• Minimum number of items required for a country to appear on the map: 5

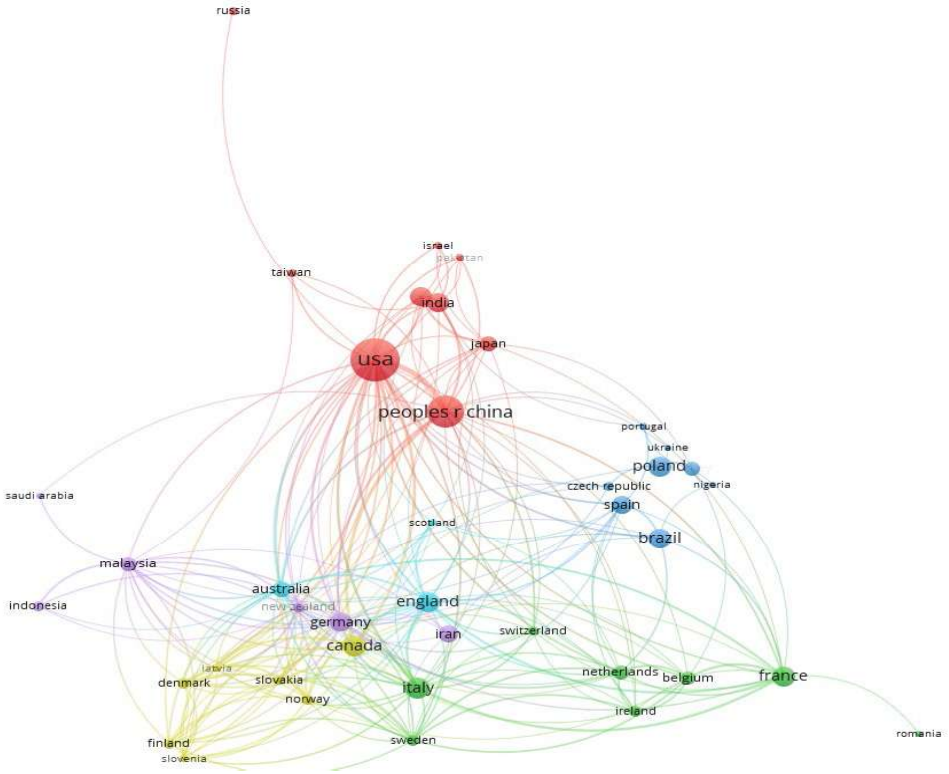

Figure 5 The link between the co-author countries on the concept of "sustainability"

Source: Own graphical representation based on data extracted from the Web of Science.

Figure 5 shows the countries that give interest to the topic on "food sustainability" by the size of the nodes, and the diversity of colors representing the directions of research. The links between the nodes also represent the cooperative relations between the countries. The United States is followed by China and the United Kingdom, with 46.45% (883 scientific papers) of the total number of countries contributing to the research and development of the concept of "food

sustainability". Romania has contributed to the topic of "food sustainability" only through 7 scientific articles (0.4%) identified in the Web of Science database, until the time of its interrogation (Figure 5).

Figure 6 shows the links between the concept of "circularity" and other keywords such as: circular economy (circular economy), optimization (optimization), performance (performance), etc.There are two large clusters. The first cluster refers to the topic of "circularity", being a topic addressed in the period 2010-2014, while the second cluster focuses on the circular economy, a concept addressed in the period 2019-2020, according to the links between keywords by year. (Figure 6). The circular economy is a new economic model, in which the old "do-it-take-away" structure wants to be replaced by a circular approach based on the "3R" principles of "reduction-reuse-recycling" (Chiaraluce et al., 2021).

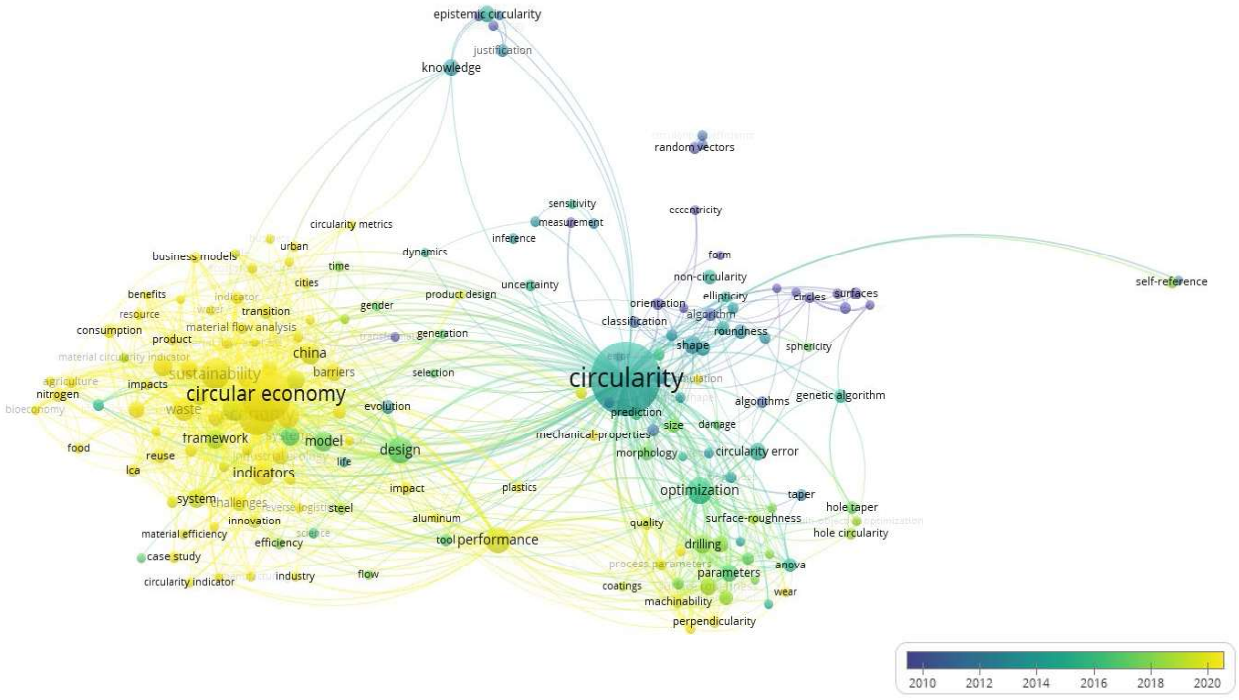

Figure 6 Link between keywords by year

Source: Own graphical representation based on data extracted from the Web of Science.

Regarding the frequency of co-authors, depending on the country, it is observed the degree of relationship between countries and the interest given to the concept of "circularity" (Figure 7). Figure 7 shows the countries that give interest to the topic approached by the size of the nodes, and the diversity of colors representing the directions of research. The links between the nodes also represent the cooperative relations between the countries. In the first place in terms of addressing this issue is the USA, followed by China and England, together representing 39.56% (2551 scientific papers) of the total number of countries that contribute to the research and development of the concept of "circularity". China developed a strategy based on the circular economy in 2002, but the concept of the circular economy has gained increasing attention in governments and researchers with the entry into force of the circular economy promotion of the People's Republic of China, which entered into force in 2009 (Feng, 2021). Romania contributed to the "circularity"

topic only through 58 scientific articles (0.9%) identified in the Web of Science database, until the moment of its interrogation (Figure 7).

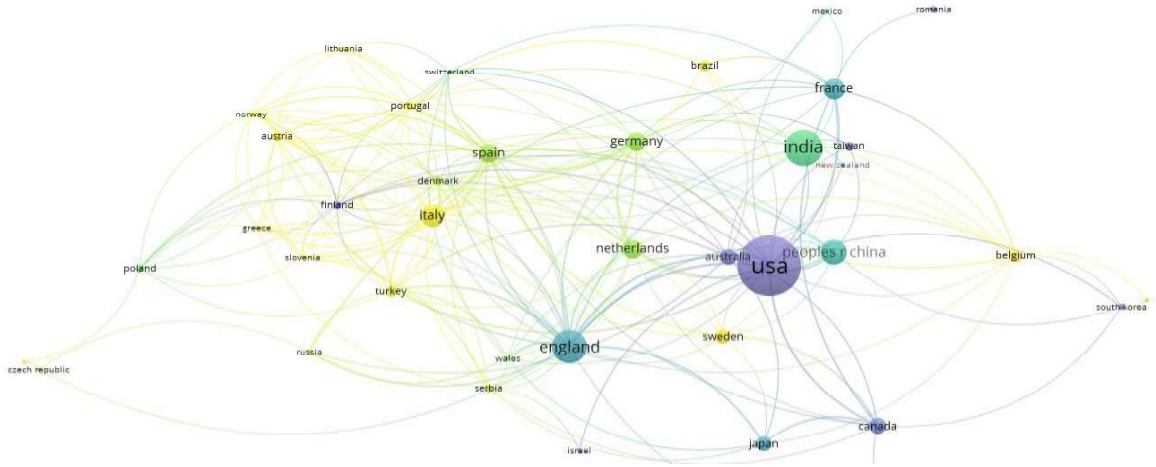

Figure 7 The link between the co-author countries on the concept of "circularity"

Source: Own graphical representation based on data extracted from the Web of Science.

Figure 8 shows the links between the concept of "sustainability" and other keywords such as: management, corporate sustainability, performance, model, framework etc. The concept of sustainability is being used and addressed more and more often in recent decades. It is supposed that there is nothing that cannot be described as "sustainable". Today there are sustainable cities, sustainable economies, management systems, business etc. and of course sustainable development (Scoones, 2007).

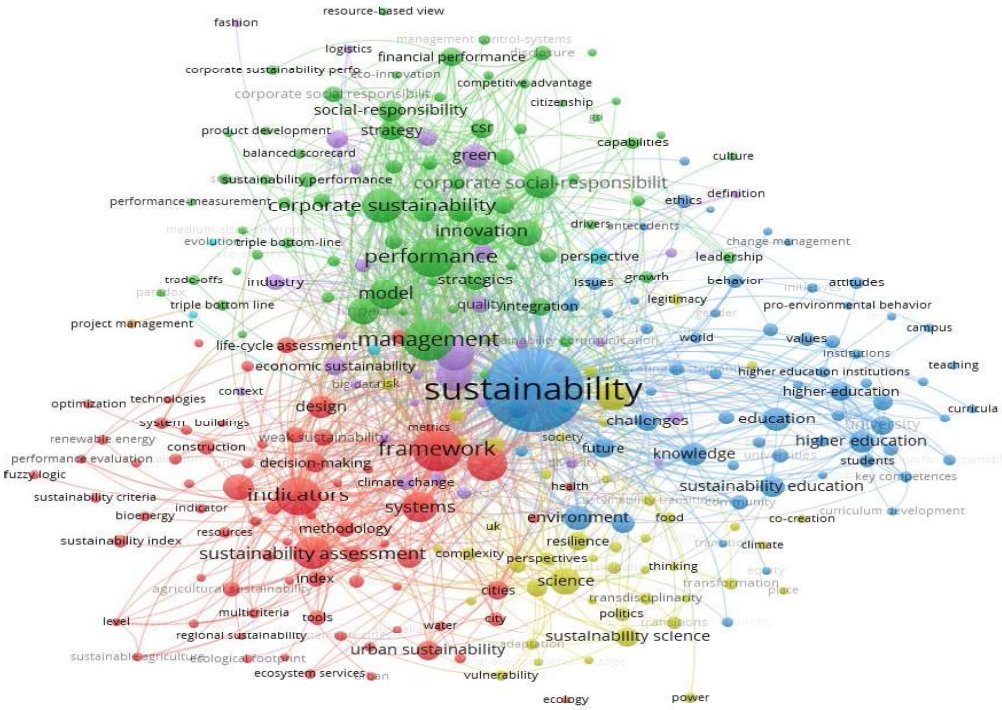

Figure 8. The link between keywords

Source: Own graphical representation based on data extracted from the Web of Science.

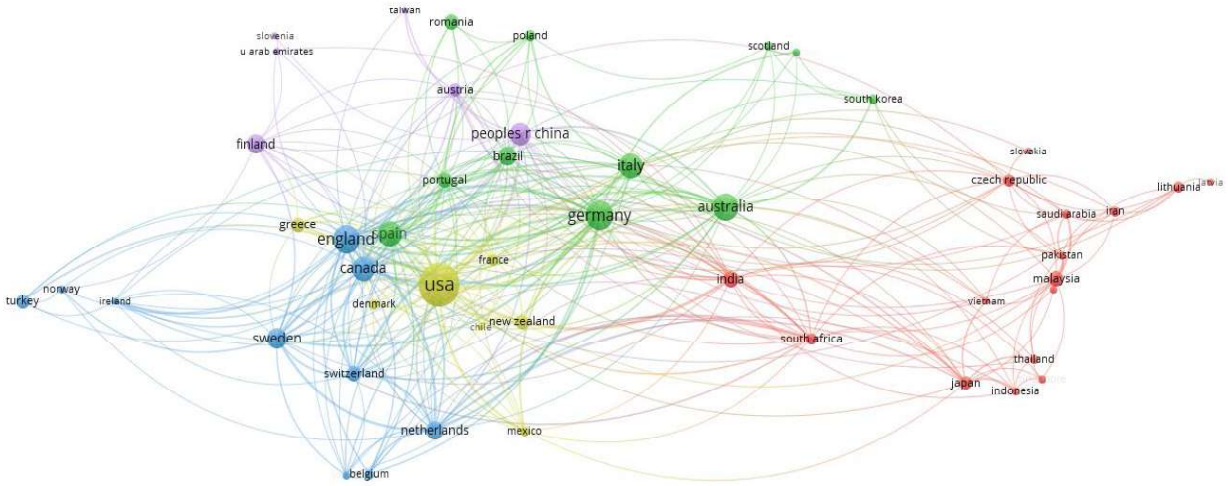

Figure 9. Interdependencebetween co-authoring countries on the concept of "sustainability"
Source: Own graphical representation based on data extracted from the Web of Science.

Regarding the approach to the subject of sustainability at the country level, the USA is the first (7.6 thousand documents), followed by Italy and England, together representing 2.31% (3.7 thousand and 3 thousand scientific papers, respectively) of the total countries that contribute to the research and development of the concept of "sustainability". Romania contributed to the topic of "sustainability" through 343 scientific articles (1.03%) identified in the Web of Science database, until the time of its interrogation (Figure 9).

Conclusion

Based on the literature analysis, it can be argued that sustainability and circularity concepts in the food market is of major interest. This fact is proved by the number of articles resulting from the query of the Web of Science database (1,793 articles for “food sustainability”, 6,354 articles for “circularity”, respectively 33,343 documents for “sustainability”), highlighting a positive trend, with an exponential increase in articles in recent times.

The scientific papers published on the topic of "food sustainability", "circularity" and "sustainability" in the period 2019-2021, represent 37.2%, 36.1% and 48.67% respectively of the total scientific papers existing so far in the Web of Science database, while the works published in the previous period (2008-2018) represent 49.2%, 45.6% and 45.84% of the total. Between 1975 and 1985, there were the fewest published works.The countries with the most publications for the two topics are the United States, followed by China and England. Romania contributed to the debate on these topicswith only 7 documents in the field of "food sustainability", 58 documents in the field of "circularity" and over 340 in the field of "sustainability".

The keywords or word structures that have been most often identified in scientific studies related to the two concepts are: "DURABILITY": performance, behavior (behavior), quality (quality), products (products), temperature (temperature), food etc., "CIRCULARITY": circular economy, optimization, performance etc.

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