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Bibliometric Analysis of Current Status of Circular Economy during 2012–2021: Case of Foods

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Abstract: Food is usually recognized as a limited resource in sustainability, recognized by the United Nations (UN) Sustainable Development Goal (SDG) 2, which aims to achieve zero hunger. It is expected that the circular economy (CE) can improve processes related to food production. The objective of the present study was to apply a bibliometric approach using VOSviewer visualization software as a research tool to analyze the relevant literature from the Scopus database in the field of circular economy and its relation to improvements in food issues throughout 2012–2021. A total of 1316 articles were analyzed. Italy was the most productive country with 313 articles, with Wageningen University & Research the organization with the most publications with 39 articles. The top 10 institutions originated from Italy, The Netherlands, France, and Denmark. *Sustainability* was the most productive journal with 107 articles. *Bioresource Technology* had the highest average citation frequency (44.68). The study helps initiate investigations to adapt the results obtained and create new strategies for increasing food circular economy efforts.

Keywords: circular economy; circular practices; sustainability; circularity; food

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1. Introduction

Recently, the Food and Agriculture Organization (FAO) estimated that nearly 690 million people suffer from hunger worldwide [1]. When evaluating the total effect of moderate and severe food insecurity, it is estimated that nearly 2 billion people in the world did not have regular access to safe [2–4], nutritious [5–11], and sufficient food in 2019 [1,12].

In terms of a sustainable approach, food manufacturers generate various ecological effects [13–21], and it the need for a sustainable process is recognized [22–32], including the production of CO_2 [33]. Approximately 40% of the food destined for human consumption ends up as waste during the manufacturing [34] and consumption process [35]. This loss can be explained by the abundant purchase of food that is stored by people but not consumed on time, which generates the waste food described above. Food manufacturing generates up to 30% of greenhouse gas (GHG) emissions [36]. It is estimated that food manufacturers in the United States generate 39.82 million tons of food waste annually, while the residential sector generates 23.95 million tons of food waste, and restaurants 17.09 million tons [37]. Therefore, the need arises to change how the various processes involved in obtaining food and its consumption are carried out. It must be possible to optimize each process involved in food systems. In this scenario, the circular economy (CE) offers a possibility of making the processes eco-efficient. A CE contributes to closing the cycle of materials and substances, seeking to reduce the consumption and waste disposal of resources from the environment. SDG 2, proposed in 2015, shows the goal of zero hunger since there is a large population in the world that does not have access to basic food, generating the deaths and subnormal development of people, with the consequent effect on their health and cognitive development. Physical development problems, especially in children, impact the brain's capacity, creating learning difficulties and achieving a social and economic impact on the countries. For this reason, goal 2 of the SDG articulates mechanisms to eradicate hunger, manage food, and efficiently achieve the benefits to the population.

Research allows us to have new arguments to improve food production processes globally through cleaner technologies, less waste, better waste management, and circular processes [38–55]. Another critical approach to improving the food management process includes the footprint of the manufacturing process [56–77].

The circular economy follows the principles proposed by McDonough [78] through the Hannover Principles, which are a set of statements about the design of buildings and objects with anticipation of their environmental impacts, effects on sustainable growth, and their general impacts on society. A beneficial proposal on which the circular economy is focused is to understand industrial processes as living beings and, therefore, to describe industrial processes as metabolic processes. It is easier to understand that the CE may have a more direct role in optimizing these industrial metabolic processes, implementing renewable energy sources, waste management, and other changes.

Traditionally, industrial firms use linear models, so the change towards circular processes initially involves changing the conception of the business model and production processes. Particularly in food production, there is a need to know the evidence regarding circularity. Given this need, it is necessary to know what the scientific literature can provide to business decision making to implement a CE and achieve ecological, economic, and social benefits from companies related to food production.

Companies can achieve economic benefits by migrating to processes based on a circular economy [79], which reports the benefit based on subsidies and the payment of taxes using the end-of-life tires fiber recycling system. Additionally, the full cost accounting (FCA) method to analyze the impact of municipal waste management has been reported [80]. Likewise, an integrated sustainable framework was developed for the Pay-As-You-Throw (PAYT) pricing model, which generates lower waste costs and creates economic, social, and environmental incentives for households [80]. Improved profitability has been reported in agriculture using biodisinfection of horticultural crops based on the circular economy [81]. A decrease of 37.2% in water consumption and 4.8% in production costs were reported. Likewise, there was an increase of 22% due to the addition of other organic amendments, reporting that farms are more sustainable and more profitable from a circular economy approach than traditional techniques [81].

There are some previous studies on circular economy and foods, but they have focused on different aspects such as the supply chain [82,83], digitalization in the food supply chain [84,85], food waste [86], and artificial intelligence in the food supply chain [87]. Moreover, systematic reviews have been published [88,89] that reported that the journals *Sustainability* and the *Journal of Cleaner Production* published the highest numbers of research papers that originated primarily in Europe. In addition, it has been reported that Italy is the country where most articles on circular economy and food waste have been published [90].

The research gap is based on the different publications on circular economy and food, which are fragmented. It is necessary to carry out an analysis to show the investigated topics, the usual contents, and the most relevant institutions and authors, which allow searches to be generated that are suitable for future studies and, likewise, to identify academic allies to develop projects with institutions and researchers' experience in the circular economy.

The objective of the present study was to apply a bibliometric approach using VOSviewer visualization software as a research tool to analyze the relevant literature from the Scopus database in the field of circular economy and its relation to improvements in food issues throughout 2012–2021 to present the current state of research in this field and provide references for further investigation. Current bibliometric analysis has described the research trends in different fields that previous studies have focused on [91,92].

The paper is structured as follows: Section 2 presents the methodology of bibliometric analysis. The results are presented in Section 3. The discussion is shown in Section 4. Finally, the conclusions are presented in Section 5.

2. Materials and Methods

The bibliometric analysis was conducted using the Scopus database, a comprehensive database suitable for analysis [93]. Terms, Boolean operators, and parentheses were used to create the search: "TS = ("circular economy"*) AND (food*))" in TITLE-ABS-KEY. The period was specified as the 2012–2021 period. All data were collected on 31 December 2021, to avoid changes in the number of publications and citations. The type of publication was the journal. In total, 1316 articles in journals were considered for analysis. All the search results were exported in tab-delimited format, which included bibliographical information such as titles, authors, journals, institutions, keywords, publication years, and abstracts for further analysis and visualization using bibliometric analysis software. VOSviewer (version 1.6.17) was utilized to evaluate the status of research and hot spots to enable visual analysis and graphic representation of co-occurrence work clustering of the published literature by country, research institution, keywords, number of citations, etc. [94,95]. Figure 1 shows the research design. This study analyzed the number of publications according to year, significant countries, affiliations, journals, highly cited papers, and keywords; annual variation trends; and the highly cited literature using Microsoft Excel 2019. VOSviewer was used for the analysis of the co-authorship relationship and co-occurrence relationship.

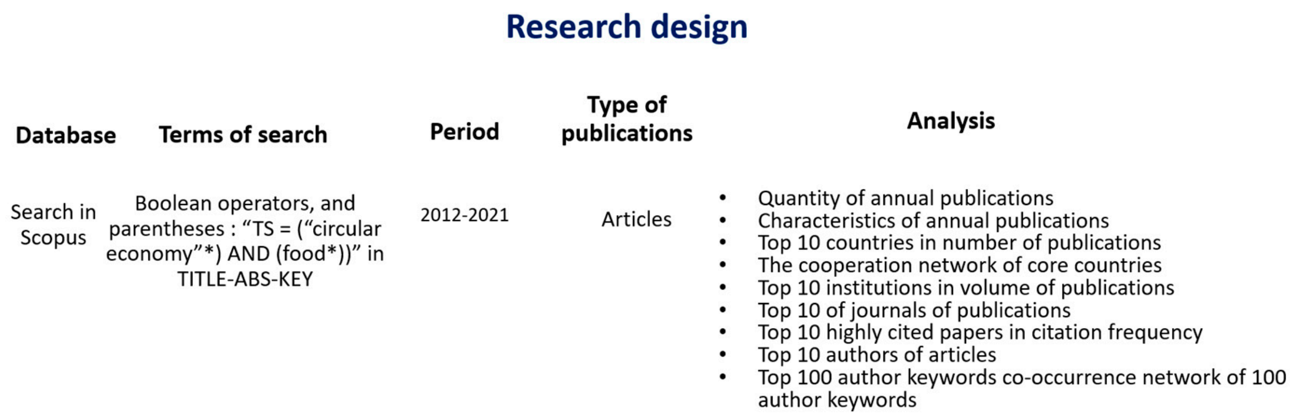

Figure 1. The research design of the study. Source: Authors' elaboration.

3. Results

3.1. Growth Trend of Publications

As shown in Figure 2, the number of publications on circular economy and foods indexed in Scopus presented an increasing scenario. The relationship between the annual number of publications and year was fitted with an exponential regression model between 2017 and 2021 where the increase was notable. The equation is shown to predict the number of articles in the future. The R^2 is the relative predictive power of the exponential model. It can be observed that circular economy and food publications increased notably between 2017 and 2021. It can be predicted that the food circular economy field will be a research hotspot for researchers in the coming years. It will be essential to analyze the increase in articles from Scopus. It will be interesting for future studies to confirm the trends using the Web of Science.

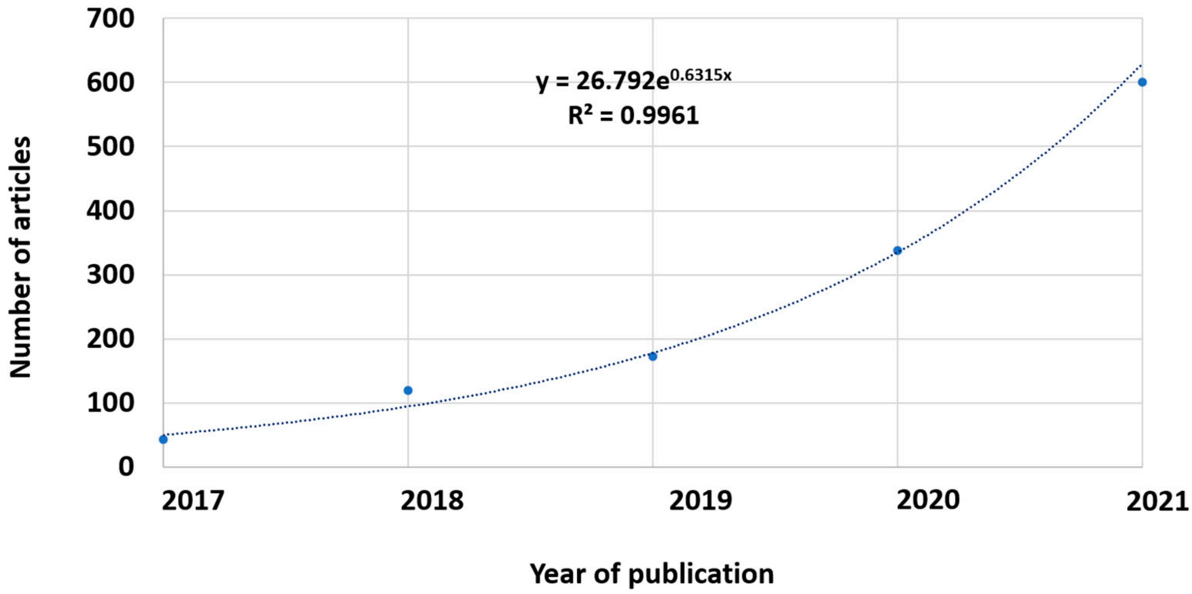

Figure 2. Quantity of annual publications on circular economy and foods during 2017–2021. Source: Authors' elaboration.

Characteristics of the publications per year are illustrated in Table 1. As the number of annual publications increases, the number of references cited per article increases. The number of references per article was 88 in 2012, compared with 96.49 in 2021, increasing over 10 years. The average number of authors was four per article in 2012, which increased to 4.97 in 2021. The average length fluctuated slightly, with an overall average of 14.03 pages. The counting of pages of articles was performed by Scopus and reviewed manually. The observed increase in the number of publications and authors reflects the increasing interest in circular economy and foods in the past 5 years.

Table 1. Characteristics of annual publications on circular economy and foods during 2012–2021.

PY	NP	NAU	NAU/NP	PG	PG/NP	CRC	CRC/NP
2012	1	4	4	11	11	88	88
2013	1	1	5.5	3	3	6	6
2014	4	15	3.75	52	13	255	63.75
2015	12	71	5.91	203	16.91	484	40.33
2016	25	102	4.08	378	15.12	1292	51.68
2017	43	244	5.67	611	14.20	2552	59.34
2018	119	599	5.03	1833	15.40	7517	63.16
2019	173	887	5.12	2304	13.31	11,475	66.32
2020	338	1772	5.24	5229	15.47	23,959	70.88
2021	600	2701	4.50	8941	14.90	44,550	74.25
Total	**1316**	**6396**	**Mean = 4.88**	**19,565**	**Mean = 13.231**	**92,178**	**Mean = 58.371**

PY: publication year; NP: number of publications; NAU: number of authors; PG: page count; CRC: cited references count; and NAU/NP, PG/NP, and CRC/NP: average number of authors, pages, references per article.

3.2. Publication Distribution of Countries

The 1316 articles in the Scopus database indicate that 91 countries contributed to the circular economy and food publication records. Table 2 shows the top ten countries ranked by the number of total publications, total cited frequency, average cited frequency per paper, and the country's h-index [96]. The top 10 countries represented 88.90% of the total number of publications.

Table 2. Top 10 countries in the circular economy and food publications during 2012–2021.

No.	Country	NP	R (%)	NC	NC/NP	h-Index
1	Italy	313	23.78	4104	12.47	35
2	Spain	174	13.22	1934	13.11	26
3	United Kingdom	162	12.31	3793	11.11	33
4	China	93	7.06	1222	23.41	22
5	Portugal	92	6.99	1190	13.14	18
6	Germany	79	6.00	1446	12.93	21
7	France	65	4.93	1190	18.30	20
8	The Netherlands	65	4.93	1433	18.31	22
9	United States	64	4.86	1174	22.05	19
10	Brazil	63	4.78	452	18.34	12

NP: number of publications; R (%): the ratio of one country's publications to the total number of publications during 2012–2021; NC: the number of citations; NC/NP: average number of citations per article.

VOSviewer software was used to visualize the co-operative relationships among the top 10 productive countries and regions from 2012 to 2021, and the results are shown in Figure 3. A circle represents each country, and its size depends on the number of publications produced by that country. The curve connecting the two circles represents a co-operative relationship between the two linked countries. The thicker the curve, the stronger the collaborations between the two countries. The circle's color in the visualization networks is determined by the cluster to which the country belongs. The distance between circles implies the degree of co-operation between countries or regions. As shown in Figure 3, there were close co-operative relations among all countries. Italy showed the most co-operative relations, co-operating with 66 countries. Of all the countries that collaborated, Italy and Spain had the most significant strength of co-operation, which illustrates that the two countries had the closest co-operation.

3.3. Publication Distribution of Institutions

In total, 157 institutions were involved in the 1316 publications related to circular economy and foods during 2012–2021. The top 10 most productive institutions in total publication numbers are shown in Table 3. The top 10 institutions originated from four countries—Italy, The Netherlands, France, and Denmark—and accounted for 224 publications (15.68%). Italy, the United Kingdom, Spain, China, and Portugal were the 10 most productive countries. However, only Italy appeared in the top 10 most productive institutions. The Wageningen University & Research reported the highest number of publications, with 39 articles accounting for 2.96% of the total. The total frequency of citations was also the highest, which was 12,832. From the total number of publications, citation frequency, and h-index, the Wageningen University & Research has made outstanding contributions to circular economy and foods. VOSviewer software was used to visualize the co-operative relationships among the research institutions, with 1316 articles published in circular economy and foods.

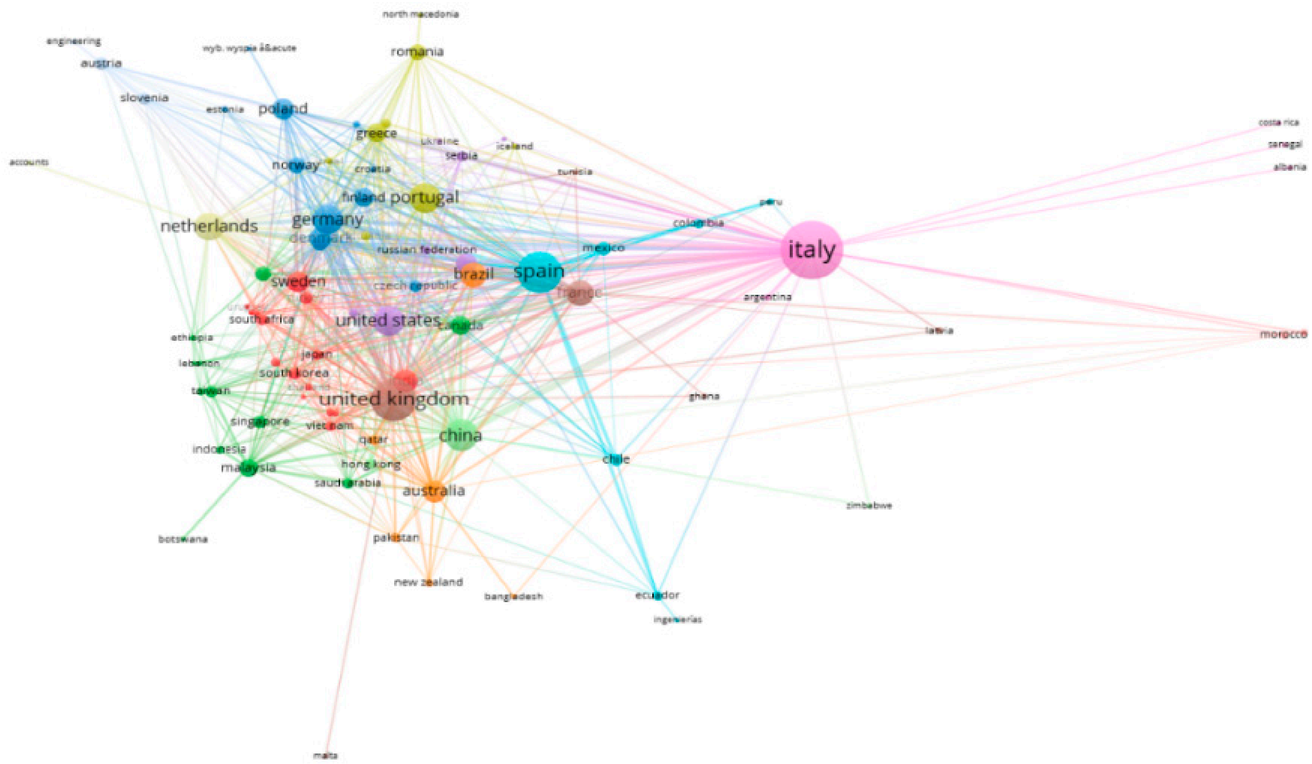

Figure 3. The co-operation network of core countries on circular economy and foods during 2012–2021. Source: Authors' elaboration.

Table 3. Top 10 institutions in the volume of publications on circular economy and foods during 2012–2021.

No.	Institution	NP	R (%)	NC	NC/NP	H-Index
1	Wageningen University & Research (The Netherlands)	39	2.96	661	16.94	15
2	Università degli Studi di Milano (Italy)	32	2.43	211	6.59	8
3	Consiglio Nazionale delle Ricerche (Italy)	25	1.90	236	9.44	8
4	Universidade do Porto (Portugal)	23	1.75	164	7.13	8
5	Università degli Studi di Napoli Federico II (Italy)	21	1.60	393	18.71	9
6	Università degli Studi della Tuscia Viterbo (Italy)	20	1.52	399	19.95	9
7	l'Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (INRAE) (France)	20	1.52	310	15.50	11
8	Rede de Química e Tecnologia REQUIMTE (Portugal)	19	1.44	110	5.78	7
9	Alma Mater Studiorum Università di Bologna (Italy)	19	1.44	132	6.94	7
10	Aarhus Universitet (Denmark)	18	1.37	254	14.11	8

NP: the number of total publications; R (%): the ratio of one institution's publications to the total number of publications during 2012–2021; NC: the number of citations; NC/NP: average number of citations per article.

3.4. Publication Distribution of Journals

Table 4 lists the top 10 most active journals concerning circular economy and food. From 2012 to 2021, 439 articles were published in the top 10 journals in this field, accounting for 33.35% of the total articles. The average impact factor in the past five years was 6.17. *Sustainability* was the most productive journal, with 107 articles accounting for 8.13% of the total number of articles, and its five-year average impact factor was 3.473. It was followed by the *Journal of Cleaner Production* and *Science of the Total Environment*, with 96 and 48 articles, respectively. The articles published in *Bioresource Technology* had the highest average citation frequency (44.68), higher than other journals, followed by the *Journal of Cleaner Production* (27.23). *Resources Conversation and Recycling* was the journal with the highest five-year average impact factor (9.003).

Table 4. Top 10 journals of publications on circular economy and foods during 2012–2021.

Rank	Journals	NP	R (%)	NC	NC/NP	Impact Factor	H-Index	Country
1	*Sustainability*	107	8.13	1458	13.63	3.473	109	Switzerland
2	*Journal of Cleaner Production*	96	7.29	2614	27.23	8.410	232	United Kingdom
3	*Science of The Total Environment*	48	3.65	1059	22.06	7.116	275	The Netherlands
4	*Foods*	41	3.12	175	4.27	4.957	53	Switzerland
5	*Resources Conservation and Recycling*	33	2.51	756	22.91	9.003	150	The Netherlands
6	*Molecules*	28	2.13	377	13.46	4.587	171	Switzerland
7	*Waste Management*	28	2.13	671	23.96	6.499	182	United Kingdom
8	*Energies*	20	1.52	133	6.65	3.085	111	Switzerland
9	*Bioresource Technology*	19	1.44	849	44.68	8.361	317	United Kingdom
10	*Journal of Environmental Management*	19	1.44	236	12.42	6.247	196	United States

NP: number of publications; R (%): the ratio of one country's publications to the total number of publications during 2012–2021; NC: the number of citations; NC/NP: average number of citations per article; IF: impact factor.

3.5. The Most Highly Cited Articles

The top 10 highly cited publications in circular economy and foods from 2012 to 2021 were analyzed by the total citations and the institutions of origin, and the results are shown in Table 5. Of all the highly cited articles, three were from developing countries (Saudi Arabia, India, and Cyprus), and the rest were from developed countries. The most highly cited article was "Current options for the valorization of food manufacturing waste: A review", published in the *Journal of Cleaner Production* in 2014, with 514 citations [97]. This article was a review article summarizing the use of food waste from food manufacturing in other industries, such as the pharmaceutical industry, as a potential symbiosis. The second was entitled "Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications", published in *Omega* in 2017, with 375 citations [98]. This article presented two case studies from different process industries (chemical and food) and compared the performance of traditional and circular production systems. It evaluated direct and indirect emissions, recovered waste, virgin resource use, and carbon maps. It is worth noting that among these top 10 highly cited publications, two articles were reviewed, which indicates that comprehensive reviews of concepts, cases, and factors are starting to be summarized for subsequent research. From the analysis of highly cited literature, cases from various countries are being presented and assessed, such as the case of landscape burning in Australia [99], the development of eco-industrial parks in China [100], the Chinese import ban and its impact in the plastic waste trade [101], and a food waste biorefinery in India [102].

3.6. Relevant Authors of Articles on Circular Economy and Food

Table 6 shows the more relevant authors of articles focused on circular economy and food, indicating their institutional filiations, countries, and total H-index

Table 5. Top 10 highly cited papers in citation frequency on circular economy and foods during 2012–2021.

Rank	Title	Authors	Country Corresponding Author	Publication Year	Journal	NC
1	Current options for the valorization of food manufacturing waste: A review	Mirabella, N., Castellani, V., Sala, S.	Italy	2014	*Journal of Cleaner Production*	459
2	Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications	Genovese, A., Acquaye, A.A., Figueroa, A., Lenny Koh, S.C.	United Kingdom	2017	*Omega*	375
3	The Chinese import ban and its impact on global plastic waste trade	Brooks, A.L., Wangand, S., Jambeck, J.R.	United States	2018	*Science Advances*	204
4	The potential implications of reclaimed wastewater reuse for irrigation on the agricultural environment: The knowns and unknowns of the fate of antibiotics and antibiotic-resistant bacteria and resistance genes—A review	Christou, A., Agüera, A., Bayona, J.M., Cytryn, E., Fotopoulos, V., Lambropoulou, D., Manaia, C.M., Michael C., Revitti, C., Schröder, P., Fatta-Kassinosh, D.	Cyprus	2017	*Water Research*	184
5	Waste biorefineries: Enabling circular economies in developing countries	Nizami, A.S., Rehan, M., Waqas, M., Naqvi, M., Ouda, O.K. M., Shahzad, K., Miandad, R., Khan, M. Z., Syamsiro, M., Ismall, I.M.I., Pant, D.	Saudi Arabia	2017	*Bioresource Technology*	190
6	Transition towards the circular economy in the food system	Jurgilevich, A., Birge, T., Kentala-Lehtonen, J., Korhonen-Kurki, K., Pietikäinen, J., Saikku, L., Schösler, H.	Finland	2016	*Sustainability*	166
7	The Global Food-Energy-Water Nexus	D'Odorico, P., Davis, K.F., Rosa, L., Carr, J.A., Chiarelli, D., Dell'Angelo, J., Gephart, J., MacDonald, G.K., Seekell, D.A., Suweis, S., Rulli, M.C.	United States	2018	*Reviews of Geophysics*	141
8	Food packaging in the circular economy: Overview of chemical safety aspects for commonly used materials	Geueke, B., Groh, K., Muncke, J.	Switzerland	2018	*Journal of Cleaner Production*	150
9	Oil palm economic performance in Malaysia and R&D progress in 2017	Kushairi, A., Loh, S.K., Azman, I., Hishamuddin, E., Ong-Abdullah, M., Izuddin, Z.B.M.N., Razmah, G., Shamala Sundram, Parveez, G.K.A.	Malaysia	2018	*Journal of Oil Palm Research*	145
10	Consumers' perspective on circular economy strategy for reducing food waste	Borrello, M., Caracciolo, F., Lombardi, A., Pascucci, S., & Cembalo, L.	Italy	2017	*Sustainability*	126

NC: the number of citations.

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Table 6. Top 10 authors of articles on circular economy and food.

N°	Authors	Articles about CE and Food	Initiation in CE and Food Publication/Research Activeness in CE and Food Publication	Institutional Affiliation	Country	H-Index
1	Marianne Thomsen	11	2014/Active	Aarhus Universitet	Denmark	32
2	Sergo Ulgiati	9	2017/Active	Beijing Normal University	China	56
3	Pierfrancesco Morganti	8	2015/Active	Università degli Studi della Campania Luigi Vanvitelli	Italy	21
4	Alba Bala	7	2016/Active	Universitat Pompeu Fabra Barcelona	Spain	21
5	Xavier Gabarrell I Durany	7	2019/Active	UAB Instituto de Ciencia y Tecnología Ambientales	Spain	41
6	Vasiliki Kachrimanidou	7	2017/Active	Ionian Panepistimion	Greece	14
7	Yigit Kazancoglu	7	2020/Active	Yasar University	Turkey	19
8	Miguel Ángel Prieto	7	2020/Active	Universidad de Vigo	Spain	28
9	Jesús Simal-Gandara	7	2020/Active	Universidad de Vigo	Spain	58
10	Daniel Tsang	7	2020/Active	Hong Kong Polytechnic University	Hong Kong	84

3.7. Keyword Analysis

A keyword analysis is essential to identify research hotspots and the direction the field is moving. VOSviewer was used to generate a keywords co-occurrence network that shows the connection and weightage of the 100 most high-frequency author keywords in circular economy and foods. It established five co-occurrences, at least for the analysis. As shown in Figure 4, nine clusters were identified. The first cluster comprises 12 items related to industrial processes such as bioenergy, biogas production, composition, critical review, environmental assessment, influence, life cycle assessment (LCA), Malaysia, role, sustainable development, tool, and urban design agriculture.

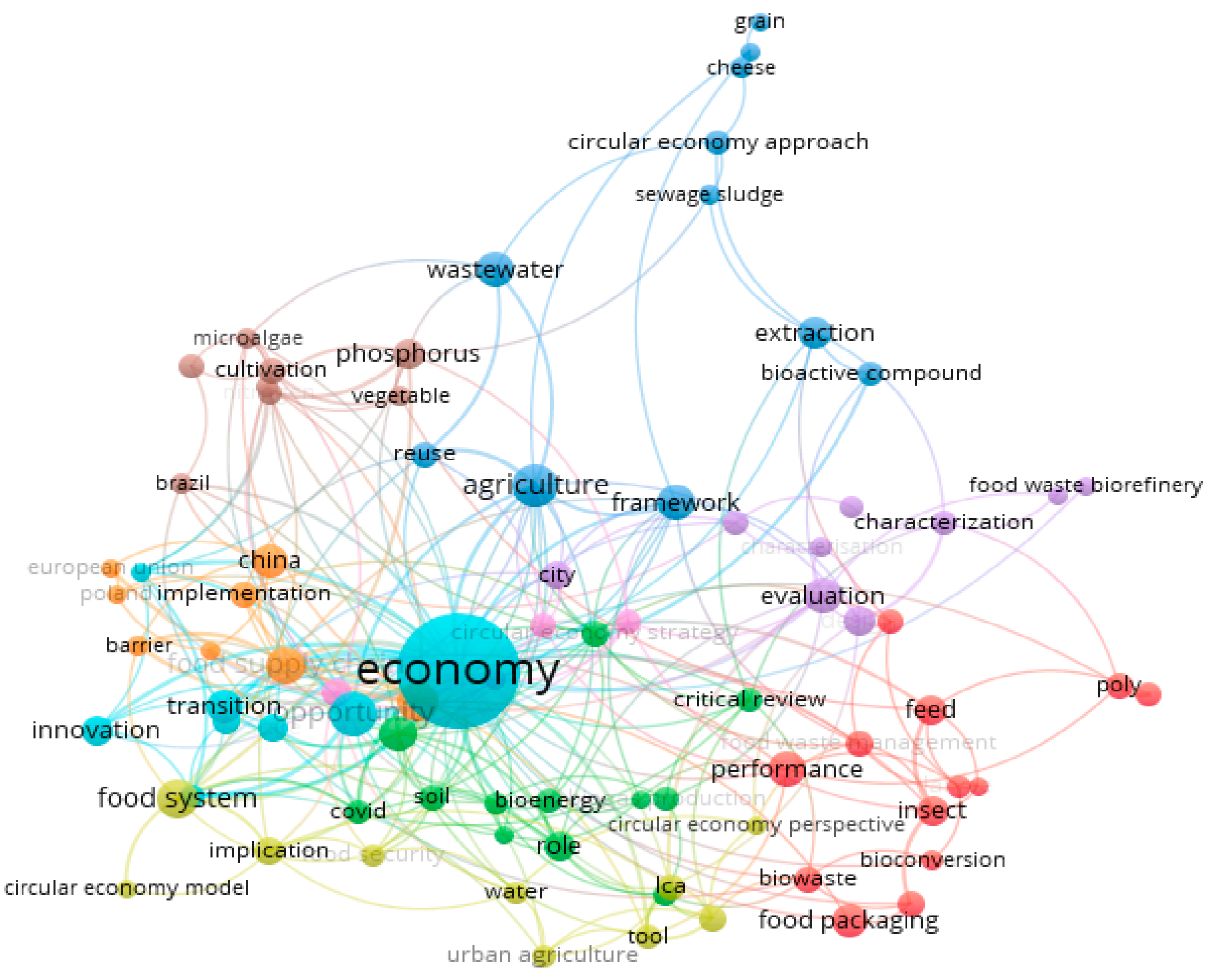

Figure 4. Top keywords co-occurrence network on circular economy and food during 2012–2021. Source: Authors' elaboration.

The second cluster comprises 11 items related to the type of amino acids and compounds, such as a benefit, food, characterization, coffee ground, design, effect, evaluation, food waste biorefinery, lactic acid, poly, and synthesis. The third cluster comprises 11 terms related to countries and processes such as barrier, challenge, China, economy, European Union, evidence, food supply chain, implementation, Italy, Poland, and transition. The fourth cluster comprises 10 items related to the manufacturing process: agriculture, bioactive compound, cheese, circular economy approach, extraction, gain, incorporation, reuse, sewage sludge, and wastewater. The fifth cluster comprises 10 items related to waste management, such as bioconversion, bio waste, feed, food packaging, food waste management, hermetic, insect, larvae, optimization, and protein. The sixth cluster comprises nine items linked to natural resources such as anaerobic digestate, Brazil, cultivation, effectiveness, industrial waste, microalgae, nitrogen, phosphorus, and vegetable. The seventh cluster comprises nine items linked to agriculture, including circular economy strategy, city, comparison, covid, framework, organic fertilizer, organic waste, soil, and waste management. The eighth cluster comprises seven items related to the management of the circular economy model, circular economy perspective, food security, food system, implication, plant, and water.

Figure 5 shows a density map of co-occurrence. The keywords of research have changed over time, according to VOSviewer. The usual keywords were reuse and food packaging. The most common keywords are food packaging, food waste, and biowaste.

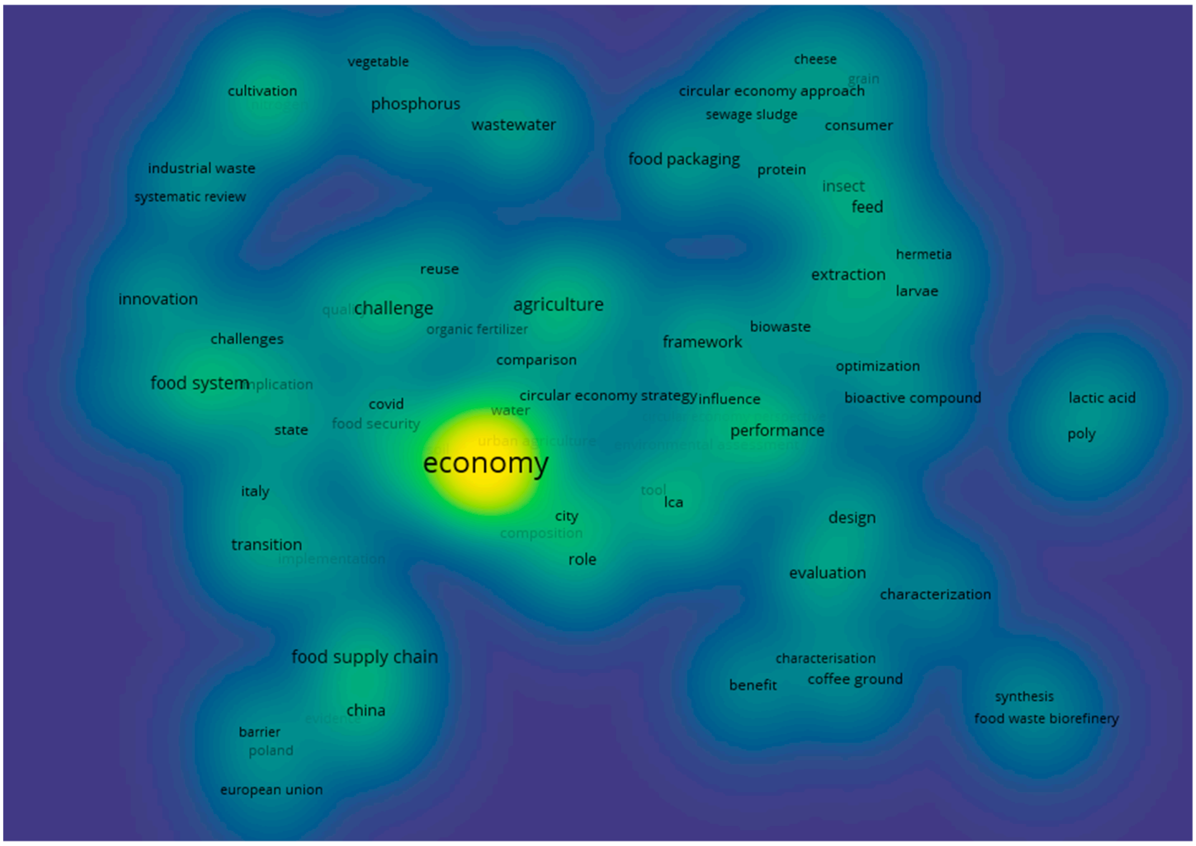

Figure 5. Keywords co-occurrence map density on circular economy and food during 2012–2021. Source: Authors' elaboration.

4. Discussion

Recent studies have reported novel approaches to processing food waste and promoting a greener environment and circular economy. For instance, Mateus et al. [103] evaluated the combination of pretreatment processes and primary treatments with bentonite impregnated with magnetic nanoparticles to reuse wastewater from the food industry. Leong et al. [104] evaluated a waste biorefinery as a sustainable bio-based circular economy and, therefore, as a means for promoting a greener environment. Cortes et al. [105] evaluated the skipjack tuna (*Katsuwonus pelamis*) value chain within a canning industry, demonstrating that the multiproduct strategy applied to the canning sector is ecologically viable. Kurniawan et al. [106] reviewed the nutrient content of wastewater that supports plant growth and the performance of constructed wetlands (CA) for nutrient uptake using macrophytes as treatment agents. Another critical review was carried out by O'Connor et al. [107], which examined different slag generation processes in steel plants, their physicochemical characteristics related to their beneficial use as a soil amendment, and ecological implications and risk assessment of their use in agricultural soils. Mohammadhosseini et al. [108] determined the potential of using polypropylene-type plastic food trays as low-cost fibers to improve the strength and durability of concrete; they found that the inclusion of these fibers decreased the workability of fresh concrete and the compressive strength. Badgett and Milbrandt [109] proposed cost–benefit models that described the economic favorableness of managing food waste by state: landfill, composting, anaerobic digestion, incineration, and the production of biofuels through hydrothermal liquefaction. Regardless of these novel approaches, there is still a lack of publications focused on some specific topics, such as the case of fast-food restaurants as reported by the European Food Agency [110], GreenBiz [111], and the Environmental Defense Fund [112]. As research in circular economy and foods expands into new fields, it needs not to forget about food insecurity and the presence of residual pesticides in foods and their corresponding waste [2]. In terms of investments, Forbes [98] recognizes that a circular economy can serve as an opportunity for the growth of companies such as bioplastic companies [113], evaluating foreign direct investment [114], impacting the price [115], and using blockchain [116]. Our study has identified the most critical articles on circular economy (CE) and foods during 2012–2021. Since 2017, it has been possible to observe an evident growth in publications addressing the circular economy and its relationship with food. The number of publications on CE and foods is expected to continue increasing. However, not only will the number of publications increase, but various aspects of CE can be addressed to contribute to the improvement in food production and its use, thus contributing to achieving the United Nations Sustainable Development Goal (SDG) 2: zero hunger. The current bibliometric analysis reported that China, along with various European countries, is the main one developing CE and food research. It was recognized that Italian universities play a leading role in CE and food research, so it can be of strategic value to generate collaborative projects with these universities since they have research experience in this field and resources to be optimized for further research. The list of the 10 articles with the most citations offers an excellent guide to formulate new research that can further analyze these topics. Additionally, policymakers should consider these articles to generate implementation proposals with specific funds and research agencies to expand their related priority issues. Knowing the major research trends, further research can be guided to achieve innovative results and publications.

The current study reported a constant growth in the topic, as previously described by Esposito et al. [88], Hamam et al. [89], and Oliviera et al. [90]. Furthermore, it was reported that the journals *Sustainability* and the *Journal of Cleaner Production* have the highest number of published research articles. In addition, the top 10 remain the following journals: *Science of The Total Environment*, *Foods, Resources Conservation and Recycling*, *Molecules*, *Waste Management*, and *Energies*. On the other hand, it has been recognized that Europe continues to be the region where the most significant amount of research on circular economy and food is carried out [88], as can be seen in Table 2, where 8 of the 10 countries are European. The present study and that reported by Oliveira et al. [90] coincide in reporting that Italy is the country with the highest number of publications on circular economy and food. In the case of institutions, the top 10 are European institutions. Finally, in the case of authors with the most publications on circular economy and foods, 8 out of 10 are European.

The current evidence shows that the circular economy is a topic that is growing very fast, and the focus on food is a very active topic. The information can help recognize authors who are the research leaders in circular economy and foods and can evaluate which trends for new research and the development of foods are based on new technology.

The current study presents some limitations; for instance, it only uses a single database to retrieve the information. Publications outside the Scopus database and citations outside the Scopus-registered journals were neither included nor analyzed, which may have excluded some influential articles. In addition, some of the documents retrieved were weakly related to circular economy and food. Manual screening is difficult, time-consuming, and highly subjective. Therefore, further research should use multiple databases to retrieve publications and use text mining tools to filter results, which would help improve the analysis's accuracy. Overall, these results generated by bibliometric analysis reveal the global research trends in circular economy and food. Thus, this research helps researchers understand the development trends and themes in the circular economy and food and guides future research.

5. Conclusions

SDG 2 requires a multisectoral effort to contribute sustainably to achieving the zero hunger indicators necessary to optimize product and food consumption. All the bibliometric information reviewed allows us first to know that research in circular economy and food is increasing and that researchers from China and European countries are the ones with the most published articles. At the same time, the institutions of those same countries have the most significant number of publications related to the topic addressed in this research.

The research and development areas identified in this study reveal important information since they help evaluate all global research trends to improve their processes. Knowing the areas also helps initiate investigations to adapt the results obtained in other jurisdictions and to contact the researchers of these studies to understand the results better and to bring to reality the improvements that science disseminates.

The present study has made it possible to show that research in the circular economy and food has an exponential growth, which shows the greater interest of research centers around investigating more about it since food is a dynamic area in which, through technology, the processes of the preparation and management of food waste are improved. Future research must be focused on characterizing the type of research most described in food items. Likewise, it is helpful that an analysis can be generated by geographical area or even by grouping the countries by economic blocs or trade agreements such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTTP) or the Organization for Economic Co-operation and Development (OECD).

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