



Sustainable vs circular business models in agribusiness: a comparative bibliometric analysis

Modelos de negócios sustentáveis vs circulares no agronegócio: uma análise bibliométrica comparativa

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Abstract: Agribusiness is using several strategies to achieve sustainable development. The sustainable business models and the circular business models tools are adopted to turn agro-industrial waste into new sustainable products and business opportunities. Even if they are two different tools, the boundary between them is not strictly defined but quite flexible, making it difficult for researchers and stakeholders to discriminate among them. Helping to simplify the understanding of their boundaries, authors purpose to carry out a bibliometric comparative analysis between the sustainable business models and the circular business models in agribusiness. The study aims to underline their different and similar trends in literature. For the analysis, Bibliometrix R-Tool was used and the metadata of two databases (WoS and Scopus) were retrieved and merged. Biblioshiny was used to provide graphical outputs. Data from the two groups were compared in different analysis, such as keywords used, country's research performance, annual scientific production, among others. It resulted that, although circular business models are more recent in comparison with sustainable business models, both present an increasing publication interest in literature and a similar geographical distribution interest about the issues. However, some interesting differences have been identified, such as the most frequent keywords plus and citation used, among others. These findings can help identify overall trends in circular and sustainable business models in agribusiness, and point out contrasting and common aspects, providing an overview about these research topics in academic literature over time. Additionally, this investigation provides clear outlines and helpful information to researchers, scholars, government managers, industry managers, and consultants.

Keywords: circular business models, sustainable business models, agribusiness, bibliometric analysis, sustainability.



Resumo: A agroindústria está a utilizar várias estratégias para alcançar o desenvolvimento sustentável. Os modelos de negócios sustentáveis e os modelos de negócios circulares são ferramentas adotadas para transformar resíduos agroindustriais em novos produtos sustentáveis e oportunidades de negócios. Mesmo que sejam duas ferramentas diferentes, a fronteira entre elas não é estritamente definida, mas bastante flexível, o que dificulta aos investigadores e partes interessadas a discriminação entre elas. Com o objetivo de simplificar a compreensão de suas fronteiras, os autores propõem realizar uma análise bibliométrica comparativa entre os modelos de negócios sustentáveis e os modelos de negócios circulares na agroindústria. O estudo visa destacar as tendências diferentes e semelhantes na literatura. Para a análise, foram utilizados documentos de duas bases de dados (WoS e Scopus), combinados e analisados mediante Bibliometrix R-Tool. O Biblioshiny foi usado para fornecer resultados gráficos. Os dados dos dois grupos foram comparados em diferentes análises, como palavras-chave utilizadas, desempenho de pesquisa por país, produção científica anual, entre outras. Verificou-se que, embora os modelos de negócios circulares sejam mais recentes em comparação com os modelos de negócios sustentáveis, ambos apresentam um interesse crescente de publicação na literatura e uma distribuição geográfica semelhante sobre as questões de investigação. No entanto, algumas diferenças interessantes foram identificadas, como as palavras-chave mais frequentes e as citações utilizadas, entre outras. Essas descobertas podem ajudar a identificar tendências gerais em modelos de negócios circulares e sustentáveis na agroindústria, e destacar aspetos contrastantes e comuns, proporcionando uma visão geral sobre esses tópicos de pesquisa na literatura académica ao longo do tempo. Além disso, esta investigação fornece linhas orientadoras claras e informações úteis para investigadores, académicos, gestores governamentais, gestores industriais e consultores.

Palavras-chave: modelos de negócios circulares, modelos de negócios sustentáveis, agroindústria, análise bibliométrica, sustentabilidade.

1. Introduction

Nowadays, thinking about solutions for sustainable development is a priority in every field and industrial sector. Sustainability is, in fact, essential to ensure a healthy future for the next generations. In this context, the circular economy is becoming the new paradigm to overcome the limits of a linear economy (Geissdoerfer et al., 2020; Kirchherr et al., 2017). With Agribusiness being one of the most polluting sectors (Food and Agriculture Organization of the United Nations, 2020), it is crucial to ensure its sustainable development. In particular, agriculture, farming, forestry, and aquaculture industries, which provide renewable resources, are essential for the development of a circular bioeconomy (D'Amato et al., 2020) and are a good starting point for the implementation of sustainable and circular practices.

Creating new sustainable and circular businesses, as well as turning existing companies into sustainable and circular ones, are the current challenges in the entrepreneurial world. To achieve these goals, management tools are used to operationalize new business strategies (Geissdoerfer et al., 2020). Among them, sustainable business models (S BM) and circular business models (C BM) are the most promising tools to help managers and decision-makers to turn their linear business into a sustainable and circular one. In fact, business models in agro-industrial fields are undergoing changes and innovation to achieve sustainability and circularity (Rosato et al., 2021; Zucchella & Previtali, 2019). Although the sustainable and circular business models seem to be the same tool, they are different (Bocken & Ritala, 2021; Donner et al., 2021; Goni et al., 2021). Nevertheless, they have some similarities and connections (Donner et al., 2020; Galvão et al., 2020; Geissdoerfer et al., 2020). Both sustainable and circular business models came from business model innovation (Mitchell & Coles, 2004). In this context, when a business model is innovated to respond to the sustainability needs and aims, it could be considered a sustainable business model (Nosratabadi et al., 2019) and a sustainability tool. Successively, when a sustainable business model is innovated with circular practices and is implemented with a circular flow, it can be referred to as a circular business model (Galvão et al., 2020).

Hence, the circular business model is a sustainable tool capable to include circular economy into an innovative and sustainable business model (Basile et al., 2021; Geissdoerfer et al., 2020). Therefore, we can assume that the circular business model came from the sustainable business model and represents its subcategory (Bocken et al., 2014; Donner et al., 2021, 2020; Van Keulen & Kirchherr, 2020). However, the boundaries between the two concepts are not well-defined yet, and it is still difficult in the academia and entrepreneurship environment to distinguish between them (Basile et al., 2021). Moreover, literature comparing S BM and C BM is missing. For these reasons, this work aims to compare for the first time the sustainable business models and the circular business models, in a bibliometric perspective, to contribute to the comprehension of the boundaries between the two concepts and to the analysis of their similarities and differences. To achieve these goals, the study performed a systematic collection of documents related to S BM and C BM in agribusiness in the scientific databases and successively it carries out a bibliometric comparative analysis between S BM and C BM groups, as described in "methods" section of this work. Following this brief introduction, "methods", "results and discussions", and "conclusions" sections are presented. Results obtained in this work can be used by researchers, scholars, entrepreneurs, managers, and consultants to compare and understand better the S BM and C BM.

2. Methods

For this study, two different groups of publications, the S BM and the C BM, have been bibliometrically compared. To collect publications in the two groups, a systematic search has been performed using the same criteria both in Scopus and Web of Science (Wos) databases (Quesado & Silva, 2021). Scopus and Web of Science databases have been chosen since they are the most used and recognized database platforms for scientific literature worldwide (Singh et al., 2021). The keywords and Boolean operators used are summarised in Table 1.

Table 1. Criteria used in the Wos and Scopus databases for document collection. Table adapted from (Rodríguez-Soler et al., 2020).

WOS	SCOPUS
(Topic) ("sustainab* business model*" OR "circular* business model*" OR "circular* econom* business model*" OR "CE business model*" OR "close*-loop business model*")	TITLE-ABS-KEY ("sustainab* business model*" OR "circular* business model*" OR "circular* econom* business model*" OR "CE business model*" OR "close*-loop business model*")
AND	AND
(Topic) "agri*" OR "agro*" OR "agrar*" OR "forest*" OR "farm*" OR "aquaculture*" OR "food*"	TITLE-ABS-KEY ("agri*" OR "agro*" OR "agrar*" OR "forest*" OR "farm*" OR "aquaculture*" OR "food*").
All fields	All fields
All types of document	All types of documents
All years up to present (search done 28/01/2022), added "anytime"	All years up to present (search done 28/01/2022), added "anytime"
All languages	All languages
Search performed on the 28 th of January 2022	Search performed on the 28 th of January 2022

To have a comprehensive perspective of C BM and S BM in agribusiness, no extra refinement, in terms of evolution during time, areas in which topics have been discussed, languages and types of documents, have been applied for the bibliographic search. At first, the search

provided 147 documents in Scopus and 122 in WoS. The number of documents collected from both databases has been further refined by exporting the two databases' document lists in BibTeX format to Bibliometrix. The open-source R-package tool (RStudio version 4.1.2) (Aria & Cuccurullo, 2017), Bibliometrix, is used at first to perform a screening of documents and to identify duplicates in the databases (Cardoso et al., 2020; Rodríguez-Soler et al., 2020).

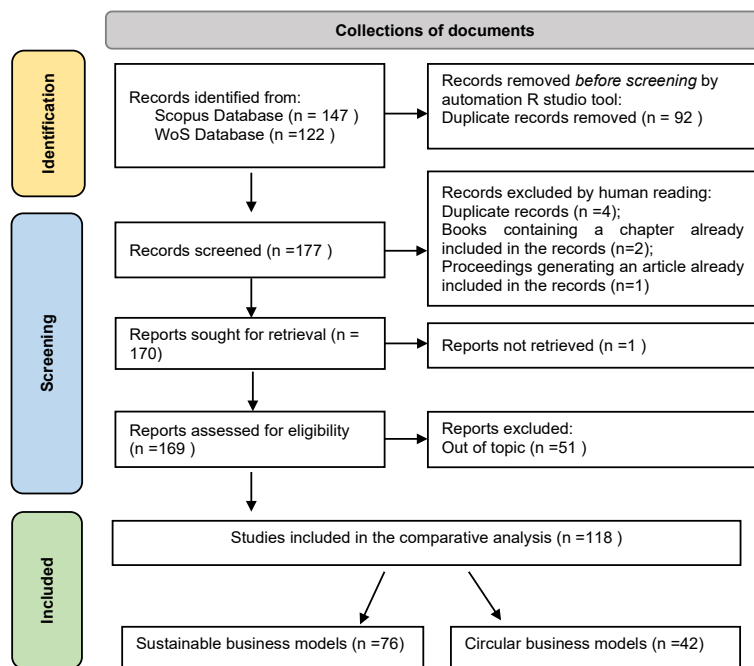


Figure 1. Flow diagram summarising document selection procedure, adapted from PRISMA 2020 guidelines (Page et al., 2021).

In addition to the 92 duplicates removed by the R-tool, authors remove by human reading other documents which were duplicated (4), proceeding abstracts of already included documents (3) and not retrieved full documents (1). Moreover, 51 documents were considered out of topic and therefore eliminated. In fact, those out of topic documents included the required keywords, but only in general sentences, without focusing on the topic or in the context. Finally, 118 documents were selected to be included in the analysis and divided according to the discussed topic in S BM group (76 documents) and C BM group (42 documents). The scheme in Figure 1 shows the systematic steps of the PRISMA guidelines (Liberati et al., 2009; Page et al., 2021) followed to select the documents to be included in this comparative study. Successively, Biblioshiny, the Bibliometrix shiny app for web interface (Nasir et al., 2020), is used to perform the bibliometric analysis on the two documents' groups. Excell is also used to help comparing the Biblioshiny results of the two groups. The results of the comparative analysis are discussed by the authors in the "results and discussion" section.

3. Results and Discussion

The first step of the bibliometric comparative analysis between sustainable business models and circular business models in agribusiness is the characterization of the two collections of documents presented in Table 2 (Cardoso et al., 2020; Rodrigues et al., 2021). From the table, the first difference between the two groups is evident. The first document about S BM in

agribusiness was published in 2004, while the first one about C BM was in 2017. Thus, we can conclude that the concept of C BM in agribusiness is relatively new with respect to the S BM. However, even if the number of documents collected for the C BM group is lower, the number of review documents is slightly higher than for the S BM. This result could be explained by the need of companies, policymakers, and stakeholders to understand the emerging concept of circular business models (D'Amato et al., 2020). For this purpose, a comprehensive review is the best way to summarise the studies about the topic and to facilitate its comprehension to managers and entrepreneurs outside the academic world (Tranfield et al., 2003).

Table 2 Characterization of the S BM and C BM documents. Source Biblioshiny, elaborated with Excell.

Description	SBM	CBM
MAIN INFORMATION ABOUT DATA		
Timespan	2004:2021	2017:2022
Sources (Journals, Books, etc)	59	28
Documents	76	42
Average years from publication	3.77	1.93
Average citations per documents	8.079	11.38
Average citations per year per doc	1.99	3.656
References	3683	2912
DOCUMENT TYPES		
article	55	29
article; early access	3	2
book	0	1
book chapter	4	3
conference paper	6	1
proceedings paper	5	1
review	3	5
DOCUMENT CONTENTS		
Keywords Plus	266	200
Author's Keywords	325	172
AUTHORS		
Authors	188	182
Author Appearances	200	186
Authors of single-authored documents	15	1
Authors of multi-authored documents	173	181
AUTHORS COLLABORATION		
Single-authored documents	15	1
Documents per Author	0.404	0.231
Authors per Document	2.47	4.33
Co-Authors per Documents	2.63	4.43
Collaboration Index	2.84	4.41

Other interesting data from Table 2 are the collaboration index and the co-authors per document. In the case of C BM, these data are higher, indicating that different groups of researchers are joining to discuss and provide their interdisciplinary contribution to the emerging topic of circularity. This result can also be explained and influenced by the fact that the publications about C BM are more recent in comparison with S BM ones, and in the last years has been easier, and even recommended, to collaborate in international and multidisciplinary teams to carry out research (Horta et al., 2021).

The comparison of these collaborative networks between countries in S BM and C BM groups is shown in Figure 2. Different colours represent different collaborating groups, and the dimension of the sphere indicates the number of documents published per country, that is the bigger the sphere, the bigger the number of publications. As criteria, all collaborations, from a minimum of 1, are considered. It can be noticed that the collaboration networks are slightly different in the two groups, indicating a change and variability in research groups about the studied topics. However, Germany and Netherlands collaborate on both topics, as well as the United Kingdom with China, and Italy with the USA.

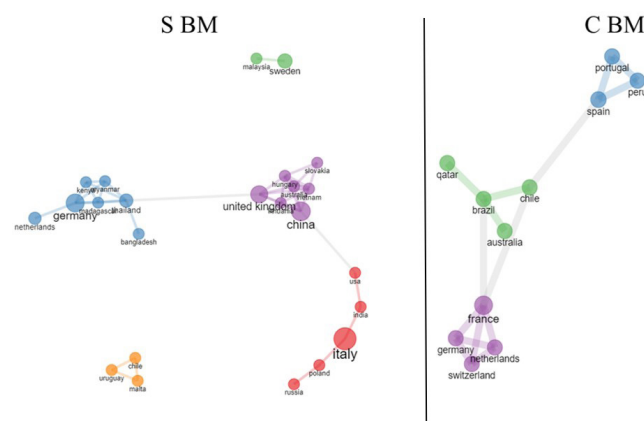


Figure 2. Comparative collaboration network between countries. Source Biblioshiny.

Continuing the analysis of the data obtained in Biblioshiny, the authors present in Figure 3 the graph of the comparative annual production of the documents of the two groups. The year 2022 is excluded in the analysis of documents’ production since the data collection has been performed in January 2022 and, therefore, the year is not completed. As already learnt from Table 2, the production of S BM documents starts in 2004, with a limited number of publications until 2016, the year when the topic production starts to increase exponentially. In the same way, C BM publications’ production increases exponentially since 2017, the year of the first document publication. Differently from S BM, which concept has been mentioned for years before becoming a topic of increasing attention, in C BM the interest was raised immediately. Thus, we can conclude that in the last years, the interest in sustainable and circular business models in agribusiness has significantly escalated in academia.

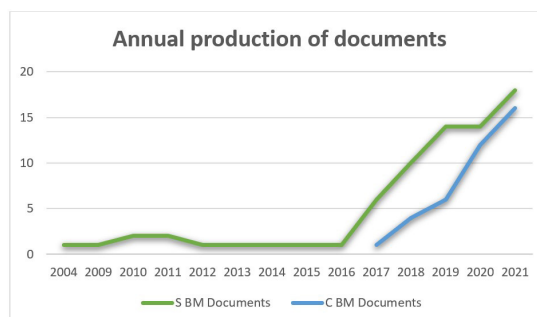


Figure 3. Comparative annual production of documents of S BM and C BM. Source Biblioshiny, graph made in Excell.

In terms of countries which publish the most about sustainable and circular business models in agribusiness, the two worlds map in Figure 4 allow an understanding of the geographical

distribution of the research in these areas. The S BM publication distribution is represented in green colour, instead of the C BM in blue colour. Observing the two maps, it results that the geographical distribution of the two groups is quite similar. In both cases, Italy is the country publishing the most about sustainable and circular business models, followed by the USA and Central Europe area. In the case of S BM, also China and India play a pivotal role in research, followed by Australia, Russia, Brazil, and Canada. Africa produced few publications. In C BM instead, Canada, India, Russia, and African countries have no publishing work, and the contribution of Australia and China is lower compared to S BM. However, in C BM, Brazil's contribution is stronger, and more countries in Latin America are discussing the topic.

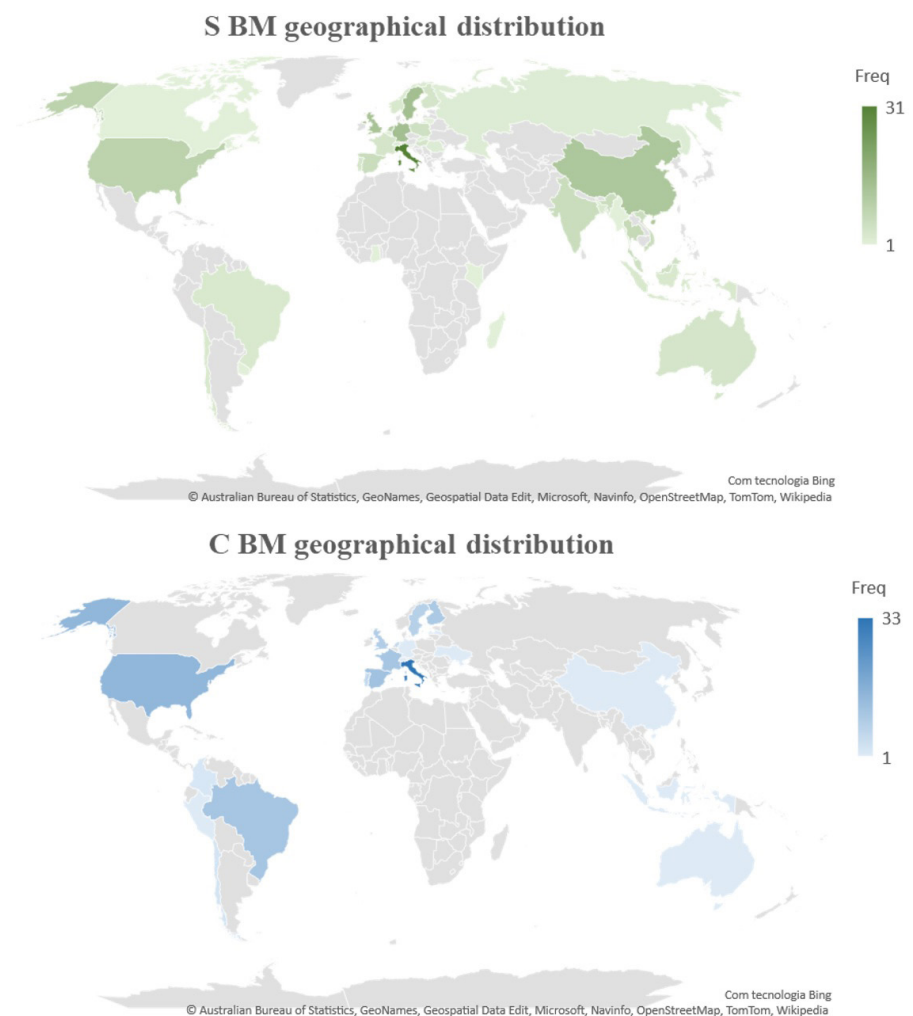


Figure 4. Geographical distribution of publications about S BM and C BM. Source Biblioshiny, maps elaborated with Excell.

In addition to these results, Table 3 is showing the most relevant affiliations of published documents in the two groups. Affiliations with at least 3 documents in the database are reported. As shown in the table, affiliations of the S BM are different with respect to the ones of C BM. Thus, there are no research groups focusing on both topics as their main research interest. The University of Turin is leading the group of S BM research, while the University of Montpellier is leading the C BM group.

Table 3. Most relevant affiliations in S BM and C BM groups. Source Biblioshiny, elaborated with Excell.

Most Relevant Affiliations S BM	Documents	Most Relevant Affiliations C BM	Documents
UNIV TURIN	8	UNIV MONTPELLIER	6
HALMSTAD UNIV	6	PURDUE UNIV	5
TON DUC THANG UNIV	4	UNIV MILAN	5
UNIV NAPLES PARTHENOPE	4	UNIV TECNOL FED PARANA UTFPR	4
UNIV PALERMO	4	UNIV PAVIA	3
UNIV TEKNOL MARA	4	UNIV SANTIAGO DE COMPOSTELA	3
INDIAN INST SCI	3	UNIV SASSARI	3
SZENT ISTVAN UNIV	3		
UNIV APPL SCI	3		
UNIV PARIS SACLAY	3		
UNIV POLITECN VALENCIA	3		
UNIV TORINO	3		
UNIV YORK	3		

The next step in the comparative analysis is the identification of relevant articles in the groups. Table 4 presents the 5 most global cited documents per group. Those documents are the ones which have been cited the most among the works included in the two research groups. Therefore, they represent a “must read” and the basic conceptual framework in agribusiness literature of the S BM and C BM respectively.

Table 4. Most global cited documents in S BM and C BM groups. Source Biblioshiny, elaborated with Excell.

	Most global cited documents S BM	Most global cited documents C BM
1 st	(Nosratabadi et al., 2019)	(Zucchella & Previtali, 2019)
2 nd	(Brehmer et al., 2018)	(D’Amato et al., 2020)
3 rd	(Di Vaio et al., 2020)	(Ghisellini & Ulgiati, 2020)
4 th	(Barth et al., 2017)	(Donner et al., 2020)
5 th	(Davies & Doherty, 2019)	(Paiho et al., 2020)

To have a comparative overview of the contents of the S BM and C BM works, a wordcloud analysis provides a summarising picture of the most used keywords in both collections. Figure 5 represents the wordclouds formed by the 50 most frequent “keywords plus” used in each group. Keywords plus are words or phrases frequently used in the titles of an article’s references and that may appear or not in the title of the article or as author keywords. The dimension of the word characters is associated with the keyword’s frequency. Thus, the bigger the word’s characters, the more frequent the keyword, the smaller the characters, the less frequent it is. The two wordclouds present similar keywords. “Innovation” is the most used “keyword plus” in both groups. This result can be explained by the fact that it is impossible to talk about S BM and C BM without talking about innovating the linear business model toward sustainability and circularity (Galvão et al., 2020; Nosratabadi et al., 2019).



Figure 5. Wordclouds of the S BM and C BM most frequent keywords plus. Source Biblioshiny.

“Management” and “framework”, as well as sustainability (e.g. “sustainable development” and “sustainable business” in S BM, and “sustainability” in C BM) and “industry” are common relevant keywords in both groups since S BM and C BM are tools born and discussed in management area to improve sustainability performances of industrial business (Geissdoerfer et al., 2020; Marczevska & Kostrzewski, 2020). As a difference, “entrepreneurship” and “design” are pinpointed in the S BM, while the C BM group outlines the “performance” and “economy”. One explanation for this result is that the concept of sustainable business models emerged before the circular business models, when the discussion about sustainable development was focused on re-designing products and businesses to achieve sustainability (Fargnoli et al., 2014). In this case, entrepreneurs started to invest in green businesses, sustainable practices, and eco-designed products. Instead, the concept of circular business models is relatively new, and arose at a moment in which it is essential to improve, control and measure the performances of sustainable and circular businesses to ensure that they accomplish the goals for sustainability

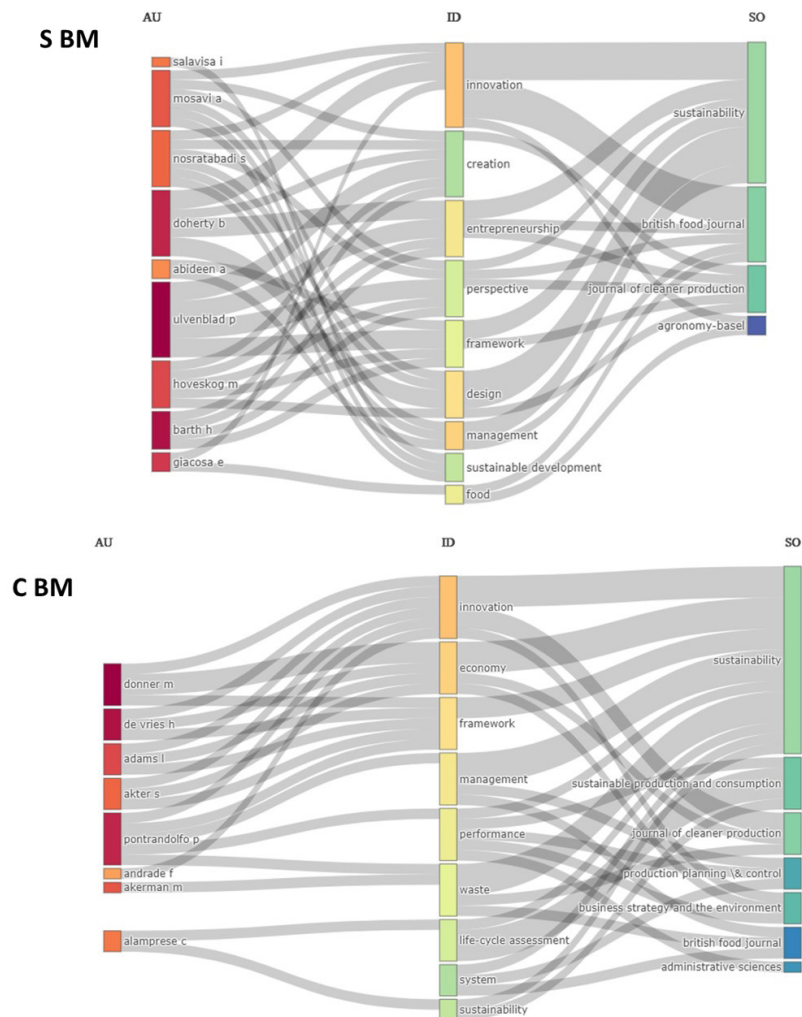


Figure 7. Three-field plots of the S BM and C BM groups, considering authors, keywords plus and sources. Source Biblioshiny.

4. Conclusions

This research compared the sustainable business models and the circular business models in the agribusiness sector by bibliometric comparative analysis. The boundaries between S BM and C BM are not well-defined, although they are two different tools. Some of their common aspects and divergent characteristics are underlined in this work by carrying out different analyses, such as keywords used, country's research performance, annual scientific production, most global cited documents, most relevant affiliation, collaborative and co-occurrence networks, wordclouds and three-field plot. It resulted that, although the concept of the circular business model is more recent in comparison with the sustainable business model, both present an increasing publication interest in literature and a similar geographical distribution of research groups interested in the issues, as well as similar most frequent keywords and common sources of publications. However, citation used and collaborative networks are different, together with the most relevant authors, affiliations and research groups. These findings provide a first comparative analysis of S BM and C BM and an overview of their trends in agribusiness.

The outlines of this comparison can be useful for academia, consultants, entrepreneurs, policymakers and managers to have a better and simplified perception of the contrasting and common aspects of sustainable and circular practices in business modelling. However, this study compares the S BM and C BM just from a bibliometric perspective. Further studies about a comparative content analysis between the two groups are recommended.

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