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A Bibliometric Analysis of Sustainable Food Consumption: Historical Evolution, Dominant Topics and Trends

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Abstract: The major goal of this study is to trace the emergence of SFC-related research across time, using a thematic map and a list of corresponding publications. In addition, this study aims to determine the author who has made the most significant contribution to this particular field. This study provides a comprehensive bibliometric analysis of the historical development and current trends in sustainable food consumption research, examining 2265 articles published between 1990 and 2023. Using the bibliometrics package of R Studio software version 4.2.1 and its Biblioshiny package, articles from the Scopus and Web of Science databases are examined. In the field of sustainable food consumption, we identify five distinct research phases: initial stagnation, infant growth, post-economic crisis, expanding phase and COVID-19 and post-pandemic. While research on broader sustainability topics can be traced back to the early 20th century, a very limited number of articles on sustainable food consumption was published in the 1990s. However, the number of publications increased incrementally over time, with a notable uptick in interest around 2015, and the subject was still being discussed in 2022. The emergence of the COVID-19 pandemic marked the beginning of the most recent phase of research, which analyzed the consumption patterns of consumers before and after the pandemic. Our study highlights key authors, documents and sources related to sustainable food consumption. The United States, Italy and the United Kingdom emerged as the most active contributors to the research on sustainable food consumption and were additionally the countries with the largest global market shares for organic products. Major sub-themes including organic food, food waste, sustainable development and food security, together with consumer behavior and organic products appeared as being the most researched sub-themes of recent times. The results of this study suggest that more research is related to sustainable food consumption in countries with a low organic food market share. In addition, the investigation of actual data on food waste, carbon footprints and greenhouse gas emissions resulting from food production and consumption is essential to gain holistic insights.

Keywords: sustainable food consumption; consumer behavior; bibliometric analysis; Biblioshiny

Citation: Kristia, K.; Kovács, S.; Bács, Z.; Rabbi, M.F. A Bibliometric Analysis of Sustainable Food Consumption: Historical Evolution, Dominant Topics and Trends. *Sustainability* **2023**, *15*, 8998. https://doi.org/10.3390/su15118998

Academic Editors: Áron Török and Zsófia Benedek

Received: 12 May 2023
Revised: 31 May 2023
Accepted: 31 May 2023
Published: 2 June 2023

1. Introduction

The first official discussion of sustainable consumption took place at the 1994 Oslo Symposium. The United Nations Environment Program (UNEP) defines sustainable consumption as the use of products or services to meet the demand of consumers and enhance quality of life while reducing the use of unrenewable resources, hazardous substances and waste generated during consumption [1,2]. From the producers' point of view, large corporations and widely recognized brands began to market their goods and services as "environmentally friendly" [3,4]. On the other hand, it was shown that a growing number

of people prefer to choose environmentally friendly products and are inclined to spend more, although these products were made mainly from recycled materials [5–8]. The application of sustainable consumption was carried out in various sectors, including the energy sector [9,10], household [11,12], electricity [13], tourism [14,15] and food sector [16–19]. Achieving sustainable food consumption (SFC) is one of the most important goals to strive for and has additionally received much attention from various parties, following the United Nations Sustainable Development Goal 12.3 [20,21].

In recent years, SFC-related research has garnered the attention of academics and policymakers. The literature review or bibliometric research on the SFC topic that has been conducted thus far has centered on SFC organic food consumption [22], contemporary issues and policies [18], determinants of sustainable eating out behavior [23], determinants of sustainable food consumption among students [24], trends of research on food security [25] and edible insect consumption [26]. To the best of the authors' knowledge, there remains a limited number of bibliometric studies that have attempted to provide general insights that encompass the wide field of SFC. In previous similar studies, a literature review with in-depth analysis characteristics and content analysis of a small number of research articles was employed [18,22–26]. This leads the authors to believe that it is crucial to chart the evolution of the SFC topic, especially through bibliometric research. Using a quantitative technique known as bibliometric analysis, the purpose of this study is to determine the development trend of the SFC topic over time and the potential future research agenda that could garner more interest. Therefore, the bibliometric investigation of the overall development of SFC is crucial. This present study aims to provide a comprehensive analysis of the broader field of SFC, in order to fill this gap. The primary objective of this research study is to investigate the historical progression of the research associated with SFC, based on publication numbers and thematic maps. Additionally, revealing the authors with the greatest influence on this discipline was in the center as well. This bibliometric approach allows for a holistic understanding of the development of the field and provides a valuable resource for researchers and policymakers. The following research questions (RQ) are addressed in this study:

RQ1: How was SFC-related research historically developed?

RQ2: Who were the most relevant authors with the most influential documents and sources on the topic of SFC?

RQ3: What are the recommended upcoming research agendas related to SFC?

This research differs from the previous studies since it utilizes a bibliometric approach by collecting more than 2000 publications for the analysis, and it focuses more on general SFC topics instead of specific sub-topics. In addition, the articles analyzed in this research come from both the Scopus and Web of Science databases and are primarily focused on business, management and accounting.

1.1. Literature Review

1.1.1. Sustainable Food Consumption

Sustainable food consumption is the process of meeting consumer needs related to food, starting from acquiring, using and disposing of products while minimizing the negative environmental impacts that can arise from the consumption process [27,28]. Sustainable consumption behavior is often known as ecological behavior [29,30], environmentally friendly [31], green consumption [32–35], responsible consumption [36,37], conscious behavior [38,39] and mindful consumption behavior [40–42]. Vegetarian and vegan lifestyles are additionally commonly associated with sustainable food consumption, as plant-based diets are suggested instead of meat consumption to mitigate climate change-related issues [43,44]. However, many consumers find it difficult to abstain from eating meat altogether; consequently, a new group known as "flexitarians" has emerged who consume less meat [45,46]. The customer segment that engages in sustainable food consumption practices is concerned with the consumption process, the food production process, the use of eco-friendly raw materials and the disposal process following consump-

tion [47]. Choosing products with a fair-trade label or certification is one way to ensure that the social aspects of the food production process are conducted ethically, and thus social sustainability is achieved [28,48]. A brand that has been certified as fair-trade has met the standards of not discriminating against the genders, races or religions of its employees, not employing children and paying suppliers and other business stakeholders decently, as well as having prices that are typically higher than the average market price [48,49].

Sustainable food consumption has multiple implications, including the consumption of organic food [50–58], the reduction of meat consumption and the choice of a plant-based diet [5,59,60], the purchase of locally grown and seasonal food [19] and the disposal aspects of food consumption [61,62]. Although some parts of society in some developed countries already had a positive attitude towards sustainable consumption, this study area remained a less studied segment, especially in developing countries [2,28]. This is mainly because organic food products and those produced in an environmentally friendly manner are usually sold at a premium price. The high price of organic food is certainly not just a pricing strategy to display a premium, exclusive image and provide a sense of security for consumers. However, the production costs of organic products are much higher than the agriculture of regular vegetables and fruits. Organic food producers must ensure that the entire value chain involved in the production process is safe for the environment and consumer health by avoiding harmful chemicals, synthetic hormones, radiation and genetic engineering [63,64].

Due to the high prices, the relatively unappealing appearance of organic products, the fact that organic products spoil faster than chemically produced foods and their limited availability in the market, some consumers are less interested in buying organic food [45–48]. This phenomenon is worsened by current high global inflation and skyrocketing food and energy prices that reduce consumer purchasing power substantially. As a result, not many people can easily alter their behavior to become more responsible. Consumers, who are willing to consistently perform SFC and pay more attention to other ethical aspects of their lives, are typically well-educated, knowledgeable and have a higher amount of disposable income [49–52]. Decisions on daily food consumption are often made, especially by people who are young and do not have health problems. Low-involvement decision-making is heavily influenced by emotional appeal, convenience, taste, buying ability, hedonism motivation and habit, which is difficult to change [28,53].

1.1.2. Historical Development of Sustainable Food Consumption

The field of SFC has developed substantially over time, resulting in a vast and diverse body of literature. The emergence of SFC as a research theme can be traced back to the latter half of the 20th century, which predominantly focused on exploring the concept's infancy [54]. During this phase, SFC was acknowledged as a crucial factor in environmental sustainability [55], in spite of the relatively limited research. As environmental issues gained more attention, so did the interest in SFC. Following the adoption of the UN Sustainable Development Goals in 2015, there was a significant increase in this interest [56,57]. In the subsequent years, the focus shifted from merely comprehending SFC to investigating methods for promoting sustainable consumption practices. The examination of the interaction between various SFC domains, such as food waste [58], organic foods [59] and sustainable development [60], has additionally been emphasized. Recent research has investigated the effects of the COVID-19 pandemic on sustainable food consumption [61,62].

1.1.3. Bibliometric Studies of Sustainable Food Consumption

Some literature has discussed sustainable consumption using bibliometric methods; however, more literature is needed to employ bibliometrics to discuss the food aspects especially. One study used bibliometric and network analysis techniques to monitor the evolution of sustainable consumption research from 1995 to 2014, identifying key authors and co-authorship networks and emphasizing the topics studied [2]. By analyzing publications from 1974 to 2019, bibliometric studies of sustainable consumption in general have

been conducted to identify trends in publications, prominent journals, productive countries and psychosocial factor-related keywords [63]. In addition, a study employing a systematic review methodology identifies the significant facets, theories, methodologies, predictors, outcomes and mediators/moderators of sustainable consumption using a publication period of only 10 years, from 2000 to 2020 [64]. A literature review that discusses food as a part of sustainable consumption has been conducted to answer specific aspects, such as segments and consumer behavior regarding SFC consumers [65].

2. Materials and Methods

This bibliometric study is based on various types of scholarly literature. In both instances, rigorous and well-defined inclusion and exclusion criteria (Figure 1) were applied to ensure that the present review comprises only papers pertinent to the topic of sustainable food consumption and hence deserving of consideration for inclusion. Articles that discussed various aspects of SFC that had been published between the years 1990 and the beginning of 2023 were considered for selection. The bibliometric approach was employed by applying quantitative techniques to describe bibliometric data, mainly taken from the Scopus metadata database and the Web of Science (WOS), whose research data are copyrighted and require academic subscription access. In searching for articles, the keywords used in general included words that reflect (1) sustainable, especially "sustainab*", "green", "ecology*", "environmental* friendly", "eco-friendl*", "environment* conscious*", "fair trade", "mindful*", "organic", "plant base*", "vegan", "vegetarian", "flexitarian", (2) the exact word "food" and (3) behavior with the words "behave*", "choice", "consum*", "habit", "pattern*", "attitude*", "aware*", "perception*", "perceive", "prefer*, "select*" and "knowledge". The search using these keywords resulted in 137,461 documents from the Web of Sciences and 103,960 documents from Scopus. In order to increase the precision of our analyses and to refine the dataset, we applied an exclusion procedure. In particular, because English has become the dominant language of scientific communication, articles published in languages other than English were excluded. In addition, the inclusion criteria of this study focused on selecting documents from the research fields of management, economics and accounting. This decision was made with the intention of providing comprehensive insights to researchers in these disciplines who are particularly interested in exploring sustainable food consumption from an organizational, managerial and financial perspective. On the other hand, we decided to exclude certain types of documents from our analysis, such as editorial material, early access articles and proceedings. This decision was influenced by the inherent characteristics of these document types, which often represent preliminary or incomplete findings, and their subject can be changed before final publication. To ensure the validity of our analysis, we relied exclusively on articles, review articles and book chapters. These tend to provide more complete and refined data that are appropriate for our research objectives. The download process was carried out in January 2023. The search results were obtained from Scopus (1968 documents) and the WOS (406 documents). The extracted data on keywords including the author's keywords, titles and abstracts were then downloaded in a BibTex format from Scopus and as plain text from the WOS. Both files were then merged, with the removal of duplicates using the bibliometrix package. The final data consisted of 2265 articles and were further examined bibliometricly using the Biblioshiny application. After that, the figures and tables generated by Biblioshiny were evaluated, and a content analysis was conducted of important articles directly related to SFC-related topics. Figure 1 demonstrates the progression of this research.

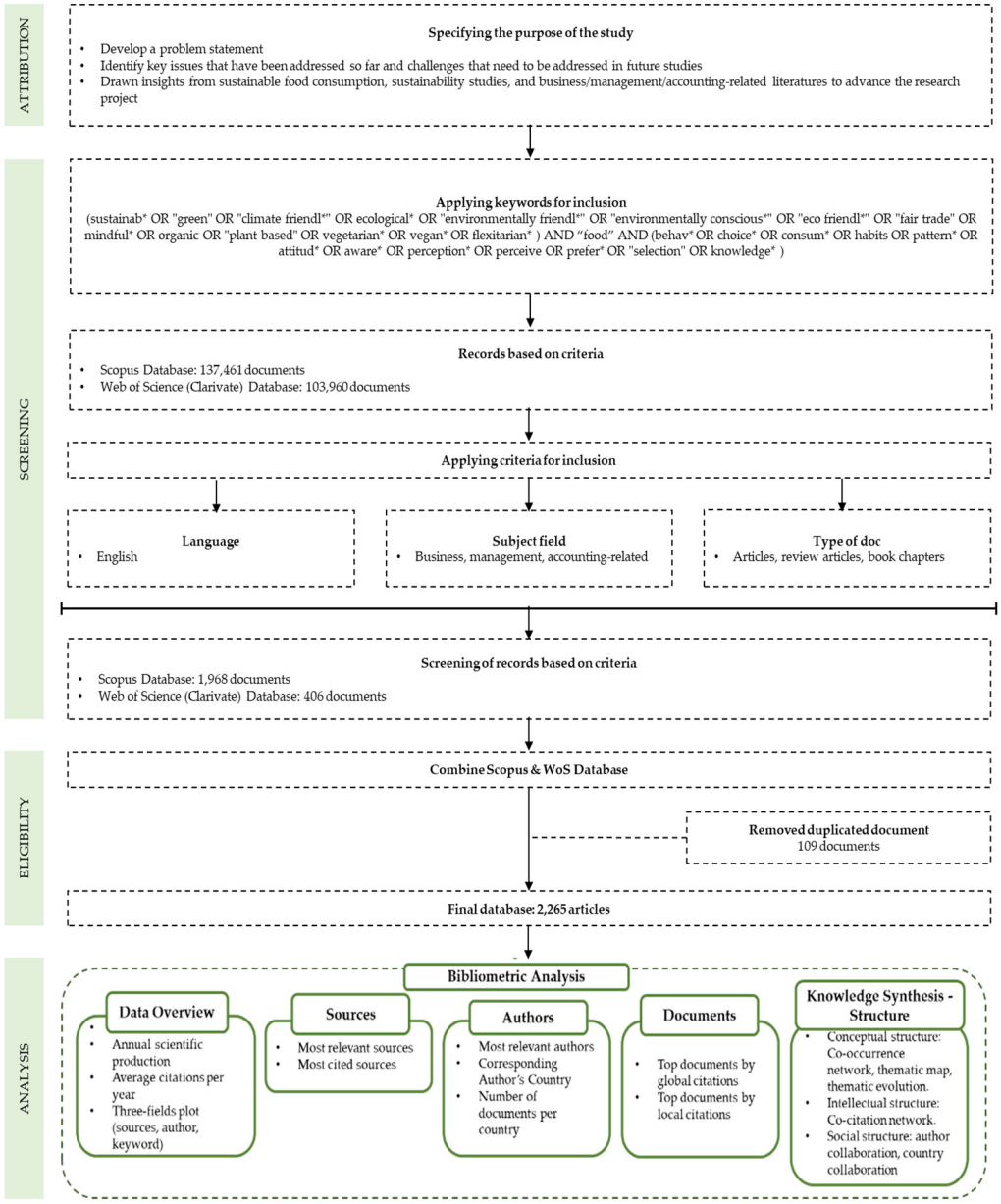


Figure 1. Flowchart of the Investigation. Source: Authors' Elaboration.

This analysis was conducted with R 4.2.1 Software's bibliometrix package and its Biblioshiny web interface. It is meant to produce concise and clear data visualizations regarding the most influential authors, countries that produced the most SFC articles, the most influential articles and those that received the most citations, trending SFC sub-topics and future research issues that need to be addressed. The bibliometric method involves processing quantitative data, mainly through bibliometric data in the form of written publications [66]. Several helpful softwares exist, such as VosViewer, Bibexcel, Gephi, Pajek, Citespace and packages in R Software for performing graphical visualizations of bibliometric data [67,68]. The authors preferred to use R Software, specifically Biblioshiny which can generate tables, network graphs or maps. In the first stage, data overview, a visualization of the most relevant sources, the most influential authors and the most cited documents and networks relating to the collaboration between authors, institutions and countries was presented. Content analysis was performed in the second stage as well as the interpretation of the results, by examining the top 10 recommended articles.

In order to answer the RQ1 pertaining to the historical development of the SFC topic, the authors utilized information on the annual scientific production, annual average citations and three-field plot. The conceptual structure of the data was additionally examined to reveal the most dominant topics in the period analyzed. The most influential authors (RQ2) and their countries of origin can be found in the "Most Relevant Authors" section. Insights regarding the corresponding author's country and country scientific production have additionally been discussed to determine which authors from which countries were the most concerned about SFC. In addition, to understand the most influential documents (RQ2) in the field of SFC, the top 10 documents were determined based on their global and local citations. The most relevant sources and the most cited sources were additionally examined within the frame of the second research question. The authors additionally provided recommendations for potential future research directions and limitations in connection with RQ3, taking the answers to the first two research questions into consideration.

3. Results and Discussion

The descriptive statistics provided an overview of the data, as shown in Table 1. The description of the data indicated 2265 business, management or accounting-related documents published between January 1990 and January 2023 including 2136 articles, 16 book chapters and 113 review articles in the analyzed database. The annual growth rate of the articles was 9.82 percent, with an average document age of 5.93 years and an average of 31.88 citations per document. A total of 5722 authors contributed to the covered documents, and only 230 wrote single-authored articles. Among all the articles, 258 were written by only 1 person without collaborating with other authors. The average number of co-authors per document was 3.23, and the percentage of international co-authorship was 4.68 percent. The historical development of SFC-related publications is described in the following Section 3.1.

Table 1. Top 10 Authors with the Most Publications and Citations.

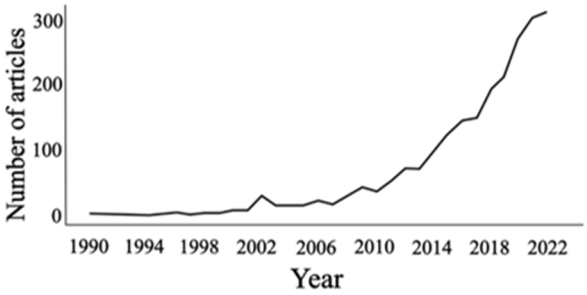
Authors	Number of Published Articles	Authors	Number of Citations
Wang Y	15	Thøgersen J	1156
Thøgersen J	13	Krystallis A	1069
Zhang Y	13	Wang Y	699
Liu Y	12	Aschemann-Witzel J	555
Aschemann-Witzel J	11	Mangla S	489
Krystallis A	11	Hamm U	452
Spiller A	11	Liu Y	320
Filimonau V	10	Filimonau V	317
Hamm U	10	Spiller A	261
Wang J	10	Cheng C	255

3.1. Historical Development of SFC Research

3.1.1. Annual Scientific Production

The research development phases related to the SFC topic can be broadly divided into five parts: initial stagnation, infant growth, post-economic crisis, expanding phase and COVID-19 and post-pandemic stage. Researchers have been involved in sustainability studies since the early 20th century [69]; however, evidently, there have only been a few articles discussing SFC-related topics in the 1990s. Figure 2 shows the growth of research articles related to sustainable consumption from 1990 to the beginning of 2023. In phase 1, namely early stagnation, starting from 1990 to 2001, there were no frequent publications every year; however, at the end of the period, which was 2000 to 2001, there were six articles annually mostly discussing organic sub-topics [70–72]. The number of publications increased during the second phase (infant growth), starting with 28 articles in 2002 and ending with 30 articles in 2008. The increase was mainly due to the standard definition of

sustainable consumption in 2002, ratified by the OECD. Since that year, several developed nations have become concerned with aligning themselves with sustainable consumption policies [73]. Remarkably, the United Kingdom has enacted regulations regarding the clarity of food labeling, educated the citizens to be more environmentally conscious and initiated the implementation of green taxes [74].



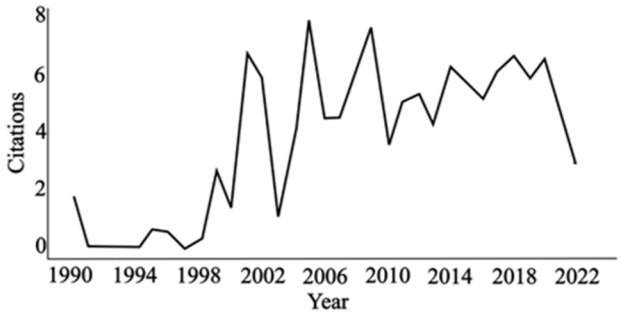
Phase	Years	Phase Name
1.	1990 – 2001	Initial stagnation
2.	2002 – 2008	Infant growth phase
3.	2009 – 2013	Post-economic crisis phase
4.	2014 – 2019	Expanding phase
5.	2020 – 2022	COVID-19 and post Pandemic

Figure 2. Publication Phases and Annual Scientific Production. Source: Developed by Authors.

The momentum of the economic crisis in 2008 did not reduce the interest of researchers in producing more publications related to SFC, as evidenced in the third phase (post-crisis phase), which began in 2009 with 42 publications, and since then the number has continued to increase until it almost doubled in 2013. Some researchers viewed the slowdown of economic growth during the crisis as an opportunity instead of a threat, due to the fact that the reduction of consumption, the generated pollution and all of the adverse effects were additionally reduced [75]. Topics regarding SFC entered an expanding phase in 2014, until it reached 215 articles in 2019. Due to a greater emphasis on news, information, political agendas and the publication of the first articles of the United Nations Sustainable Development Goals, there was a significant increase in interest in this topic around 2015 [76]. In this fourth phase, research on the sub-topic of organic food reemerged as a topic of interest for both developed [77,78] and developing countries [79–84]. Sustainable food consumption continued to be discussed until 2022, producing the most articles in all years. The final phase began between 2020 and 2022, which was additionally the beginning of the COVID-19 pandemic and its recovery period. Consumers' consumption patterns before and after the pandemic were the subject of a significant amount of research conducted during this time [85–87].

3.1.2. General Citations Structure

Figure 3 depicts the movement of average citations per year. It can be seen that average citations fluctuated significantly throughout the period studied, and documents published in 2005 articles received the most average citations (7.86 citations per year). Most papers on the SFC topic received less than 50 citations, namely a proportion of 72.54% (1643 documents), as shown in Figure 3. There were 241 documents during the observable period that received 0 citations. In contrast, 2.6% of the total articles were cited more than 200 times. British Food Journals published the three most cited articles in 2005, all regarding organic food [88–90], and each of them received more than 200 citations. Articles published in 2009 ranked second in average citations per year, reaching 7.67 citations per article. The most popular research topics from that year were still related to organic food [91–95], consumer attitudes [96] and the relationship between local food and sustainable tourism [97] receiving a total of 1743 citations. Publications in 2001 ranked third, receiving an average of 6.75 total citations per year, and those articles received the most citations which dealt with customer attitudes toward organic foods in Swedish settings [71].



Number of citations	Number of papers	% of paper
Over 200	59	2.60%
Between 100 and 200	96	4.24%
Between 50 and 100	226	9.98%
Less than 50	1643	72.54%
0 citations	241	10.64%
Total	2265	100%

Figure 3. Average Citations and General Citations' Structure. Source: Developed by Authors.

3.1.3. Thematic Evolution

The longitudinal analysis of thematic maps revealed the development of research themes over time, as shown in Figure 4. The entire sample of 2265 documents was utilized for the thematic mapping. Four time slices were employed, based on the publication phases. In the first phase, which spanned from 1990 to 2001, attitudes, consumer behavior and organic foods were the predominant sub-topics studied, even though the number of publications on SFC was relatively low compared to later phases. During this period, the topic of organic foods and the driving factors towards organic foods were the most popular along with the commencement of legal regulations for organic food production in the US, European Union countries, Japan and Australia [98]. The highest-cited article in phase 1 was the work of Magnusson et al. (2001), which discussed the attitude of Swedish customers towards organic food consumption. Other articles additionally discussed consumer behavior towards organic food in the context of consumers in Denmark, New Zealand [72] and Greece [99].

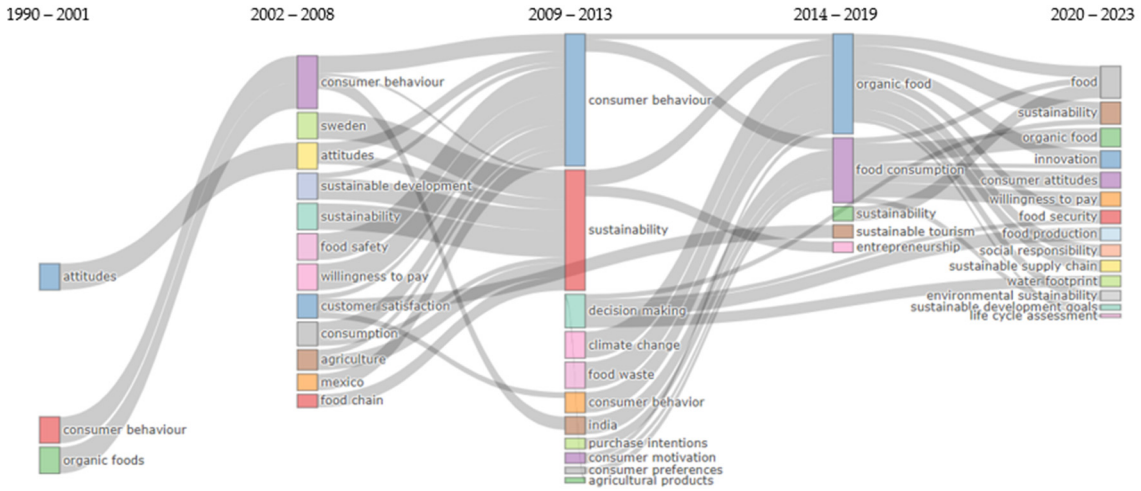


Figure 4. Thematic Evolution. Source: Developed by Authors.

The topic of consumer behavior remained a key topic for the next two periods, namely until 2013. In the second phase, the infant growth phase, along with the growth of organic food producers and the increase of the organic food import and export processes, the majority of research works have focused on consumer behavior regarding organic food purchase intent and willingness to pay. One of the most cited articles in the second phase, with 722 global citations, was the work of Padel and Foster (2005) which examined the attitude–behavior gap of UK customers in organic food consumption. In the third phase, namely the post-economic crisis phase, consumer behavior research continued to be a topic that dominated publications. The publication by Sims (2009) was the most cited document in the third phase, with 696 global citations, which raised a different theme of sustainable food, being not only about organic food however about local and authentic

food in the context of consumers in the United Kingdom. The development of research on food consumption to disposal and food packaging waste has additionally begun to receive attention since this period [100]. India, with the second-largest population in the world, is a highly prospective market for marketing organic products. Hence, research on consumer behavior, particularly for the organic food segment, has become the focus of study in India [101].

During the fourth phase, which began in 2014, when the UN Sustainable Development Goals were established and became the governance agenda of UN member states, researchers were gradually prompted to concentrate more on sustainability issues [102]. This phenomenon was in accordance with the United Nations Sustainable Development Goal 12 (responsible consumption and production), which stated that changes in consumer attitudes and environmentally friendly production processes were required. The inseparable aspects of consumption and production, especially in the context of reducing the negative impact of food waste, were studied by Papargyropoulou et al. (2014) [103] and received the greatest attention with 779 global citations in the fourth phase. The dominant research focus returned to the organic food sub-topic, with a more diverse group of countries for context such as India [104], Thailand [81], Germany [105] and Iran [106]. Additionally, the tourism industry's focus on the application of sustainable food consumption began to emerge as a dominant research topic in this phase. For example, Sidali et al. (2015) [107] examined the theoretical framework of local food tourism that promoted sustainability. Extensive research had additionally been conducted on entrepreneurship, in terms of supporting the creation of sustainable food production and consumption, particularly concerning the business model of organic food producers [108] and the efforts of food bank actors to reduce food waste [109]. In the subsequent period, between 2020 and 2023, topics that have been studied for a long time remained in focus such as organic foods, consumer attitudes, willingness to pay and food production. Several new issues additionally emerged, such as innovation, food security, social responsibility, willingness to pay, sustainable supply chain, water footprint and life cycle assessment.

3.1.4. Trend Topics

The analysis of the major terms per time (Figure 5) provided a more detailed display of the current trends by year. The bubbles and lines in Figure 5 represent the trending terms or keywords extensively studied between 1990 and 2023. The larger the bubble size was, the more frequently the term appeared in publications throughout the specified period. In addition, the line length indicated how much time was spent discussing the given topic. The "sustainable" term had the largest bubble size and became popular in 2019, with 439 documents containing this keyword. The "organic" term was highly popular in 2016, with 411 publications. The direction of academic interest and the topics that were receiving the most attention during the last couple of years can be determined by examining the trending topics between 2019 and 2023. In 2020, the three most frequently used authors' terms were "food waste", "purchase intention" and "innovation". In 2021, SFC was primarily associated with "circular economy", particularly in research about food supply chains and the "theory of planned behaviour" for the fundamental theory was used to analyze consumer behavior. Life cycle assessment was an additional popular topic of conversation in 2021. This life cycle assessment was a bottom-up approach to assess whether the food production and consumption process is environmentally friendly or harmful, by evaluating the greenhouse gas emissions produced at each stage of a life cycle [110].

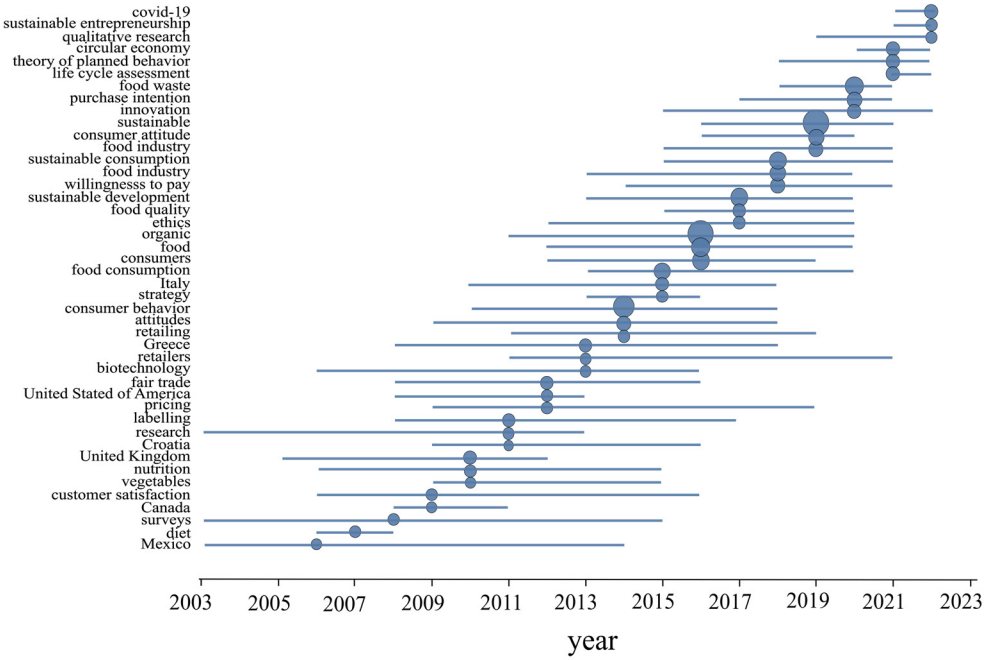


Figure 5. The Most Frequent Terms with Respect to Time. Source: Developed by Authors.

In 2022, three emerging trends were related to "COVID-19", "sustainable entrepreneurship" and "qualitative research". The keyword "COVID-19" continued to be a popular subject of study even in 2022, particularly concerning food security and changes in food consumption behavior during the pandemic and post-pandemic periods [111,112]. Due to a change in consumer behavior in which it became more comfortable to use technology for gathering information, purchasing food and making contactless payments during the pandemic were largely viewed as an opportunity for businesses in the food sector to be involved as cyber entrepreneurs [113]. Efforts to achieve environmental sustainability cannot rely solely on changes in consumer consumption behavior; sustainable food production additionally requires the participation of entrepreneurs; therefore, the topic of sustainable entrepreneurship needs to be further explored. In pieces of research related to SFC, especially when researching the aspects of consumer behavior, quantitative methods were widely used, especially in the form of surveys. However, in 2022 eight qualitative studies were published only to enrich theory building [114].

3.2. The Most Relevant Authors, Documents and Sources

3.2.1. The Most Relevant Authors

To determine the most influential authors, it was necessary to examine which authors published the most SFC articles and who received the most citations, as seen in Table 1. So as to enrich the understanding of the SFC topic studied by the leading authors and their journal publications, the information from the so called "three-fields plot" can additionally be utilized (Figure 6). The three-fields plot, visualized with a Sankey diagram, illustrates the relationship between the top 10 authors in the middle section, the most popular sources in the left panel and the research keywords on the right side of the plot. The size of the box on the Sankey diagram shows the frequency of recurrence. Sankey diagrams are mainly used to show the quantitative linkages between information and their transformations [115]. Wang was the most productive author on the subject of SFC, who was active between 2013 and 2023 with a total of 15 publications and received a total of 699 citations for all of his works. Figure 6 shows that organic foods [83,116–119], food waste [120,121], sustainable development [122,123] and food security [124] were the primary sub-themes of Wang's publications. Most of Wang's articles were published in the British Food Journal and in the Journal of Cleaner Production. Regarding the number of

citations, Thøgersen ranked first with 1156 citations in 13 publications published between 2006 and 2022. Thøgersen's research focused on sustainable consumption in general. The factors of purchase intention of organic foods were studied in various countries, including Thailand [81,125], China [126–128], Germany [125] and Brazil [127]. Krystallis discussed the organic food market and investigated the factors that contributed to the willingness to pay for organic food in the Greek market [129–133]. Furthermore, the research context was increasingly developing with respect to the consumer attitudes towards organic foods in Brazil [129,134], China [135] and Italy [136].

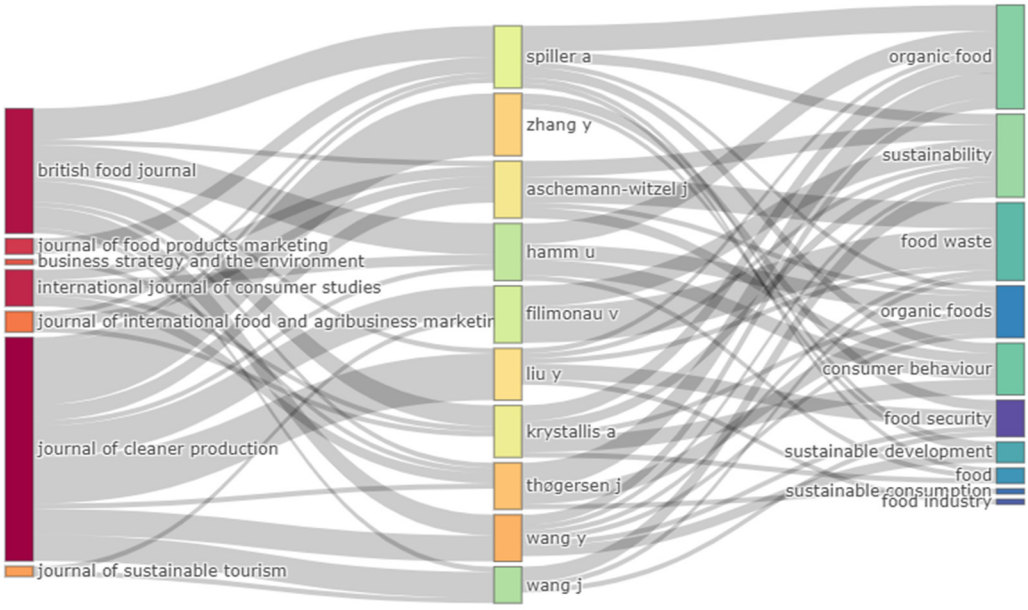


Figure 6. Three-Fields Plot. Source: Developed by Authors.

3.2.2. Corresponding Author's Country and Collaboration Network

The Corresponding Author's Country section lists the corresponding author's origin. The countries and collaboration networks of the corresponding authors will likely improve our understanding of which researchers are most committed to SFC. The corresponding author is responsible for communicating with the journal that publishes his or her work and other interested researchers. Figure 7 and Table 2 show the ten countries of origin of the corresponding authors and whether the research was conducted in collaboration with researchers from the same country (single country publication (SCP)) or with researchers from other countries (multi country publication (MCP)). The top ten countries of origin of the corresponding authors in this list additionally play a significant role in producing organic food and additionally serve as the global destination markets for organic product sales. Italy, one of the countries in the European Union with the largest organic product area, had the most corresponding authors. From the year of 1990 to 2023, Italy produced 183 single country publications; however, only 7 articles were from international collaborations. The United States is the country with the largest retail market for organic food in the world, accounting for 40 percent of the total retail sales worldwide [137]. It occupied the second place in the ranking of the countries of the corresponding authors. As one of the pioneering countries in the production and consumption of organic products, the United Kingdom ranked third with respect to the countries of the corresponding authors with 151 single country publications and 15 multi country studies as a result of the large amount of collaborative research compared to other countries on the list. In contrast to the top three countries, which are developed countries, the fourth place was occupied by a developing country, namely China, which is the biggest supplier of organic products to European countries, and this country itself additionally has the third largest market share for organic products in the world. The next place in the rank list was held by Germany, the

country with the largest market for organic products in the European Union. Australia and India ranked seventh and eighth, respectively, since Australia is the country with the largest organic agricultural land in the world, and India is the country with the largest number of organic producers in the world in 2022 [137].

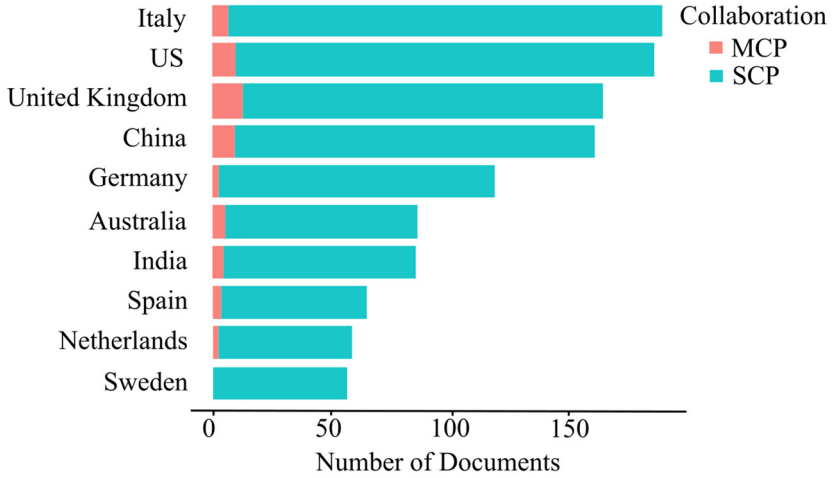


Figure 7. Corresponding Author's Country. Source: Developed by Authors.

Table 2. Collaboration Based on the Corresponding Author's Country between 1990 and 2023.

	Country	Articles	Single Country Publications (SCP)	Multiple Country Publications (MCP)
1	Italy	190	183	7
2	US	186	176	10
3	United Kingdom	166	151	15
4	China	161	150	11
5	Germany	119	116	3
6	Australia	87	81	6
7	India	86	82	4
8	Spain	65	61	4
9	Netherlands	59	55	4
10	Sweden	55	55	0

The structure of research collaborations between countries can be seen in Figure 8. There were three large research clusters and some smaller ones, as is evident. The largest (green) cluster in Figure 8 had the most member countries. The top three countries of corresponding authors, namely Italy, the United States and the United Kingdom were members of this cluster. In addition to the cooperation between the three major nations, there were additionally research collaborations with other European nations, such as Switzerland, Ireland, Finland, Spain, France, Belgium, Poland, Romania, Croatia, Lithuania and Greece, as well as with countries of the American continent, such as Mexico and Colombia. The second (red) cluster had fewer nodes, and its size was smaller than the first cluster, indicating that fewer countries were involved in research and collaboration from this cluster. India, Australia, Spain, the Netherlands, Saudi Arabia, Malaysia and Indonesia collaborated in the red cluster. The third (blue) cluster had relatively fewer nodes, indicating that there were fewer international country collaborations compared to the previous two clusters. This group included China, Germany, South Africa, Ghana and Ethiopia. China collaborated not only with countries in the same cluster however additionally with the United States, Pakistan and Australia, which were in separate groups.

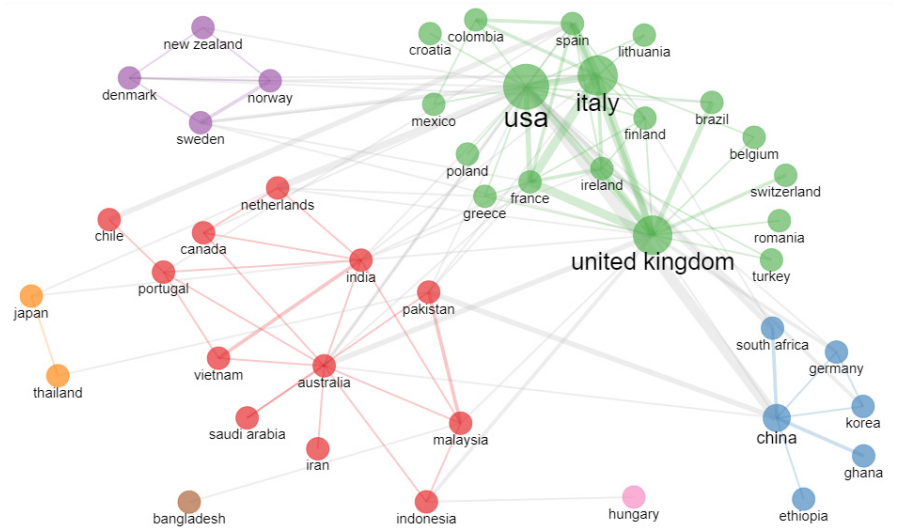
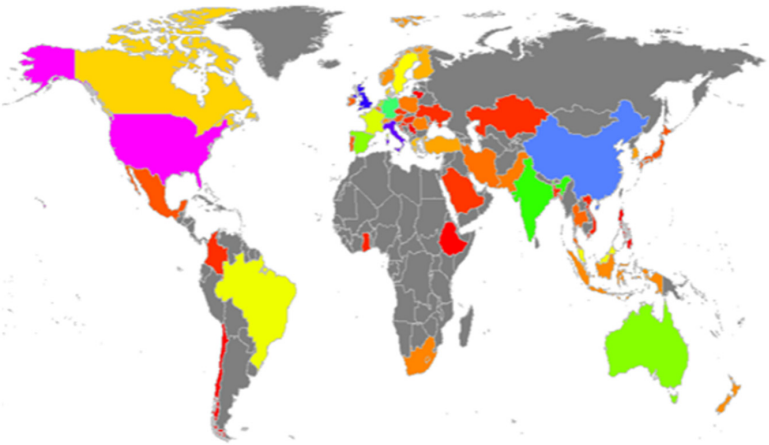


Figure 8. Country Collaboration Network. Source: Developed by Authors.

Apart from the examination of the corresponding author's country and collaboration network, the understanding of the scientific production of each country additionally needs to be reviewed, namely in relation to the number of publications produced on a related topic in a country during the study period as shown in Figure 9. The top 10 rankings of the countries with the largest production were very similar to the top 10 rankings with respect to the corresponding author's country. The United States ranked first among the most productive nations, producing 287 documents during the study period. Italy and the United Kingdom, both member states of the European Union, have published 241 and 233 articles, respectively, between 1990 to early 2023. China took the fourth place, with 207 publications on organic food, gas emissions from production and consumption processes and food security. In the fifth to eighth places, each country produced approximately 100 documents, especially Germany (134), India (116), Australia (101) and Spain (100).



Country	Tp	%Tp
USA	287	12.7%
Italy	241	10.6%
UK	233	10.3%
China	207	9.1%
Germany	134	5.9%
India	116	5.1%
Australia	101	4.5%
Spain	100	4.4%
Netherlands	98	4.3%
France	75	3.3%

Figure 9. Country Scientific Production. Source: Developed by Authors.

3.2.3. The Most Locally Cited Documents

Table 3 displays the ten most influential SFC-related articles, based on the number of local and global citations they received. The local citations represent the number of times the article was cited by the 2265 articles analyzed in this study. In contrast, the global citations represent the number of times the document was cited in the Scopus and Web of Science databases, including citations by other pieces of research in various scientific fields. Table 3 reveals that, in general, the global citation number for the ten documents was significantly greater than the number of local citations. This underlines that the impact of these papers

was not limited to pieces of research on the subject of SFC however additionally impacted interdisciplinary research, especially concerning sustainable themes. The ten documents with the most local citations ranged in age from seven to seventeen years, and the top three publications were literature reviews. The document that received the highest number of local citations was written by Maloni and Brown (2006) [138], regarding the implementation of corporate social responsibilities in the supply chain aspects of companies engaged in the food industry, which had 11 local citations and 528 global citations. The majority of the topics discussed in the most locally cited documents were related to sustainable food supply chains, namely in publications by Maloni and Brown (2006) [138]; Beske et al. (2014) [139]; Van Der Vorst et al. (2009) [140]; Validi et al. (2014) [141]; Grekova et al. (2014) [142]; and Wilhelm et al. (2016) [143]. In addition, researchers of the topic of SFC have paid attention to consumer behavior toward organic food consumption, particularly the articles by Rana and Paul (2017) [104] in second place and Pivato et al. (2007) [144] in fifth place.

Table 3. The Most Locally Cited Documents.

Author Code	DOI	Year	Local Citations	Global Citations
[138]	10.1007/s10551-006-9038-0	2006	11	528
[104]	10.1016/j.jretconser.2017.06.004	2012	7	290
[139]	10.1016/j.ijpe.2013.12.026	2014	7	530
[140]	10.1080/00207540802356747	2009	6	305
[144]	10.1111/j.14678608.2008.00515.x	2008	4	350
[141]	10.1016/j.ijpe.2014.02.003	2014	4	202
[142]	10.1016/j.ijpe.2013.12.019	2014	4	49
[145]	10.1007/s10551-014-2047-5	2015	4	408
[143]	10.1016/j.ijpe.2016.08.006	2016	4	145
[146]	10.1108/IJCHM-03-2015-0163	2016	4	66

3.2.4. The Most Relevant Sources

Analysis related to the most relevant sources can be used for researchers who want to find relevant sources related to the SFC topic, or for researchers who want to publish their work that is connected to the SFC topic. Figure 10 depicts the journal sources with the most published articles and citations by researchers on sustainable food consumption. The Journal of Cleaner Production, British Food Journal and International Journal of Consumer Studies were the top three journals that produced the most articles and served as the most important reference sources for research on the SFC topic. In the next sequence, journals that published many articles on the SFC theme as well were the Journal of Food Products Marketing, Journal of Retailing and Consumer Services and Business Strategy and the Environment from the subject area of business and management.

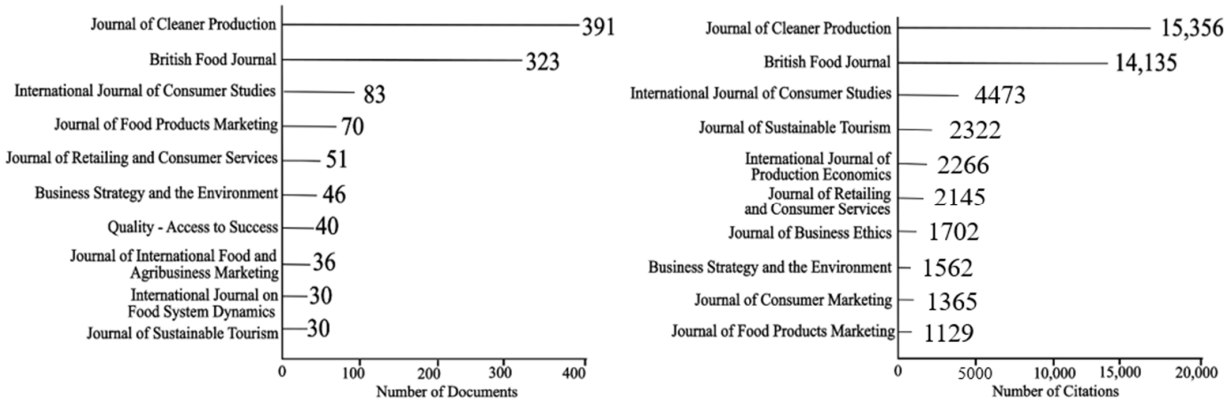


Figure 10. Top Ten Sources with the Most Publications and Local Citations. Source: Developed by Authors.

3.3. Topic Reccomendation for Future Research

3.3.1. Thematic Map

To address the recommendations for future research topics, we should analyze the sub-topics' position on the thematic map. Thematic maps, additionally called strategic maps, represent the position of the authors' keywords and group them into several study clusters [147,148]. The *X*-axis indicates the significance or centrality of the study's topic. The *Y*-axis represents density, which measures the progression of the theme [149]. Throughout the whole study period, there were four core clusters, and each quadrant was occupied by one or two main clusters. Figure 11 depicts a thematic map with four primary quadrants as follows:

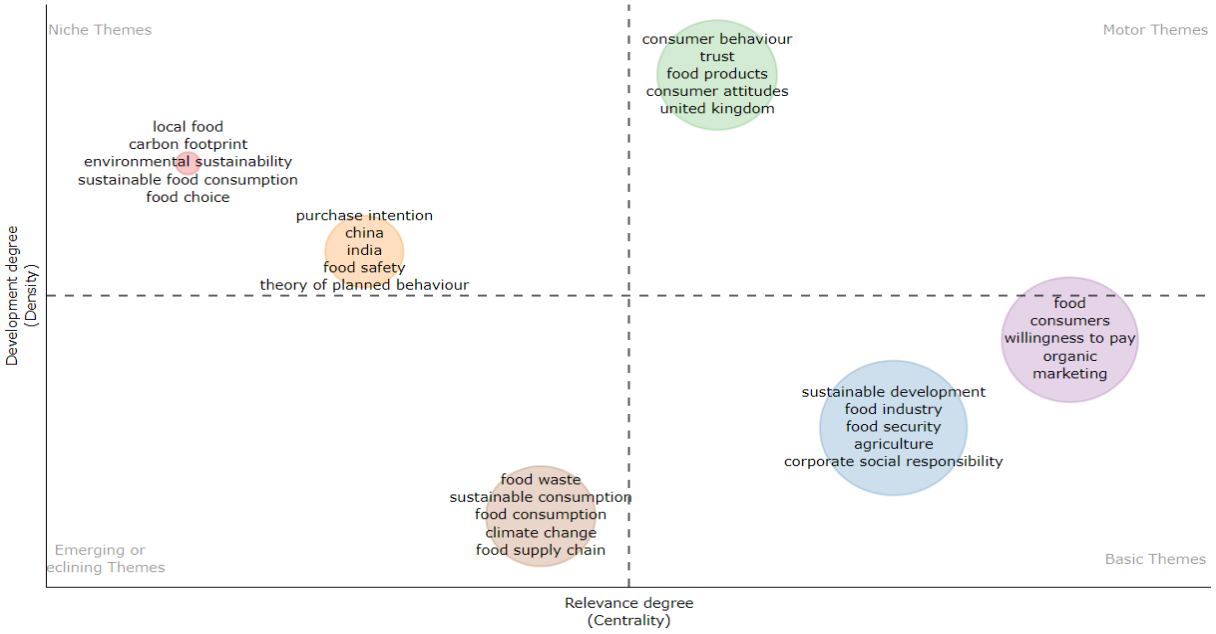


Figure 11. Thematic Map. Source: Authors' Own Construction.

The first and upper right quadrant contains the motor themes with a high degree of relevance and development, indicating that the research topics in this quadrant are well-developed and significant for the knowledge domain. These motor themes are consumer behavior and attitudes, trust, food products and the United Kingdom. The SFC sub-topic is associated with both a positive attitude towards SFC and the realization of SFC behavior. Often there is a gap between the attitude and the real behavior; therefore, many studies were looking for ways to reduce the attitude–behavior gap in SFC [34,89,134,150–155]. Most of these pieces of research were focused on consumers in the United Kingdom as a developed country. In addition, publications produced in the United Kingdom received the highest total citations. Hence, the degree of centrality related to the topic of "United Kingdom" was high.

The second quadrant is the top left quadrant, which is additionally known as niche themes with a high degree of density however a low degree of centrality or limited significance for the field [156]. In this quadrant, there are two main clusters. The first one is located on the upper left side, with a smaller bubble size and includes the topics of local food, carbon footprint, environmental sustainability, sustainable food consumption and food choice. Indeed, research on local food as a type of SFC was less popular than research on organic food. Local food was frequently associated with a competitive advantage as a tourist attraction, because it sells authenticity and is expected to have a smaller carbon footprint than imported food products, and it can additionally boost the local economy [19,73,78,95,97,157]. Environmentally friendly production without chemicals cannot be guaranteed in local food, unlike organic food, which has received a certification for its

environmentally friendly production process. Local food research is always less popular than organic food research for this reason. The second larger bubble contains topics about purchase intention, China, India, food safety and the theory of planned behavior. These were well developed topics, yet with a rather low number of research citations. Carbon and water footprints should additionally be mentioned in connection with food production and consumption processes, since this is one of the main topics from 2020 to 2023. This quadrant contains topics with a lower degree of centrality, possibly because these are relatively new topics with a low citation count.

The lower left quadrant, additionally known as the emerging or declining theme quadrant, contains study topics with low centrality and density, indicating that the development of the topic is limited. Topics that belong to this cluster include issues regarding food waste, sustainable consumption, food consumption, climate change and the food supply chain. According to the authors, these are not declining topics; instead, they are emerging study topics, particularly research related to food waste, which has become a topic of interest in 2020 and merited ongoing consideration when discussing SFC. Since the consumption process includes not only the purchase or consumption of food however including the disposal of food waste as well, it is necessary to consider a reduction strategy to prevent environmental pollution. The food supply chain had a low degree of development, possibly as a result of the barriers for researchers to obtain information related to the supply chain process, which is highly dependent on the disclosure of information provided by producers and the data collection process, which is relatively time-consuming and more costly than conducting consumer surveys.

The fourth quadrant on the lower right is the basic theme quadrant, which involves research topics with a high level of relevance however a low level of development, indicating that these themes are significant for a study field and cover general topics across multiple research areas. In this quadrant there are two main clusters, and the first has a higher relevance and development degree than the other clusters in the same quadrant. This cluster contains consumption-related topics such as food, consumers, willingness to pay, organic foods and marketing. The other cluster is centered on the aspects of food production and is dominated by the topics of sustainable development, food industry, food security, agriculture and corporate social responsibility.

3.3.2. Upcoming Research Agenda

From the thematic map, we can conclude that the themes in the quadrants labelled "emerging themes" and "niche themes" can be further developed. In order to achieve sustainable food consumption, the topics that need to be researched are not limited to attitude, willingness to pay and behavior in regard to purchasing organic food, which have been studied in many pieces of research in countries with matured organic food markets such as the US, European countries, China and India. Antecedent variables of purchase intention that were widely discussed included clear food labels, internal aspects of consumers such as knowledge, perceptions of the country of origin, attitude, subjective norms, perceived behavioral control and aspects of consumption values such as universalism, hedonism or utilitarian values. Consumers in countries with matured organic food product markets, such as the United States and Europe, have different motivations for consuming organic food than those with a low organic food market share. The determinant factors for organic food consumption in developed countries are self-actualization, concern for the environment and consumption values.

The antecedent variables that significantly affect organic food consumption in developed countries can be significantly different from those that influence consumer decisions in countries where most consumers are less familiar with organic food. Due to the limited and relatively expensive availability of organic food products, low consumer knowledge and government regulations that do not regulate many aspects of environmentally friendly food production, research on consumer behavior must additionally be conducted in the context of countries with a low organic market share. Consumers in countries with a low

market share treat organic products as exclusive and expensive. Hence, their motivation for consumption in these countries is mainly due to the positive impacts of organic food consumption such as safety and positive health benefits. Sustainable food consumption can be achieved not only by consuming organic foods. There are several other ways towards sustainable food consumption, for example, the consumption of local or authentic foods with a minimal carbon footprint, reduced consumption of dairy and meat products, reduced food consumption with excessive plastic consumption, reduction of food waste and becoming a vegetarian or flexitarian. Therefore, there needs to be more in-depth research on the driving factors of and strategies for realizing sustainable food consumption apart from eating organic food.

The results of the bibliometric analysis indicated that most SFC-related research examined consumer behavior by using survey data collection. To complement studies on consumer behavior, it is necessary to conduct research on actual data concerning food waste, carbon footprint levels and greenhouse gas emissions originated from food production and consumption. It is possible to achieve sustainable food consumption and production for consumers, producers and the government as soon as regulators know the precise actions they must take. The achievement of sustainable food consumption can be measured by decreased carbon footprints, water footprints, greenhouse gas emissions and other environmental pressure indicators, and this low level can be maintained. Further research is required to determine what type of industry is the most environmentally unfriendly due to its high emissions and waste production and how to mitigate the damage caused by this sector.

Based on the above-mentioned factors, the following future prospects can be recommended:

(1) The study of alternative forms of action for realizing sustainable food consumption in countries with a low market share of organic products;
(2) The determination of factors that can move consumers in these countries to achieve sustainable food consumption;
(3) The detection of production and consumption processes that are the least environmentally friendly, with respect to the environmental pressure indicators;
(4) The search for alternatives and policies that must be implemented to reduce the environmental impact of specific industries and consumption processes.

4. Conclusions

The following findings can be drawn based on the analysis in this paper:

1. The historical evolution of SFC-related research can be divided into five phases: initial stagnation, infant growth, post-economic crisis, expanding phase and COVID-19 and post-pandemic stages. The number of publications on SFC topics has gradually been increased over the years, especially after the OECD ratified the standard definition of sustainable consumption in 2002. The COVID-19 pandemic additionally influenced research in this area, particularly in examining how consumers consumed before and after the pandemic. Organic food, consumer behavior and sustainable production and consumption have been at the center of research throughout the different phases;

2. Based on the number of publications and citations, the most influential authors in the field of SFC were identified. Wang Y emerged as the most productive, whereas Thøgersen emerged as the most cited. These authors have been significant contributors to the research on organic food, consumer behavior and sustainable development. The analysis additionally revealed the corresponding authors' countries of origin and collaborative networks, with Italy, the United States and the United Kingdom as the most prominent countries;

3. Based on the analysis of the thematic map, several recommendations can be made for future research. Firstly, research is needed into the drivers of and strategies for sustainable food consumption beyond organic food, especially in countries where the market share of organic products is low. Different motivations and barriers may influence consumer behavior in these contexts. In addition, research should focus on actual data on food waste,

carbon footprints and greenhouse gas emissions to complement studies on consumer behavior. Targeted policies and interventions to reduce environmental pressures can be developed by understanding the environmental impacts of specific industries and consumption processes. Overall, advancing the SFC field requires interdisciplinary research combining insights from consumer behavior, production processes and environmental indicators.

This paper's findings will benefit researchers and scholars in sustainable food consumption (SFC), as it provided insights into the historical development of SFC research, identified influential authors and emphasized critical areas for future studies.

Limitations

The findings point to several directions for future research on sustainable food consumption, with regard to reducing the use of natural resources, harmful materials, waste and environmental pollutants. The lack of research in emerging countries indicates a vacuum that needs to be bridged, in order to have a more thorough understanding of the issue. The social and economic ramifications of using alternative diets and proteins are currently being given greater attention in the research, in addition to the environmental effects of consuming conventional food, which has previously been extensively examined. As a result, the potential social and economic effects of alternative products (plant-based meat; cultured meat) might spur new research directions in the field of sustainable food consumption, such as determining how the knowledge of such effects influences a consumer's food consumption reduction or how social impacts can lead public and private actors' communication tactics on consumption reduction issues.

This paper has several limitations: Firstly, the bibliometric analysis only examined factors associated with sustainable food consumption in developing nations; however, it neglected food loss and waste, which is a crucial component of sustainable food consumption. Secondly, the scope of the bibliometric analysis was not extended to sustainable food production, which is linked to sustainable food consumption. During the life cycle of a product, sustainable food production fulfils fundamental needs and minimizes the use of natural resources, harmful materials, waste and pollutants. Thirdly, this report omits in-depth case studies that describe the effects of sustainable food consumption beyond underdeveloped and developed nations. Fourthly, the analysis moreover largely ignored additional, unpublished grey literature sources in favor of secondary published papers in the Scopus metadata database and the Web of Science. This implies that some important and relevant studies might have been overlooked in this study. Furthermore, bibliometrics have several inherent limitations; for example, they do not reflect a scholarly journal's quality while distinguishing between cited and uncited documents.

Author Contributions: Conceptualization: K.K. and Z.B.; formal analysis and methodology: K.K. and S.K.; software: S.K.; visualization: K.K.; writing (draft article) K.K. and M.F.R.; writing (review and editing): K.K., S.K., M.F.R. and Z.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethics approval was not required for this study.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data will be made available on request.

Conflicts of Interest: The authors declare no conflict of interest.

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