



Climate change and marketing: a bibliometric analysis of research from 1992 to 2022

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Abstract

Climate change with adverse impacts on the environment, economy, and society requires marketing to change current attitudes and behaviors towards sustainable production and consumption, and thus climate change is interrelated to marketing. However, no body of literature has comprehensively investigated the connections and relationships between climate change and marketing. This study examined such connections and relationships from a bibliometric approach using Web of Science and Scopus databases from 1992 to 2022. The search strategy utilized topic and title/abstract/keyword search. The search query retrieved 1723 documents. VOSviewer and Biblioshiny were utilized to analyze data on authors, keywords, institutions, countries, sources, citations, and co-citations. The findings showed an upward trend in the annual number of publications with the top three most productive countries being the USA, the UK, and Australia and the most productive institutions in the USA, New Zealand, and the UK. The top three author keywords were climate change, sustainability, and marketing. The *Sustainability* journal ranked first in terms of productivity while *Energy Policy* in terms of citations. International collaborations were mostly between developed countries also known as Global North Countries, and collaborations between these countries and developing and developed countries should be encouraged. During the COVID-19 pandemic, the number of documents increased, and research themes altered. Research on energy, innovation, insect farming, and carbon management is a top priority. The results proved that most studies were conducted outside the field of marketing.

Keywords Climate change · Marketing · Bibliometric analysis · Bibliographic coupling · Co-citation analysis

Introduction

Unsustainable extraction of natural resources and economic growth due to rapid industrialization pose environmental threats such as global warming and climate change. The world is warming up as the energy going into space decreases with the increase of greenhouse gases in the atmosphere, and the consequent global warming has eventuated in radical changes in the world's climate, called climate change. Hand in hand with global warming and other environmental threats, climate change threatens human life and health on vital issues such as drinking water, clean air,

food, and shelter. Severely affected by the adverse effects of climate change, people all around the world have become more conscious of this global problem and have settled down to handle it.

The COVID-19 period has advanced public awareness of climate change and the importance of living sustainably. Because of restrictive measures such as lockdowns and movement restriction directives, business and financial operations have been suspended or reduced (Dass 2021). Recently, there has been general agreement on the need to reduce resource use, energy consumption, and carbon emissions, but there is no consensus on whether reducing or changing consumption will increase consumers' contribution to resource conservation. In this context, the sustainable marketing trend incorporates sustainability into basic marketing strategies and actions. Through sustainable marketing, companies can encourage the development of a resource-efficient way of consumption that includes the reduction of consumption and waste and its acceptance by

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consumers. In this respect, marketing contains potential solutions to some of the sustainability problems encountered today, such as climate change (Calvo-Porrall 2019), and it has attained several forms like social marketing and green marketing (Vazifehdust et al. 2011) which can be considered within the scope of sustainable marketing (Gordon et al. 2011; Murphy 2005; van Dam and Apeldoorn 1996). Sustainable marketing refers to “the process of planning, implementing, and controlling” the marketing mix elements of products by meeting consumer needs, achieving company goals, and adapting this process to ecosystems (Fuller 1999, p. 4), and places the marketing concept within the sustainable economic development (van Dam and Apeldoorn 1996, p. 46). It covers marketing activities that contribute to the conservation of biodiversity and persuades consumers that the promoted products/services are produced with renewable energy sources, thus decreasing the rate of greenhouse gas emissions and environmental pollution. Social marketing is a term first coined by Kotler and Zaltman in 1971 with an emphasis on the marketing mix and process for societal benefits (Kotler and Zaltman 1971, p. 5) and addresses “the application of commercial marketing technologies to programs designed to influence the voluntary behavior of target audiences to improve their welfare and that of the society of which they are a part” (Andreassen 1994, p. 110). Some of the key characteristics identified through the analysis of different definitions of the term “social marketing” are that social marketing centers upon voluntary behavior change and that the primary aim of social marketers is to stimulate that change by turning the attention of the consumers onto the benefits gained through behavior change (MacFadyen et al. 2012, p. 698). In doing so, social marketing points to the benefits not only to consumers, but also to society at large (Bloom and Novelli 1981, p. 79).

As a holistic and integrated approach, green marketing is a concept in the sustainability literature that constantly re-evaluates how companies achieve their corporate goals and meet consumer needs while minimizing long-term ecological damage stemming from carbon footprint, mis-breeding, or unsustainable food consumption patterns. The concept of green marketing was first discussed in a seminar at the American Marketing Association (AMA) in 1975 and came into literature in the late 1980s (Peattie and Crane 2005). One year after, Hennion and Kinnear (1976) turned the seminar into a book called “Ecological Marketing.” Hence, green marketing finds its basis in the concept of ecological marketing, defined as all marketing activities that help mitigate and restore environmental problems (Hennion and Kinnear 1976). Since then, awareness of green marketing has been increasing rapidly, and consumers are responding favorably to brands that promote environmental responsibility. Consumers make their purchasing decisions by considering the environmental and ethical concerns and are more

conscious of the environmental and social consequences of their consumption (De Chiara 2016). According to a study conducted by First Insight (2019), nearly 90% of Generation X consumers are willing to spend an extra 10% or more for sustainable products. A significant proportion of consumers are willing to pay for sustainability, which shows that there is a market for “green mission-driven” companies and why we are seeing an increase in sustainable companies around the world (Simon-Kucher and Partners 2021; Pope, 2021)

The task of creating a sustainable market is entrusted to the marketing function of commercial organizations. In a sustainable market, it is a priority for consumers to adopt green products, shift their purchasing preferences from traditional products to contemporary green products, and be willing to contribute to the improvement process of ecology. Therefore, the marketing function of commercial organizations plays an important role in promoting cleaner production and sustainable consumption (Kaur et al. 2022). The emergence and development of green marketing is associated with an increase in the number of sensitive consumers. Like the concept of green marketing, the concept of green consumer has also taken its place. Brands have also implemented a kind of “green advertising strategy.” Zinkhan and Carlson (1995, p. 1) define green advertising as a type of advertisement in which highly sensitive sustainable ecology-oriented messages are used, to the needs of the consumer, such as environmental concerns and health problems.

Green advertising is a controversial concept, which has been highly disputed in the literature so far. On the one side, it was criticized by some scholars (Carlson et al. 1993; Davis 1993; de Freitas Netto et al. 2020; Fernando et al. 2014; Naderer and Oprea 2021; Parguel and Johnson 2021; Polonsky et al. 1998) as a misleading and deceptive way of promoting products and/or services with a so-called commitment to the consumers’ sensitivity to the environmental issues by seemingly adhering to the requirements of green consumerism, which means the individual preferences of consumers to use less clustery damaging products/services (Holder 1991, p. 323), and thus as a way of greenwashing (Furlow 2010, p. 23; Gephart et al. 2011, p. 20; Kärnä et al. 2001, p. 59; Parguel and Johnson 2021, p. 59; Yılmaz and Baybars 2022, p. 122). On the other side, some authors (Agarwal and Kumar 2021; Iyer and Banerjee 1993; Kärnä et al. 2001; Segev et al. 2016) addressed it as a kind of advertising which companies apply to deliver honest messages and claims regarding their initiatives to lessen the impact of their brands and products on the environment. In this regard, Nguyen Viet and Nguyen Anh (2021) highlighted the importance of communicating honest and transparent messages through advertising by providing information about the positive impact of advertising on brand trust. When customers see ads, they gain a sense of trust and extend brand expectations (Fernandes et al. 2020). Most scholars agree on the

crucial role of green advertising in marketing. However, the effectiveness of environmental claims in advertising on consumers' trust and perception of green advertising remains unclear (Kao and Du 2020; Kong and Zhang 2014; Schmuck et al. 2018; Tee et al. 2022; Wang et al. 2020).

Another significant contribution to the green marketing literature came from Ottman (1993), who identified two main goals for green marketing in 1993. The first of these is that products are developed with minimal change to the environment and society and combine the convenience of price/performance with the needs of the consumer. The second goal is to include high quality both because of the features of the products and because the manufacturer acts according to the rules and regulations, because of containing all environmental elements. For green marketing research trends and future projections, five notable predictions and trends drawn from a recent study are the low carbon economy; research from emerging economies; greenwashing; green consumerism; and eco-innovation (Saleem et al. 2021, p. 17). These trends are important because of their ability to form the basis of what needs to be focused on urgently in the coming periods in integrated marketing activities.

Every act of consumption will have an impact on the environment. In this context, marketing can be used to change consumers' attitudes and activities. Marketing helps transform the cultural values of consumption to address environmental issues, raises awareness about the environmental impact of consumption, and promotes sustainable ways of consumption. However, the relationship between marketing with sustainability is not very clear. On the one hand, marketing promotes unsustainable demand levels and unsustainable consumption patterns, and, on the other hand, it produces mechanisms to overcome environmental problems. It focuses on promoting increased and unsustainable consumption. From a different perspective, marketing has the power to influence and change the behavior of consumers. Through sustainable marketing, companies integrate sustainability into their core marketing strategies and actions; if product design and development, production, distribution, and promotion are sustainable, consumption and waste can be decreased (Calvo-Porrá 2019, p. 268). Sustainable communication techniques and approaches have been adopted to improve consumer responses to sustainable brands. Several green marketing strategies and tools are used to promote brands' sustainable characteristics to consumers (Gaspar Ferreira and Fernandes 2022, p. 20).

The number of academic publications in this field is increasing rapidly, and it is becoming more impossible to be aware of every published research. For this reason, this study aims to present the scientific activities and general trends in climate change and marketing literature with a holistic approach. To provide statistical and factual information, bibliometric analysis was performed on scientific

documents exported from the Web of Science (WoS) and Scopus databases for 30 years (1992 and 2022).

Many bibliometric studies (Hu, Becken and He 2022; Kovaleva, Filho and Borgemeister 2022; Zhong et al. 2022; Okolie et al. 2022; see Table 1 for other prominent examples) address sustainability and climate change on various subjects. As is evident from the limitation statements of some of the bibliometric studies listed in Table 1, previous bibliometric studies lack significant aspects of the field by either extracting documents from a single database, refining the search to only one document type, or considering only a few indexes for analysis. However, this study, separating itself from others by conducting bibliometric analysis of several document types indexed in many indexes on Scopus and WoS, presents an extensive review on climate change and marketing studies, and identifies and monitors developments related to these two concepts. By identifying key and emerging issues, we aim to make a detailed contribution to better understand the climate change and marketing literature and to discuss gaps to be filled by further studies. In line with this purpose, we seek an answer to the following research questions:

RQ1. What are the main topics discussed in the climate change and marketing literature?

RQ2. What are the emerging and niche topics to be further addressed in future studies?

Methodology

The study attempts to explain the academic background and general and emerging trends in the climate change and marketing literature. As justified in many other studies (Sweileh 2020; Saleem et al. 2021; Zhang, Yu and Li 2021; Kovaleva, Filho and Borgemeister 2022; Kumar Kar and Harichandan 2022; Phan Tan 2022; Zhong et al. 2022), bibliometric analysis is reliable and useful for identifying the main and emerging trends of any discipline or academic field. A bibliometric analysis was conducted to examine the key authors, countries, institutions, publishers, and keywords. The reason for choosing this research method is that the quantitative approach in bibliometric techniques limits subjectivity, is replicable, enables a more exhaustive analysis (Sarkar and Searcy 2016 p. 1425), and serves as a guide to evaluate publication success while explaining the structural dynamics of the study subject (Taddeo et al. 2019; Kumar Kar and Harichandan 2022, p. 2). The use of bibliometrics as a quantitative/statistical method (Saleem et al. 2021, p. 3) has spread to various disciplines over time and enables researchers observe the emerging and future trends in single or across multiple disciplines.

Table 1 Some remarkable interdisciplinary studies on climate change and marketing

Authors, year, and title	Findings and limitations	TC
Okolie et al. (2022) Climate-smart agriculture amidst climate change to enhance agricultural production: a bibliometric analysis	Findings: Increasing agricultural productivity, ending hunger, eradicating poverty, and improving people's well-being in the face of climate change can be achieved through climate-smart agriculture Limitations: Made using articles indexed in Scopus. Also contained documents that may not be required for review	N/A
Hu, Becken, and He (2022) Climate risk perception and adaptation of tourism sector in China	Findings: More people visit the tourism information site when it is rainy, cloudy, summer, or working day Limitations: There are some limitations in applying the results to other regions due to regional characteristics, and the study period is limited to one year	N/A
Dinesh et al. (2021) Enacting theories of change for food systems transformation under climate change	Findings: Nine priority areas for transformation in food systems under climate change: (1) empowering farmer and consumer organizations, women, and youth; (2) digitally enabled climate-informed services; (3) climate-resilient and low-emission applications and technologies; (4) innovative financing; (5) reshaping marketing and purchasing; (6) promotion of facilitating policies and institutions; (7) knowledge transfer; (8) fragmentation of information and innovation systems; (9) food safety Limitations: Agriculture lags behind other sectors in the implementation of digital tools and services, which is a significant opportunity for transformation	16
Milán-García et al. (2021) Climate change-induced migration: a bibliometric review	Findings: There has been a steady increase in the number of articles published and citations received during the period under review. The most productive countries of the USA, England, Germany, and China are North American organizations that support and promote research on these issues Limitations: The study is limited to articles in WoS and Scopus	11
Sharifi et al. (2021) Three decades of research on climate change and peace: a bibliometrics analysis	Findings: Research has grown steadily since 1990, but trends have picked up rapidly since the publication of the IPCC assessment report in 2007. Four main thematic focus areas were identified: (1) war and violent conflict, (2) conflicts, (3) disasters that can lead to major human displacements and other climatic impacts, (4) political tensions and institutional mechanisms to deal with water resource conflicts/cooperation Limitations: Other events, such as crime and other forms of social conflict and violence, are out of focus	25
Gordon et al. (2018) Empirically testing the concept of value-in-behavior and its relevance for social marketing	Findings: Consumer profile with high behavioral value perception and energy efficiency has a significant and positive relationship Limitations: More research is needed in other consumption contexts such as health and well-being, ethical consumption, and sport and wellness	79
Tigchelaar et al. (2018) Future warming increases probability of globally synchronized maize production shocks	Findings: Increasing instability in the global grain trade and international grain prices affects approximately 800 million people, especially those living in extreme poverty. There is an urgency to investments in breeding for heat tolerance Limitations: CO2 fertilization effects have been excluded from analysis	309
Eagle et al. (2017) Social marketing strategies for renewable energy transitions	Findings: Attitudes towards renewable energy are overwhelmingly positive, driven by economics and altruism Limitations: The article attempts to address the challenges of renewable energy technologies from only social sciences perspective	17
Grote (2014) Can we improve global food security? A socio-economic and political perspective	Findings: Three main areas of action have been identified that are important for ensuring future food security: (i) sustainable intensification, (ii) food system changes, and (iii) policy reforms with increased consumer awareness Limitations: Only secondary literature is considered for evaluation. No original research is conducted	117

Table 1 (continued)

Authors, year, and title	Findings and limitations	TC
Wang et al. (2014) An overview of climate change vulnerability: a bibliometric analysis based on Web of Science database	Findings: The results show that climate change vulnerability research has increased rapidly since 2006, with publications being widely circulated in several source journals, with the two most productive institutions being the University of East Anglia and the Potsdam Climate Institute. The most focused research topics are health problems in the socioeconomic system, food security and water resources management, etc. Limitations: Analyzes are based on the SCI-Expanded and SSCI database from WoS, which does not include all literature in this area from 1991 to 2012	195

Data acquisition and search terms

This study analyzes the climate change and marketing literature which encompasses academic studies published between 1992 and 2022. The data were obtained from the Web of Science (WoS) and Scopus databases. The WoS database was used as it covers 20,345 results for bibliometric documents published in 200 categories with information science library science (4625), computer science interdisciplinary applications (2378), environmental sciences (1697), and management (1542) at the top (Clarivate 2022c). Depending on the scope, databases are multi-disciplinary or subject specific. The most reliable and widely recognized databases for bibliographic data are Clarivate Analytics' WoS and Scopus (Mongeon and Paul-Hus 2016; Garrigos-Simon et al. 2018; Tabacaru 2019). WoS, created over 115 years ago as the world's first citation index by Dr. Eugene Garfield (Clarivate 2022b; Gasparyan et al. 2013, p. 1271; Kovaleva, Filho and Borgemeister 2022, p. 727), covers over 254 subject disciplines, more than 18,000 high-impact journals, over 180,000 conference proceedings, and over 80,000 books from around the world (Clarivate 2022a). Later, Scopus (provided by Elsevier in 2004) was utilized for data extraction since it is a source-neutral abstract and citation database with more than 23,452 peer-reviewed journals, 294 trade publications, and over 852 book series (De Groote and Raszewski 2012; Elsevier 2020; Faruk, Rahman and Hasan 2021).

The data were obtained from the two databases on December 31, 2022, by searching for the “climate change” and “marketing” topic in the WoS database and for “title, abstract, and keywords” search on Scopus. The WoS database search was filtered through eight indexes (Social Sciences Citation Index (SSCI); Science Citation Index Expanded (SCI-EXPANDED); Emerging Sources Citation Index (ESCI); Conference Proceedings Citation Index–Science (CPCI-S); Conference Proceedings Citation Index–Social Science & Humanities (CPCI-SSH); Book Citation Index–Science (BKCI-S); Book Citation Index–Social Sciences & Humanities (BKCI-SSH); Arts & Humanities Citation Index (A&HCI)), with no restrictions

on language, year, category, or document type. The search query only included the keywords “climate change” and “marketing.” No synonyms were considered for search query, as previous studies (Huang, Chen and Zhou 2020; Faruk, Rahman and Hasan 2021; Zhang, Yu and Li 2021; Liu et al. 2022; Maucuer et al. 2022) did in their bibliometric analysis of the literature. This process was carried out in this way to obtain an elaborate and comprehensive overview of the relevant literature instead of narrowing down the literature (Zyoud and Fuchs-Hanusch 2020), which in turn will not serve the research aim of this study. Another reason was that the keyword “marketing” cannot be degraded to any of its elements like “advertising,” “sales promotion,” or “pricing” (Blythe 2006; de Pelsmacker, Geuens and van den Bergh 2010; Belch and Belch 2018). Similarly, “climate change” cannot be a synonym of “global warming” since the latter is the cause of the former (Zhong et al. 2022).

The search query yielded 895 results on WoS and 1285 results on Scopus. The documents from WoS were extracted to .txt files, and those from Scopus were extracted to .bib files in order to merge into a single .xlsx file using R version 4.2.2 (Sebastian 2022). The R codes (Sebastian 2022) removed 454 duplicate documents from the merged .xlsx file. After merging the data obtained from databases into a single file, one of the authors checked the file for any other duplicates and removed the documents retracted ($N=2$) from the journals and the reprinted ($N=1$). Finally, 1723 documents remained for analysis.

Data management and analysis

The use of bibliometrix, an R-tool for comprehensive science mapping analysis (Aria and Cuccurullo 2017) provides an opportunity to present data graphically via category maps. For visualizing, mapping, and analyzing the subject's framework, identifying current and emerging research topics, and summarizing the most influential scholars and publications (Kumar Kar and Harichandan 2022, p. 2), Biblioshiny was used. Also, VOSviewer was applied to perform co-citation and bibliographic coupling analyses and

visualize the bibliometric networks (van Eck et al. 2010; Ding 2019; Chistov et al. 2021). Co-citation analysis is a technique for quantifying the relationships and connections between articles (van Eck and Waltman 2014). It is conducted to analyze and visualize the relationships between author's publications in a specific field and to create clusters of documents (Griffith et al. 1974; Mas-Tur et al. 2021; Small 1973). A co-citation occurs when a third publication cites two publications at the same time, and the strength of the co-citation relationship between these two publications increases as the number of publications citing these two publications increases (van Eck and Waltman 2014; Phan Tan 2022). Therefore, co-citations can identify key publications as well as distinct themes (Small 1973; Garfield 1979; Frerichs and Teichert 2021; Phan Tan 2022). Unlike co-citation analysis, which refers to one type of relationship in bibliometric networks, bibliographic coupling deals with the overlap in the reference lists of publications and occurs when two different publications cite the same third publication (Kessler 1963; Mas-Tur et al. 2021), and the bibliographic coupling relations between the publications increase in proportion to the number of references that the two publications use in common (Kessler 1963; van Eck and Waltman 2014; Phan Tan 2022). Through bibliographic coupling, the potential research themes can be identified (Phan Tan 2022).

Results and discussion

Over the past three decades, 1723 documents on the topic of “climate change” and “marketing” have been published by 4944 authors in 1007 sources. Publications were mainly in the form of research articles (66.5%), followed by review articles (9.8%), proceeding papers (9.7%), book chapters (7.6%), and editorial materials, notes, books, short survey, and letters (6.4%) (Table 2).

The languages of the publications varied greatly. They were mostly published in English ($N=1688$), followed by German ($N=13$), Spanish ($N=9$), French ($N=4$), Chinese ($N=2$), Italian ($N=2$), Portuguese ($N=2$), Bosnian ($N=1$), Czech ($N=1$), Dutch ($N=1$), Finnish ($N=1$), Japanese ($N=1$), Korean ($N=1$), Persian ($N=1$), Russian ($N=1$), Slovenian ($N=1$), and Turkish ($N=1$). It was also noteworthy that some papers ($N=6$) were written multilingually. Although the analysis points to a wide variety of languages and even multilingualism, English has been the dominant language as it is accepted as a universal language. In this case, as Morton (2007) points out, languages other than English should be included at a higher level to broaden the debate in the literature.

The most common authorship pattern is single authorship ($N=483$), followed by the collaboration of two authors

Table 2 Details of the search conducted, and information generated through WoS and Scopus databases

Attributes	Results
Period	1992–2022
Publications	1723
Authors	4944
Sources	1007
Countries	100
Institutions	2384
Cited reference	79,744
Cites per documents	20
Keywords	4761

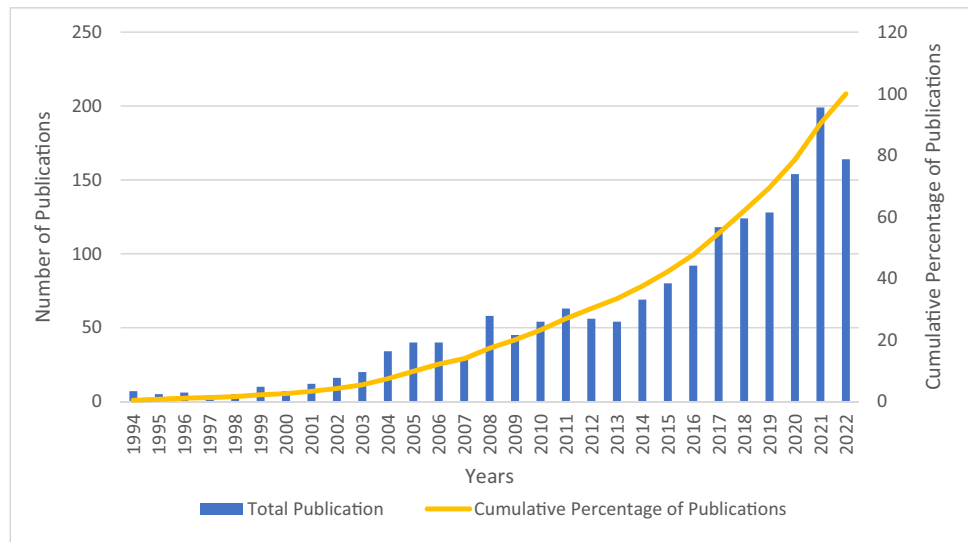
($N=411$), three authors ($N=279$), four authors ($N=217$), and five authors ($N=122$). Although the number of single-author publications is the highest, it can be said that authors prefer to work collaboratively (72%) rather than individually (28%), when all alternatives to teamwork are considered. The number of authors of publications varies, such as an article with 41 authors, an editorial document with 29 authors, a compilation with 26 authors, a letter with 22 authors, two book chapters with 18 authors, a note with 15 authors, or a conference paper with 14 authors.

The authors used 4761 different keywords and 79,744 references with an average of 20 citations per document. The following subsections are presented to uncover the existing knowledge composition of this field.

Scientific publications by year and document type

Climate change is not a new issue, but it is a bigger threat than ever before. The number of publications by year can be evaluated in three stages with the cumulative percentage shown in Fig. 1. The first stage, 1992–1998, covers the period with limited single-digit documents, probably issued in 1992 under the influence of the United Nations Framework Convention on Climate Change (UNFCCC), an international agreement to combat climate change, or the Kyoto Protocol, signed in 1997 as a result of the negotiations started in 1995 in order to strengthen the global response to climate change, to set joint efforts and binding targets (UNFCCC, 2020b). The seriousness of the issue and its place on the agenda of countries, international organizations, and NGOs were reflected in the research of many scientists. The number of papers published in the second period from 1999 to 2016 reached double-digits, with 27 times more publications than in the previous stage. A significant development took place in 2007. In 2007, the Nobel Peace Prize was awarded to the Intergovernmental Panel on Climate Change (IPCC) and former US Vice President Al Gore for their efforts to raise awareness and to establish foundations for

Fig. 1 Annual scientific growth with cumulative percentage of publications



interventions of human-caused climate change (UN, 2007). In the third phase from 2017 to 2022, publications reached a boom period with annual triple-digit publications accounting for 53.05% (914 documents) of the total publications. Ding (2019, p. 455) named the second stage, when the first studies were carried out as the embryonic stage, as the seed time and the third stage, when the explosion occurred, as the blossom stage.

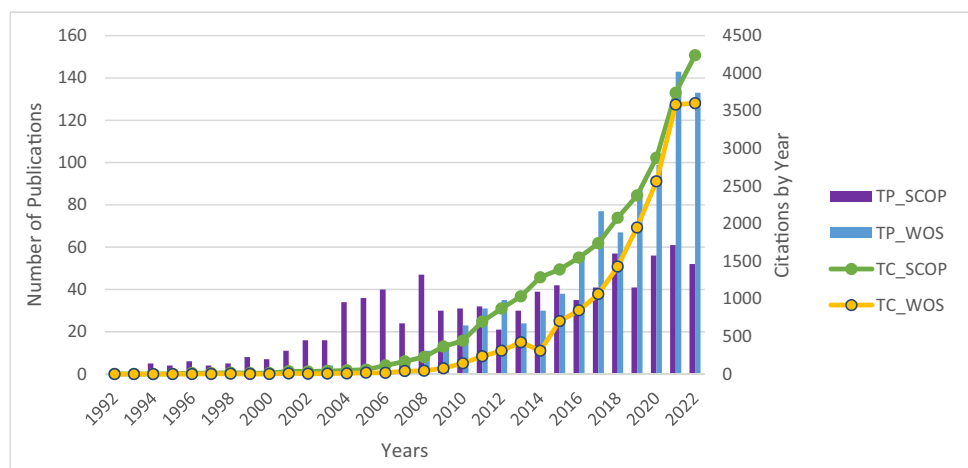
Although there is a decrease in the number of publications in 2022, the non-linear continuous increase in the number of cumulative publications indicates that publications will continue to increase in the future. This is a sign of the related field as a growing field, which attracts the attention of scholars from various disciplines.

The earliest publications found in the Scopus database were Nepstad et al.'s study (1992) that drew the attention to the impoverishment of the Amazon forests and Skea's study (1993) that highlighted the market-based tools for greenhouse gas control. Although the number

of publications fluctuated over the years, the general publication trend has increased continuously since 2014 ($N=69$).

Scholars' recent interest in climate change and marketing can also be reported for the citation analysis of the field. The chronological order of the publications from WoS and Scopus databases with citation movements is shown in Fig. 2. While the number of publications in the Scopus database was consistently higher until 2015 (excluding 2012), this situation turned in favor of the WoS database in 2016, and the number of publications continued steadily (2021: TP Scopus 30.7%, TP WoS 69.3%). Although in WoS more publications were found than in Scopus, the number of citations occurred lower. An opposite situation has been found for Scopus. Although the number of publications is less in Scopus, the number of total citations is higher (59%) than in WoS (41%).

Fig. 2 Annual scientific growth with citation movements



Productivity among scientists

Lotka’s law (1926, p. 321) is a well-known scientific productivity law by which patterns of productivity among scientists in a specific field and timeline can be studied. By law, the proportion of all contributors to a single item should be just over 60%.

According to the results shown in Fig. 3, a total of 4944 authors wrote 1723 documents, of which 4578 have published only one publication (92.71% of the total). Distribution is based primarily on diversification by the number of authors, not the concentration of publications on the few most prolific authors. The authors’ productivity was as such 282 authors with two publications, 48 authors with three publications, 15 authors with four publications, nine authors with five publications, one author with six publications, two authors with seven publications, one author with eight publications, and one author with 12 publications. The authors of 37 studies were not included in this analysis, as they were not disclosed.

Top prolific authors and citations

Table 3 indicates that C.M Hall is the most prolific author in the climate change and marketing research with 12 publications, 604 total citations, a citation impact of 50.33, and an 11 h-index. The h-index (Hirsch Index) measures an author’s productivity and impact; in this case, it is the highest value since 2013. His first year of publication (FYP) dates back to 2013. However, the ranking of authors after C.M. Hall varies between indicators. Subsequent authors are D. Scott (8 publications), S. Gössling, J.A. Kemper, and L. Eagle. A list of all researchers with at least 5 publications is presented in the table below. All listed authors, except Scott D. (in 2001), have recently made their first publications.

Table 3 Authors with the highest total number of publications and citations

Author	TP	TC	CI	FYP	h-index
Hall CM	12	604	50.33	2013	11
Scott D	8	360	45.00	2001	7
Gössling S	7	469	67.00	2012	7
Kemper JA	7	172	24.57	2017	6
Eagle L	6	85	14.16	2016	4
Abdous B	5	58	11.60	2009	4
Belanger D	5	58	11.60	2009	4
Gosselin P	5	58	11.60	2009	4
Kumar S	5	105	21.00	2017	3
Li X	5	133	26.60	2012	3
Marinova D	5	10	2.00	2017	2
Parker P	5	45	9.00	2001	4
Singh S	5	20	4.00	2015	3
Valois P	5	58	11.60	2009	4

After C.M. Hall, the list of the most prolific authors includes D. Scott with eight publications, S. Gössling and J.A. Kemper with seven publications each, and L. Eagle with six publications as the most prolific authors. S. Gössling, who made his first publication in the field in 2012, is the author with the highest citation index (CI=67.00). This indicates that the most prolific and cited authors are from the developed countries that allocate more funds and support to actions against climate change (Sweileh 2020).

Top Cited Publications

The most cited articles (see Table 4 for a full list) cover issues related to environmental governance, climate change, carbon emissions, disease and health management, green consumption, and sustainable consumer behavior and

Fig. 3 Productivity among scientists

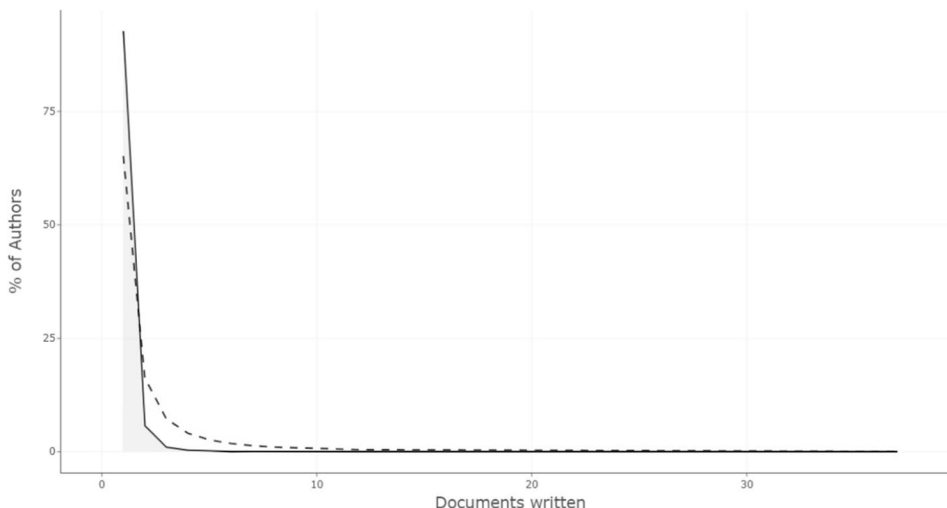


Table 4 Summary information of the most cited publications

PT	Author(s), year, title, and source	TC	TCpY	Keywords and findings
RV	Lemos and Agrawal (2006) Environmental governance. Annual Review of Environment and Resources	1080	60.00	Keywords: Climate change, co-governance, decentralization, ecosystem degradation, globalization, market Findings: The authors identified three sets of partnership in terms of environmental governance, which are namely “co-management” between state agencies and communities, “public-private partnerships” between state agencies and market actors, and “social-private partnerships” between communities and market actors
RA	Morton (2007) The impact of climate change on smallholder and subsistence agriculture. PNAS	866	50.94	Keywords: Developing countries, subsistence farmers, vulnerability, livelihoods Findings: The author stressed that climate change had a powerful impact on the smallholder and subsistence farmers. He made a special emphasis on the non-climate (farm size, technology, capitalization) and resilience (family labor, diversification from agriculture and indigenous knowledge) factors which he set forth that had a tendency in increasing vulnerability. He also underlined the variety of crop and livestock species and the importance of marketing for the climate change impacts and adaptations
RA	Dietz T et al. (2009) Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. PNAS	818	54.53	Keywords: Climate mitigation, climate policy, energy efficiency, household behavior, energy consumption Findings: The authors found that single policy actions were not effective in the reduction of household energy consumption and that attitudes towards and knowledge of energy consumption can be augmented, but interventions for behavior change may fail to trigger the desired actions through mass media appeals and informational programs
RV	Bondad-Reantaso et al. (2005) Disease and health management in Asian aquaculture. Veterinary Parasitology	437	23.00	Keywords: Aquaculture; parasite disease; production loss; disease management Findings: The authors argued that the topic of aquaculture health management in the Asia-Pacific region needs more research from an interdisciplinary perspective and that the policies and strategies implemented in this region to enhance the aquaculture health system help reduce the probable risks (disease epizootics, in accurate and inconsistent health reporting system, etc.) at not only national and regional levels, but also the international levels
RV	Chanprateep (2010) Current trends in biodegradable polyhydroxyalkanoates. Journal of Bioscience and Bioengineering	423	30.21	Keywords: Polyhydroxyalkanoates (Phas); microbial polyester; biodegradable polymer Findings: Chanprateep discussed that although it has been asserted in the life cycle assessment reports that petrochemical polymers are better eco-profiles in the manufacturing technology due to their “energy for polymer manufacture,” “their effects of the number of recycling loops,” and “end-of-life disposal,” polyhydroxyalkanoates are more sustainable and can more easily help public become more environmentally aware
RV	White, Habib and Hardisty (2019a) How to SHIFT consumer behaviors to be more sustainable: a literature review and guiding framework. Journal of Marketing	392	78.40	Keywords: Corporate social responsibility, ecological behavior, environmentally friendly behavior, sustainable consumer behavior Findings: White et al suggested that the SHIFT framework which they developed on a basis of the behavioral science literature could help motivate the consumers to change and develop their behavior in a more sustainable way and that the framework could work at its best through the integration of all the elements (psychological routes), which are “social influence,” “habits,” “individual’s self,” “feelings and cognition,” and “the presentation of tangible solutions.”

Table 4 (continued)

PT	Author(s), year, title, and source	TC	TCpY	Keywords and findings
RV	Peattie (2010) Green consumption: behavior and norms. Annual Review of Environment and Resources	390	27.86	Keywords: Consumption processes, pro-environmental behaviors, sustainable marketing Findings: Peattie highlighted that the current literature focused on a narrower part of the environmentally sustainable consumer lifestyle; however, it was discussed in the review paper that the gap in the literature could be filled through interdisciplinary and multi-method studies
RA	Berkhout, Hertin and Gann (2006) Learning to adapt: organisational adaptation to climate change impacts. climatic change	298	16.56	Keywords: Adaptive capacity, climate change impact, adaptation measure, climate sensitivity, climate change adaptation Findings: Berkhout et al. discovered that the organizations cope with pressures of climate change in a similar way to traditional market, technological, or regulatory adaptation. They also found out that organizations depend on advice from external climate change experts, and since this advice is not easily turned into practice, the authors recommend that trial-and-error practices can help especially in climate-sensitive sectors, considering that adaptation to climate change depends on the structure of organizations
RA	Xu et al. (2006) China's ecological rehabilitation: unprecedented efforts, dramatic impacts, and requisite policies. Ecological Economics	292	16.22	Keywords: Soil erosion, desertification, ecological rehabilitation, natural forest protection, land conversion Findings: Xu et al. found out that the consultation and interaction system between the farmers and the government in the government-led programs fails due to the undersupplied value the government added to the contracts, open bidding, and market-based mechanisms; that governments fail to implement an ecosystem management system with a special focus on sustainability, functionality, and integrity; and suggested that the attention should be drawn more to the underlying sources of environmental problems than to the environmental impacts themselves
RA	Ciscar et al. (2011) Physical and economic consequences of climate change in Europe. PNAS	284	21.85	Keywords: Climate adaptation policy, climate impact and adaptation assessment, integrated assessment model, computable general equilibrium Findings: Ciscar et al. propounded based on their 2080s scenario that the climate change could have a devastating impact on the agriculture and social life in the European countries at different levels and that the European regions other than Northern Europe would be more vulnerable to the disasters (river floods, loss of biodiversity, famine, etc.) stemming from climate change. They also alleged that the disasters would also affect adversely the human health and lifestyle, tourism, and eventually the economic system, and thus adaptation measures should be efficiently implemented

PT publication type, RV review, RA research article, PNAS Proceedings of the National Academy of Sciences

Table 5 Top sources with the highest number of total publications and total citations

Source	TP	TC	IF	Q
Sustainability	50	544	3.88	Q1
Energy Policy	30	1532	7.57	Q1
Journal of Cleaner Production	22	755	11.07	Q1
Climatic Change	18	802	5.17	Q1
IOP Conference Series: Earth and Environmental Science	16	9	0.17	Q4
Acta Horticulturae	15	38	0.25	Q4
Journal of Destination Marketing & Management	15	213	7.158	Q1
American Solar Energy Society - Solar 2008	13	2	N/A	N/A
Journal of Sustainable Tourism	12	753	9.47	Q1
PLOS ONE	11	279	3.24	Q1
Journal of Macromarketing	10	128	1.979	Q2
Psychology & Marketing	10	136	5.507	Q1
Journal of Public Policy & Marketing	9	115	6.343	Q1
Journal of Social Marketing	9	81	4.115	Q2
Proceedings of The National Academy of Sciences of the United States of America	9	2293	N/A	N/A
Developments in Marketing Science: Proceedings of the Academy of Marketing Science	8	0	N/A	N/A
Journal of Environmental Management	8	327	8.91	Q1
Journal of Marketing Management	8	225	4.707	Q2
Land Use Policy	8	88	6.189	Q1
Petroleum Review	8	3	N/A	N/A

sources address climate change issues in marketing-related journals and books listed as Zone 1: the *Journal of Destination Marketing & Management*, *Journal of Macromarketing*, *Psychology & Marketing*, *Journal of Public Policy & Marketing*, *Journal of Social Marketing*, *Developments in Marketing Science: Proceedings of the Academy of Marketing Science*, and *Journal of Marketing Management*. 5.9% of all sources ($N=1007$) (journals $N=45$, books $N=11$, and conference proceedings $N=3$) related to climate change and marketing were published in marketing-related journals. This finding supports Hall's (2018, p. 3) explanation that the vast majority of research on climate change and marketing takes place outside the field of marketing. However,

as Morton (2007) argues, an interdisciplinary approach should be adopted in order to come up with robust solutions and actions, and scientists working in the field of climate change should produce productive results by incorporating the knowledge and experience of marketing academics into their work.

Top influential countries and institutions

According to Table 6, the USA produced an extraordinary rate of 19.21% of publications (TP=331) and similarly received an impressive number of citations (TC=7701) over the years. This is followed by the UK with 10.67% (TP=184;

Table 6 Top ten influential countries and productive institutions

Country	TP	TC	CI	Institution	TP
USA	331	7701	23.26	USA—Michigan State University	33
UK	184	5524	30.02	New Zealand—University of Canterbury	27
Australia	147	2938	19.98	UK—Cardiff University	24
Germany	90	1167	12.96	Australia—University of Queensland	24
India	89	598	6.71	Canada—University of Waterloo	21
Canada	86	1380	16.04	Australia—Charles Sturt University	20
China	75	965	12.86	Australia—James Cook University	20
Spain	48	794	16.54	Finland—University of Oulu	20
Italy	47	718	15.27	Australia—Griffith University	18
Netherlands	47	817	17.38	Australia—Deakin University	17

TC=5524) and Australia with 8.53% (TP=147; TC=2938). However, it should also be noted that the UK has the highest citation impact rate of 30.02. Other countries with a high number of publications and citations are Germany, India, Canada, China, Spain, Italy, and the Netherlands. Most of the top ten influential countries contributing to the relevant literature include the well-developed Global North Countries, with the exception of India. The underlying reason may be that the developed countries in the Global North have been assigned by the UNFCCC as the leading countries to battle against climate change through sustainable marketing implementations (Sachs 2001). The list also includes six countries (USA, China, the European Union, Russia, India, and Japan) identified by the World Bank as those emitting the largest quantity of CO₂ into the atmosphere (Sengupta 2008). Among the countries in the list, the only developing country is India. The reason why it takes part in the list can be that the social and economic outcomes of the climate change exert an enormous influence on the livelihoods of nearly two-thirds of the Indians. As a country in the hotspot of climate change (Brenkert and Malone 2005; Sengupta 2008; Swain 2014; Sarkar and Borah 2018) and with mostly climate-sensitive sectors (agriculture, forestry, etc.), India has a special budget for understanding the climate change risks and adaptation strategies (Agrawal 2010; Ganguly and Panda 2010; Kumar Sharma 2015).

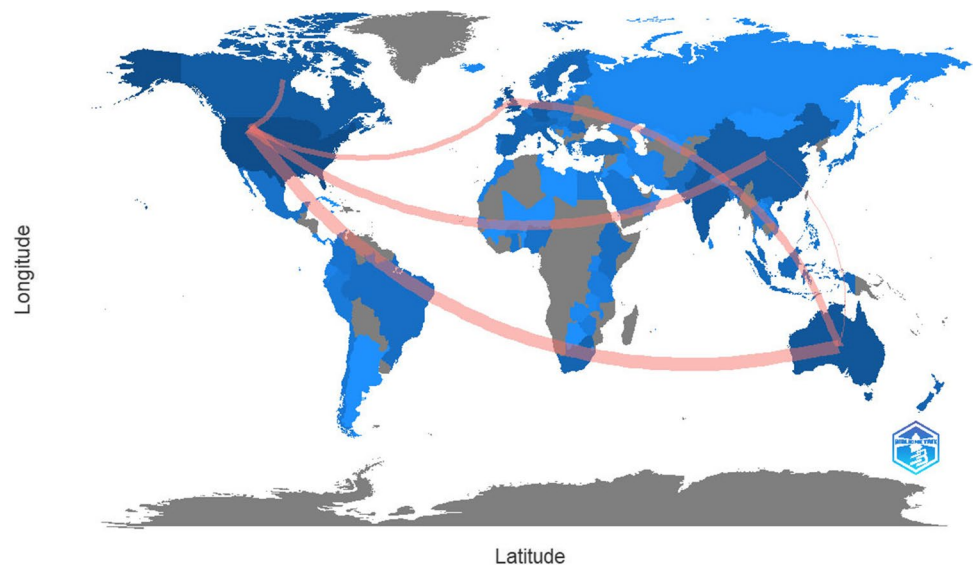
Alongside countries, the Michigan State University takes the lead as the most prominent institution with a total number of 33 publications followed by the University of Canterbury ($N=27$), the Cardiff University ($N=24$), and the University of Queensland ($N=24$). Other productive institutions are the University of Waterloo, the Charles Sturt University, the James Cook University, the University of Oulu, the Griffith University, and the Deakin University. This can

be considered again as an indication that the institutions in the Global North show a high level of interest in research on climate change and marketing issues.

Seventy-three countries were involved in the publication of climate change and marketing research. When the contributions of the countries to the climate change and marketing literature are examined, the dominance of the USA is clearly seen both within 30 years and in the last two years. This supports the findings of previous literature (Haunschild, Bornmann and Marx 2016; Pasgaard et al. 2015)

Figure 5 shows that collaborations between countries are predominantly between the USA, the UK, China, Australia, and Scandinavia. Specific collaborations are between the USA and Australia ($N=14$), the USA and China ($N=12$), Australia and the UK ($N=11$), New Zealand and Finland ($N=9$), the UK and Germany ($N=9$), and the USA and the UK ($N=9$). Other notable collaborations include Australia and China ($N=8$), Sweden and New Zealand ($N=8$), the UK and Norway ($N=8$), and the USA and Canada ($N=8$). The analysis between countries in Africa, Russia, Asia, and the rest of the world does not provide effective cooperation. This clearly indicates that intellectual cooperation is mostly concentrated among the developed countries and that the countries located in Africa, South America, and Asia (except from China) are left out of the scientific collaboration in the related literature. One possible explanation for this could be that the exclusion of these regions is due to the limited funding, scientific expertise, and the unstable political situation, as Sweileh (2020) claims. Interestingly, the finding that only China as an Asian country takes place in the collaborating countries list supports previous research (Alexandre-Benavent et al. 2017; Haunschild, Bornmann and Marx 2016) which stated that the collaboration of China and other countries lies in the changes in the climate change policy and

Fig. 5 Country collaboration map



attitudes of the Chinese government. However, this finding is also interesting as India as an Asian country is listed among the top ten prolific countries, but there is no significant collaboration between India and other countries. In this regard, Pasgaard et al. (2015) discovered the presence of imbalances and divisions in different geographies in terms of the intellectual production in the climate change literature and found collaborations among the developed countries and collaborations between India and Pakistan. Furthermore, Goodale et al. (2022) emphasized that although both India and China are Asian countries with similar climate change problems, they often cooperate with other developed countries, but lack common intellectual networks, and recommended joint projects and regional collaboration in terms of scientific production. Although it is realized that collaborations are mostly between the developed countries, establishing cooperations between developed and developing countries will contribute more to the literature since climate change and marketing are topics on the agenda of all countries in order to develop a sustainable world. These are common issues that need to be addressed by all countries in the world (Fig. 5).

Keywords and themes

The authors producing papers in the current literature on climate change and marketing used various keywords. The ten most used author keywords are climate change ($N=280$), sustainability ($N=103$), marketing ($N=62$), social marketing ($N=43$), adaptation ($N=39$), sustainable development ($N=32$), tourism ($N=32$), food security ($N=31$), green marketing ($N=31$), and environment ($N=29$). As expected, “climate change” and “marketing” as author keywords were the main drivers of publications, and the other author keywords indicated that this topic generated more research on sustainability, food, and environmental issues (green marketing, environment). Adaptation was also a popular author keyword, probably because of the scholars’ interest in answering the question of whether societies are ready for the issues related to climate change and whether they can adapt to the conditions originated from climate change problems. To help societies adapt to climate change issues (Peattie 2010; Didiek Wiet Aryanto and Vega Paramitadevi 2018), scholars in the life sciences need to engage and collaborate with those working in the social sciences, as Biesbroek et al. (2013) stated in their study. It can be considered that it yielded the popularity of the keyword “social marketing.” Just like societies, the necessity of organizations to be sensitive to the environment has directed the attention of the scientists to the issues of environment and green marketing (Chanprateep 2010). Furthermore, as Sweileh (2020) contended, there is a strong interrelation between agriculture and climate change; thus, agriculture-related issues gained importance. This has caused scientists to pay more attention to “food security.”

Tourism has also been a hot topic in the relevant literature, since climate change-related problems have the potential to alter the tourism patterns, and as an economic issue of great importance for the societies (Borland and Paliwoda 2011; Ciscar et al. 2011; Calvo-Porrall 2019; Rume and Islam 2020; Fu and Waltman 2022), tourism research has shown interest to the climate change and marketing literature.

The interaction of the keywords can also be tracked in Fig. 6, which shows the niche, motor, emerging/declining, and basic themes of the relevant literature. As can be deduced from the figure, the themes “climate change,” “adaptation,” and “tourism” are basic as well as emerging themes; however, the motor themes are “food security,” “agriculture,” and “climate,” and this supports Sweileh’s (2020) view that asserts that climate change and agriculture are interrelated. In this context, the niche themes of “marketing,” “consumption,” and “conservation” denote to the importance of the marketing’s role in changing consumers’ behavior towards sustainable consumption, while social marketing’s role in reinforcing consumers’ attitude and behavior towards energy efficiency and renewable energy loses attention, despite its still being a niche theme. Therefore, the scholars working in this field are recommended that they direct their attention to the “marketing,” “consumption,” and “conservation” issues.

It was indicated that there was a boom in the number of publications in 2021 (Fig. 7). By selecting 2020 as the cut-off year, a comparison was made to understand how the author keywords evolved before and after the peak year. While the main trend before 2020 was mostly on climate change, marketing, and social marketing (Moser 2010), it has turned into marketing, climate change, sustainability, COVID-19, and social marketing within the last 3 years. While the keyword “climate change” dominated in the first period, it lost ground to marketing by also being replaced by the keyword “sustainability.” Similarly, the keyword “social marketing” was used less frequently in the last 3 years and has been replaced by the umbrella keyword “marketing.” Within the last 3 years, probably due to the COVID-19 pandemic, “sustainability” gained more importance, and the marketing research focused more on pandemic-related issues. This consolidated the views of recent papers (Fuentes et al. 2020; Rume and Didar-Ul Islam 2020; Mende and Misra 2021; Selmi et al. 2022) on the interrelationship between COVID-19, sustainability, and climate change. Selmi et al. (2022) asserted that amid the rising anxiety of the pandemic, societies attempted to tackle the health-related problems while focusing on the green investments and yielded to hazardous climate actions to rebuild the global economy, which in turn resulted in unsustainable development. To sum up, although “climate change” and “marketing” in general dominated in the first period, the COVID-19 pandemic in the second period led to the field to change its direction.

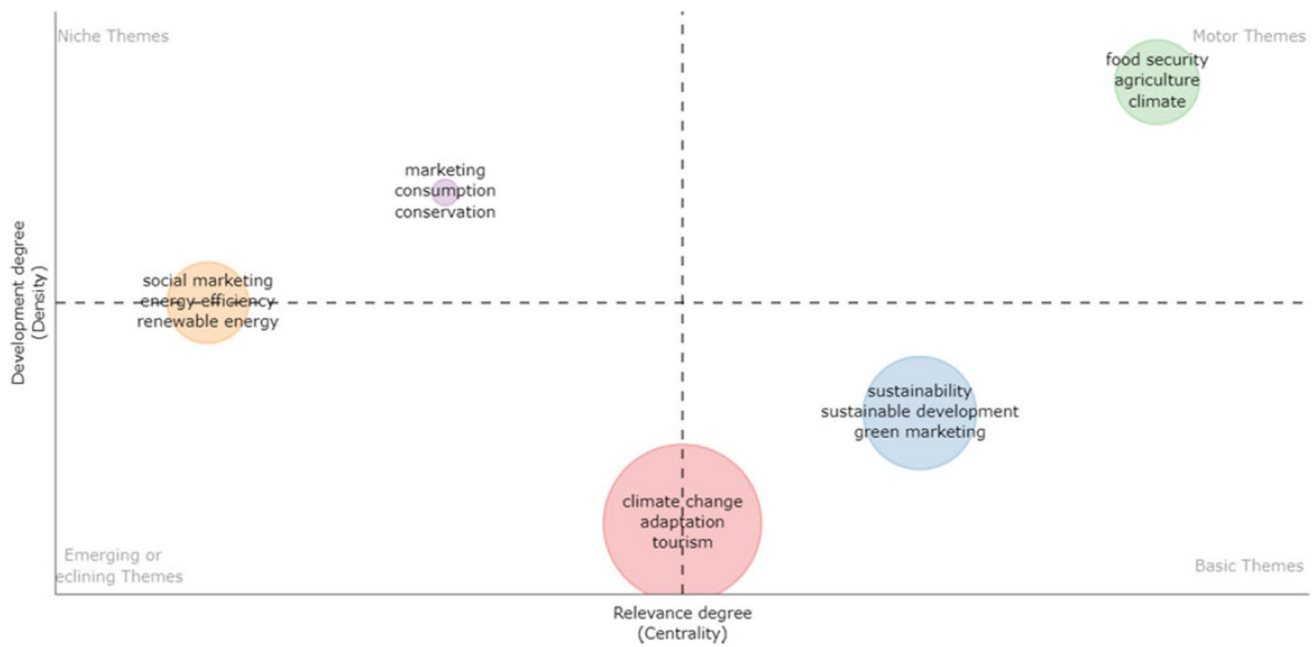
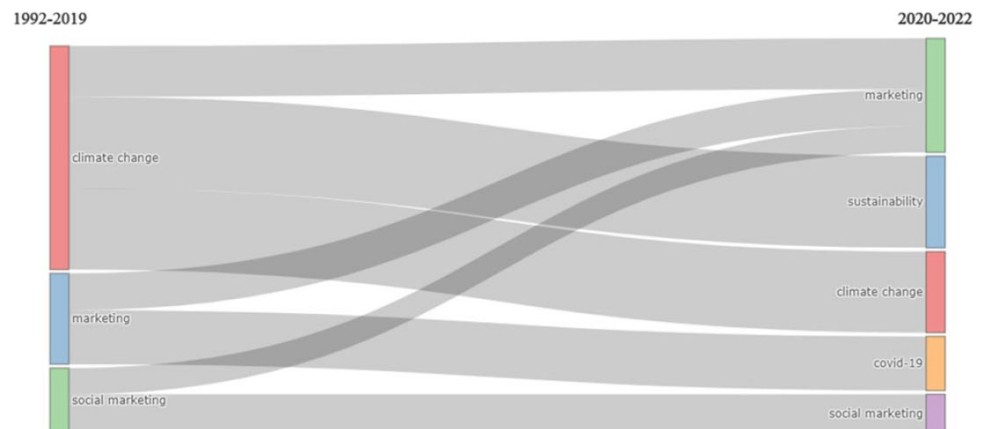


Fig. 6 Themes within the relevant literature

Fig. 7 Evolution of author keywords throughout the years (CY: 2020; Algorithm: Leading-Eigenvalues)



Although COVID-19 had a substantial impact on the relevant literature, it is evident in Fig. 8 that the field has two main strands: “Climate Change” and “Marketing.” The topic dendrogram (created through the multiple correspondence analysis of 45 author keywords) is comprised of two main strands and five main clusters. The first strand (red) refers to the climate change orientation of the field in general. However, the second strand has two main paths: “climate change and marketing issues” (blue) and “marketing orientations,” which consists of three clusters. The three clusters point to the “social marketing orientation” (green), “green marketing orientation” (purple), and “sustainable marketing orientation” (orange), respectively. The “climate change and marketing issues” path includes the keywords “resilience,” “vulnerability,” “food security,”

“policy,” “water,” “adaptation,” “agriculture,” “mitigation,” and “drought.” This path highlights the marketing and climate change resilience and adaptation issues mostly focusing on agriculture (also linked to water and drought issues), and this supports the previous studies (Peattie 2010; Ciscar et al. 2011; Sweileh 2020) that climate change-related issues cannot be separated from the agricultural issues and that marketing research is linked with climate change and agriculture. The “marketing orientations” path is divided into three main marketing-related clusters. The first one (green) contains the author keywords “communication,” “social,” “energy efficiency,” “nutrition,” “production,” “renewable energy,” “behavior change,” “energy,” “social media,” “conservation,” “consumption,” “marketing,” “segmentation,” “social marketing,”

Topic Dendrogram

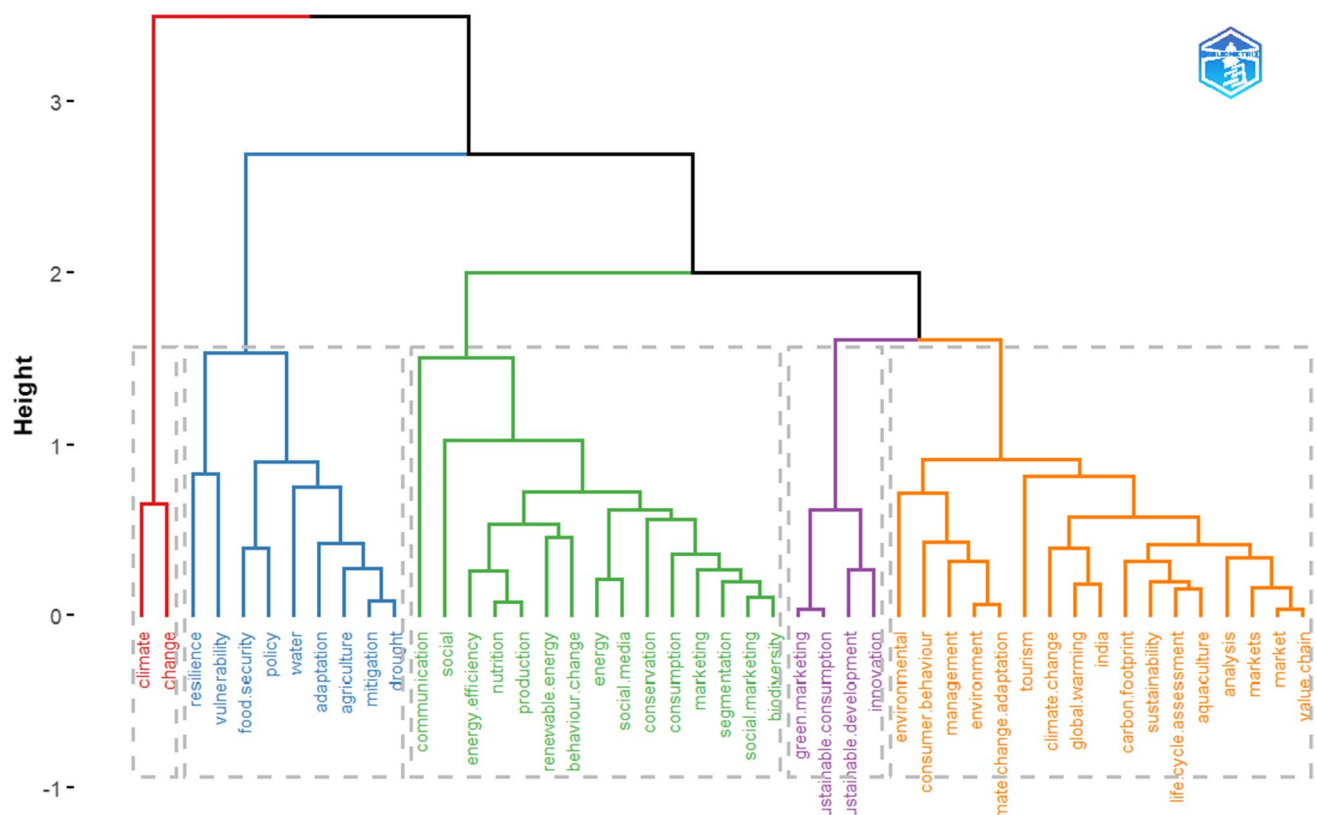


Fig. 8 Topic dendrogram of author keywords

and “biodiversity.” Social marketing deals with the marketing actions attempting to change individuals’ attitudes and behavior toward desired actions (Halady and Rao, 2010; Peattie 2010). In this regard, it can be stated that the relevant literature mostly focuses on social marketing actions to change consumers’ behavior in terms of energy and nutrition consumption and production and conservation of biodiversity through social media marketing activities. The second orientation “green marketing” (purple) is mostly related to the marketing activities of organizations for a sustainable environment. It can be clearly seen from the topic dendrogram figure that this orientation includes the keywords “green marketing,” “sustainable consumption,” “sustainable development,” and “innovation,” and this underlines the efforts of green marketing activities to enable sustainable development through initiating sustainable consumption and using innovative solutions. The last cluster (orange) refers to “sustainable marketing,” which has three main dimensions: “social dimension” (focusing on the society and its well-being of the society), “environmental dimension” (focusing on the organizations’ activities and contributions to the environment), and “economic dimension” (focusing on the value generation and financial

performance of organizations) (Maibach, Roser-Renouf and Leiserowitz 2008; Peattie, Peattie and Ponting 2009; Chanprateep 2010; Pomeroy 2017; Thomas, 2018; Lučić 2020). One of the influential keywords in this cluster is India and global warming. It is evident from the figure that the sustainable marketing research concentrates mostly on the interrelationship between global warming and India in terms of climate change and marketing mostly because India is a major producer of global greenhouse gas emissions leading to its hazardous contribution to the global warming and hereby climate change (Billett 2010).

Co-citation and bibliographic coupling

The co-citation network of the relevant literature was created on VOSviewer by narrowing down the initial list of 1723 publications to a list of 66 publications with at least 20 citations. In the co-citation network map (Fig. 9), the size of the circles within the clusters refers to the numbers of citations the publications received, and the thickness of each line indicates the strength of the citations. The distance between the circles denotes the co-citation relationships (Phan Tan 2022). As is evident from Fig. 9, four clusters emerge. One

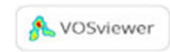
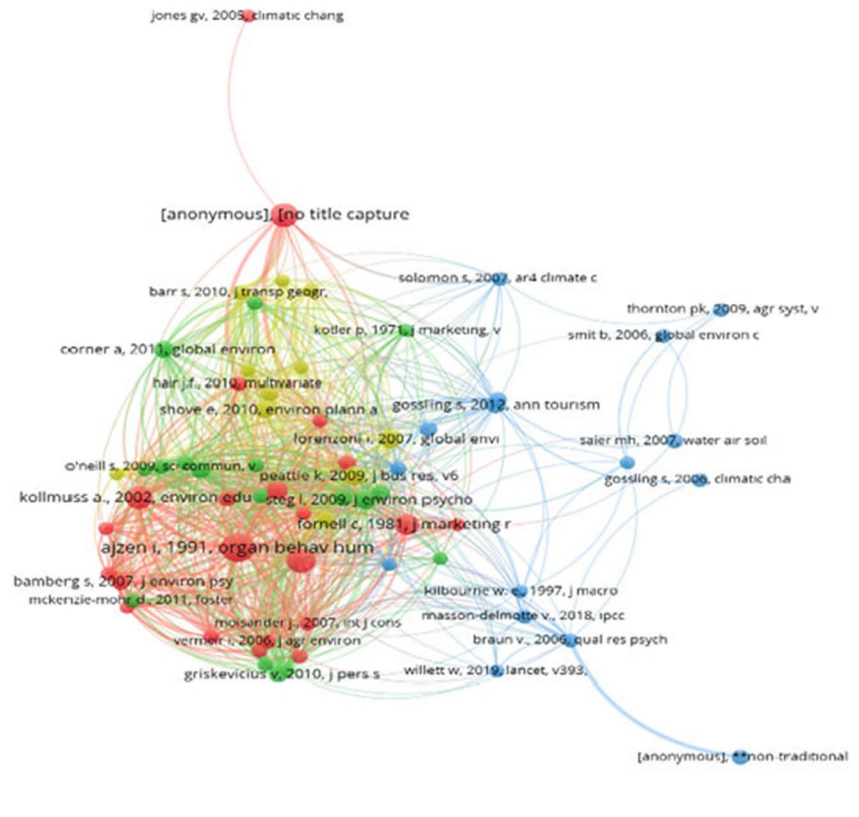


Fig. 9 Co-citation network map

of the authors carefully read each publication and named the clusters in accordance with the common themes which the publications within each cluster refer to.

The first cluster (red) covers publications focusing on topics related to tourism, transportation, and environmental sustainability and the link between these topics and social marketing. It is dominated by the studies of Barr and Gössling. While Barr concentrates on environmental sustainability, Gössling conducts mainly tourism research. The second cluster (green) is comprised of publications on the theory and method in the field of marketing and climate change. The first three remarkable publications with the highest number of links in this cluster are Ajzen (1991), Stern (2000), and Kollmuss and Agyeman (2002). The third cluster (blue) includes publications related to the issue of sustainable marketing. The three most dominant publications in this cluster are Steg and Vlek (2009), Goldstein, Cialdini, and Griskevicius (2008), and McKenzie-Mohr (2011). Lastly, the fourth cluster (yellow) is a collection of publications focusing on the issues related to climate change risks, adaptation, mitigation, and marketing. These are mostly reports and working papers. The top three notable publications in this cluster are Thøgersen and Crompton (2009), Kotler (2011), and Braun and Clarke (2006).

The bibliographic coupling network was also created on VOSviewer by narrowing down the corpus of 1723 publications to a final corpus of 98 publications with at least 50 citations. The analysis yielded seven main clusters. The first cluster (red) consisting of 21 publications is related to sustainable marketing and related issues. The second cluster (green) with 20 publications refers to digital marketing, behavior change, and green consumption. The third cluster (blue) comprised of 18 publications is about destination marketing, tourism, and climate change risks and adaptation. The fourth cluster (yellow) with 14 publications denotes to agriculture, aquaculture, and environmental governance. The fifth cluster (purple) which includes 11 publications is related to energy and innovation. The sixth cluster (light blue) with eight publications is centered around food security, poisoning, and insect farming. Finally, the seventh cluster (orange) is formed by six publications focusing on carbon management, carbon footprint, and hydropower (Fig. 10).

Phan Tan (2022) suggests that comparing co-citation themes and bibliographic coupling themes helps researchers reveal the emerging trend topics in the relevant literature. Drawing upon this suggestion, four co-citation themes and seven bibliographic coupling themes were compared. As a result of this comparison, three main trending topics are identified. One trending topic is carbon footprint, carbon

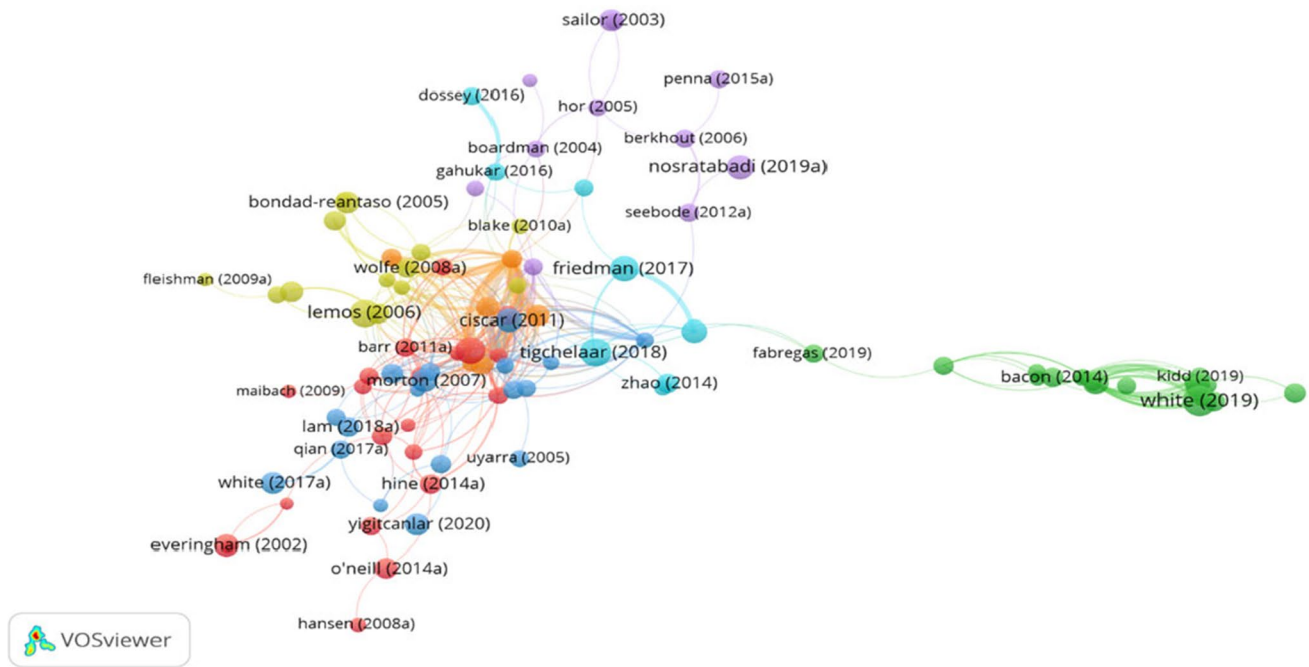


Fig. 10 Bibliographic coupling network

management, and hydropower. This trending topic, which is closely related to the tourism field, is drawing attention as growing global tourism activities result in high levels of CO₂ and other greenhouse gas emissions (Gössling, Scott and Hall 2015; Gössling et al. 2023). Another trending topic is energy innovation, which should be enhanced to reduce the climate change risks (Popp 2020). In this regard, innovating energy which is clean is important for the use of renewable energy and energy efficiency, but also significant for combating against the problems of climate change as climate change gains its strength also from types of energy production systems, resulting in global warming and environmental unsustainability. Thus, encouraging clean energy use and production is of great importance, and this can be possible through attitude and behavior change, which can be triggered through marketing activities. In this scope, this is a new terrain of research for further studies. Finally, one of the interesting trending topics is the edible insect farming. It is considered as an advantage against the food insecurity problems caused by the climate change and global warming. In this regard, edible insects can be used as a feed source (van Huis and Oonincx 2017; Sweileh 2020; Moruzzo, Mancini and Guidi 2021). So, future research can focus on such topics (insect farming, energy innovation, carbon management, etc.) in relation to climate change and marketing.

Conclusion

The bibliometric analysis enables researchers to comprehensively evaluate the field of research in which they are scholarly interested. This research allowed the authors to make visible the invisible state and development of climate change and marketing research. According to the study, climate change and marketing research has gained enormous impact in the literature and has received significant interest from more than 2000 scholars. Here, the author with the highest rate of publication appears to be C. Michael Hall, and the proceeding paper by Morton (2007) is outsourced as the most cited publication. The geographical location of the countries that contribute significantly to climate change and marketing studies are the USA, the UK, and Australia. Effective collaborations are dominantly between the USA and Australia, the USA and China, Australia and the UK.

Various institutions from different countries contribute to the research; however, the main institutions are mostly from Australia. The most common document types are articles and proceedings papers, respectively, but, within the last 2 years, authors' interest in proceedings has waned. The analyses reveal research clusters that form the core and periphery of the research area. The most common keywords and themes—namely, climate

change, sustainability, and marketing—play a basic role in the literature followed by sustainable development, green marketing, and environmental issues. These keywords and themes also clarify the high number of publications in the journals *Sustainability*, *Journal of Cleaner Production*, and *Journal of Sustainable Tourism*. The themes which are “social marketing analysis,” “renewable energy,” “conservation,” and “consumption,” as emerging themes need more focus, and energy innovation and efficiency, insect farming, food security, and carbon management showed up as a new area of research, which requires also more concentration from authors in the field. A look at the ten most frequently referenced publications also provides an initial insight into the leading keywords and themes in climate change and marketing research.

Some limitations of the current study also warrant mention. First, the publications were extracted from only two databases—Web of Science (WoS) and Scopus. Although WoS and Scopus are regarded as the two of the most comprehensive databases for bibliometric analysis on various topics, the size of the publications covered in the analysis may not be adequate to represent the related literature. Further studies should be conducted to provide a more comprehensive map of research in the field of climate change and marketing by analyzing the publications available in other databases. Second, the topic search on WoS and Scopus was based on the English language; that is, the keywords used for the search on WoS and Scopus were solely English. Thus, this study did not cover the publications with titles, abstracts, and keywords in other languages published in journals indexed by WoS and Scopus, and further studies are recommended for the bibliometric analysis of research in other languages. Finally, the results were based on the tests and analyses inherent in the statistical programs—VOSviewer and Biblioshiny—used for bibliometric analysis in the current study, and further studies are invited to use other programs for bibliometric analysis to reveal related results. Despite these limitations, the study provides valuable information and guidance on emerging trends in climate change and the marketing literature and provides inspiration for future research.

Author contribution Conceptualization and design: SH and HA
 Formal analysis: HA and SH
 Visualization: HA
 Data curation: SH and HA
 Writing—original draft preparation: BU and AG
 Writing—review and editing: SH and HA
 Supervision: BU and AG

Data availability All data generated or analyzed for this study are available from the corresponding author on reasonable request.

Declarations

Ethical approval Not applicable

Consent to participate Not applicable

Consent for publication Not applicable

Competing interests The authors declare no competing interests.

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