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Overview of disruptive technologies. A bibliometric approach

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Abstract

Disruptive technologies have integrated into all aspects of our modern lives, rapidly transforming industries and economies on a global scale. Although this phenomenon has attracted considerable attention from researchers and specialists across various fields, there is still an acute need for a detailed and comprehensive analysis. These technologies are both expansive, having a large-scale impact, and specific, acting differently depending on the sector in which they are implemented. This research aims to conduct a rigorous bibliographic analysis, using the Bibliometrix R package and VOSviewer, to understand the fundamental concepts underlying these innovative technologies and their disruptive nature. The study will deeply investigate how disruptive technologies modify traditional economic structures, causing essential changes in the way businesses operate and how economies develop. Additionally, the key findings include the identification of major conceptual clusters, such as innovation management, digital transformation, and sustainability, and the emergence of technologies like blockchain, cloud computing, and additive manufacturing. Trend analysis also highlights a shift in focus over time, with formerly central topics like the internet declining in prominence.

Keywords: Disruptive Technologies, Disruption, Emerging Technologies, Innovation
JEL Classification: O310; O330; O360

1. Introduction

It is already well known that we are in a period marked by rapid technological development and continuous change in global economic and social structures. Several factors have shaped this context, including the emergence of technological innovations (emerging technologies), globalization and digital interconnectivity, as well as the appearance of socio-economic challenges.

Although disruptive technologies have been extensively discussed across various sectors, the academic literature lacks a comprehensive and comparative analysis of how these technologies are interconnected, categorized, and distributed across traditional and emerging domains. Much of the current research is fragmented – focusing either on individual technologies or sector-specific case studies – without offering a broader synthesis of trends, terminology, and conceptual overlap. This study addresses this gap by

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employing a bibliometric approach to map and compare the key terms associated with disruptive technologies, the fields they have transformed, and the areas where they are most prominently applied. By identifying clusters of research activity and conceptual relationships, the study aims to clarify the current structure of knowledge and propose new directions for interdisciplinary exploration.

When discussing emerging technologies, they are developing at a rapid pace, many having the potential to significantly transform entire industries. Moreover, the internet and communication technologies have created a global marketplace where ideas and innovations circulate without geographical restrictions, enabling the swift implementation of innovative solutions (Schiller, 1999).

Considering socio-economic challenges, issues related to climate change, public health, and social inequalities require the development of new technologies that can effectively address these challenges. The effects of disruptive technologies are now clearly observable throughout numerous industries (Mohideen, 2020). We are discussing the transformation of industries and the labour market, as technologies such as artificial intelligence (AI), automation, and robotics have the potential to replace traditional jobs, particularly those based on repetitive tasks, especially in the manufacturing and service sectors. On the other hand, these technologies are creating new fields of activity and roles that require advanced technical skills, such as AI engineering, data analysis, and software development (Acemoglu & Restrepo, 2019).

In another vein, economic paradigms are also shifting, as digital platforms and the sharing economy, such as Uber or Airbnb, are changing how resources are utilized and how traditional business structures operate. These platforms enable access to resources and services without the need for direct ownership, redefining the functioning of markets. At the same time, blockchain technology enables the decentralization of transactions, thereby creating financial ecosystems without traditional intermediaries (such as traditional banks), promoting alternative financial systems such as cryptocurrencies and smart contracts.

Advances are also being made in healthcare and quality of life improvement, where technologies such as telemedicine, AI-based diagnostics, and wearable health monitoring devices have revolutionized medical care. These innovations enable faster diagnoses, continuous health monitoring, and access to medical services remotely. New technologies have made genomic editing (e.g., CRISPR) and 3D tissue printing possible, which have a disruptive impact on healthcare. These advancements open new perspectives for treating genetic diseases and developing artificial organs.

The acceleration of the green transition and sustainability is another example of how disruptive technologies support ecological initiatives, such as the shift to green energy through the development of alternative sources (solar, wind energy) and the creation of high-efficiency batteries for energy storage. Smart agriculture, supported by IoT and data analytics, helps optimize resources (water, energy) and reduces environmental impact.

Finally, we must also consider the social impact. While technological evolution brings new opportunities, it also creates ethical and social challenges. These include dilemmas about privacy and surveillance, automated decisions made by algorithms, and the economic and social inequalities exacerbated by unequal access to technology. Disruptive technologies, by their nature, can amplify and polarize society. Limited access to cutting-edge technologies can create a "digital divide" between those who have access and those who do not.

This study aims to improve the existing literature by presenting the comparison between the main key terms of disruptive technologies based on existing technologies, traditional fields that were improved by the innovations, the most popular emerging technologies and most popular domains that suffered positive changes. We analysed the connections between the concepts associated with disruptive technologies and developed a better understanding, in order to detect the gaps of the actual knowledge, to come with newer perspective and to propose further research directions.

2. Literature review

2.1. Key disruptive technologies concepts and their connections

The term "disruptive technology" broadly refers to an innovation that fundamentally transforms an industry or sector by replacing existing technologies and creating new markets and opportunities. The concept was introduced by Clayton M. Christensen (1997), who defined "disruptive technologies" as innovations that initially deliver lower performance but meet the needs of an underserved market segment and eventually evolve to replace established technologies (e.g., traditional retail replaced by e-commerce). In the 2000s, the concept was expanded and gained new meanings to include its impact on industries such as healthcare, education, and energy, as well as technologies like the internet and digital platforms, which have transformed economic and social paradigms (Bower & Christensen, 1995). We can take in consideration also the definition "…a technology that changes the bases of competition by altering the performance metrics along which firms compete" (Bower & Christensen, 1995; Danneels, 2004).

By the 2010s, the term had gained popularity and was used to describe major innovations such as artificial intelligence, blockchain, and autonomous vehicles, although it faced criticism for not adhering to the original definition (Lepore, 2014; Markides, 2006).

Later, around 2020, the concept evolved further to contain ethical and social challenges, including unequal access to technology and its impact on the labour market, with significant examples in green energy, healthcare, and the sharing economy (Gans, 2017). Despite reinterpretations, the term remains essential, defining a technology that has a significant short-, medium-, or long-term impact, drives and forces change, and is felt across society and the economy.

Analysing other bibliometric studies, we observe a strong connection between the terms "disruptive technology," "disruptive innovation," and "emerging technology." The comparison between the terms "emerging" and "disruptive" is not clearly defined in the specialized literature, despite the fact that the links between these concepts can be implicitly understood. In this regard, there are already studies suggesting the need to analyse these two terms separately, as emerging technology is suggested to be more of an operational field rather than a theoretical arena (Li et al., 2018).

Markides (2006) highlighted the conceptual ambiguity and potential misuse of the term "disruptive technology," while the concept of "emerging technology" also reveals a lack of theoretical direction in research. The use of the terms "emerging" and "disruptive" in academic literature is significant, leaving room for interpretation regarding the possibility that almost any new technology could be labelled as emerging and/or disruptive, especially if it originates in the field of engineering. Additionally, it has been observed that in social sciences, management, business, or marketing, a new technology can be defined as both emerging and disruptive during the same period, albeit in different articles. This trend may stem from the appeal and popularity of presenting something as emerging, disruptive, or both (Li et al., 2018).

Given that disruptive technologies have profoundly influenced a majority of economic sectors by replacing traditional technologies and creating new business opportunities, we can highlight the most well-known sectors and technologies where industries have been redefined (Frank et al., 2019; Webb, 2019).

One of the most notable sectors affected by disruptive technologies is the commercial sector, known as retail, which replaced traditional commerce based on physical stores. Platforms such as Amazon and Alibaba have eliminated the need for physical locations, reduced operational costs, and expanded consumer access to a vast range of products (Rigby, 2011). Additionally, technologies used for digital payments, advanced logistics, and the application of artificial intelligence to personalize customer experiences have further strengthened this model, significantly reducing foot traffic in traditional stores.

When referring to the financial sector, we consider the contribution of blockchain technology and cryptocurrencies, which have improved traditional banking systems. Transactions have become more secure in terms of transparency, have been decentralized, and have provided greater control to direct beneficiaries (Nakamoto, 2008). These new alternative financial technologies offer users increased trust but also, in some cases, come with challenges related to regulation and potential cybersecurity threats.

The energy sector has undergone various changes and improvements, both legislative and technological, as it is closely tied to and has a significant impact on the environment. New technologies that advance the production, storage, and utilization of renewable energy also emphasize the development of dedicated batteries. These technologies aim to significantly reduce, and eventually eliminate, the use of more polluting traditional energy sources, such as fossil fuels and conventional power stations. Solar and wind technologies have accelerated the transition to clean energy sources, while new battery technologies, such as lithium-ion batteries, support more efficient energy storage. Both types of technologies facilitate the adoption of electric vehicles, the optimal use of renewable energies, and the reduction of carbon emissions (Jacobson et al., 2017).

The transportation sector features some of the most popular technological innovations: electric and autonomous vehicles. New technologies that have made possible to reduce or eliminate carbon dioxide emissions in traffic and limit human errors through the integration of artificial intelligence and sensors have gained popularity and increased road safety (Bimbraw, 2015).

The healthcare sector includes some of the most controversial technologies, as traditional medicine has been introduced to artificial intelligence, telemedicine, and CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats). Through the emergence of specialized platforms and intelligent diagnostics, traditional techniques such as manual diagnosis have become faster. Moreover, these technologies have provided access to medical services for individuals in remote or hard-to-reach areas (Topol, 2019). The advent of CRISPR has transformed traditional genetic interventions and holds the promise of treating genetic diseases more effectively (Hsu et al., 2014). Considering traditional mindsets, these technological innovations raise questions regarding the ethics and professionalism of practices, emphasizing the need for dedicated legislative frameworks and thorough analysis.

Another sector profoundly transformed by technological advancements is agriculture, where precision farming and IoT technologies have been successfully integrated. By using these disruptive technologies, resource efficiency has been achieved, addressing the waste prevalent in traditional farming. Data analysis and the integration of IoT sensors have optimized the use of essential resources such as water and fertilizers, increased yields, and reduced carbon dioxide emissions as well as the overall negative environmental impact (Wolfert et al., 2017).

Considering that the technological evolution seen in the previously discussed economic sectors represents some of the most visible examples in society, these areas serve as key references in earlier bibliometric and technology-related studies. As such, they provide valuable context for understanding the broader impact of innovation. To fully grasp the disruptive potential of current technologies, it is essential to clearly define the domains most affected by these transformative changes.

2.2. Previous bibliometric studies on disruptive technologies concepts

Most studies on disruptive technology focus on a single technology model, given their complexity. To provide a quick overview, based on bibliometric analysis, Table no. 1 presents some of the articles related to disruptive innovation.

Table no. 1: Bibliometric studies on disruptive technologies concepts

Author	Year	Database	Terms
Patel et al.	2022	Wos	Banking And Finance Blockchain Fintech
Li et al.	2018	WoS	Disruptive Technology Disruptive Innovation Emerging Technology
Marques et al.	2023	WoS	Artificial Intelligence Service Systems Bibliometric Analysis Smart Services
Soledispa-Cañarte et al.	2023	WoS	Logistics 4.0 Agribusiness Sustainability Agribusiness Competitiveness
Jajic et al.	2022	WoS	Augmented Reality
H. Huang et al.	2024	WoS	Environmental Engineering Technology Disruptive Innovation Discontinuous Transformation
Reis et al.	2023	WoS	Circular Economy. Solid Waste Management;
Del Vecchio & Menegoli	2023	WoS	Bibliometric Analysis Business Model Industry 4.0 Internet of Things Servitization
L. Huang et al.	2023	WoS	Artificial intelligence Autonomous vehicles Application scenarios
Rosário & Dias	2022	WoS	Industry 4.0 Marketing
Frank et al.	2019	WoS	Artificial Intelligence

Source: Own compilation based on research on Web of Science Database.

Based on Table no. 1, we have created Figure no. 1, which represents the most popular research topics considered part of the category of disruptive technological innovations. The most popular and frequently used concepts are as follows: "Artificial Intelligence (AI)", "Global Internet Penetration", "Machine Learning", "Internet of Things (IoT)", "Blockchain", "Advanced Manufacturing", "Autonomous Vehicles", "Drones", "Biotechnology and CRISPR", "Renewable Energy", "Energy Storage", "Quantum Computing", "5G & Advanced Connectivity", "Augmented Reality (AR)" and "Virtual Reality (VR)."

We are aware that this summary of categories closely related to the disruptive field represents only a small presentation of the big picture and that there are many other technologies that could be included but have not yet gained popularity in academic research.

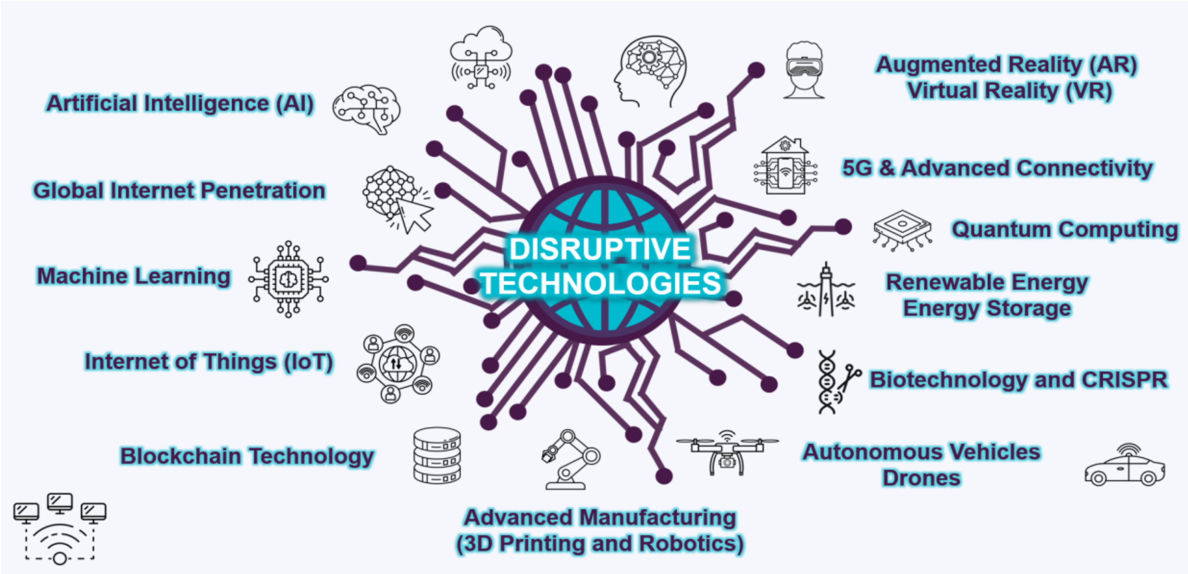

Figure no. 1: Concepts and Terms related to 'disruptive technology' topic

Source: Own compilation based on Table no. 1

3. Methodology

The research methodology encompasses study design and data collection, bibliometric analysis, as well as network construction and mapping (Mougenot & Doussoulin, 2022). The bibliometric analysis was performed using publications from the Web of Science Core Collection database, accessed via the Clarivate - Web of Science (WoS) platform (https://www.webofscience.com/). The search spanned all globally recognized indexes, including the Science Citation Index (SCI), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (AHCI), Conference Proceedings Citation Index (CPCI), Book Citation Index (BKCI), Emerging Sources Citation Index (ESCI), Current Chemical Reactions (CCR), and Index Chemicus (IC). The query was built around the topic term (TS), 'disruptive technology', as the TS field was chosen for its inclusion of the title, abstract, and keywords, ensuring a broader and more relevant capture of the literature.

Taking into consideration only the topic 'disruptive technologies' in the Web of Science (WoS) database, we noticed that the articles classified under this topic amount to just 1,483. The WoS database was selected due to the high quality of its indexed publications and to avoid duplication of sources found in other databases. We chose not to include topics such as 'technology,' 'disruption,' 'innovation,' 'digital,' 'technologies,' or other terms that might be associated with disruptive technologies, as there is a risk of creating confusion. The distinction between an innovative or emerging technology and a disruptive one is very subtle but nonetheless important. Our focus was on the association with the complete term and on avoiding any potential confusion.

All exported records contained the following information: authors, title, source, citation count, addresses, and keywords. The following indicators were analysed: the number of documents published per year, the number of multi-authored and single-authored documents, the average time since publication, the average number of citations per document, the average citations per year for each document, the annual number of publications per search term, the annual number of publications by country for each search term, the annual citation count by country for each search term, and the frequency of keywords for each search term.

Bibliometric analysis is a quantitative method used to statistically assess the impact of published articles as well as the effect of citations on the research field (Goyal et al., 2021). The bibliometric approach relies on three perspectives, according to Biancolillo et al. (2020): the productivity of researchers, the performance of studies, and the connections between them. Additionally, bibliometric analysis provides all these indicators at various levels of aggregation, considering elements such as individuals, groups, institutions, or countries (Furness et al., 2021; Konstantinis et al., 2018; Zhong et al., 2016). To calculate these variables, we used the R Bibliometrix package, accessed via the R Studio program, which offers comprehensive tools for processing metadata (Mougenot & Doussoulin, 2022; Pilkington & Meredith, 2009). Based on the obtained results, it is possible to create visual representations of the number of published works, highlighted through citation counts, the performance of a study, and the countries achieving the best results in each field (Ranjbari et al., 2022). Using this analysis, all the relevant information and the impact of disruptive technologies and of the related and associated topics could be extracted and defined.

Finally, social network analysis (SNA) was conducted to understand the relationships between various dimensions, such as institutions, authors, countries, and keywords (Biancolillo et al., 2020; Wasserman & Faust, 1994). The focus was on analysing the connections between keywords, considering the total number of documents, which highlighted the most discussed and popular term among all those included. To achieve this, we used the VOS Viewer software developed by Ludo Waltman and Nees Jan van Eck. Our aim was to generate connections between nodes using the exported metadata (Biancolillo et al., 2020; Perea et al., 2020; Ranjbari et al., 2022; Wang et al., 2020).

4. Results and discussions

The results obtained from the WoS database synthesized information reflecting the quality of the data, as presented in Table no. 2, indicating a total of 1,483 articles from 1,285 sources, of which 394 were authored by a single author. It is worth mentioning that the first reference to the term "disruptive technology" appeared in Christensen's book in 1976, followed by sporadic mentions until 1996, when it began to garner significant interest from researchers.

The most recent research concepts are closely linked to massive digitalization trends such as AI, VR, Blockchain, IoT, and others. Other indicators of data quality can also be observed, such as the growth rate of articles associated with the studied topic, which stands at 13.16%. If we exclude the less significant time period in terms of the number of publications (1976-1995) and analyse only the period from 1996 to 2024, the average growth rate increases to 35.47%. This trend is further supported by the average age of the articles, which is only 5.62 years (5-6 years).

Table no. 2: Indicators of database quality

Description	**Results**
Timespan	1976:2024
Sources (Journals, Books, etc)	1285
Documents	1483
Annual Growth Rate %	13,16
Document Average Age	5,62
References	50098
Authors	4423
Single-authored docs	394
Co-Authors per Doc	3,14
International co-authorships %	17,73

Source: Own compilation based on results from R Studio - Bibliometrix, exported WoS Database

Table no. 3 presents the most locally cited academic sources in the field of disruptive technologies and reflects the prominence of key journals in shaping the academic discourse around this topic.

At the top of the list is Technological Forecasting and Social Change, with 587 citations, indicating its central role in publishing research related to innovation, technology assessment, and future-oriented studies. It is followed by Strategic Management Journal (286 citations) and Harvard Business Review (276 citations), both of which emphasize strategic implications and real-world business transformations triggered by disruptive technologies.

Other influential journals include Research Policy (264 citations), known for its focus on innovation systems and science policy, and Sustainability (Basel) (263 citations), reflecting the growing interest in the intersection between sustainability and technological disruption. Further down the list are journals specializing in innovation management, information systems, and business research, such as Journal of Product Innovation Management, MIS Quarterly, IEEE Access, and Journal of Business Research, all with citation counts ranging from 218 to 237.

This distribution highlights the interdisciplinary nature of the topic, drawing from technology, business strategy, innovation management, and sustainability studies. These sources represent the foundational literature for understanding the academic landscape of disruptive technologies.

The results presented in the table of the most cited publications confirm the observations found in the literature review regarding the interdisciplinary nature of disruptive technologies and the wide range of domains in which they are applied. The fact that the most frequently cited sources come from journals focused on technological forecasting (Technological Forecasting and Social Change), strategic management (Strategic Management Journal), research policy (Research Policy), sustainability (Sustainability-Basel), product innovation (Journal of Product Innovation Management), or information systems (MIS Quarterly, IEEE Access) clearly reflects the broad impact of disruptive technologies. This thematic distribution supports the idea that these technologies are not confined to a single sector but simultaneously transform diverse industries—from economics and management to engineering, healthcare, and the environment. Therefore, the analysis of the most cited sources reinforces the conclusion that disruptive technologies represent a cross-cutting phenomenon with significant implications across multiple fields of activity.

Table no. 3: Most Local Cited Sources

Sources	Articles
TECHNOL FORECAST SOC	587
STRATEGIC MANAGE J	286
HARVARD BUS REV	276
RES POLICY	264
SUSTAINABILITY-BASEL	263
J PROD INNOVAT MANAG	237
MIS QUART	229
IEEE ACCESS	219
J BUS RES	218

Source: Own compilation based on results from R Studio - Bibliometrix, exported WoS Database

Figure no. 2 highlights the annual growth in the number of published articles starting from 1976. It is evident that the number of articles directly referencing the term "disruptive technologies" has increased over the past 20 years, from fewer than 50 articles annually to over 350. At the same time, this growth may be attributed to the low level of interest prior to the 2000s, as well as the increasing need to classify and understand these technological innovations, which have profoundly influenced all aspects of personal and economic life.

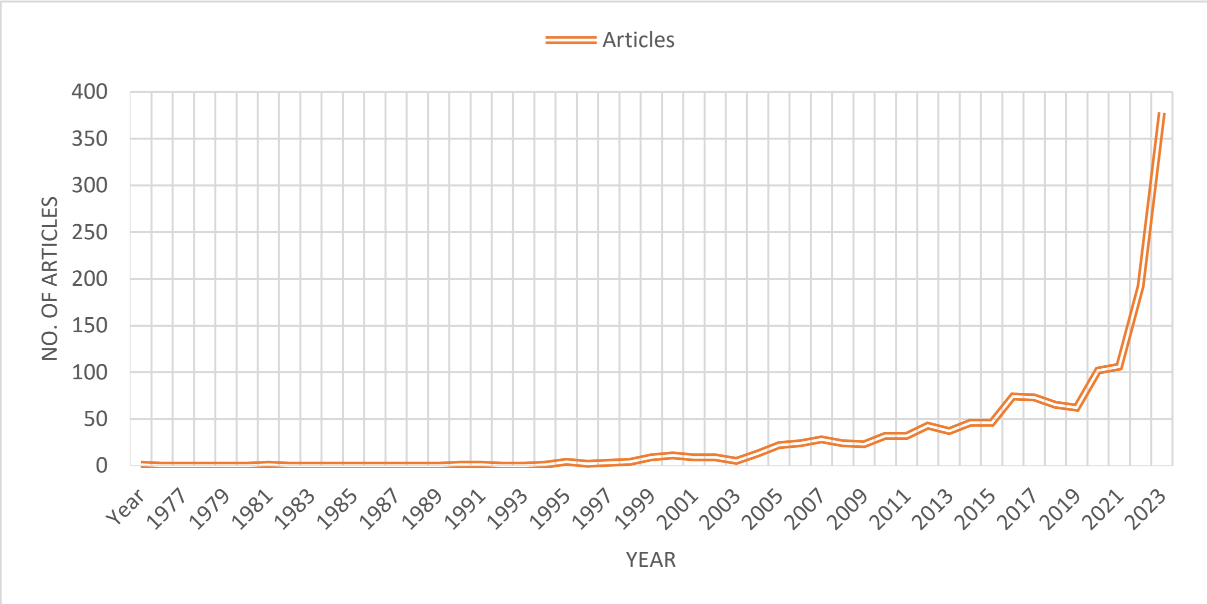

Figure no. 2: Number of articles per year (annual data, 1976-2024)

Source: Own compilation based on results from R Studio – Bibliometrix, exported WoS Database

In the Figure no. 3, the distribution of articles across the most active countries in research on the studied topic over the 48-year period can be observed. In addition to the country distribution, the numerical difference between articles published by a single country and those resulting from international collaborations is also evident. Over the past half-decade, the United States has been the most active in publishing articles on disruptive technologies, with over 300 articles, double the number produced by the second major player, China. Looking at Europe, the United Kingdom and Germany are represented individually, ranking third and fourth, with over 50 published articles each. Considering the overall perspective, most countries have opted to produce articles individually, with only 18.81% choosing to collaborate internationally.

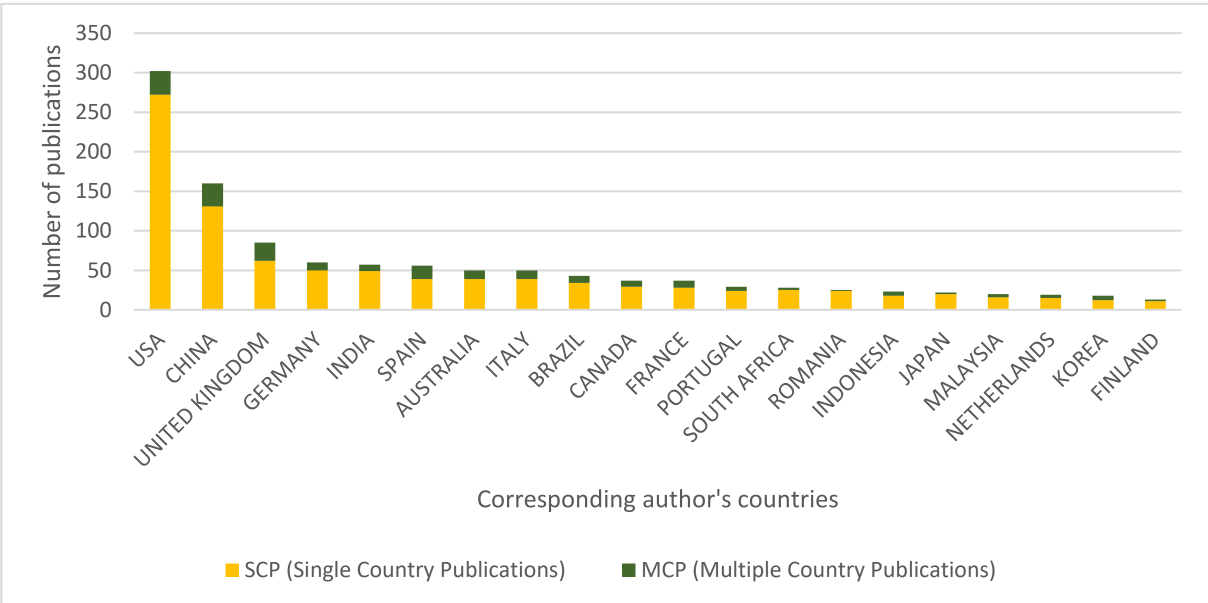

Figure no. 3: Number of published documents by type (SCP/MCP) per country (annual data, 1976-2024)

Source: Own compilation based on results from R Studio – Bibliometrix, exported WoS Database

Analysing the network of countries, we observed an interesting pattern, as shown in Figure no. 3. Although China, Japan, the USA, the United Kingdom, and other English-speaking countries have contributed the highest number of articles, their interest in this field has recently declined. The analysis reveals that the most recent studies were published in India, Spanish- and Portuguese-speaking countries, and India, followed closely by other European countries such as Italy, Romania, and Germany.

Using the VosViewer software, five clusters were identified, with the groupings based on both the publication period of the articles and their volume. In the first cluster, we can observe the inclusion of several countries previously mentioned in Figure no. 4, such as the USA, China, and India.

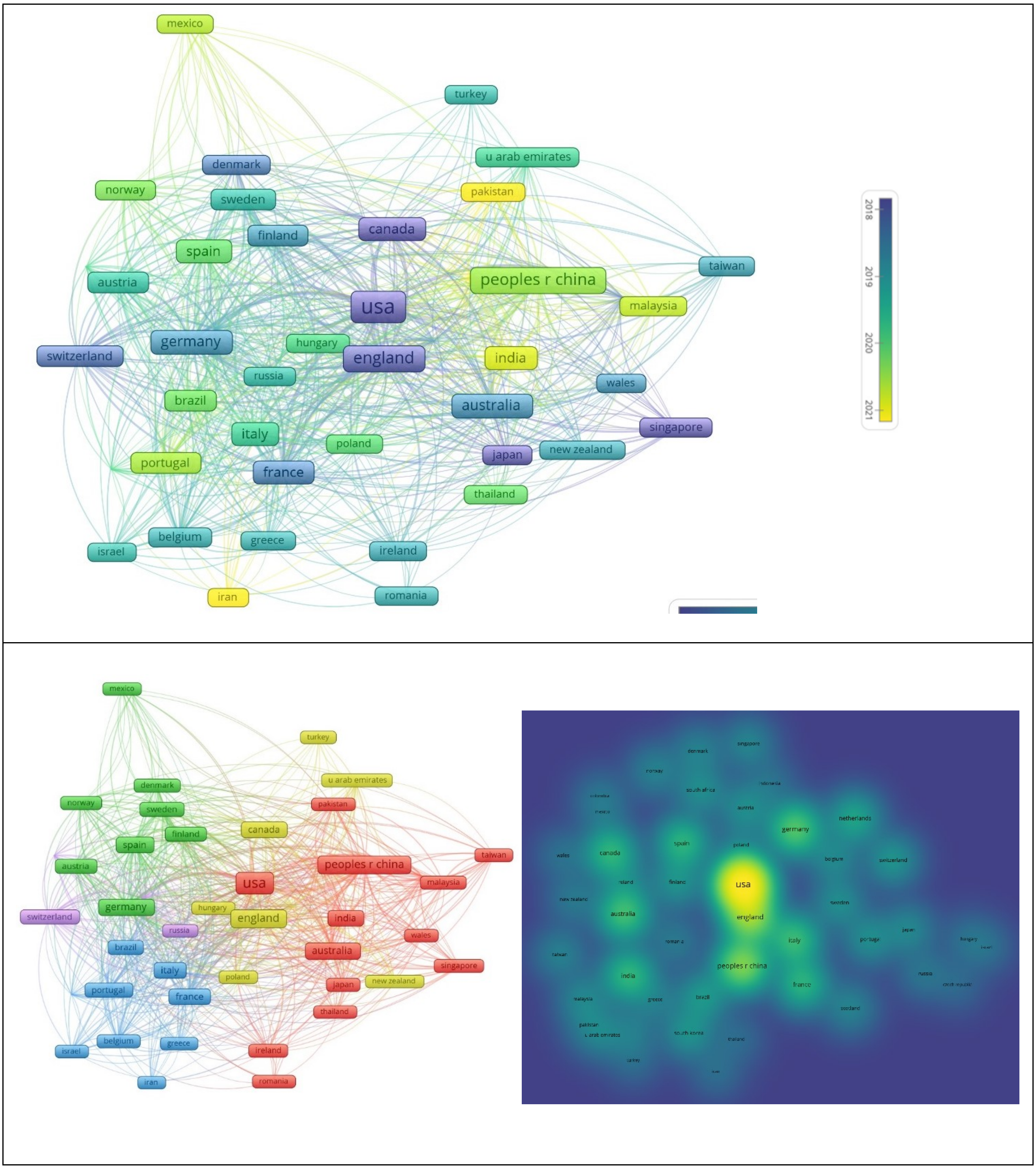

Figure no. 4: Number of published documents by type (SCP/MCP) per country (annual data, 1976-2024)

Source: Own compilation, generated in VosViewer based on WoS database

To identify and establish the main purpose of studies in the field of disruptive technologies and to simultaneously determine the most widespread concepts, we applied a co-occurrence analysis of keywords (Figure no. 5). The term "disruptive technology" is closely tied to any type of innovation that necessitates adaptation. Consequently, the following concepts were identified: blockchain, innovation, artificial intelligence, machine learning, big data, cloud computing, IoT, and many other technologies highlighted and mentioned in the specialized literature, as shown in Figure no. 1 and Table no. 1.

Figure no. 5: Keywords co-occurrence network by field

Source: Own compilation, generated in VosViewer based on WoS database

As part of the analysis, we also identified the periods when the concepts mentioned in the articles gained increased academic interest. We observed that the term "disruptive" became more popular starting in 2016 and that it was identified in various forms, such as "disruptive technology", "disruptive innovation", and "disruptive transformation". Interestingly, the concept of "internet" was classified as a disruptive technology during the 2008-2018 period, which is justified given the massive development of the IT sector and its infrastructure during that time. After 2016, trends were identified in the emergence of studies on "cloud computing", "emerging technologies", "3D printing" and more (Figure no. 6).

Another aspect that gained interest and significance between 2018 and 2023 focused on "higher education", which may reflect a collective awareness of the importance of quality education to facilitate seamless integration into this era of disruptive technologies.

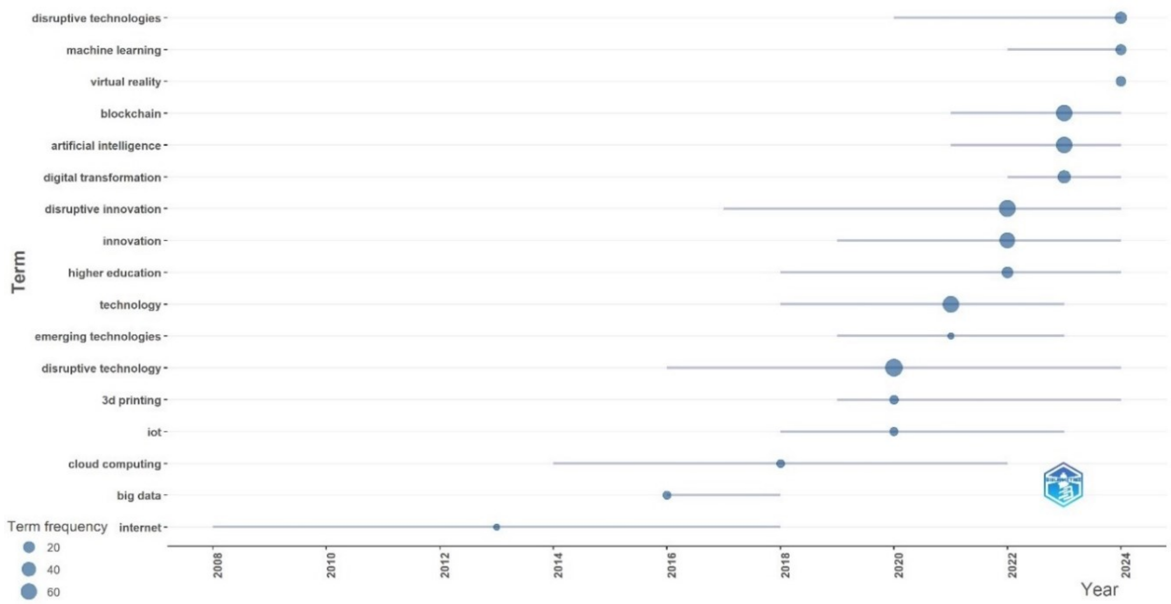

Figure no. 6: Keywords co-occurrence network by field

Source: Own compilation, generated in R Studio – Bibliometrix based on WoS database

5. Conclusion

The paper is based on a scientometric analysis of the main concepts relevant to the topic of "disruptive technology," which hold notable importance in the economic and academic research environments. It primarily highlights the most popular technologies considered disruptive, based on the literature review. The study also incorporates quantitative analysis results, which play a crucial role in understanding the popularity of terms, connections between countries, and identifying the most impactful concept.

One of the initial findings relates to the increasing popularity of the term "disruptive," which gained momentum in the early 2000s, despite originating over two decades earlier. Technological innovations had been highlighted previously, but under different terms than "disruptive." This revealed a limitation in research, as the database referring to terms like "innovation" or "technology" is significantly larger. This discrepancy might reflect either a lack of academic awareness or insufficient promotion until the 2000s-2004 period, during which the number of articles grew exponentially.

From the quantitative analysis, it was concluded that the United States and China were the leading academic contributors to the term "technology," followed closely by European countries like the United Kingdom and Germany. However, their interest has declined recently, while Portuguese- and Spanish-speaking countries have become more active. In this context, one recommendation and observation of the study is to emphasize that we are in an era profoundly marked by technological innovations across all economic sectors and should investigate these developments to identify their disruptive potential. Moreover, greater clarity is needed regarding the distinctions between "emerging" and "disruptive."

Additionally, the analysis of key concepts identified several technologies considered disruptive, such as "blockchain," "cloud computing," "additive manufacturing," and others. These technologies have been individually subjected to detailed academic analysis, resulting in a large number of articles, but are not always associated with the topic analysed in this paper. This revealed a major limitation, as it is very challenging to summarize the actual number of articles in the disruptive technologies field. Consequently, there is consideration for conducting another bibliometric study that includes the concepts identified in the current analysis and examines them individually for a deeper understanding.

An interesting result emerged from the analysis of trends within the academic field related to the topic of this article. It showed past and current trends, sparking curiosity for a more detailed analysis of each trend. One notable aspect that caught our attention was that the internet was a very popular concept between 2008 and 2018 but has since become less relevant over time. We aim to explore this aspect in greater depth to define the trajectory of an innovative technology, from its disruptive impact to its adoption as a standard, as it is perceived today.

As previously mentioned, the study's limitations include the relatively small number of articles associated with the analysed topic. This limitation stems from an incomplete understanding of the "disruptive" factor, as there are many other studies that present technologies falling into this category but are not explicitly targeted.

This study contributes uniquely to the bibliometric literature on disruptive technologies by not only mapping the key terms and their interrelations but also by identifying conceptual gaps in how these technologies are classified and studied across disciplines. By integrating scientometric analysis with contextual interpretation, the paper bridges a methodological gap and offers a foundation for more comprehensive analyses that connect technological, managerial, and policy-related perspectives.

Future research could analyse adjacent databases for the concepts identified in this study to clarify their classification as "disruptive." In addition, future studies should explore interdisciplinary connections more deeply, as disruptive technologies inherently span multiple fields, such as economics, engineering, healthcare, and sustainability, each influencing and being influenced by technological change in distinct ways. Exploring these intersections would enable a more holistic understanding of technological disruption and its far-reaching implications.

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