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Adoption and Applications of Blockchain Technology in Marketing: A Retrospective Overview and Bibliometric Analysis

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Abstract: Blockchain technology has disrupted the traditional approaches of marketing and introduced altogether contemporary marketing frameworks using its unique capabilities of decentralization, security and transparency. In recent times, this technology has attracted both academicians and practitioners to study the underlying processes and opportunities of the application of blockchain technology in marketing. Although there is an increasing deliberation in researching the use of blockchain in marketing, there exists an intermittent gap in holistic overview of the current trends and future boundaries. This article is an attempt to present a comprehensive current state and prospects of expansion in the research of the application of blockchain technology in marketing using state of the art bibliometric review analysis. The bibliometric analysis using 161 articles from Scopus database revealed the influential aspects of research such as prolific authors, influential documents, countries, affiliations, sources and keywords. Moreover, emerging research streams about the application of blockchain is identified and enumerated using network synthesis and visualization of co-citation, and keywords co-occurrence networks. These findings pave the ways for future research expansion. The results shows that the research on applications of blockchain technology has been maturing over time. However, the research streams reveal that blockchain based marketing framework is still in its infancy stage.

Keywords: blockchain marketing; bibliometric analysis; co-citations analysis; keywords co-occurrence analysis

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1. Introduction

The evolution of technologies significantly transformed the way businesses were carried out. The proliferation of digital technologies, especially the internet, has offered new possibilities and is disrupting traditional business processes on a regular basis. The emergence of blockchain technology is one of the most promising and disruptive technologies that might substantially revolutionize the marketing processes and management. The adoption and application of blockchain technology by companies would entirely transform the way they interact and transact with their stakeholders and reshape their entire communication framework and processes.

Blockchain is a decentralized distributed ledger that is made up of blocks which contains highly encrypted bits of information to achieve secure [1], fast and trustworthy transactions in real-time environment [2]. The blocks are immutable, i.e., once added to the blockchain, it cannot be altered or tampered that makes block chain free from nasty

intruder or hackers to inject proxy blocks or hoax the network [3]. Moreover, blockchain technology eradicates the middle man from the processes and transactions are happening among trusted and verified parties [4]. This makes the whole process highly transparent and ultimately enroots enormous trust among the participants of a blockchain network [4].

Blockchain is usually understood as a technology being used for fintech and digital currency such as Bitcoin, Ethereum, etc. It is extensively used in the trading of cryptocurrency and other financial transactions of buying and selling where bitcoin is accepted as a mode of payment [3]. There are very few cases of use for the adoption of blockchain in marketing applications, while it has got all the potential to create a more secure and trustworthy relationship with the customers and brands [5]. The application of blockchain in marketing has revolutionized B2C payments and transactions [6], distribution tracking by customer for their ordered brand [7], loyalty programs [8,9], digital marketing programs [10–12], review management [13], internal marketing processes management [14,15] and paid click [16], etc.

The research in this subject is fragmented and in an infant stage. There are few review studies available in the existing literature that have been carried out to understand the importance of block chain technology in a certain marketing strategy, such as loyalty program, communication strategies, promotional activities and personalization [17]. There are few articles that have reviewed the application of blockchain in supply chain, tourism, finance, etc. [18,19]. Very few articles on this focusing on this phenomenon holistically and presenting a comprehensive mapping of social and intellectual structure of knowledge have been published.

Application of Blockchain Technology in Marketing

The application of blockchain technologies in marketing can give the discipline a new wing to re-activate its saturated state. It can be applied to advertising and marketing for better and efficient result. The decentralization feature of blockchain enables marketers and advertisers to manage data effectively, gain deeper insights about customer reactions to their advertisements and make sustainable customer relationship [20,21].

Blockchain can be effectively utilized for content creation and delivery, all the stakeholders of the digital assets will get real-time updates about the content. The transferability and ownership of the digital content are at the core of blockchain based content applications [22,23].

Another important application of block chain technology is in e-commerce, it enables a more efficient and flexible payment system and the deployment of an anti-fraudulent system that ensures secure online financial transactions at relatively low cost [24].

Data are another important aspect of marketing where blockchain is playing a pivotal role. Whether it is IoT data or customer related data, the decentralized mechanism makes it quite effective to use services without furnishing personal data. The customers are getting directly rewarded from the businesses if they are using customer personal information [25,26].

This article is an attempt to study, evaluate and summarize the existing literature to understand the current state of research, its social and intellectual structure and future avenues of expansion in adoption and application of blockchain technology in marketing. This article builds on the state-of-the-art bibliometric review and visual network analysis to answer the following research questions. What is the current state of research in the application of blockchain technology in marketing? What is intellectual structure, i.e., emerging trends in the adoption and application of blockchain in marketing? What are the probable areas of future research in this field?

The rest of the article is arranged as follows. The research methodology and data strategies are discussed in Section 2. Section 3 addresses the bibliometric analysis, such as publication trends, best documents, authors, institutions, countries, etc. While Section 4 is based on the visualization of networks, such as co-citations analysis and keyword co-occurrence analysis. Then, Section 5 presents the future avenues of research which is followed by the conclusions in Section 6.

2. Data Strategy and Research Methodology

This research has adopted a systematic literature review approach using bibliometric analysis techniques, it is being used extensively to map the knowledge in a particular discipline of study [27]. We chose Scopus because it is the largest database of the abstract and citation database of the peer-reviewed articles [28–31]. The international database "Scopus" is used as the data source for this research, Scopus is considered as the largest database of social science and it is being used for similar studies by several authors [27,32–34]. Although Web of Science (WOS) and Scopus database overlap to great extent, Scopus is considered an extensive index of the existing social sciences literature [35]. Scopus search engine is equipped with operating functionalities, such as journal name, h-index matrix, citations matrices, etc., that enables efficient bibliometric analysis [36].

The data were searched in the "TIT-ABS-KEY" field of Scopus search engine with deliberately selected combinations of keywords syntax using logical operators AND and OR to retrieve all the possible literature in the subject area of adoption of technology in marketing, such as ("Blockchain" AND "Marketing") OR ("Blockchain" AND "Digital Marketing") OR("Blockchain Technology" AND "Marketing") OR ("Distributed Ledger" AND "Marketing") OR ("Digital Ledger" AND "Marketing") OR ("Public Transaction Ledger" AND "Marketing") OR ("Public Transaction Ledger" AND "Retail Marketing") OR ("Cryptographic Ledger" AND "Marketing") OR ("Ledger" AND "Digital Marketing"), etc. This search resulted in 378 articles which were further subjected to inclusion criteria. Only those articles which have been written in English language, final articles and of conference, article or book chapter were included. This stage reduced the data size to 269 articles. These articles were exported in a .CSV file for further screening and data preparation. Furthermore, the researchers made sure that the included articles were purely focused on the research studies having central theme of blockchain technology and marketing. The researchers looked at the tittle and abstract of each article and excluded the papers which were not falling under the scope of current research. This stage further reduced the data set to 161 articles which are finalized for further data analysis and discussion.

The data analysis was carried out in two steps. In the first step, bibliometric analysis was carried out by employing biblioshiny web-interface of R application. Biblioshiny application enables researchers to process and analyze bibliographic data in a comprehensive manner and extract the results in tabular and graphical forms for further discussion and analysis [32,37]. The performance analysis was carried out to evaluate the most influential aspects of the current state of research in adoption and application of blockchain technology in marketing, such as best documents, prolific author, institutions, countries, keywords, etc. Then, in the second stage, scientific mapping and network analysis was performed for understanding the current intellectual and social structure of research publication, network visualization and synthesis, such as co-citations and keyword co-occurrence analysis, were carried out using VOSviewer software application. VOSviewer application was widely used by the researchers in bibliometric analysis studies to build and analyze networks for publications and keywords based on the citations [38,39].

3. Bibliometric Analysis

The following section is based on the important aspects of research trends in the adoption and application of blockchain technology in marketing. The following Table 1 shows the data set characteristics used for this analysis. As is evident from the table, the data set consists of 161 articles which were published by 161 sources over a period

of 6 years. The majority of the publications had an average time of 1.24 years since publication, which shows the recency of the importance of research from the perspective of integration of blockchain in marketing. There were 6538 references used that indicated the multidisciplinary nature of research, that blockchain technology integrates subjects such as computer science, modelling in management, operations research, supply chain management and other allied areas. It is also worthwhile to note that more than 35% of the literature is conference papers that show that the research is in more of a theoretical stage and needs more time to be adopted in business applications.

Table 1. Data Characteristics.

Data Characteristics	
Timespan	2017:2022
Sources (Journals, Books, etc.)	120
Documents	161
Average years from publication	1.24
References	6538
article	77
book	1
book chapter	17
conference paper	57
review	8
Keywords Plus	791
Author's Keywords	492
Authors	474
Single-authored documents	25
Documents per Author	0.34
Authors per Document	2.94
Co-Authors per Documents	3.27
Collaboration Index	3.3

474 authors have produced these articles out of which only 25 papers are single authored, and rest are authored in collaboration that is amounting to 3.27 authors per documents.

3.1. Publications & Citations Trends

The annual publications and citations trends are presented in Figure 1. The first paper found in 2017 and the field grows consistently by then. The trend has seen an exponential growth during last three years which indicates the deliberations of researchers in understanding and studying probable applications of blockchain technology in marketing management. As far as citations are concerned, the articles published in the beginning have been comparatively cited more and recent articles will attract citations in the times to come. Overall, there is an upward trend in this research domain.

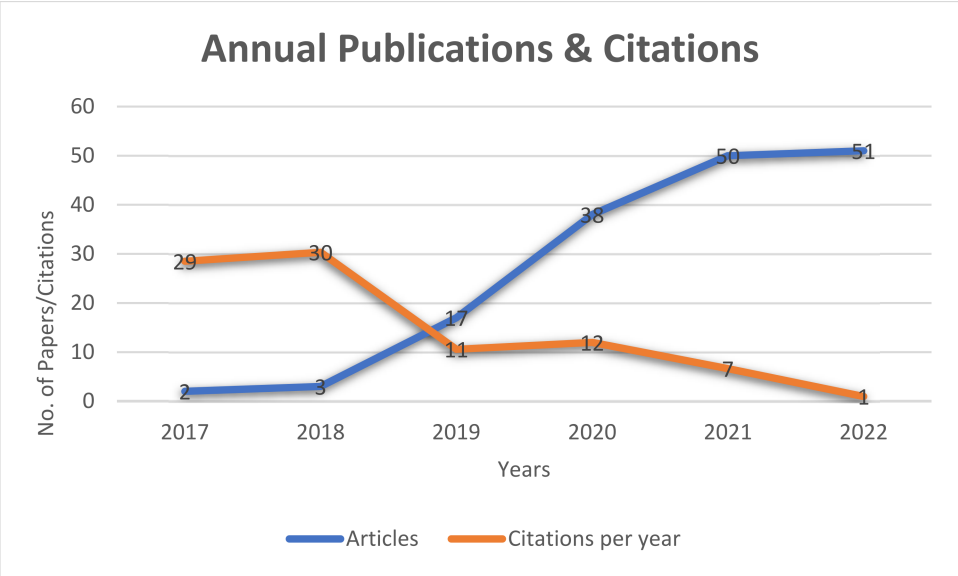

Figure 1. Annual Publications & Citations Trends.

3.2. Influential Documents

Table 2 shows that the 10 most influential documents, along with their total citations, have been published on the adoption and application of blockchain technology in marketing. The top document in the list is titled as "A framework for analyzing blockchain technology adoption: Integrating institutional, market and technical factors", attracted total citations of 129 since it was published in 2020. This article has investigated the various challenges in the adoption of technologies in businesses and possible integration of blockchain in businesses. The article titled "Anonymous reputation system for IIoT-enabled retail marketing atop PoS blockchain" is the most cited document having been cited 80 times since its publication in 2019. This article emphasizes on the integration and implementation of blockchain technology and Internet of Things (IoT) for retail businesses at their Point of Sales (POS). Another important document in the list is about the impact of disruptive technologies in businesses and marketing. The article "Influence of new-age technologies on marketing: A research agenda" was published in 2021 and had attracted 74 citations by then. Other documents also touched important angles of blockchain applications in marketing such as modern retailing, innovative product design, capturing users' behavior on social network and managing information on Omni channels.

Table 2. Top 10 Documents.

Authors	Year	Source	Tittle	(TC) Total Citations	TC per Year
Janssen M	2020	International Journal of Information Management	A framework for analyzing blockchain technology adoption: Integrating institutional, market and technical factors	129	43
Liu D	2019	IEEE Transactions on Industrial Informatics	Anonymous reputation system for IIoT-enabled retail marketing atop PoS blockchain	80	20
Kumar V	2021	Journal of Business Research	Influence of new-age technologies on marketing: A research agenda	74	37
Ahluwalia S	2020	Technological Forecasting and Social Change	Blockchain technology and startup financing: A transaction cost economics perspective	67	22

Table 2. *Cont.*

Authors	Year	Source	Tittle	(TC) Total Citations	TC per Year
Grewal D	2018	Journal of Marketing Education	The evolution and future of retailing and retailing education	64	13
Mansfield-Devine S	2017	Computer Fraud & Security	Beyond Bitcoin: using blockchain technology to provide assurance in the commercial world	52	9
Chen Y	2019	Information Sciences	DEPLEST: A blockchain-based privacy-preserving distributed database toward user behaviors in social networks	46	12
Rahmanzadeh S	2020	International Journal of Production Research	Integrated innovative product design and supply chain tactical planning within a blockchain platform	42	14
Cui Th	2021	Journal of Marketing	Informational challenges in omnichannel marketing: remedies and future research	38	19
Tozanli Ö	2020	International Journal of Production Research	Trade-in-to-upgrade as a marketing strategy in disassembly-to-order systems at the edge of blockchain technology	35	12

3.3. Most Prolific Authors

Table 3 shows the top 10 authors researching and publishing in the field of applications of blockchain technology in marketing. The authors h, g and m-indices are also presented along with total number of citations and number of publications. These indices are the indicators of the authors productivity and citations of their publications. The most prolific author in this list is "Sivarajah U", who has published 2 papers, though his publications received 162 citations. The author studied the importance and challenges of integrating blockchain technology with marketing processes. The second top author in this list is "Irani Z", with only one publication that has been cited 129 times. The paper discusses the blockchain adoption for businesses and suggested a framework for assessing the probable impact of blockchain adoption. With one publication and 129 citations, "Ismagilova E" is the third most influential author. This author is co-author with "Ismagilova E". The other authors have also contributed significantly to understanding the amalgamation of blockchain technology with marketing practices.

Table 3. Top 10 Most Important Authors.

Author	h_index	g_index	m_index	TC	NP
Sivarajah U	2	2	0.667	162	2
Irani Z	1	1	0.333	129	1
Ismagilova E	1	1	0.333	129	1
Janssen M	1	1	0.333	129	1
Weerakkody V	1	1	0.333	129	1
Lin X	2	3	0.5	84	3
Liu D	2	3	0.5	84	3
Ni J	2	3	0.5	84	3
Shen X	2	2	0.5	82	2
Alahmadi A	1	1	0.25	80	1

3.4. Most Important Countries

The publications and citations of the top 10 countries are depicted in Figure 2, author appearances are also shown, which indicate how the author of a particular country is collaborating with other authors globally. From a citation perspective, the USA, the UK and India are the top three countries. Whereas China tops the list in terms of publications, and is followed by India, the UK and the USA. The publications of the USA are more referred to and citated when compared to another countries. As far as author appearances are concerned, India has the most appearances with a score of 137, followed by China with 96 and the USA with 36. This result indicates that Indian and Chinese authors have produced more globally collaborated research compared to other countries.

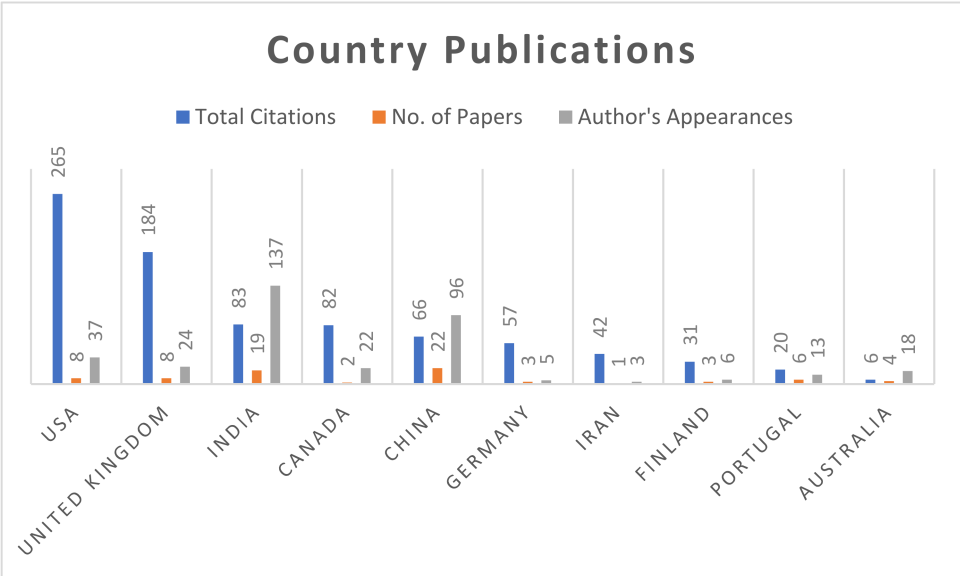

Figure 2. Top 10 Countries Publications & Citations.

Figure 3 explains the collaborations among authors and the number of papers which are single-country-authored or multicountry-authored for 20 countries. Consistent with the previous results, China has the highest number of single-authored papers followed by India and the United Kingdom. A few countries, such as Portugal, Canada Greece, Tunisia, Austria, etc., have produced papers which are written by their own authors.

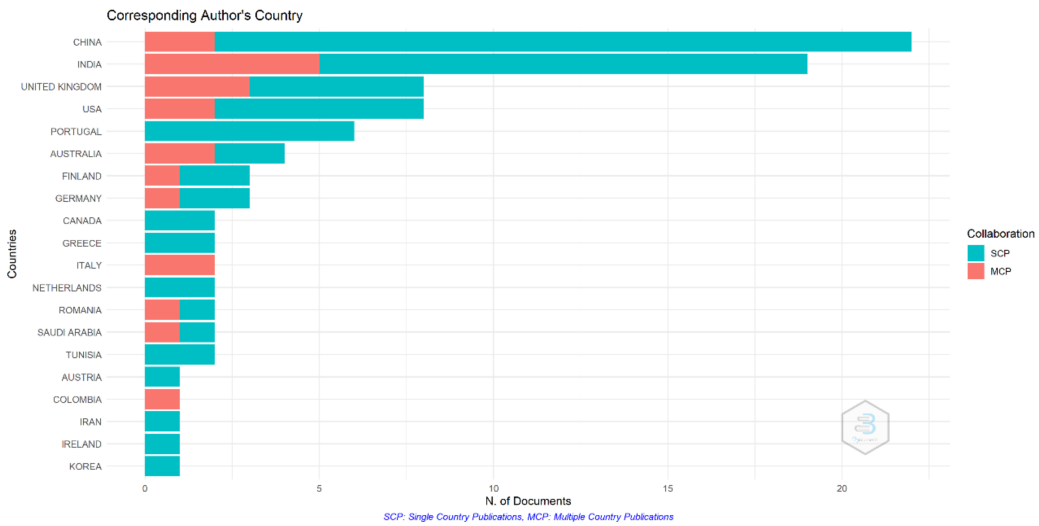

Figure 3. Top 20 Corresponding Author's Country.

3.5. Most Relevant Affiliations

The organizations which contributed the most to the development of the research in blockchain and marketing are presented in Figure 4. The most productive affiliation is "Guilin University of Electronic Technology" in China, it has produced 15 articles on various aspects of application of blockchain technology in marketing practices. The first article on blockchain application in marketing was published around 2013 and within a span of 9 years it contributed 15 articles which were based on the behavioral aspect of marketing. The second most influential affiliation found in this discipline of research is "Bucharest University of Economic Studies" in Romania which has published 8 articles. Next in this list is "Agricultural University of Athens" in Greece, and "University of Waterloo" in Canada, which contributed 6 articles each. The other affiliations have also contributed significantly to the development of the research in the field of blockchain integration with marketing processes.

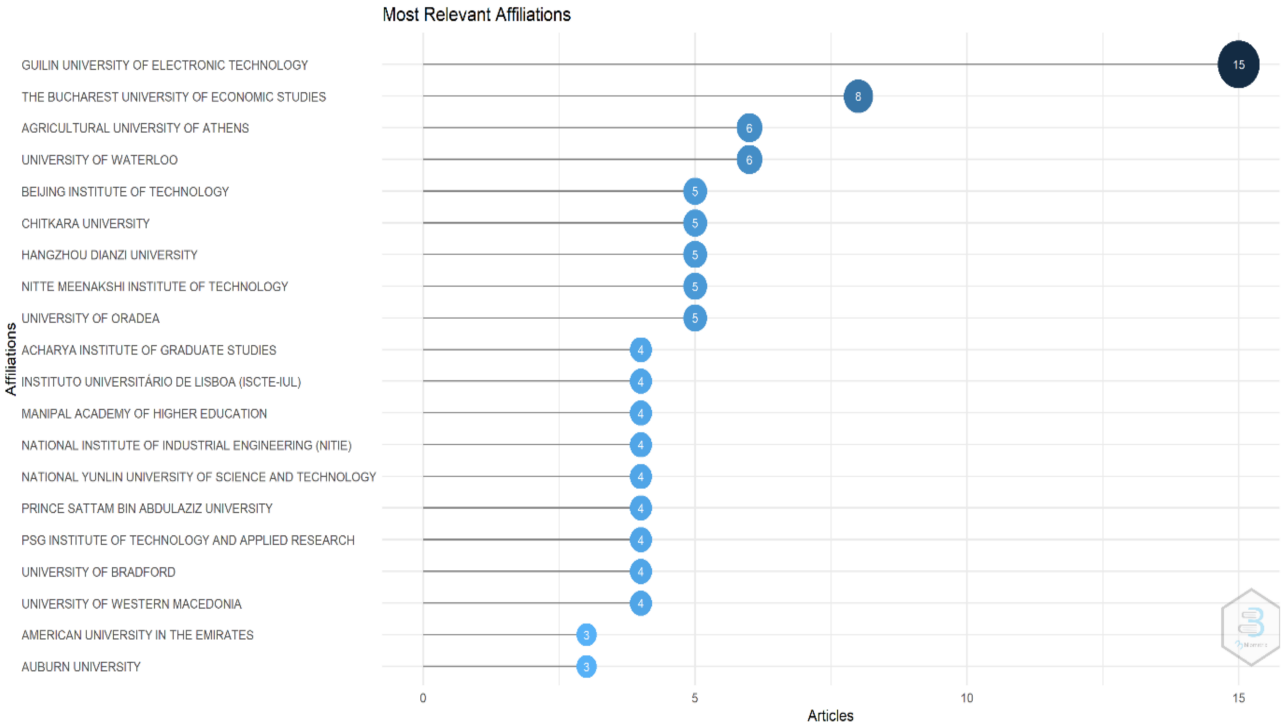

Figure 4. Top 20 Influential Affiliations.

3.6. Most Important Sources

The sources which contributed the most to the understanding and development of research in blockchain technology and marketing are presented below. Figure 5 shows the top 20 sources in terms of number of articles that they have published on this subject.

The highest number of articles (8) have been published in the book "Blockchain Technology and Applications for Digital Marketing", published by IGI global. The second highest publications are found in the conference proceedings series of "Springer Proceedings in Business and Economics" that have contributed 4 articles. The journal of "Sustainability" published by MDPI has also contributed 4 articles in the research domain of blockchain and marketing.

Figure 5. Top 20 Influential Sources.

The ranking of sources from the angle of total number of citations it received over the period is presented in Table 4. The table depicts important productivity and citations indices such as h, m and g-indices, Total Citations (TC), Number of Paper (NP) and Production Start (PY_start). The top journal/source is "International Journal of Information Management" which has been cited 129 times since its publication in 2020. The journal "Technological Forecasting and Social Change" is second in the list and attracted 100 citations since it started publication in 2020. While "Journal of Business Research" is cited 95 times and published 2 papers within a year of its first publication. It is quite obvious that the majority of the sources started publishing on blockchain marketing from 2017 onwards. It shows the evolution of blockchain in marketing within the last five years.

Table 4. Top 10 Most Important Sources.

Source	h_index	g_index	m_index	TC	NP	PY_start
International Journal of Information Management	1	1	0.33	129	1	2020
Technological Forecasting and Social Change	2	2	0.67	100	2	2020
Journal of Business Research	2	2	1.00	95	2	2021
IEEE Transactions on Industrial Informatics	1	1	0.25	80	1	2019
International Journal of Production Research	2	2	0.67	77	2	2020
International Journal of Information Management Data Insights	2	2	1.00	74	2	2021
Journal of Marketing Education	1	1	0.20	64	1	2018
Computer Fraud and Security	1	1	0.17	52	1	2017
Information Sciences	1	1	0.25	46	1	2019
Journal of Marketing	1	1	0.50	38	1	2021

3.7. Thematic Evolution

Thematic evolution is an approach which integrates performance analysis and scientific mapping to discover and visualize emerging research streams and sub-domains in a given specific research domain [40]. Thematic evolution and mapping were performed using biblioshiny application and the results are presented in Figures 6 and 7. The thematic map presents the important themes in the development stages of the research in blockchain and marketing practices (Figure 6). The four quadrants of the map exhibit the basic themes, emerging or declining themes, niche themes and motor themes. Each of these quadrants signifies the important subdomains of research, for instance, network security, supply chain and Ethereum are the niche themes which indicate that research is progressing in these areas of application of blockchain technology. Whereas data privacy, big data and digital storage are motor themes, i.e., these are main streams of the research and primarily addressed. Electronic commerce, information management, marketing and artificial intelligence are found to be the basic theme in the research of blockchain and marketing. The applications of blockchain technology in economics, agriculture, smart contract, social media, social media networking and food supply are emerging and clustered around emerging themes.

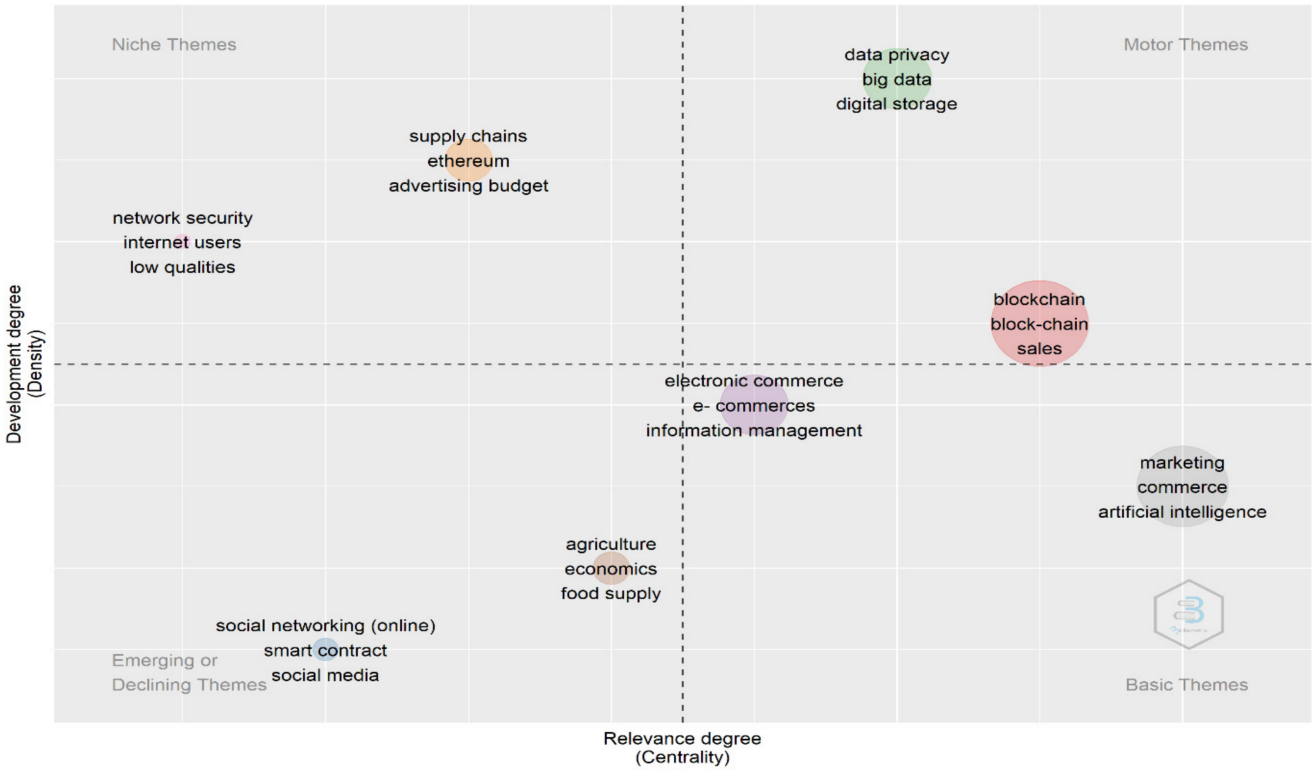

Figure 6. Thematic Map.

In addition to thematic map, a three-field plot of the research evolution is presented in Figure 7. The figure shows the relationship amongst authors keyword (left), author (middle) and tittle (right) and how they evolved over the period. Most of the keywords used by the authors are quite like the words used in the tittle of the articles. A few of the important streams which can be visualized are the amalgamation of marketing, commerce and blockchain to advertising, media and online management.

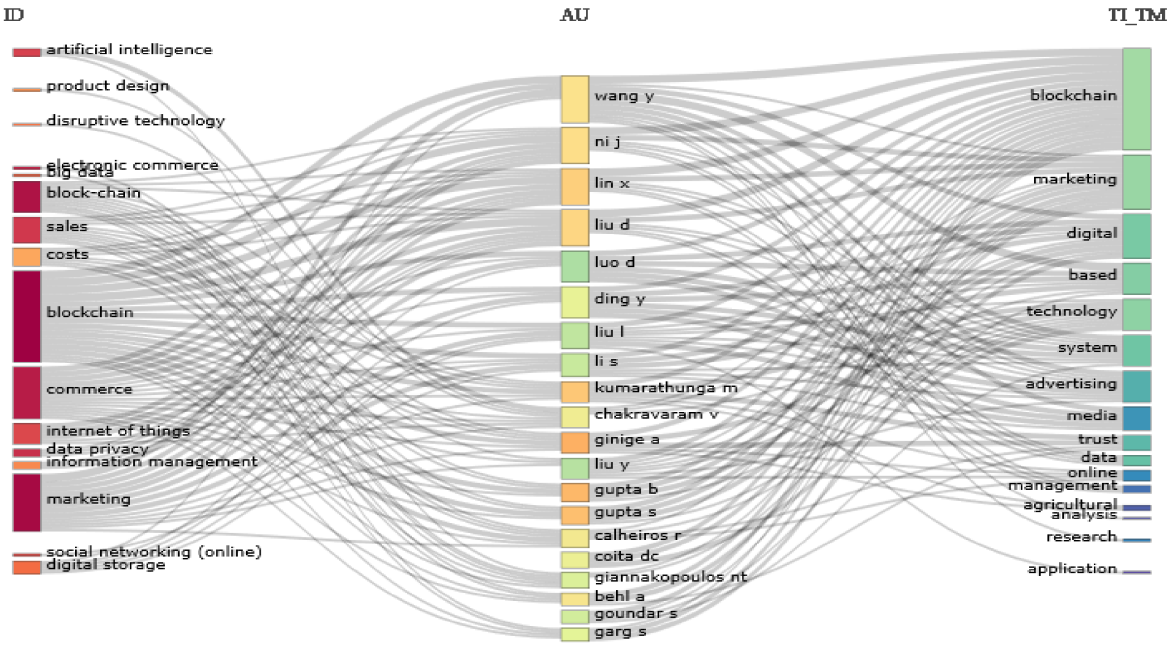

Figure 7. Three Filed Plot.

4. Network Analysis

Network analysis technique is useful in understanding the inter-relationship and inter-dependencies among the documents, authors, words, organizations sources, etc. [41]. Moreover, it helps the researchers to visualize the intellectual structure and landscape. VOSviewer application is employed for conducting network analysis, such as co-citations and keywords co-occurrence analysis that would help in identifying the key research streams to be expanded in the future.

4.1. Co-Citations Analysis

Co-citation analysis is a technique of searching, tracking and identifying an author's documents which have been cited together in another document, these documents do have a common characteristics and form a cluster [42]. The co-citation analysis of the cited authors is conducted to reveal the structure of research and presented in Figure 8. The minimum number of citations of an author was kept at 10, only 91 authors met this criterion and the network formed was thus based on four clusters having 2873 links and total link strength of 13,396.

The largest cluster of the network (violet) is made up of 27 authors, the prominent authors in this cluster are Beck, R; Jannsen, M; Tapscott, A; Tapscott, D; Crosby, M; Hawlitscheck, F, etc. These authors are researching on the important aspects of blockchain adoption and applications in marketing processes. This stream highlights the importance of technological advancement that is required for the digital transformation of the organizations specially marketing practices. Some of the important technologies, such as Internet of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL) and Artificial Neural Network (ANN) [43], have already been applied in business and commerce and achieved better productivity, revenue and profitability [44]. The role of blockchain technology in agricultural marketing [45], digital marketing [46–48], social media [17,49] and communication [43] are some of the core themes of this cluster. This cluster further indicates that there are various unexplored facets of adoption and application of blockchain technology that need further investigation.

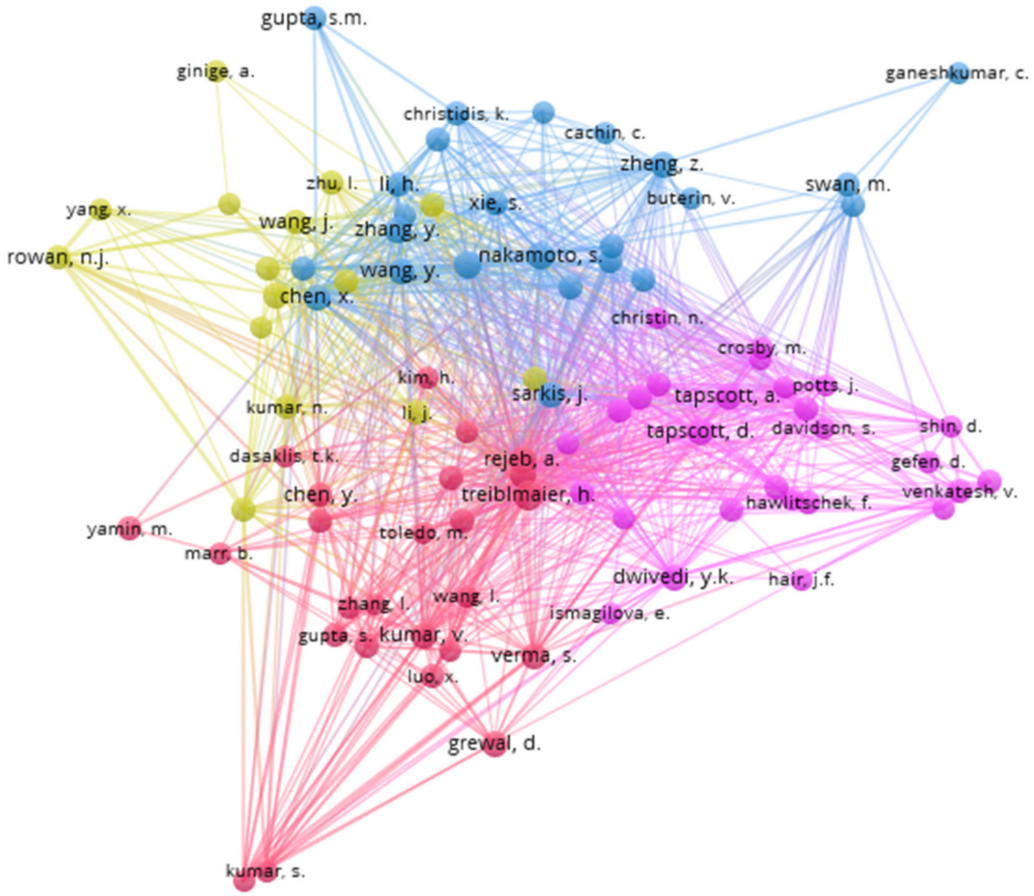

Figure 8. Co-Citation Network of authors.

The second cluster (red) is made up of 25 authors and is identified as the cluster containing studies which are pertaining to the application of blockchain technology in e-commerce activities. Together with big data analytics, behavioral intelligence and real time personalization e-commerce has become an important channel for attracting, engaging and assuring excellent customer experience. Some of the very important facets in this cluster are information management [46], product design [50], decentralization [51], real-time analytics [6], advertising budget [12], loyalty programs [9], reviews and feedback [52], etc. The customers on e-commerce websites are bombarded with promotional information, they are required to be handled with utmost personalization to ensure longevity of stay on the website. The longer the stay, the longer the engagement with brand which ultimately leads to sales revenue. The behavioral aspects of adoption of blockchain technology in marketing and its acceptance from customers have not been explored much, so this could be a crucial avenue for future researchers.

Third cluster (Blue) consists of 24 authors, this cluster is made around the theme of big data processing and analytics in blockchain adoption for marketing processes. Data are the most crucial component of any system, and it should be handled properly to gain important insights about the critical business processes [53]. Data analytics tools and techniques are developing day-by-day and gaining momentum in marketing applications. The big transactional data collected are needed to be analyzed using blockchain technology that can help in business modelling, such as behavioral analytics [4], digital behavior [4], demand forecasting [17], marketing budget analytics [13], etc. Big data analytics using blockchain is developing and needs more deliberation from modelling perspectives to study the probability and feasibility of adoption in marketing.

The fourth and last cluster (yellow) of the network constitutes 15 articles and based on the central theme of data privacy and security. One of the most important factors of keeping

organizations and consumers away from adoption of technologies and their application is the fear of online fraud, data hacking, trust deficit, nasty intruders and network security [54]. Blockchain technology would probably solve these problems of privacy and security using highly secured digital distributed ledgers that can be tampered with and hacked [10]. The future researchers can explore the privacy and security issues of blockchain technology applications, such as consumer personal data protection, information trustworthiness, breaching of information, etc. in marketing.

A careful investigation of the network clusters reveals that data privacy and security is going to be the main focus of the marketers in adopting blockchain technology for their firms. Therefore, it will be challenging to gain customer trust that will help in attracting, engaging and transacting with target customers in a blockchain-enabled environment.

4.2. Keywords Co-Occurrence Analysis

Keyword co-occurrence analysis is a method of identifying the similarities in the content of the scientific literature, it is basically a semantic measure of the keywords used in the scientific literature [55]. Co-occurrence network analysis of author's keywords is conducted and presented in Figure 9. The minimum number of occurrences of a keyword was kept at 3, 155 keywords met the threshold and were included in the network construction. The network thus obtained has four clusters containing emerging theme of research in the application of blockchain in marketing.

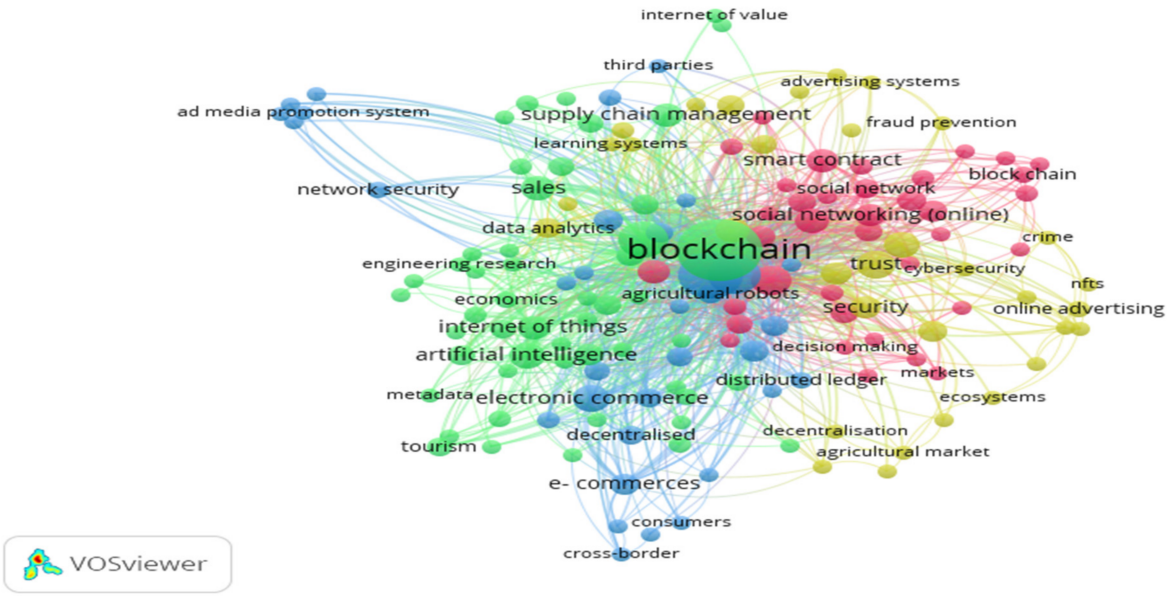

Figure 9. Keywords Co-Occurrence Network.

The cluster (green) is the largest cluster of the network and is made up of 51 keywords. Some of the prominent keywords in this cluster are artificial intelligence, text mining, internet of things, metadata, technological innovation, emerging technologies, sustainable development, sales, retailing, consumer behavior, value creation, internet of value, etc. [6,56–58]. This cluster is about the applications of technologies in marketing, especially blockchain technology that offers utmost possibilities in varied marketing applications. These keywords emphasize the advantages of blockchain technology, namely that a marketing firm can exploit for better marketing communication, effective customer relationship management and increased sales revenue. The technological advancement has not only empowered the customers but also forced the brands to be consistent on its all channel with excellent customer experience [15].

The second cluster (red) consists of 37 keywords. This cluster has keywords such as data privacy, smart contracts, security perseverance, privacy, trust, security, cybersecurity,

transparency, digital marketing [13,52,59,60], etc. This cluster specifies the privacy and security of blockchain based marketing applications. This result is consistent with the results of co-citation analysis where data security and privacy has emerged as one of the core clusters of the research in applications of blockchain in marketing. Moreover, it also indicates that security is the key for keeping customers and other stakeholder's trust in blockchain's applications in marketing domain.

The cluster (blue) is made up of 34 keywords. Some of the prominent words are agricultural robots, cross border, cryptography, information management, online marketing, digital marketing, digital storage [4,13,50,61], etc. It highlights the applications of blockchain technology in agricultural marketing, international business and information management. Blockchain technology has been applied to agriculture and supply chain management which resulted in excellent performance because of its capabilities of bypassing third party and availability of transactional information in real-time to all the agreed stakeholders on the chain [62–64]. It has revolutionized cross-border trade because of its unique features of decentralized mechanism, as well as a high level of trust because of its immutability [65,66].

The smallest cluster (yellow) constitutes 33 keywords. The keywords are decentralization, fraud prevention, crime, cybersecurity, agricultural technology, ecosystems, online systems, online advertising, etc. This cluster indicates the role of blockchain technology towards economic development, it constitutes keywords that indicate critical aspects of blockchain technology in marketing, such as security, applications and economic systems [67,68]. Additionally, it can also be noted that the keyword online systems, online advertising and online advertising budget indicate the use of blockchain technology in online businesses. Social media networks have applied blockchain technology to target their users with real time behavioral intelligence and noticed significant growth in sales revenue [58,69].

Trends in the blockchain marketing are promising and are going to be at the center point of marketing campaign and other consumer-related activities. The technology enable chat bots, AR/VR and virtual trial rooms will revolutionize the retailing landscape. Moreover, online marketing in general and online consumer behavior shall be disrupted and give rise to altogether new economic framework of business.

5. Future Research Directions

The critical investigation of the clusters formed by co-citations and keyword co-occurrence analysis, along with other bibliometric analysis of the following research streams and sub-streams, are identified. They need further exploration to understand the complexity and applicability of blockchain technologies in marketing.

Table 5 shows the emerging streams and sub-streams that shall be studied further to answer the questions and fills the gaps in the literature. Some of the key future research questions in the implementation of blockchain technology for marketing applications are handling of big data and its analytics to deep dive into customers insights that can help in designing efficient marketing strategies. It is worthwhile to note that blockchain technology in marketing applications is known to be a recent affair and most of the trends were found between 2017 to 2022. Another important area of concern is the designing and testing of a blockchain-based marketing applications model that can be applied to online businesses especially e-commerce. There are very few articles that emphasized the integration of blockchain and marketing, more deliberations are required to study the interlinkage amongst them. Moreover, the future of marketing because of blockchain integration shall also be thoroughly examined. As the most crucial aspect of implementation of blockchain applications in marketing is privacy and security, there is an urgent need of research in studying these challenges and proposing frameworks for combating privacy and security issues on blockchain-based applications.

Table 5. Research Streams and Sub-Strems of Blockchain Applications in Marketing.

Main Strems	Sub-Streams	References
Blockchain Marketing	Social media platforms	[58,69]
	Social media networks	[58,70,71]
	Digital Marketing	[72–75]
	e-commerce	[76–78]
	Product design	[7,17,79]
	Behavioral Research	[17,80]
	Internet of value	[81–83]
Blockchain & Data	Digital Storage	[67,84]
	Big Data Analytics	[13,81,85,86]
	Data Mining	[43,53,87]
	Cryptography	[4,88]
	Forecasting	[89–91]
	Predictive analytics	[92,93]
Blockchain data privacy & Security	Data Privacy	[94,95]
	Fraud Detection	[96,97]
	Transparency	[4,12,83]
	Data corruption	[98,99]
	Smart Contracts	[100–102]
	Network Security	[51,103]

6. Conclusions

The future of marketing appears to be drastically transformed with the adoption of blockchain technology. Marketing will substantially benefit from the unique features of blockchain technology, such as real time reviews and feedback, cost savings, risk mitigation and superb customer satisfaction. The current study is unique in the sense that very few studies have critically examined the adoption and application of blockchain technology in marketing. This study has adopted a state-of-the-art bibliometric analysis using biblioshiny application coupled with network visualization techniques through VOSviewer application. A number of 161 articles from Scopus database were used for conducting bibliometric analysis which helped in enumerating the current state of the research and identifying the prominent aspects of the literature in the adoption and application of blockchain technology in marketing. The research streams and sub-streams were identified using network visualization techniques that enable the researcher to frame future research questions and avenues for expansion.

This study substantially contributes to the existing knowledge of blockchain technology adoption in marketing by highlighting (a) publications and citations trend, prolific authors, influential documents, most contributing country, important affiliations, most contributing source and thematic evolution; (b) identification of emerging research themes viz. Blockchain marketing, blockchain and Data, Blockchain data security and privacy and c) suggesting future research avenues. The above contributions signify its importance for academicians, as well as practioners. The marketing strategies can be designed using the various tools available because of blockchain proliferation.

This research study is subject to few limitations. The Scopus database was used for article extraction and there might be good quality articles which are not indexed in Scopus database. Moreover, bibliometric analysis is based on the citations' metrics, good quality articles having less citations may not be included in the analysis. Future studies can adopt

other techniques and databases to accommodate maximum articles based on the research of applications of blockchain technology in marketing.

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