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Exploring the potential of Block Chain Technology; a bibliometric analysis using VoSViewer

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ABSTRACT
Blockchain Technology is evolving and the applications are increasing with newer areas being touched upon. Naturally, there has been enough research through publications also happening in the same space. Thus, it is important to do a bibliometric analysis to provide an understanding of the progress till now and the available trends thereon. This study aims to explore the state of affairs, progress till now, issues & trends and the future of Blockchain Technology through a bibliometric analysis covering the period from 2015 to 2024. For the study, the researchers use Scopus database to collect relevant publications. These are further analysed through Vosviewer software. This will provide rich insights for the future researcher.

Keywords: *blockchain, cryptocurrency, bibliometric, VOSviewer, Ethereum, artificial intelligence, consensus algorithm*

1. INTRODUCTION

In this digital age where information is power and security is paramount, a revolutionary technology has emerged to redefine how we perceive and manage large amounts of data called Block Chain. Block chain technology, a groundbreaking form of distributed ledger technology, is revolutionizing data storage and information sharing. It is a decentralized computing platform enabling secured data storage and transactions without requiring mutual trust among users. The technology is gaining traction across various sectors, including finance and healthcare. At its core, block chain creates an immutable, shared digital record of transactions. Each transaction is recorded as a block, which is then connected to the previous block, forming a chain. This chain-like structure of blocks gives block chain its name and contributes to its robust security features.

The security of block chain technology is enhanced by its use of sophisticated cryptography, which safeguards data and ensures that only authorized individuals can access and modify it (Sheping Zhai et al 2019). This makes block chain an ideal solution for applications demanding the highest level of security, such as those in financial services, healthcare, and government sectors. It is innovation that is much more than just a back bone of crypto currencies. Here in this paper, researchers try to demystify this complex technology, breaking it down in simple and digestible term whether you are tech enthusiast or a curious beginner or forward thinking entrepreneur.

In simple terms just imagine a game of whispers where a message is passed from one person to another person. By the end of the line the original message is often distorted. Now imagine there is a way to ensure that the message remains the same no matter how many people it passes through; the essence of block chain is similar. In the simplest terms, a block chain is like a digital dairy that is shared among a group of people. Everyone in the group can write their entries in this diary but once an entry is made it can't be changed or erased. It is there for everyone to see forever. This diary is not stored in one place like a library or single computer. Instead it is distributed across many computers all over the world making it decentralized. Let's take another example suppose there is a group of people who decide to start a book clubto keep track of who has which book. There is requirement of creating and sharing document, every time a book changes hands, the person who gives the book and the person who receives it both write an entry each. This way, everyone in the club can see who has which book at any given time. If someone tries to claim that they returned the book when they didn't, everyone else can check the document and see the truth. This is the basic example of how Block chain works.

In the world of technology this book club could be anything from a group of people making financial transactions like Bitcoin to a network of computers sharing data. The books could be anything of value like monies, property, contracts or even votes in an election. So in simple terms the block chain is a transparent unchangeable decentralized digital dairy that records transactions across many computers. It's is way to ensure Trust, Accountability and Security in a world where these qualities are more important than others.

1.1 Importance of BCT

The main purpose of a Block Chain is to enable secure, transparent and tamperproof transactions in a decentralized manner. It is about creating trust in a trustless environment (Tan, Teck Ming and Saraniemi, Saila (2020)). Next is elaboration of these in details as follows:

Security

In a block chain each transaction is encrypted and linked to the previous one. This chain of transactions is visible to everyone within the network. But altering any transaction requires changing all subsequent transaction which is computationally impractical. This makes the block chain secure against fraud and tampering by the external parties or individuals.

Transparency

Every transaction on the block chain is visible to all the participants in the network this transparency ensures the accountability and makes nearly impossible for any participant to cheat the system.

Decentralization

Unlike, traditional databases that are controlled by a single entity like a bank or government, a block chain is distributed across multiple nodes or computers. This decentralization, means that no single entity has complete control over the entire chain making it resistant to censorship and single point of failure.

In essence, the main purpose of block chain is to provide secure and transparent way for parties. The individual or groups that may not necessarily trust each other to agree on the state of a database without needing a trusted intermediary whether it is transferring crypto currencies like bit coin, recording property deeds, or tracking goods in supply chain. This way it can be concluded that the purpose of block chain which is to enable secure, transparent and efficient transactions.

1.2 What can a block chain really do?

Block chain technology while often associated with crypto currencies has a wide range of applications that can benefits everyday people in many ways. Here is what block chain can really do:

1. **Secure financial transactions**: Block chain can facilitate secure peer to peer transactions eliminating the need for intermediaries like Banks. This could mean faster transactions with lower fees which is beneficial for remittances or when you are sending money to overseas.
2. **Supply chain transparency**: Block chain can provide transparency in supply chain for consumers. This means you can verify the authenticity of products, track their journey from source to store and make ethical purchasing decisions.
3. **Digital Identity**: Block chain can provide a secure way to manage digital identities. This could simplify the process of verifying identities online making it are easier and safer to access services like online banking, ecommerce or even government services.
4. **Voting**: Block chain could be used to create secure, transparent voting systems reducing the risk of fraud and making it easier for people to vote remotely which could increase voter turnout.
5. **Health Records**: Block chain could be used to create secure inter operable health records. This will give more control over their health data and could improve the quality of care.
6. **Copyright protection**: For artists and creators block chain could provide a way to register and protect intellectual property rights and ensure they are fairly compensated for their work.
7. **Decentralized Finance**: Block chain is the backbone of DEFI which aims to recreate traditional financial systems like loans or insurance in a decentralized manner. This could provide financial services to people who are currently unbanked or under banked as it can be seen that the possibilities are endless.

As block chain continues to advance, the applications of this incredible technology will only become more diverse and powerful (Tasatanattakool, P and Techapanupreeda, C (2018)).

1.3 How block chain works

Understanding how block chain works can seem complex but let's break it down into simple step by step terms:

1. Transaction Initiation: A user initiates a transaction. This could be anything from sending crypto currencies like Bitcoin to another user, casting a vote in an election or even recording a contract for sell or purchase of property or other deeds.
2. Transaction Verification: Once a transaction is initiated it needs to be verified. In a block chain network, this verification is done by a network of computers also known as nodes. These nodes confirm the details of the transaction including the validity of the transaction in details and the status of participants.
3. Transaction added to a block: Once transaction is verified, it is grouped with other verified transactions into a block. Each block has a certain capacity and once that capacity is reached, a new block is created.
4. Block added to the chain: Before the block is added to the chain, it needs to be given a unique identifier known as cryptographic hash. This hash is created from the transaction data in the block and it is unique to that block. The block hash also contains the hash of the previous block in the chain creating a link between the blocks. This is where the term block chain comes from.
5. Consensus: The block is now added to the block chain but before it can be accepted nodes in the network need to reach a consensus that the block is valid. This is done through a process known as mining in some block chains like bitcoin where nodes solve complex mathematical problems. Other block chains use different consensus mechanism like proof of stake. Here is the complete way shown in the diagram below about consensus mechanism.
6. Completion: After consensus is reached the block is added to the chain and the transaction is complete. The block chain has now been updated and everyone in the network can see the new block and the transactions it contains. (Toorajipour, Reza and Oghazi, Pejvak et al (2022))

1.4 Can a block chain be hacked?

While block chain technology is designed to be secure and tamper resistant. It's not entirely immune to hacking however successfully hacking a block chain is extremely difficult and requires significant resources. One potential vulnerability in block chain is the 51% attack this occurs when a single entity gains control of more than half of the network's mining power allowing them to manipulate the recording and verification of new blocks. They could potentially double spend coins, spend the same digital currency more than once, or prevent other miners from validating new transactions. However, executing a 51% attack on a large well established block chain like bitcoin would require an enormous amount of computational power and is therefore highly unlikely to be performed (Dwyer, Gerald (2015)).

Another potential vulnerability is in the smart contracts that run on some block chains. If there is a bug in the code of a smart contract it could be exploited by hackers. This was the case of infamous Dao hack on the ethereum block chain in 2016. It is also important to note that while the block chains itself may be secure, applications and digital wallets that interact with the blockchain can be vulnerable to hacking. Many reported block chain hacks are actually hacks of this peripheral system and not pertaining to the underlying block chain (Dhillon, Vikram and Metcalf, David et al (2017)).

1.5 Types of Block chain

Block chain technology has evolved into several different types each withits own characteristics and use cases. Here are the four main types

1. Public block chains
2. Private block chains- Hyperledger fabric
3. Consortium block chain
4. Hybrid block chain

(Hossain, Jafrin Md and Jahan and Umme Nusrat et al (2024))

1.6 Research Questions

The authors chose to address the following Research Questions (RQ)

RQ1: What has been the pattern of research publications over the years in the research area of Block Chain Technology and its applications?

RQ2: In what ways have countries, institutions, and authors helped with research in this space.

RQ3: Which journals and articles in the blockchain research field have the most significant citations?

RQ4: Based on citations, which of these research works is the most widely cited in the blockchain communities?

2. DEFINITIONS AND CRITICAL DESCRIPTION

Block chain technology is gaining popularity day by day and lot of researchers have already submitted their work as review of existing work. A comprehensive review was done by researchers and (Ghazi, A. et al. 2022) shown that this term block chain as a subject is searched and found in approximately1246 articles. An overview of applications of block chain technology is done and it was found that there are huge applications like energy, medical services, cultural applications, promoting, copyright insurance, protection and incorporation of digital currency (Charaan R M, 2022). A chapter is included in series of intelligent system library on bitcoin which explains the factors which are affecting the downfall and rise of price of bit coin price such as miner revenue, the marketplace and market-cap etc. (Saxena, R. et al. 2021There are hundreds of authors who have worked upon this ground breaking decentralized distributed chain of block containing transactions. The researchers present a literature review covering various aspects of this unique technology. The same has been arranged chronologically for finding out the trends in a sequence.

Authors	**Year**	**Definition/ Critical description**
Nakamoto, S.	2008	Introduced block chain to support Bitcoin
Buterin, V.	2014	Launch of Ethereum
Bonneau, J., Miller, A., Clark, J., Narayanan, A., Kroll, J. A., and Felten, E. W.	2015	Details about consensus protocols like Proof of Stake (PoS) and Proof of Work (PoW)
Pilkington, M.	2016	Cryptography and use of Hash function for security of data and authenticity of transactions Hyperledger for developing open source Linux use cases
Azaria, A., Ekblaw, A., Vieira, T., and Lippman, A.	2016	MedRec project which support use of Block chain for managing medical records
Croman, K., Decker, C., Eyal, I., et al.	2016	Taking scalability in concern and research for layer 2 solution
Zheng, Z., Xie, S., Dai, H., Chen, X., and Wang, H.	2017	Discussed about Distributed ledger technology (DLT) ensuring redundancy of data across the nodes
Zheng, Z., Xie, S., Dai, H., Chen, X., and Wang, H.	2017	Initial Coin Offerings (ICOs) as a fund-raising method with regulatory scrutiny
Baygin, N and Baygin M et al	2019	We have the applications being highlighted but this research studied in detail the disadvantages related to the applications
Xu, X., Weber, I., and Staples, M.	2019	Polkadot and Cosmos for connecting to block chain
Stoll, C., Klaaßen, L., and Gallersdörfer, U.	2019	Bitcoin's carbon footprint which highlighted environmental concerns, taking initial efforts toward green or safe blockchain Energy savings
Zavolokina, L., Dolata, M., and Schwabe, G.	2020	Decentralized nature of blockchain creates problem in government regulations
Dutta, P., Choi, T. M., Somani, S., and Butala, R.	2020	Block chain for supply chain operations; examines various function of supply chain which can be enhanced with block chain

Panda, S K and Jena, A et al	2021	Open usage of Blockchain technologies in the areas of education, cloud computing, crypto currency, smart cities, healthcare and cyber security.

Agrawal, K and Aggarwal, M et al	2022	The researchers comprehend all possible areas of applications of BCT and then suggest a taxonomy for each application.
Jiang, P., Zhang, L., You, S., et al.	2023	Survey of recent development in block chain and its application for sustainable waste management. They also discussed challenges and available opportunities looking at digitized waste management and circular economy clarification
Tripathi, G., Ahad, M. A., and Casalino, G.	2023	Reviewed block chain technology and presented own perspective in terms of use case and misuse cases with discussion of consensus algorithm. Challenges and future scope of this emerging field of secure decentralized transaction recording
Singh, B.	2023	Telemedicine, Wearable fitness technology, AI-enabled medical devices, smart watches are just a few examples of how health care which is going through digital transformation. They examined the block chain as digital transformed way of securing, authenticating, providing transparency and interoperability of healthcare related data. Suggested other advanced uses of block chain through analysis of existing challenges and remedies for the same
Akanfe, O., Lawong, D., and Rao, H. R.	2024	Technology-Organization-Environment (TOE) Nine General Data Protection Regulation (GDPR) proposition enforcement along with friction and coexistence opportunities. Reconciled view of block chain in dealing with constraints like privacy aware digital framework
Chowdhury, R. H.	2024	They showed Future of block chain as multi chain Examples from Maersk and IBM's TradeLens, Walmart's food supply chain management and give a concrete realization as supply chain clarity and functioning of blockchain's as well as its benefits
Qahtan, S., Mourad, N., Ibrahim, H. A., et al.	2025	Introduced fuzzy weighted zero inconsistency (FWZIC) which is an innovative and intelligent approach. They show interrelationship process under a normal wiggly hesitant fuzzy set (NWHFS) environment named NWHFS– FWZIC method with some ranking and alternative functional mapping. Decision matrix is built for the study by intersecting 10 6G technical requirements with 7 block chain evaluation features of 6G frameworks promising improvement in already attained privacy, security, efficiency, and cost-effectiveness.

Alotaibi, E. M., Issa, H., and Codesso, M.	2025	Proposed GovBlockchain which is a blockchain-based framework to U.S. government agencies' procurement. Follows design science research methodology which enables the agencies to provide more transparent reporting, obviously improving accountability. Facilitates data extraction based on the proposed methodology and reduces the risk of modification to recorded transaction details and stakeholders with a higher level of transparency

3. METHODOLOGY & DATA

Scopus, published by Elsevier Co., is a database for abstracts and indexing that includes links to full-text articles. The name, Scopus, has an unique origin. Apparently, it is taken from the bird, Hammerkop (Scopus umbretta), which, incidentally, possessed the ability to navigate with ease. (Burnham, Judy F, 2006). Scopus database has emerged to be a reliable database for research. It is useful for academic research for searching articles similar to one's area of research and it has a comprehensive collection of knowledge on every important area of research collated over the years. The collation is in the form of conference publications, academic articles, review articles, books, book reviews, editorial, book chapter and book series (Guz, A N and Rushchitsky, J J, 2009).

VOSviewer is a popular bibliometric tool frequently utilized to construct bibliometric networks involving various entities, such as authors and organizations. It employs diverse network analysis techniques, including co-authorship, co-citation, term co-occurrence, and bibliographic coupling (Van Eck & Waltman, 2009). In this study, we used the mentioned analysis extensively and played with the various aspects namely authors, journals, articles, countries and keywords. The maps obtained from this software include nodes andedges, indicating the keywords (nodes) and their relationship (edges). Interested readers should refer to the VOSviewer manual for more details about these different analyses. The details are obtainable at: https://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.20.pdf.

VOSviewer is a software tool that generates network visualizations based on terminology frequently used in a specific field. It is widely used in bibliometric analysis due to its ability to position the most influential authors at the center of the map, with less prominent ones placed at the periphery, making these differences easily apparent. Additionally, the VOSviewer method offers a more accurate and informative representation of the data compared to maps created with other techniques (Van Eck, Nees Jan and Waltman, Ludo, 2009).

Unlike tools like SPSS and Pajek, which are frequently used for bibliometric mapping, VOSviewer places a strong emphasis on the graphical visualization of bibliometric maps. Its features are particularly valuable for presenting large bibliometric maps in a clear and easily interpretable manner (Van Eck, Nees Jan and Waltman, Ludo, 2009).

The development of research that eventually gave rise to the subfield of bibliometrics is traced from its origins up to 1969, when the term "bibliometrics" was introduced as an alternative to "statistical bibliography." (Broadus, Robert, 1987). Allan Pritchard first introduced the term "Bibliometrics" in 1968, but it gained greater popularity during the 1980s. He used the term to describe a new field that applied quantitative methods to study the scientific communication process by measuring and analyzing different aspects of written documents.

Nicholas and Ritchie (1978), in their book entitled "Literature and Bibliometrics", stated that bibliometrics "…provide information about the structure of Knowledge and how it is communicated…". Sengupta (1990) had defined this term as the "organization, classification and quantitative evolution of publication patterns of all macro and micro communications along their authorship by mathematical and statistical calculus".

The increasing volume of publications presents challenges in analyzing these studies through traditional methods (Olson, David and Delen, Dursun (2008)). For example, identifying the research topics favored by authors and understanding how trends in these areas have evolved can be a complicated task. The significant increase in data and publications on each topic has led to the exploration of newer methods for managing it. In this regard, some researchers have started using approaches like systematic reviews and bibliometric analysis to identify trends and research topics within a particular field (Nie, Binling and Sun, Shouqian (2016)).Assessing the relatedness between bibliometric units (such as journals, documents, authors, or words) is a fundamental aspect of bibliometric analysis. These measures of relatedness are employed for various purposes, including the creation of maps or visual representations that illustrate the connections among all items within the dataset (Klavans, Richard and Boyack, Kevin (2004)).

3.1 Need for the study

We found very few papers on bibliometric analysis on Blockchain technology. We have latest papers done on the bibliometric analysis style on the applications of BCT covering the areas of healthcare, land registry, utilities management, manufacturing et al but not much on the concept of the same.

3.2 Dataset

For the work, Scopus data base was searched on 09-Dec 2024. The steps involved in choosing the set of articles for review are as follows

		Include	*Exclude*	*Net*
Step 1	Scopus search using the following search transcript: (TITLE-ABS-KEY (blockchain) AND TITLE-ABS-KEY (blockchain AND technology) AND TITLE-ABS-KEY (blockchain AND technology AND application))	17611		17611
Step 2	Filter & limit to Publication years from 2015 to 2024	17502		17502
Step 3	Filter & limit "Document type" to "Article", "Book" and "Book Chapter"	8450		8450
Step 4	Filter & limit to "Final" in "Publication Stage"	8248		8248
Step 5	Filter & limit to "English" in "Language"	7728		7728
Step 6	Filter & limit "Source type" to "Journal", "Book" and "Book Series"	7687		7687
Step 7	Filter and exclude articles with the following keywords: Healthcare (251), Article (220), Human (204), Covid, Healthcare (197), 'current (128), Surveys (124), Trust (115), Interoperability (114), Humans (106), Systematic Literature Review (80), Vehicles (76), Antennaes (62)		1246	6441
Step 8	Filter & limit "Open Access" to "All open access"	2527		2527
Step 9	Filter and manually exclude article(s) with missing author names		1	2526

The copy of the exact query is as follows: ((TITLE-ABS-KEY(blockchain) AND TITLE-ABS-KEY(blockchain AND technology) AND TITLE-ABS-KEY(blockchain AND technology AND application)) AND PUBYEAR > 2014 AND PUBYEAR < 2025 AND (LIMIT-TO (DOCTYPE,"ar") OR LIMIT-TO (DOCTYPE,"ch") OR LIMIT-TO (DOCTYPE,"bk")) AND (LIMIT-TO (PUBSTAGE,"final")) AND (LIMIT-TO (LANGUAGE,"English")) AND (LIMIT-TO (SRCTYPE,"j") OR LIMIT-TO (SRCTYPE,"b") OR LIMIT-TO (SRCTYPE,"k")) AND (EXCLUDE (EXACTKEYWORD,"Health Care") OR EXCLUDE (EXACTKEYWORD,"Article") OR EXCLUDE (EXACTKEYWORD,"Human") OR EXCLUDE (EXACTKEYWORD,"Healthcare") OR EXCLUDE (EXACTKEYWORD,"Antennas") OR EXCLUDE (EXACTKEYWORD,"Vehicles") OR EXCLUDE (EXACTKEYWORD,"Systematic Literature Review") OR EXCLUDE (EXACTKEYWORD,"COVID-19") OR EXCLUDE (EXACTKEYWORD,"Interoperability") OR EXCLUDE (EXACTKEYWORD,"Trust") OR EXCLUDE (EXACTKEYWORD,"'current") OR EXCLUDE (EXACTKEYWORD,"Surveys") OR EXCLUDE (EXACTKEYWORD,"Humans")) AND (LIMIT-TO (OA,"all")))

All the analysis in this paper would be basis these 2526 research items. The categories are as follows

Publication types	***Number***
Article	2476
Book Chapters	27
Book	23
Total	***2526***

Table 1: Types of publications covered for the bibliometric analysis

Source: Collated by authors basis data from Scopus

4. ANALYSIS AND INTERPRETATIONS BASED ON DATA FROM SCOPUS AND VOSVIEWER

Analysis has been done basis various parameters. The basis and the results are appended ***4.1***

Publications trends

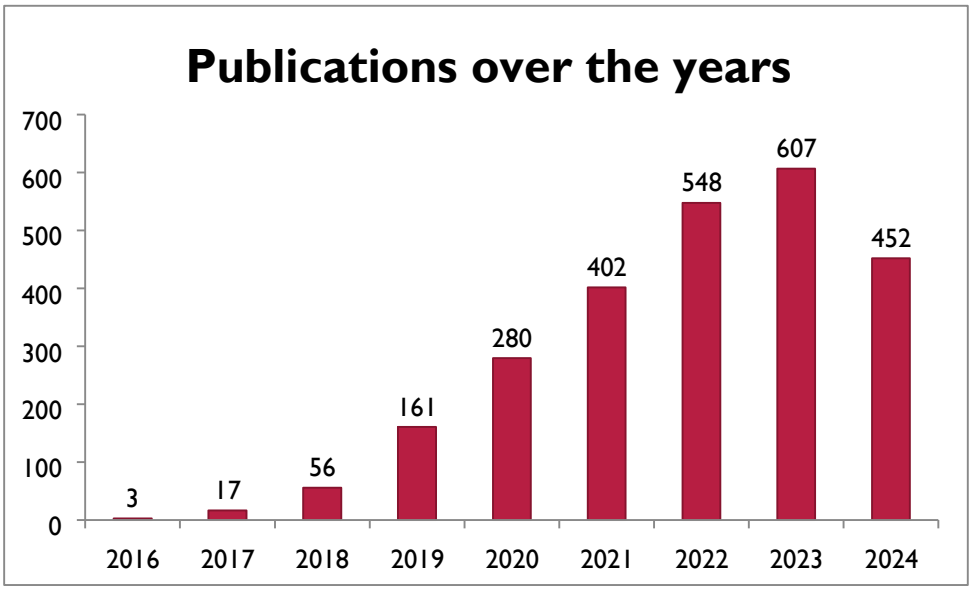

Fig 1: Publication over the years

Source: Compiled by authors basis data from Scopus

It is observed that most of the research publications have happened after 2016. We see a progression in terms of total number of publications from 2017. 2022 and 2023 saw publications over 500 in one year itself. It is evident from the analysis that the publications have picked up post 2016 as the phenomenon of BCT itself is new. The data of 2024 pertains to publications till 08-Dec 2024.

4.2 Basis article publications

The details of journals with the maximum published articles on BCT are as follows

Journal Name	***# articles***	***ISSN***	***Publisher***
IEEE Access	260	2169-3536	Institute of Electrical and Electronics Engineers Inc.
Sustainability (Switzerland)	115	2071-1050	Multidisciplinary Digital Publishing Institute (MDPI)
Applied Sciences (Switzerland)	87	2076-3417	Multidisciplinary Digital Publishing Institute (MDPI)

Electronics (Switzerland)	76	2079-9292	Multidisciplinary Digital Publishing Institute (MDPI)
International Journal of Advanced Computer Science and Applications	41	2158-107X	Science and Information Organization
Security and Communication Networks	40	1939-0114	Hindawi Limited
Wireless Communications and Mobile Computing	38	1530-8669	Hindawi Limited
Future Internet	36	1999-5903	Multidisciplinary Digital Publishing Institute (MDPI)
Frontiers in Blockchain	32	2624-7852	Frontiers Media SA
Sensors	30	1424-8220	Multidisciplinary Digital Publishing Institute (MDPI)
Computers, Materials and Continua	29	1546-2218	Tech Science Press
Energies	29	1996-1073	Multidisciplinary Digital Publishing Institute (MDPI)
IEEE Internet of Things Journal	26	2327-4662	Institute of Electrical and Electronics Engineers Inc.
Mathematics	24	2227-7390	Multidisciplinary Digital Publishing Institute (MDPI)
Mobile Information Systems	23	1574-017X	Hindawi Limited

Table2: Best journals in terms of articles published on BCT

Source: Authors basis data from Scopus

The sorting of the above table has been done basis number of articles. IEEE Access and Sustainability (Switzerland) have the largest number of articles on BCT. Multidisciplinary Digital Publishing Institute as a publisher has the largest number of top journals.

4.3 Publication basis countries

Country	***# articles***
China	681
India	309
United States	267
United Kingdom	247
Saudi Arabia	182
South Korea	154
Australia	126
Italy	120
Malaysia	101

Pakistan	90

Table3: Country-wise publications

Source: Authors basis data from Scopus

The countries with maximum publications are mentioned above. What is important is that these 10 countries combined constitute 90.14 percent of the total 2256 targeted research documents. China beats all countries by huge margin.

4.4 Basis journal citations

Journal Name	***# citations***	***ISSN***	***Publisher***
IEEE Access	13021	2169-3536	Institute of Electrical and Electronics Engineers Inc.
Sustainability (Switzerland)	3363	2071-1050	Multidisciplinary Digital Publishing Institute (MDPI)
Future Generation Computer Systems	1885	0167-739X	Elsevier B.V.
IEEE Internet of Things Journal	1788	2327-4662	Institute of Electrical and Electronics Engineers Inc.
Applied Sciences (Switzerland)	1577	2076-3417	Multidisciplinary Digital Publishing Institute (MDPI)
Future Internet	1367	1999-5903	Multidisciplinary Digital Publishing Institute (MDPI)
IEEE Communications Surveys and Tutorials	1341	1553-877X	Institute of Electrical and Electronics Engineers Inc.
Electronics (Switzerland)	1290	2079-9292	Multidisciplinary Digital Publishing Institute (MDPI)
IEEE Open Journal of the Communications Society	1102	2644-125X	Institute of Electrical and Electronics Engineers Inc.
Transportation Research Part E: Logistics and Transportation Review	1056	1366-5545	Elsevier Ltd
International Journal of Production Research	966	0020-7543	Taylor and Francis Ltd.

IEEE Communications Magazine	926	0163-6804	Institute of Electrical and Electronics Engineers Inc.
Financial Innovation	835	2199-4730	Springer Science and Business Media Deutschland GmbH
Energies	831	1996-1073	Multidisciplinary Digital Publishing Institute (MDPI)
Computers and Industrial Engineering	709	0360-8352	Elsevier Ltd

Table4: Best journals in terms of citations on articles on BCT

Source: Authors basis data from Scopus

IEEE Access has the largest citations.Infact, its citations are larger than the next seven journals. Ten journals have citations more than 1000 each. The data has been sorted basis number of citations.

Basis the number of articles (Table 2) and citations (Table 4), it comes out that the following journals are the most important journals in terms of good research related to BCT:

IEEE Access (ISSN: 2169-3536)

Sustainability (Switzerland) (ISSN: 2071-1050)

Applied Sciences (Switzerland) (ISSN: 2076-3417)

Electronics (Switzerland) (ISSN: 2079-9292)

Future Internet (ISSN: 1999-5903)

Energies (ISSN: 1996-1073)

IEEE Internet of Things Journal (ISSN: 2327-4662)

They have high number of articles as well as citations.

4.5 Basis Article Citations

Article Name	***Authors***	***# citations***	***Year***	***Journal name***	***ISSN***
6G Wireless Communication Systems: Applications, Requirements, Technologies, Challenges, and Research Directions	Chowdhury, Mostafa Zaman; Shahjalal, Md.; Ahmed, Shakil; Jang, Yeong Min	1045	2020	IEEE Open Journal of the Communications Society	2644-125X
Blockchain technology in supply chain operations: Applications, challenges and research opportunities	Dutta, Pankaj; Choi, TsanMing; Somani, Surabhi; Butala, Richa	876	2020	Transportation Research Part E: Logistics and Transportation Review	1366-5545
An overview on smart contracts: Challenges, advances and platforms	Zheng, Zibin; Xie, Shaoan; Dai, Hong-Ning; Chen, Weili; Chen, Xiangping; Weng, Jian; Imran, Muhammad	720	2020	Future Generation Computer Systems	0167-739X

Blockchain for AI: Review and open research challenges	Salah, Khaled; Rehman, M. Habib Ur; Nizamuddin, Nishara; Al-Fuqaha, Ala	670	2019	IEEE Access	2169-3536
Blockchain technology: implications for operations and supply chain management	Cole, Rosanna; Stevenson, Mark; Aitken, James	622	2019	Supply Chain Management	1359-8546
Blockchain research, practice and policy: Applications, benefits, limitations, emerging research themes and research agenda	Hughes, Laurie; Dwivedi, Yogesh K.; Misra, Santosh K.; Rana, Nripendra P.; Raghavan, Vishnupriya; Akella, Viswanadh	589	2019	International Journal of Information Management	0268-4012
Blockchain applications in supply chains, transport and logistics: a systematic review of the literature	Pournader, Mehrdokht; Shi, Yangyan; Seuring, Stefan; Koh, S.C. Lenny	578	2020	International Journal of Production Research	0020-7543
Blockchain for Supply Chain Traceability: Business Requirements and Critical Success Factors	Hastig, Gabriella M.; Sodhi, ManMohan S.	544	2020	Production and Operations Management	1059-1478
Security and privacy on blockchain	Zhang, Rui; Xue, Rui; Liu, Ling	543	2020	ACM Computing Surveys	0360-0300
Blockchain for Industry 4.0: A comprehensive review	Bodkhe, Umesh; Tanwar, Sudeep; Parekh, Karan; Khanpara, Pimal; Tyagi, Sudhanshu; Kumar, Neeraj; Alazab, Mamoun	526	2020	IEEE Access	2169-3536
Blockchains for business process management - Challenges and opportunities	Mendling, Jan; Weber, Ingo; Van Der Aalst, Wil; Brocke, Jan Vom; Cabanillas, Cristina; Daniel, Florian; Debois, SÃ¸ren; Di Ciccio, Claudio; Dumas, Marlon; Dustdar, Schahram; Gal, Avigdor; GarcÃaBaÃ±uelos, Luciano; Governatori, Guido; Hull, Richard; La Rosa, Marcello; Leopold, Henrik; Leymann, Frank; Recker, Jan; Reichert, Manfred ; Reijers, Hajo A.; Rinderlema, Stefanie; Solti, Andreas; Rosemann, Michael; Schulte, Stefan; Singh, Munindar P.; Slaats, Tijs; Staples, Mark; Weber, Barbara; Weidlich, Matthias; Weske, Mathias; Xu, Xiwei; Zhu, Liming	523	2018	ACM Transactions on Management Information Systems	2158-656X

Blockchain technology in agri-food value chain management: A synthesis of applications, challenges and future research directions	Zhao, Guoqing; Liu, Shaofeng; Lopez, Carmen; Lu, Haiyan; Elgueta, Sebastian; Chen, Huilan; Boshkoska, Biljana Mileva	504	2019	Computers in Industry	0166-3615
Blockchain's roles in strengthening cybersecurity and protecting privacy	Kshetri, Nir	477	2017	Telecommunications Policy	0308-5961
Security of the Internet of Things: Vulnerabilities, Attacks, and Countermeasures	Butun, Ismail; Osterberg, Patrik; Song, Houbing	464	2020	IEEE Communications Surveys and Tutorials	1553-877X
When mobile blockchain meets edge computing	Xiong, Zehui; Zhang, Yang; Niyato, Dusit; Wang, Ping; Han, Zhu	462	2018	IEEE Communications Magazine	0163-6804

Table 5: Best articles in terms of citations on articles on BCT

Source: Authors basis data from Scopus

The articles have been selected basis number of citations of each. They have been sorted in decreasing order of number of citations. We have 12 articles with each having atleast 500 citations. We observe that the article titled"6G Wireless Communication Systems: Applications, Requirements, Technologies, Challenges, and Research Directions" has the largest number of citations. It tops the list and is the only article with citations of over 1000.

4.6 Basis Productive Authors

The details with respect to the best productive authors are as follows

Authors	# of articles
Zhang, Lei	10
Zheng, Zibin	10
Treiblmaier, Horst	9
Niyato, Dusit	9
Tanwar, Sudeep	8
Imran Muhammad	7
Park Youngho	7

Table 6: Productive authors basis number of articles on BCT

Source: Authors basis data from Scopus

These authors have been selected basis their authorship. It is to be noted here that each of them have been authors as well as co-authors in many of the papers in which they are resent as an author.

4.7 Basis Productive Co-Authors

The details of paper publications with multiple authors are as follows

Authors	**# articles**
Campbell-Verduyn M.; Hutten M.	3
Ahmed W.A.H.; MacCarthy B.L.	2

Alqahtany S.S.; Syed T.A.	2
Baniata H.; Kertesz A.	2
Chen L.; Zhang X.; Sun Z.	2
Curty S.; Harer F.; Fill H.-G.	2
Dashkevich N.; Counsell S.; Destefanis G.	2
Delgado-von-Eitzen C.; Anido-Rifon L.; Fernnandez-Iglesias M.J.	2
Dhillon V.; Metcalf D.; Hooper M.	2
Fernandez-Carames T.M.; Fraga-Lamas P.	2
Fu J.; Saad N.H.M.	2
Fu Y.; Zhu J.	2
Gatteschi V.; Lamberti F.; Demartini C.; Pranteda C.; Santamaria V.	2
Hisham S.; Makhtar M.; Aziz A.A.	2
Jiang J.; Chen J.	2
Kim S.-K.; Huh J.-H.	2
Langaliya V.; Gohil J.A.	2
Lashkari B.; Musilek P.	2
Nguyen D.C.; Pathirana P.N.; Ding M.; Seneviratne A.	2
Parmar M.; Kaur H.J.	2
Rosa-Bilbao J.; Boubeta-Puig J.; Rutle A.	2
Sarfaraz A.; Chakrabortty R.K.; Essam D.L.	2
Stodt F.; Reich C.	2
Varveris D.; Styliadis A.; Xofis P.; Dimen L.	2
Wang H.; Zhang J.	2

Table 7: Productive co-authors basis number of articles on BCT Source: Authors basis data from Scopus

These authors have been selected basis their co-authorship. It is clear that there are not many co-authors working on this topic; they probably work with multiple authors. The data has been sorted as per the number of authors.

4.8 Country coupled bibliometric analysis

We used the minimum number of documents for a country as 5 and arrived at 72 countries. The screenshot of Vosviewer result is appended below.

Countries	**Total link strength**
China	208291
United Kingdom	142596
United States	129286
India	109338
Australia	72167
Saudi Arabia	68746

South Korea	63576
Italy	53529
Pakistan	48847
Germany	44529

Table 8: Country couple data basis total link strength

Source: Vosviewer results basis data from Scopus

The total link strength is a combination of number of articles and their respective citations. We saw in Table 3 that Malaysia had large number of publications but apparently, their citations is not that high. On the other hand, Germany has lesser number of articles but their citations apparently is higher.

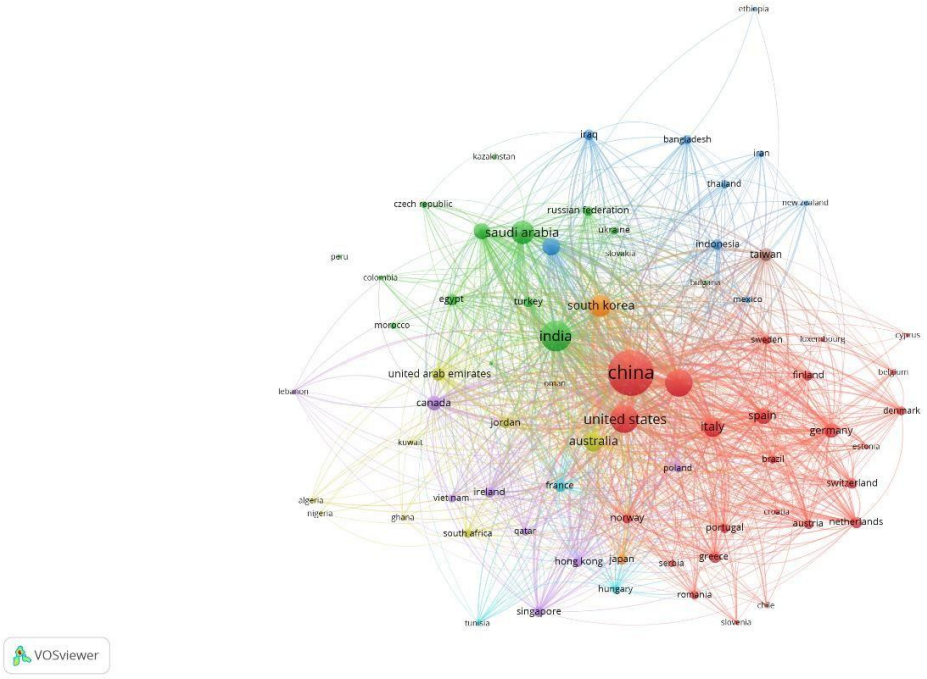

Fig 2: Country couple data basis total link strength

Source: Vosviewer basis data from Scopus

4.9 Co-occurrence of author keywords

We used the minimum number of co-occurence of author keywords as 10 and we arrive at 114 keywords out of 5834 which meet the threshold. The screenshot of Vosviewer result is appended below.

We had 7 Clusters and the top key words of each Cluster are as follows:

Cluster 1: blockchain, blockchain security, blockchains

Cluster 2: access control, authentication, block chain

Cluster 3: blockchain technology, case study, circular economy

Cluster 4: bibliometric analysis, bitcoin, cryptocurrencies

Cluster 5: artificial intelligence, blockchain applications, cybersecurity

Cluster 6: 5G, 6G, AI

Cluster 7: applications, big data, challenges

The top keywords used in terms of total strength were as follows:

Keyword	***Total strength***
blockchain	2489
smart contract	415
security	403
Internet of things	391
Ethereum	364
Smart contracts	341
IOT	285
Artificial intelligence	279
privacy	258
Blockchain technology	237
machine learning	216

Table 9: Author keywords basis total strength *Source:*

Vosviewer results basis data from Scopus

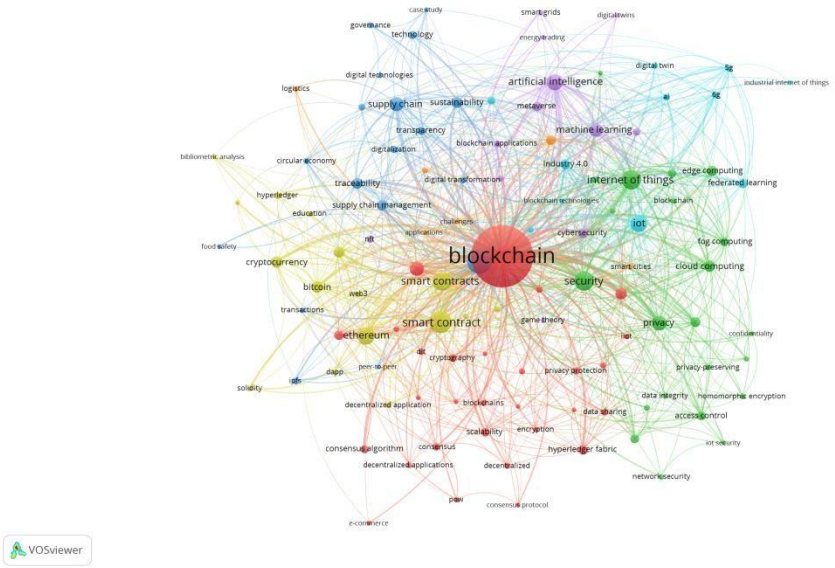

Fig 3: Cooccurence of author's keywords

Source: Vosviewer basis data from Scopus

As shown in Table 9,we can see that "blockchain" is the most used keyword. We also see the same in the Vosviewer screenshot where it literally overshadows every other keyword.

4.10 Co-authorship countries analysis

We used the minimum number of documents of a country as 10 and the minimum number of citations of a country as 2. Accordingly, we obtained 55 countries out of a total of 118 countries. The country wise analysis basis strengths and the screenshot of Vosviewer result is appended below.

Countries	*Documents*	*Citations*	*Linkages*	*Total link strength*
China	682	17987	41	372
United Kingdom	248	13116	50	323
United States	267	13535	47	280
Saudi Arabia	183	4967	40	268
India	309	7508	45	243
Pakistan	91	3500	35	177
Australia	126	6818	34	166
South Korea	154	6349	33	144
Malaysia	101	1888	34	128
Canada	73	2561	32	109

Table 10: Country wise co-authorship analysis

Source: Vosviewer results basis data from Scopus

The countries have been sorted basis the Total link strength. It is clear that weightage of inter-country linkage is the highest. China, United Kingdom and United States have a distinct advantage of having large number of citations. The linkages are not that distinct across the group of Top 10 countries. China, India, United States and United Kingdom have a clear advantage of havnig the largest number of articles. Upon Cluster analysis we observe 6 Clusters. A cluster wise analysis is as follows

Cluster No.	*# of countries*	*Top Country(ies) basis total link strengths*
Cluster 1	12	United States
Cluster 2	12	India
Cluster 3	10	Pakistan, Saudi Arabia, Malaysia
Cluster 4	9	Australia, China, South Korea, Canada
Cluster 5	7	-
Cluster 6	5	United Kingdom

Table 11: Cluster details of Country wise co-authorship

Source: Vosviewer results basis data from Scopus

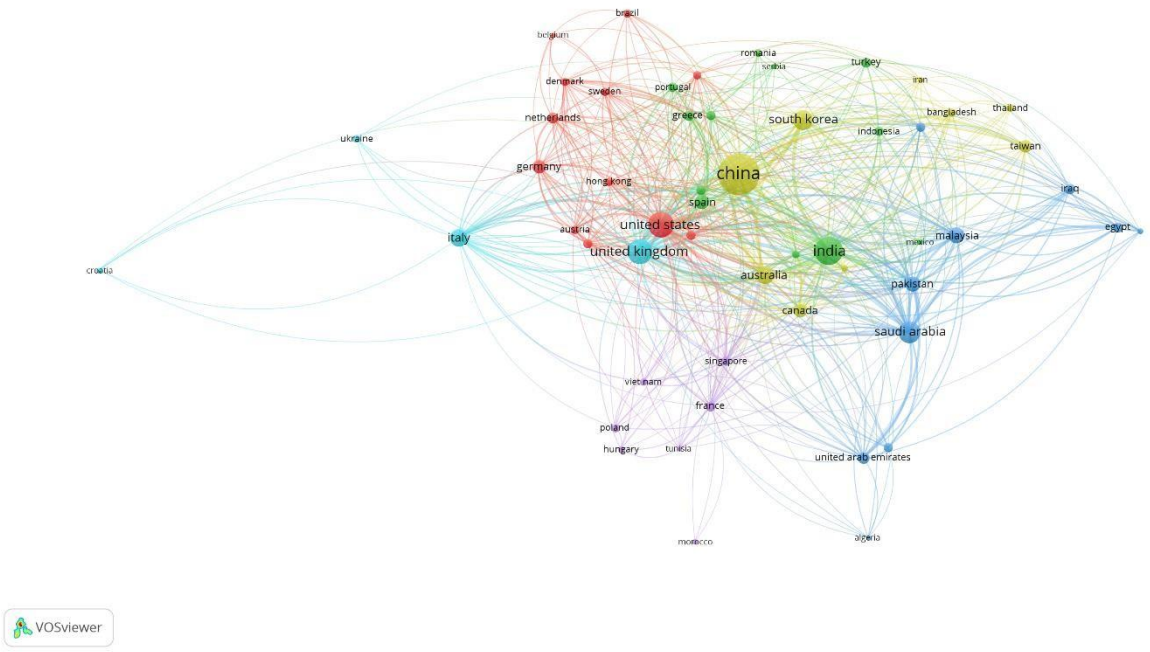

Fig 4: Co-authorship-countries analysis

Source: Vosviewer basis data from Scopus

4.11 Funding

We have 1115 research works which have received funding. The top funding Institutions along with the number of articles funded areas follows

Funding agency	***# Researches***	***Country***
King Saud University, KSU	7	Saudi Arabia
Deanship of Scientific Research, King Saud University	3	Saudi Arabia
Deutsche Forschungsgemeinschaft, DFG	3	Germany
European Commission, EC	3	EU
European Regional Development Fund, ERDF	3	EU
Prince Sultan University, PSU	3	Saudi Arabia
Bucharest University of Economic Studies	2	Romania
Bundesministerium fur Bildung und Forschung, BMBF	2	Germany
Center for Digital Supply Chain and Operations Management; Khalifa University of Science	2	United Arab Emirates
Commonwealth Scientific and Industrial Research Organisation, CSIRO	2	Australia
Department of Computer Science, Polish Naval Academy	2	Poland

Department of Corporate and Information Services; NTG	2	Australia
Department of Foreign Affairs and Trade, Australian Government, DFAT	2	Australia
Ministry of Education, Belgrade	2	Serbia
MinisterstwoNaukiiSzkolnictwaWyzszego, MNiSW	2	Poland
Ministry of Natural Resources of the People's Republic of China, MNR	2	China
Ministry of Science and Information Technology, NRF	2	South Korea
National Office for Philosophy and Social Sciences, NSSFC	2	China
Natural Sciences and Engineering Research Council of Canada, NSERC	2	Canada
Office of Small Business Innovation Research, U.S. Department of Energy, USDOE	2	United States of America
Shaqra University	2	Saudi Arabia
UniversitiSains Malaysia	2	Malaysia
University of Western Sydney, UWS	2	Australia

Table 12: Top funding agencies

Source: Authors basis data from Scopus

It is clear that Saudi Arabia has the largest number of Institutions which have funded the maximum number of papers. Needless to say, we have one of the largest contributions coming from that country.

5. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The outcome of the research is highly dependent on the papers selected and acquired from the Scopus database. It is possible that certain pertinent publications, particularly those in non-indexed or specialized journals, were not included in the analysis, thereby increasing the chances of missing out on some good & critical research papers of some serious researchers. Although the search terms employed in the study are comprehensive and encompass several expressions relating to “BCT”, it is important to acknowledge that researchers and academicians may have used alternate terminologies to indicate or represent the idea of BCT.

Limiting the search to only journal articles, books and book series may lead to overlooking important insights found in other publication formats, such as conference proceedings or reports.

The study exclusively examined the articles published in English; hence, it is possible to have missed out on few good articles in other languages.

Although the methodology of bibliometric analysis offers a strong approach for evaluating research output and impact, it fails to capture the complete qualitative effect of these studies. For example, citation counts indicate influence but may not adequately reflect how research findings are applied in real-world contexts such as classrooms or policy-making. It may just reflect the academic pursuit but may not reflect the weight in finding solution to the area of problem.

It is useful to mention here that research is inherently interdisciplinary, but bibliometric analysis tends to be centered around one discipline, which may hinder the emergence of true output. There is an expected high level of innovativeness in interdisciplinary publication (Bromham, Lindell and Dinnage, Russell et al, 2016).

It is recommended that future researchers do the analysis utilizing metadata from additional relevant sources, such as Web of Science and the like, to perform a comparative analysis.

Self-citations may be an issue and it may prop up the citation score of authors and papers ().

Future researchers (new to this area as well as wanting to improve further) can take help of this paper for finding the best journals, articles and authors. It can help them immensely. Authors and researchers specializing in structured literature review

formats can take note of the cited articles. Besides, researchers may plan linking this topic with other disciplines like economics, innovation, governance, legalities et al.

6. FUTURE DIRECTIONS AND UTILITY OF THIS PAPER

This paper aims to gift future researchers (in the space of block chain technologies) by enlisting details of serious researchers, established authors in the space and distinctive journals around the same. This in a nutshell cements the best works till now in this field. Students and academia can delve into this as a pathfinder. Researchers may delve into the highly cited papers and choose their future areas of research.

A paper in the style of structured literature review of the selected articles can also help the future students and researchers on this subject. That can complement the findings of this paper.

7. CONTRIBUTION OF AUTHORS

Dr Suman Goyat: Being a subject expert, she was instrumental in arranging for the Introduction and the extensive reviews of the articles on the subject, writing – original draft

Dr Sukhamaya Swain: Scopus searches and VosViewer analysis, writing – original draft

Dr Siddhartha Bhattacharya: Conceptualization, Writing - review & editing

Himanshu Malik: Scopus data analysis, Writing - review & editing

Dr Zenzile Khetsa: Final review

8. DISCUSSION AND CONCLUSION

This paper offers a comprehensive analysis of research on block chain technology covering the period from 2014 till date. The field has experienced a significant surge in publications in this area. Numerous journals and conferences have served as key platforms for publishing research in this area. The top journals and conference proceedings, ranked by the number of papers published, are highlighted in this work. Additionally, the study identifies the most influential authors in the field based on their citation counts, focusing primarily on first authors, despite the prevalence of papers with multiple contributors.

In real world we have a list of proper developed countries and the GDP & other economic indexes are mostly aligned in terms of that list. However, when it comes to research on such important topic, we have major names like Japan, Italy missing. China however dominates the research space with large papers, large number of authors and large citations.

Blockchain appears to be connected to various fields. However, an analysis using VOSviewer to map and visualize keywords such as "blockchain," "blockchain technology," and "blockchain application" reveals certain keywords that lack connections to others. These disconnected keywords can be identified as potential areas for future research.

Multiple studies highlight the importance of acknowledging the limitations of bibliometric analysis as a theme for evaluating a subject. Many studies also recognize the insights provided by the citation analysis. One of the benefits of using bibliometric analysis on a macro level for international comparisons is that the data is frequently updated, offering a broad overview of all fields in science and engineering.

REFERENCES

[1] Agrawal, Kanika and Aggarwal, Mayank et al (2022), An Extensive Blockchain Based Applications Survey: Tools, Frameworks, Opportunities, Challenges and Solutions, IEEE Access, 10, 116859-116906

[2] Ahn, Joongho and Yi, Eojin et al (2024), Blockchain Consensus Mechanisms: A Bibliometric Analysis(2014– 2024) Using VOSviewer and R Bibliometrix, Information, 15(10), 1-29

[3] Akanfe, O., Lawong, D., and Rao, H. R. (2024). Blockchain technology and privacy regulation: Reviewing frictions and synthesizing opportunities. International Journal of Information Management, 76, 102753

[4] Alotaibi, E. M., Issa, H., and Codesso, M. (2025). Blockchain-based conceptual model for enhanced transparency in government records: A design science research approach. International Journal of Information Management Data Insights, 5(1), 100304

[5] Aria, Massimo and Cuccurullo, Corrado (2017), bibliometrix: An R-tool for comprehensive science mapping analysis, Journal of Infometrics, 11(4), 959-975

[6] Azaria, A., Ekblaw, A., Vieira, T., and Lippman, A. (2016). MedRec: Using blockchain for medical data access and permission management. Proceedings of the 2nd International Conference on Open and Big Data, 25–30

[7] Bartneck, Christoph and Kokkelmans, Servaas (2011), Detecting h-index manipulation through self-citation analysis, Scientometrics, 87, 85-98

[8] Baygin, Nursena and Baygin mehmet et al (2019), Blockchain Technology: Applications, Benefits and Challenges, 2019 1st International Informatics and Software Engineering Conference (UBMYK)

[9] Bonneau, J., Miller, A., Clark, J., Narayanan, A., Kroll, J. A., and Felten, E. W. (2015). SoK: Research perspectives and challenges for Bitcoin and cryptocurrencies. IEEE Symposium on Security and Privacy, 104– 121

[10] Broadus, Robert (1987), Early approaches to bibliometrics, Journal of the Association for Information Science and Technology (JASIST), 38(2), 127-129

[11] Broadus, R N (1987), Toward a definition of "bibliometrics", Scientometrics, 12, 373-379

[12] Bromham, Lindell and Dinnage, Russell et al (2016), Interdisciplinary research has consistently lower funding success, nature, 534, 684-687

[13] Buterin, V. (2014). A next-generation smart contract and decentralized application platform. Ethereum White Paper

[14] Byl, Lauren and Carson, Jana et al (2016), Measuring Research Output through Bibliometrics, Working Group on Bibliometrics, University of Waterloo

[15] Casino, F., Dasaklis, T. K., and Patsakis, C. (2019). A systematic literature review of blockchain-based applications: Current status, classification, and open issues. Telematics and Informatics, 36, 55–81

[16] Charaan R M, Dilip. (2022). BlockChain Technology-An Overview. 3. 1634-1638

[17] Saxena, R., Arora, D., Nagar, V. and Mahapatra, S. (2021). Bitcoin: A Digital Cryptocurrency

[18] Chowdhury, R. H. (2024). Automating supply chain management with blockchain technology. World Journal of Advanced Research and Reviews, 22(3), 1568-1574

[19] Costas, Rodrigo and Leeuwen, Thed N van (2012), Approaching the "reward triangle": General analysis of the presence of funding acknowledgments and "peer interactive communication" in scientific publications, Journal of the American Society for Information Science and Technology, 63(8)

[20] Croman, K., Decker, C., Eyal, I., et al. (2016). On scaling decentralized blockchains. International Conference on Financial Cryptography and Data Security, 106–125

[21] Dewi, Pramita Sylvia and Widodo, Ari et al (2021), Web-based inquiry in science learning: Bibliometric Analysis, Indonesian Journal of Science and Mathematics Education, 4(2), 191-203

[22] Dhillon, Vikram and Metcalf, David et al (2017), The Dao hacked, Blockchain Enabled Applications, 67-78

[23] Donthu, Naveen and Kumar, Satish et al (2021), How to conduct a bibliometric analysis: An overview and guidelines, Journal of Business Research, 133, 285-296

[24] Dutta, P., Choi, T. M., Somani, S., and Butala, R. (2020). Blockchain technology in supply chain operations: Applications, challenges and research opportunities. Transportation research Part E: Logistics and transportation review, 142, 102067

[25] Dwyer, Gerald (2015), The economics of Bitcoin and similar private digital currencies, Journal of Financial Stability, 17, 81-91

[26] Garfield, Eugene (2009), From the science of science to Scientometrics visualizing the history of science with HistCite software, Journal of Informetrics, 3(3), 173-179

[27] Ghazi, Alaan, Al-dawoodi, Aras and Hammood, Layth. (2022). A Systematic Literature Review of Blockchain Technology. International Journal of Interactive Mobile Technologies (iJIM). 16. 10.3991/ijim.v16i10.30083

[28] Hossain, Jafrin Md and Jahan and Umme Nusrat et al (2024), A proposed architecture for securing fintech applications using Hyperledger fabric in a hybrid cloud, World Journal of Advanced Research and Reviews

[29] Jain, Shaily and Sharma, Chetan et al (2023), Blockchain and Cryptocurrency: A Bibliometric Analysis, Journal of Advanced Computational Intelligence and Intelligent Informatics, 27(5), 822-836

[30] Jiang, P., Zhang, L., You, S., Van Fan, Y., Tan, R. R., Klemeš, J. J., and You, F. (2023). Blockchain technology applications in waste management: Overview, challenges and opportunities. Journal of Cleaner Production, 421, 138466

[31] Klavans, Richard and Boyack, Kevin (2004), Identifying a Better Measure of Relatedness for Mapping Science, Journal of the American Society for Information Science and Technology, 57(2), 251-263

[32] Krishnappa, M and Sedam Mariraj et al (2022), Bibliometrics: An overview, International Advanced Research Journal in Science, Engineering and Technology, 9(2), 284-289

[33] Kuzior, Aleksandra and Sira, Mariya (2022), A Bibliometric Analysis of Blockchain Technology ResearchUsingVOSviewer, Sustainability, 14(13), 1-15

[34] Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. White Paper

[35] Pilkington, M. (2016). Blockchain technology: Principles and applications. Research Handbook on Digital Transformations, 225–253

[36] Nicholas, David and Ritchie, Maureen (1978), Literature and Bibliometrics, C. Bingley

[37] Nie, Binling and Sun, Shouqian (2016), Using Text Mining Techniques to Identify Research Trends: A Case Study of Design Research, Applied Sciences, 7

[38] Olson, David and Delen, Dursun (2008), Advanced Data Mining Techniques, Springer

[39] Panda, Sandeep Kumar and Jena, Ajay Kumar et al (2021), Blockchain Technoligies: Applications and Challenges, 203

[40] Passas, Ioannis (2024), Bibliometric Analysis: The Main Steps, Encyclpedia, 4(2), 1014-1025

[41] Qahtan, S., Mourad, N., Ibrahim, H. A., Zaidan, A. A., Bahaa, B., Deveci, M., ... and Shamini, S. (2025). Normal wiggly hesitant fuzzy modelling approach for 6G frameworks based blockchain technology. Expert Systems with Applications, 259, 125304

[42] Schubert, Andras and Schubert, Gabor (2019), All Along the h-Index-related Literature: A Guided Tour, Springer Handbook of Science and Technology Indicators, 301-334

[43] Sengupta, I.N. (1990), Bibliometrics and Identification of Core Periodicals, Herald of Library Science, 226- 245

[44] Shakeel, Yusra and Alchokr, Rand (2022), Altmetrics and Citation Counts: An Empirical Analysis of the Computer Science Domain, JCDL '22: Proceedings of the 22nd ACM/IEEE Joint Conference on Digital Libraries, 17, 1-11

[45] Singh, B. (2023). Blockchain technology in renovating healthcare: Legal and future perspectives. In Revolutionizing Healthcare Through Artificial Intelligence and Internet of Things Applications (pp. 177-186). IGI Global

[46] Stoll, C., Klaaßen, L., and Gallersdörfer, U. (2019). The carbon footprint of Bitcoin. Joule, 3(7), 1647–1661 [47] Swan, M. (2015). Blockchain: Blueprint for a new economy. O'Reilly Media.

[48] Tan, Teck Ming and Saraniemi, Saila (2020), Trust in blockchain-enabled exchanges: Future directions in blockchain marketing, Journal of the Academy of Marketing Science, 51, 914–939

[49] Tasatanattakool, P and Techapanupreeda, C (2018), Blockchain: Challenges and applications, International Conference on Information Networking (ICOIN), Chiang Mai, Thailand, 473-475

[50] Toorajipour, Reza and Oghazi, Pejvak et al (2022), Block by block: A blockchain-based peer-to-peer business transaction for international trade, Technological Forecasting & Social Change, 180, 1-10

[51] Tripathi, G., Ahad, M. A., and Casalino, G. (2023). A comprehensive review of blockchain technology: Underlying principles and historical background with future challenges. Decision Analytics Journal, 100344

[52] Van Eck, Nees Jan and Waltman, Ludo (2009), Software survey: VOSviewer, a computer program for bibliometric mapping, Scientometrics, 84, 523–538

[53] Xu, X., Weber, I., and Staples, M. (2019). Architecture for blockchain applications. Springer

[54] Zaharuddin and Wahyuningsih, Sri et al (2024), Understanding Purposeful Leadership in Entrepreneurial Contexts: A Bibliometric Analysis, APTISI Transactions on Technopreneurship, 6(2), 213−230

[55] Zavolokina, L., Dolata, M., and Schwabe, G. (2020). Designing governance for blockchain systems: A research agenda. Business & Information Systems Engineering, 62(6), 599–614

[56] Zhai, Sheping and Yang, Yuanyuan et al (2019), Research on the Application of Cryptography on the Blockchain, IOP Conf. Series: Journal of Physics: Conf. Series 1168

[57] Zheng, Z., Xie, S., Dai, H., Chen, X., and Wang, H. (2017). An overview of blockchain technology: Architecture, consensus, and future trends. IEEE International Congress on Big Data, 557–564