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Cryptocurrency and Financial Sector: A Bibliometric Analysis

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Abstract: Objective: The key objective of this paper is to provide comprehensive trends in the topic of cryptocurrency and the financial sector. Utilizing bibliometric analysis, this study examined 1293 papers published between November 2014 and 2024 to ascertain the scope of research conducted over this period.
Research Design and Methods: Data was collected from the Lens database, producing 1,293 papers. Utilizing VOSviewer, we investigated key elements of literature, including well-known organizations, authors, nations, and journals. We also looked at co-authorship, bibliographic coupling, and co-occurrence of terms.
Findings: According to the findings, the greatest number of publications, largely from journals, were discovered in 2023. The most active authors were Elie Bouri, Andreas Hani, Horst Treiblmaier, and Jochen Michaelis and Julapa Jagtiani with seven documents each. The most common topics of investigation are cryptocurrency and business. The *SSRN* electronic journal topped the list. The top three productive countries in the field include the United States, China, and the United Kingdom. As evidenced by the findings, research on cryptocurrencies is expanding rapidly, yet there is still a deficiency of international author partnerships and scientific exchanges.
Implications and Recommendations: The current study provides a comprehensive perspective and a thorough analysis of the relationship between cryptocurrencies and the financial sector, which form the theoretical foundations of the cryptocurrency deployment.
Contribution and Value Added: Summing up 10 years of academic articles on the relationship between the financial sector and cryptocurrencies, this is one of the first bibliometric studies in the field. The bibliometric analysis provides a thorough knowledge base that enables scholars to make well-informed conclusions about industrial practices and policy formation. These results highlight important knowledge gaps and provide interesting directions for further study, consolidating the present understanding of cryptocurrency research in the financial industry.

Keywords: cryptocurrency, blockchain currency, financial sector, bibliometric analysis

1. Introduction

Cryptocurrencies have grown to be a global phenomenon that is often discussed in the media, by venture capitalists, in banks, on the stock market, in political groups, etc. The emergence of cryptocurrencies as a new class of financial assets offers an opportunity to study their as-yet-undiscovered characteristics [1]. When compared to conventional fiat currencies, cryptocurrencies have become a digital and more approachable option that offers people all over the world creative solutions. Seetharaman et al. [2] stated that while many people in developed nations—such as the United States and the European Union—view cryptocurrencies as an exciting development, many other countries find it difficult to manage their own national currencies. These virtual currencies have brought forth several opportunities and difficulties that need a thorough quantitative analysis. However, their widespread acceptance in this environment has been hampered by worries about volatility and regulatory control. Another important factor that is impacted by the rise of cryptocurrencies is financial stability. These digital assets' decentralized structure offers both advantages and disadvantages [3].

Researchers, practitioners, and regulators are interested in how cryptocurrencies like Bitcoin can undermine established financial institutions. A comprehensive understanding of these digital currencies' effects on the financial sector is necessary as they become more widely accepted. In fact, this necessity finds its origin in their ability to challenge traditional financial intermediaries and institutions, as cryptocurrencies represent an innovation in the movement of money and assets. Also, the decentralized and anonymous qualities of these platforms give rise to regulatory and financial stability problems that require attention.

Applications in banking, payments, trade finance, and other financial services are made possible by the blockchain technology that powers cryptocurrencies.

Despite the quick expansion of cryptocurrency literature, systematic attempts to measure, compile, and display the abundance of knowledge in this area from a bibliometric standpoint are lacking. This article's uniqueness and innovation come from its thorough bibliometric examination of 10 years of study on the connection between cryptocurrencies and the financial industry. In contrast to

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earlier literature assessments, which were frequently more focused, this study makes use of a wider variety of bibliometric indicators and visualizations in order to comprehensively reveal the evolution, new trends, intellectual foundations, and research gaps.

The main goal is to apply bibliometric analytic tools to methodically map and assess the features and dynamics of the literature on the effects of cryptocurrencies on financial services. In particular, the following research questions are addressed:

1) What is the general pattern of study publications and growth concerning cryptocurrencies and their effects on the financial industry throughout the course of time?
2) Which top nations, organizations, and writers are making the most significant contributions to this field of study?
3) What are the main study areas or themes that come out of the bibliometric analysis of publications about finance and cryptocurrencies?
4) Which papers have received a significant number of citations and co-citations, suggesting that they are fundamental or seminal contributions in the field of understanding how cryptocurrencies and financial institutions interact?
5) Which important publications, conferences, or journals publish research on this subject on a regular basis?
6) Is it possible to identify hot subjects, developing research trends, or possible future research areas using bibliometric indicators such as keyword co-occurrence analysis?
7) From early studies on the basics of cryptocurrencies to more recent investigations of their ramifications for the financial system, how has the focus of study changed over time?
8) Based on co-authorship analysis, which research collaborations or co-authorship networks are driving influential work in this field?
9) Based on the variety of sources, author connections, and citation exchanges between other fields, how multidisciplinary is this study area?
10) Based on the bibliometric results, are there any obvious gaps, understudied regions, or possible new research directions that may be investigated?

The rest of the paper is organized as follows: Section 2 of the paper is a literature review on the development of cryptocurrencies, their use in the financial sector, and the relevant challenges that impede their use. Section 3 deals with the research methodology along with the methods for sample selection and data collection. Section 4 for the study and bibliometric analysis is dealt with in Sections 3 and 4, respectively. In Section 4, the results of the bibliometric study are discussed. Finally, Section 5 concludes the paper and develops some recommendations.

2. Literature Review

Cryptocurrency is a type of digital or virtual currency that uses cryptography for security [4]. The origin of the word "Crypt" is derived from the ancient Greek word "kryptos," meaning hidden or secret. Cryptocurrency is also difficult to counterfeit because of this security feature [5]. Digital currency allows instant transactions and transfers from anywhere in the world [6]. There are no enforced limitations on the number of transactions, whereas various countries have enforced limitations on foreign transactions. If one wants to travel abroad, they can carry millions of dollars of Bitcoins in a memory drive, and it won't have any legal limitations of any kind. Any illegal cash would have a high chance of being confiscated at customs. Cryptocurrency is highly divisible as transactions can be made for extremely small fractions, like sending an oil tanker as payment. Digital currency also provides some measure of anonymity. This feature can be improved further by the development of more advanced anonymous transaction cryptocurrencies. Since the digital currency is stored in a digital wallet located in a device or cloud service, it is highly portable compared to physical cash stored in a bank [7].

As the creation of the currency was developed thousands of years ago, currency has taken many forms and has moved from being a physical entity to being an electronic entity [8]. The invention of the credit card allowed for the transfer and spending of money without exchanging physical cash. Cryptocurrency offers a new form of digital cash that is secure and accessible. Access to forms of credit and electronic banking is not available in less developed countries. It provides a universal method of transferring money as opposed to using different currencies and exchange rates. This can allow more people in these countries to use cryptocurrency instead of relying on unsettled government-backed money and avoid dealing with the bank's high fees [9].

Overall, cryptocurrency is a digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank [10]. This virtual money only exists in the digital domain and does not possess any representation or physical form.

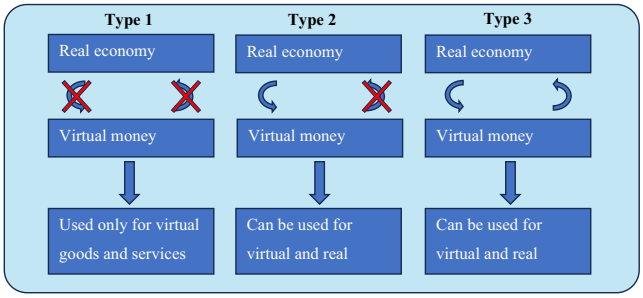
The first official definition of cryptocurrency emerged in October 2012 in a document published by the European Central Bank [11] titled "virtual currency schemes." According to this document, virtual money is defined as unregulated digital currency issued and governed by its creators, used with its usage and acceptance confined to a specific virtual community (Figure 1).

Here, users can trade currency for real money based on the exchange rates with their local currency. Such a system facilitates the purchase of both virtual and real goods and services. Table 1 describes various types of virtual currency schemes.

Later, the definition provided by significant financial institutions and legislative bodies demonstrates the growing recognition of Bitcoin and other cryptocurrencies as significant phenomena in the financial landscape. Bitcoin and leading cryptocurrencies like Ethereum and Ripple have appeared in official documents of institutions such as the Bank for International Settlements, the International Monetary Fund, and the World Bank, indicating their acknowledgment and consideration in discussions about the future challenges of the global financial system [12].

Subsequent definitions from major government agencies and financial organizations show how Bitcoin and other cryptocurrencies are becoming increasingly acknowledged as important phenomena in the financial landscape. The European Banking Authority showed a slightly different definition of cryptocurrency. They defined virtual currencies as digital representations of value

Figure 1
Types of virtual currency schema



Source: European Central Bank [11]

Table 1
Description of virtual currency scheme

Type of virtual currency scheme	Description
Closed Virtual Currency Schemes	These are commonly known as "in-game only" schemes because they have very little connection to the actual economy. In exchange for a monthly fee, users can earn virtual currency by performing well online. Only within the virtual community may the virtual currency be used to pay for virtual products and services. One such instance is World of Warcraft (WoW) Gold, which, under Blizzard Entertainment's terms and conditions, cannot be purchased or traded in the actual world.
Virtual Currency Schemes with Unidirectional Flow	In these systems, real money can be used to directly acquire virtual currency at a predetermined exchange rate; however, the virtual currency cannot be returned to the original form of payment. The scheme owner establishes the conditions for conversion. Certain schemes may permit the use of their currencies for the purchase of actual products and services in addition to virtual ones.
Virtual Currency Schemes with Bidirectional Flow	Users can trade virtual currency for real money based on the exchange rates with their home currency. Like any other convertible currency, these systems facilitate the purchase of both virtual and physical goods and services.

not issued by a central bank or public authority. They are recognized by both natural and legal persons as means of payment that can be transferred, stored, or traded electronically [13].

Recently, cryptocurrency has developed into a well-known phenomenon with several noteworthy characteristics. In addition to serving as a medium of exchange in business dealings, it serves as a channel for investments. Moreover, the performance of financial markets and cross-border remittance services. However, cryptocurrencies are still unable to achieve macroeconomic goals in some nations. For example, Vietnam does not currently have formal recognition for or protection for transactions involving this currency [14].

In summary, the global financial system is developing quickly in part because of the digital economy. Cryptographic money or cryptocurrency creates new threats as well as new opportunities for society. Emerged because of advancements in computer technology, some people describe this digital evolution as a positive value added to the financial landscape. Conversely, some people reject the usage of cryptocurrencies and think that they negatively affect the traditional financial world and economic relationships [15].

2.1. The significance of cryptocurrency in the financial system

Cryptocurrency holds importance in the modern financial system because it seeks to provide an alternative to fiat money and a centralized ledger. It is a system of online payment that eliminates the need for a trusted central authority and enables all the network users to discover the validity of every transaction [16]. The value of trust can be seen as it exceeds the inherent value of the tokens and coins themselves. Bitcoin was designed to take power out of the hands of the monetary policy controllers and put it back into the hands of the people. By having a capped supply of 21 million coins, the inflation of the currency is to decrease over time rather than matching the rate of gold [17]. Due to the decentralized nature of cryptocurrency, it serves as a left-to-right shift of the aggregate supply curves for modern fiat currencies that are controlled by central banks. This aims to avoid the scenario where an increase in the money supply leads to inflation and a loss of the currency's real value. While there are many strengths to this system within the financial system, it is not without its own set of problems. The lack of central authority does not provide the stability and trust of a system overseen by a trusted group of people [18].

Overall, the digital currency presents a strong system in the modern financial landscape. Particularly in banking institutions, it offers decentralized transactions and innovative blockchain technology seeking to streamline processes [19]. This importance is equally profound in the capital market, where it provides unique potential for substantial returns while aiming to diversify portfolios and capitalize on emerging digital assets. However, ongoing regulation will be needed to mitigate these issues, but it's an area where cryptocurrency provides an alternative solution to a real-world problem through changes in the incentive structures [20].

2.2. Cryptocurrency in the banking system

The emergence of cryptocurrencies has triggered a paradigm shift in the innovation's evolution of the financial sector. Consequently, traditional banking systems should undertake significant adjustments to remain competitive in today's digital economy. This section examines how traditional banks are responding to the different opportunities and challenges posed by the cryptocurrency revolution.

2.2.1. Adaptation to customer demands

In reaction to cryptocurrencies' disruptive potential, the banking system is reevaluating the different traditional strategies and operational structures. The quick evolution in Bitcoin's popularity has prompted banks in the United Kingdom and the United States to prioritize customer service and adjust their operations appropriately. Banks are attempting to address growing client needs and preferences for seamless management of both fiat currency and digital assets, enhancing the investigation of collaboration with fintech companies [21].

2.2.2. Partnerships and technological integration

Blockchain technology, the foundation of cryptocurrencies, facilitated the cooperation between traditional banking systems and fintech startups. These partnerships seek to enhance the security and efficiency of financial transactions [22]. Furthermore, central banks are exploring the way of creating and evaluating the central bank digital currencies (CBDCs) to capitalize on digital innovation while retaining control over monetary policy [23].

2.2.3. Implications for risk management

Transitioning to CBDCs presents significant implications for traditional banking systems, requiring changes to risk management practices, client services, and overall strategies. With the evolution of Bitcoin transactions gaining wider acceptance, banks confront challenges in mitigating associated risks, such as cybersecurity threats and involvement in illicit activities. Indeed, an effective risk management strategy requires prioritization of cybersecurity and compliance with Anti-Money Laundering and Know Your Customer regulations [24, 25].

2.2.4. Educating customers and accessibility guarantees

The incorporation of cryptocurrency and blockchain technology into the banking system requires proactive efforts and effective measures to engage customers in the dynamic digital financial landscape. To ease the shift from traditional banking to digital finance, transparency, active communication techniques, and user-friendly interfaces are primordial [26].

2.2.5. Embracing innovation

Recognition of the importance of being flexible and aligned with new technologies is the first step needed to be taken by banks during the transition phase. These adaptive processes incorporate reassessing business models, fostering collaborative innovation through partnership, and dealing with the complexities of cryptocurrency wallets and exchanges. In such a case, blockchain technology extends beyond cryptocurrencies and offers groundbreaking applications in a variety of sectors, including banking systems.

2.2.6. Disruption of traditional banks

The decentralized character of cryptocurrencies challenges central banks' monopoly on currency insurance, sparking discussions about the monetary authority's future role [23]. The emergence of CBDCs in response to the increasing prominence of cryptocurrencies underscores the importance of careful examination of how they interplay safely with financial markets [26]. Moreover, cryptocurrencies have prompted conversations concerning the function of the banking system and their capacity to adjust to the continuing digital revolution [27, 28].

2.2.7. Integration into online banking and payment systems

The integration of digital currencies and the adoption of online banking within the financial world present a strong signal of the consideration and acceptance of such feasible and viable payment methods [29]. In fact, the expansion of online banking and digitalization's integration contributes to the development of trust and confidence in electronic payment systems, which facilitates cryptocurrencies to gain traction as a standard financial instrument [30].

In summary, the adoption of cryptocurrencies by the banking sector presents a primordial shift to digital finance. The banking system must strike a balance between the challenges and opportunities presented within this transition, promoting innovation while maintaining regulatory compliance and active client accessibility.

2.3. Cryptocurrency in the investment market

The quick rise of cryptocurrency has involved a paradigm shift in the investment market. It provides various new avenues for both diversification and potential investment returns. This section analyzes numerous insights and market trends to investigate the importance of cryptocurrencies in the financial market.

2.3.1. Diversification and portfolio management

Cryptocurrency investments present new opportunities for portfolio diversification [31, 32]. Basically, the benefits of diversification may result from price fluctuations that don't always correspond with those of other assets. The strength of cryptocurrencies lies in their potential to reduce portfolio losses even when the traditional market is underperforming. Additionally, the adoption of this digital system including Bitcoin and other cryptocurrencies, leading to diversified portfolios, may help to reduce risks and enhance portfolio performance [33]. Even during recession periods, when the traditional market is performing poorly, cryptocurrencies may be able to minimize portfolio losses.

For all these reasons, investors might want to reevaluate their diversification strategies and give the chance to the inclusion of cryptocurrencies into traditional investing market methods that have changed risk-return profiles.

2.3.2. High returns and market evolution

The benefits of cryptocurrency depend on the requirements, needs, and preferences of the investor. In fact, investment portfolios are beginning to contain Bitcoin holdings as a result of shifting market dynamics and growing acceptance of digital assets. This has resulted in higher profits because cryptocurrencies have outperformed traditional assets in terms of price appreciation. This encourages innovation in the capital market and modifies conventional investing techniques [31, 32, 33].

2.3.3. Inflation hedge

Due to its stringent supply restrictions, Bitcoin is shielded from inflationary pressures, unlike cash, which is subject to devaluation as a result of monetary policies like quantitative easing. In unpredictable economic times or times of growing inflation, cryptocurrencies have the potential to hold or increase in value, giving investors a hedge to increase the total value of their financial holdings.

2.3.4. Volatility and market dynamics

Although there are many benefits in the market, including the previously mentioned diversification and high returns, the relative youth of cryptocurrencies causes extreme price volatility, which is comparable to speculative bubbles and revolutionary discoveries [34, 35]. Consequently, there is a need to reevaluate investing methods and risk tolerance due to the substantial impact that market mood and investor behavior fluctuations have on cryptocurrency values. As cryptocurrencies gain traction, risk management systems become more complex, and the global financial system may change [27].

2.4. Challenges of cryptocurrency in the financial sector

Due to the lack of consumer and investor protection in the event of a market collapse or a cybersecurity incident, there is hesitation in further cryptocurrency adoption, compared to prior to the Global Financial Crisis or in its early years. This is due to the instances of various cryptocurrency market disasters or a number of cryptocurrencies. The Greek government-debt crisis presents an example of how high speculation and an investment scheme can lead to financial instability, which eventually influenced the foreign exchange

market, and a similar event could be repeated with cryptocurrency today [36, 37]. Hence, the shift to a more favorable environment and the establishment of price stability are required, with regulation being key to achieving this.

Moreover, exchange rate fluctuations can affect international transactions, which may create a transaction risk for businesses that have receipts or payments in a foreign currency. If a business is affected by adverse changes in exchange rates, this could result in a reduction of revenue or a loss incurred, which can also occur with price fluctuations of cryptocurrency. Due to the transaction risks and speculative nature of cryptocurrency, some foreign businesses have stopped transactions with cryptocurrency until there is price stability.

Cryptocurrency was developed with the aim of offering secure financial transactions via the internet, using a digital token. However, when cryptocurrency was introduced into the financial sector, the funds were used for speculative investment in addition to secure transactions. Today, most of the cryptocurrency community is investing, holding, and selling digital assets, hoping to gain a significant return on investment. The problem with speculation is the inherent nature of gambling in investing.

The financial sector has adopted cryptocurrency because of the features it offers, such as secure and fast transactions, low fees, and others. But still, the fact cannot be denied that cryptocurrency must face many challenges to take a step forward in this sector.

2.5. Outlook for cryptocurrency in the financial sector

The idea that cash will soon be considered obsolete is one that is becoming more and more obvious. People are using credit and debit cards for everyday purchases now, and larger transactions are being done by electronic wire or other online services. It is only a matter of time until the new forms of money being developed and used will no longer involve any form of cash at all. With that said, cryptocurrencies are ideal in the sense that they are global and have no discrimination against an individual based on their financial status. This is a sharp contrast to other forms of electronic money being used today that require a bank account and/or good credit to attain. With a growing global economy, the use of a global form of currency is the most favorable and efficient method for facilitating it. This fact alone may be the driving force behind cryptocurrencies becoming an industry standard in the future.

The future outlook for cryptocurrencies in the financial sector is a subject that is widely debated as the idea of digital money becomes more and more favorable with the public. Cryptocurrencies have been labeled as ”untrustworthy” and a ”bubble” by some professionals, but many disagree and believe that using these digital currencies comes with many advantages. The future cannot be predicted, but with the ever-growing popularity and success of digital currencies, it can be expected that more people will embrace the idea of utilizing them for the changing financial climate in today’s world.

3. Research Methodology

The quantitative methodology used in the present study is the bibliometric analysis on the topic of “cryptocurrency and financial sector.” This analysis serves to arrange the pertinent data on a given topic by analyzing various sources of literature from a range of sources, including books, journals, and book chapters. Using the VOSviewer software and Lens database. It is also a means of showcasing scientific works that aim to evaluate the state of a certain subject as well as the caliber and impact of scholars and sources.

Using the keywords “cryptocurrency” OR “Blockchain currency” AND “Financial system” OR “Financial Sector” in a Lens database search, we examined academic work to find samples of studies on which bibliometric analysis was conducted. As a result, we found 1,293 publications.

Figure 2 displays the evolution of published documents from 2014 to 2024. It can be noticed that publications on the topic started in 2014. During this time, the 2014 Ethereum has been representing a noteworthy event. Peer-to-peer payment systems with minor technological compromises were the focus of non-Bitcoin cryptocurrency proposals prior to Ethereum. The creators of Ethereum had more ambitious plans for blockchain applications. Ethereum aimed to decentralize the internet rather than serve as a payment method or a store of wealth. Developers presented ideas such as automatically executing smart contracts, which, if certain criteria were satisfied, could carry out directives using just code. It was hailed as a worldwide computer that could inexorably run intricate programming in nodes surrounding the node. Additionally, Ethereum is the platform from which NFTs (non-fungible tokens) and DeFi (decentralized finance) apps originated.

It is important to note that the rise after 2017 corresponds with the cryptocurrency boom of 2017 and the formal acknowledgment of cryptocurrencies by financial markets and governments. This trend indicates that the subject of analysis is relatively new and is gaining popularity, which is indicative of the theme’s applicability.

The year 2023 is recording the highest number of publications (320 documents), with 2022 coming in second (250 documents). Other years include 2021 (180 documents), 2020 (170 documents), 2019 (140 documents), and 2018 (80 documents). It is apparent that the number of publications started increasing in 2017, which coincides with the development of the Ethereum ecosystem. Notably, NFTs began to become sought-after unique digital collectibles, particularly following the blockchain congestion caused by the game Crypto Kitties. Decentralized exchanges, one of the DeFi category’s projects, also began to grow on Ethereum.

In 2022, the cryptocurrency market revives. The peak price of a Bitcoin was approximately $70,000 during this bull market or rising share prices. Prominent corporations such as Tesla and MicroStrategy include Bitcoin in their financial statements. El Salvador really made Bitcoin accepted as currency. The growing popularity of NFTs and metaverse games also helped Ethereum draw in more users.

The information sources pertaining to the financial industry and cryptocurrency are depicted in Figure 3. Journals (900 documents), book chapters (130 documents), and conference proceedings articles (60 documents) are the top three sources. Most of the papers produced were chosen for publishing in journals, which is indicative of the reliability of the information that was searched for.

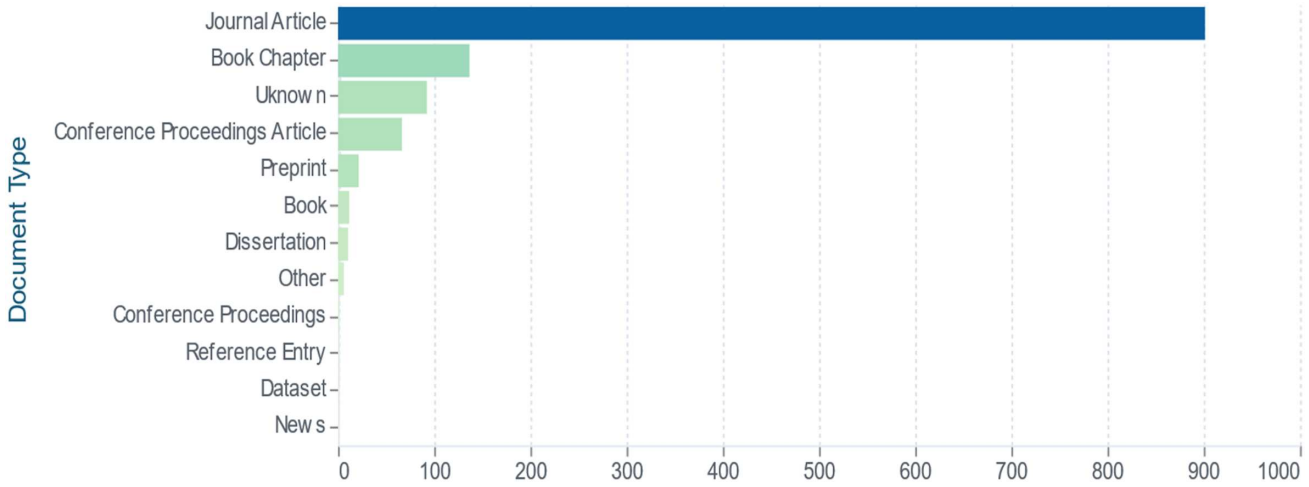
When explored corresponding to the most active authors in Figure 4, the top 10 scholars sequenced from top 1 to 10 consist of Elie Bouri (7 documents), Andreas Hani, Horst Treiblmaier, Jochen Michaelis and Julapa Jagtiani (6 documents). Each of the remaining top 20 authors produced 4 publications.

Figure 5 demonstrates the top field of study. With the appearance of cryptocurrency, it has become a subject of interest for many academics and researchers. Farther than other fields of specialization, cryptocurrency has topped the list with 857 publications, followed by business (782). Other sizable publications were obtained from the computer science field (685 publications), then economics (564 publications), computer security (526 publications), finance (436 publications), digital currency (269 publications),

Figure 2
Research published over the years

Source: https://www.lens.org

Figure 3
Types of publication

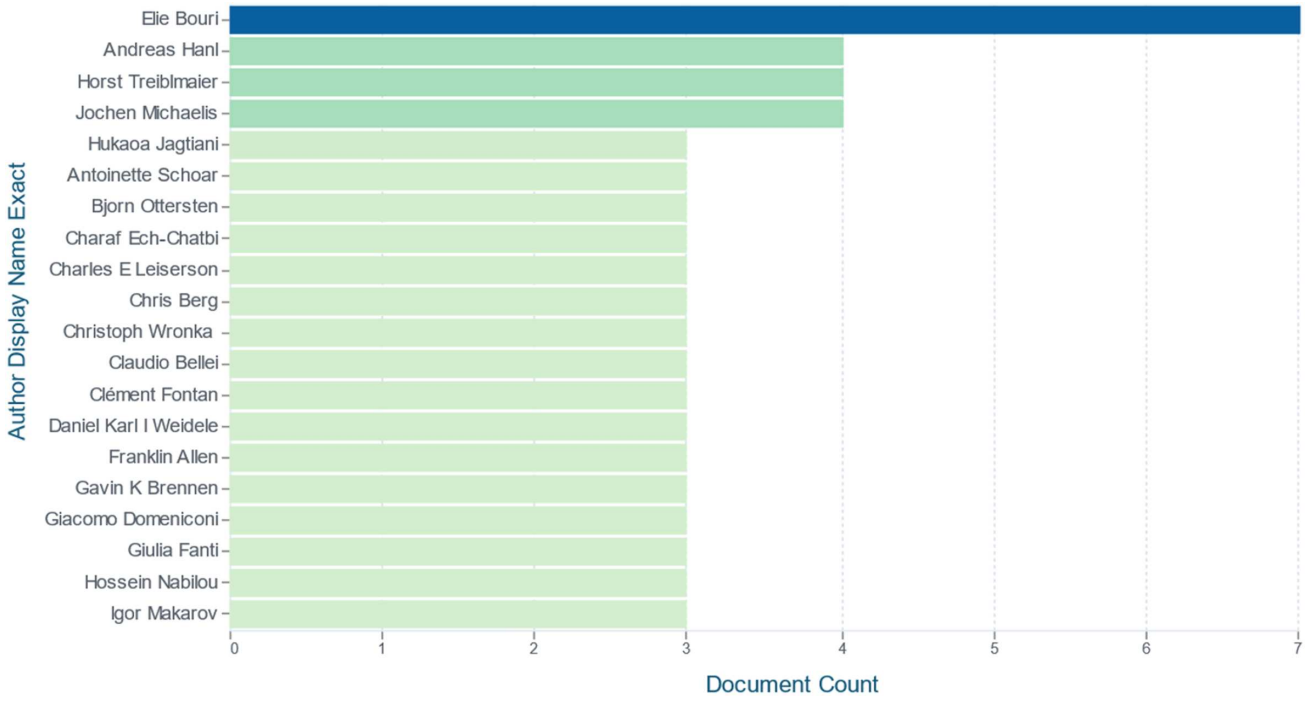


Source: https://www.lens.org

blockchain (238 publications), etc. Cryptocurrency has a crucial role in business and finance and is evident in the close connection between these two constructs. It can further be observed that the topic dealt most with computer science, utilizing technical installation. The cryptocurrency has increased significantly, especially from 2019 to 2023.

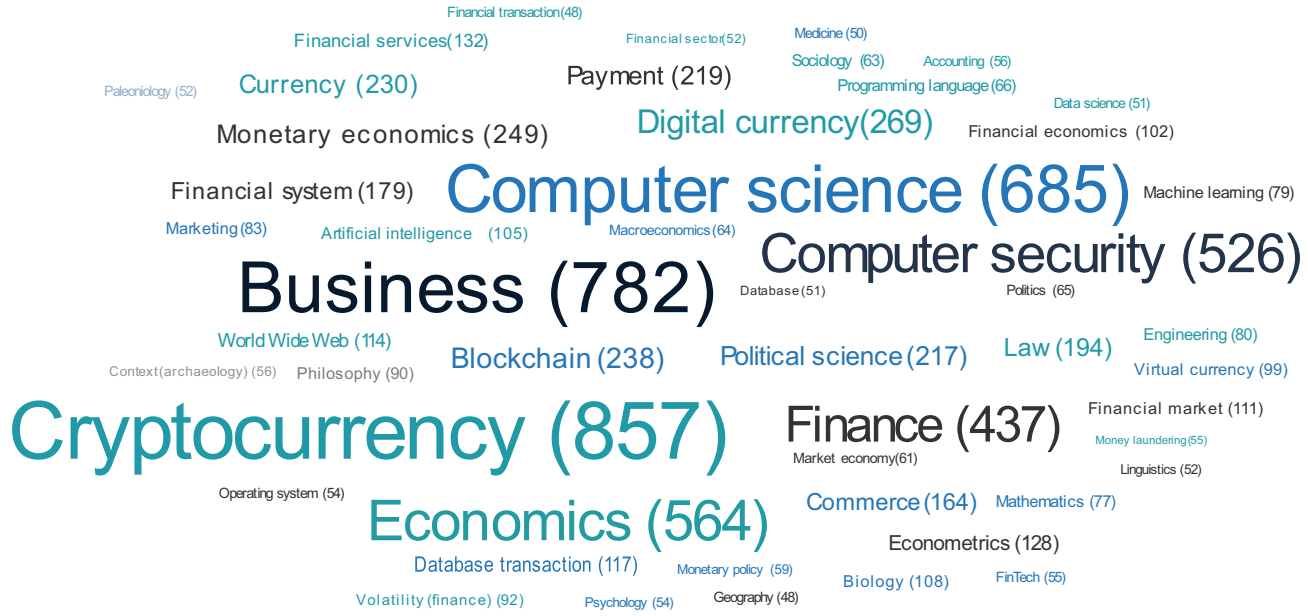
Figure 6 portrays the top 10 countries that performed studies related to cryptocurrency and the financial sector. The United States (101 documents) continues in the top list, followed by the United Kingdom (63 documents). Completing the top 10 list are China (60 documents), India (59 documents), Russia (39 documents), Italy (37 documents), Australia (34 documents), Germany (29 documents), and Indonesia (24 documents). It is observed that while growing economies like China and India compete in the field of cryptocurrency, developed nations like the USA and Europe do well in this area. This finds its origin in the fact that these countries have digital infrastructure allowing them to apply the new technology and a decentralized payment system.

Figure 4
Most active authors in the field



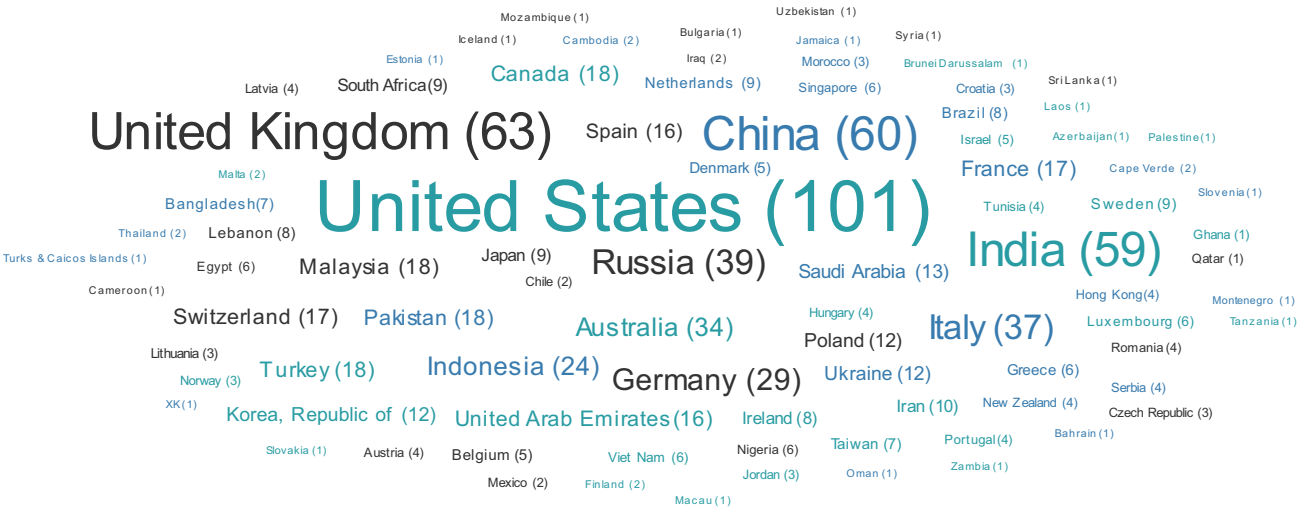
Source: https://www.lens.org

Figure 5
Top field of study



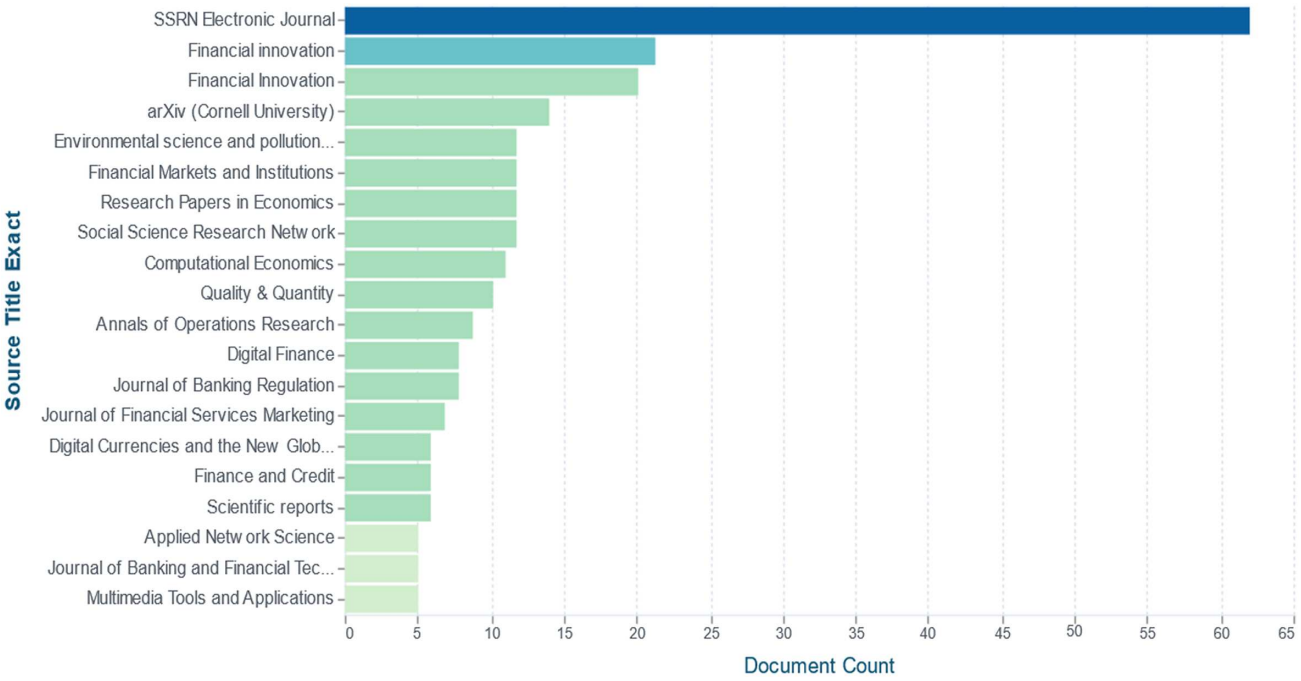
Source: https://www.lens.org

Figure 6
Most active countries in the field of research



Source: https://www.lens.org

Figure 7
Top journals in the field



Source: https://www.lens.org

Expanding the analysis to the top journals in the field, Figure 7 shows the top 10 journals. The number 1 in the list is the *SSRN* electronic journal (63 documents), followed by financial innovation (23 documents), environmental science and pollution (12 documents), financial markets and institutions (12), research paper and economics and social sciences research network (12 documents), computational economics (11 documents), quality and quantity (10 documents), and annals and operating research (9 documents). These varieties of publications reflect that publishers are more interested in researching cryptocurrency and the financial sector.

4. Bibliometric Analysis

The analysis started with keyword co-occurrences analysis with a minimum occurrence of 1, which extracted 175 elements (nodes) in the network dataset; some are unconnected to one another by any relationships or ties. This indicates that there are several disjointed subnetworks or components in the dataset. The data was further analyzed to determine 150 connected items resulting in 16 clusters and with a total link strength (TLS) of 719 (Table 2, Figure 8). In the table, it can be clearly identified that the keyword “bitcoin”

Table 2
Co-occurrences and keywords on cryptocurrency and financial sector

Keyword	Occurrences	Total link strength
Humans	7	60
Covid-19	7	49
Blockchain	7	38
Fintech	6	42
Bitcoin	5	20
Pandemics	4	33
Technology	3	27
Renewable energy	3	26
Cryptocurrency	3	14
Carbon dioxide	2	22
Economic development	2	22
Commerce	2	19
Europe	2	19
Artificial intelligence	2	11
Dcc-garch	2	11
Privacy	2	10
Security	2	10
Cryptocurrencies	2	8
Distributed ledger technology	2	8
Egarch	2	8

has the most occurrences although it only placed second in terms of TLS. The keyword "Humans" has taken the top spot in terms of occurrence and TLS. Related keywords are evident, such as "cryptocurrency," "blockchain," "fintech," and "artificial intelligence." Given the complexities of various payment methods, it is notable that the idea of privacy and security appears to be directly tied to electronic money and is not addressed by any kind of legislative control. This is because these currencies, which were once outright prohibited in some nations, have become more widely accepted. One example of this is China, which is currently producing a significant number of articles on the topic and has started to appear in the databases' keywords. However, the situation in China is complicated because the country has recently restricted the use of these currencies. The biggest crackdown happened in 2021.

A bibliometric analysis was also carried out to ascertain the co-authorship patterns. With a minimum of one author's document and a minimum of one author's citations, the VOSviewer analysis produced 1,271 authors, with 33 related items, eight clusters, and a TLS of 66.

Considering the ranking by citations (Table 3) with only one document for each, the authors "Fabio Antonelli," "Koustabh Dolui," "Massimo Vecchio," "Miguel Pincheira," "Mubashir Husain Rehmani," and "Muhammad Salek Ali" have 563 citations between them, and their TLS value is 5. The TLS value of these authors reflects a strong co-authorship relationship and suggests that they may have co-authored a highly referenced article.

With one document each and 324 citations, authors such as "Jason Bennett Thatcher," "Matti Rossi," "Michel Avital," and "Roman Beck" have a modest level of co-authorship or bibliographic coupling. Their shared TLS value is 3.

Figure 8
Bibliometric map of co-occurrences and keywords (network visualization)

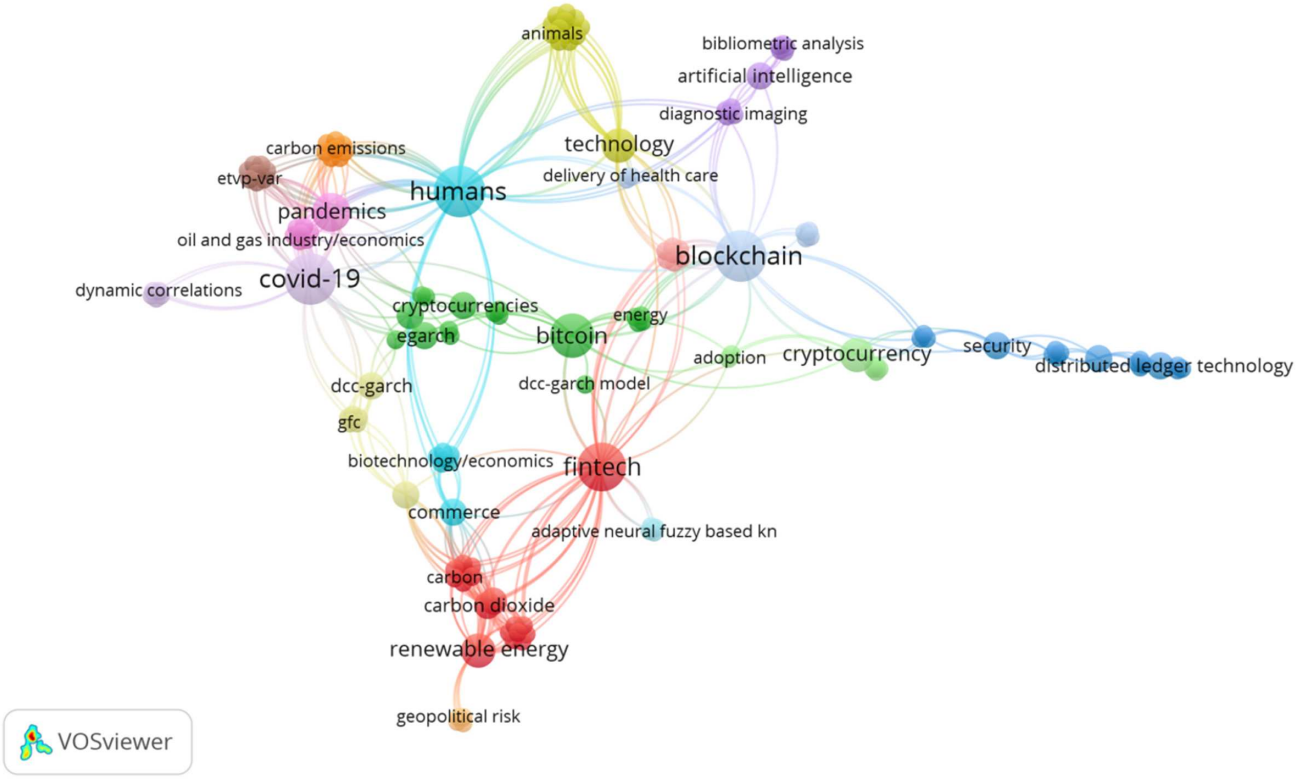


Table 3
Co-authorship and author related to cryptocurrency and financial sector (ranked by citations)

Author	Documents	Citations	Total link strength
Fabio Antonelli	1	563	5
Koustabh Dolui	1	563	5
Massimo Vecchio	1	563	5
Miguel Pincheira	1	563	5
Mubashir Husain Rehmani	1	563	5
Muhammad Salek Ali	1	563	5
Jason Bennett Thatcher	1	324	3
Matti Rossi	1	324	3
Michel Avital	1	324	3
Roman Beck	1	324	3
Elie Bouri	6	196	14
Horst Treiblmaier	3	170	2
Maribel Guerrero	1	152	2
Raj V. Mahto	1	152	2
Saurabh Ahluwalia	1	152	2
Michele Meoli	1	137	2
Silvio Vismara	1	137	2
Winifred Huang	1	137	2
Mohil Maheshkumar Patel	1	121	3
Neeraj Kumar	1	121	3

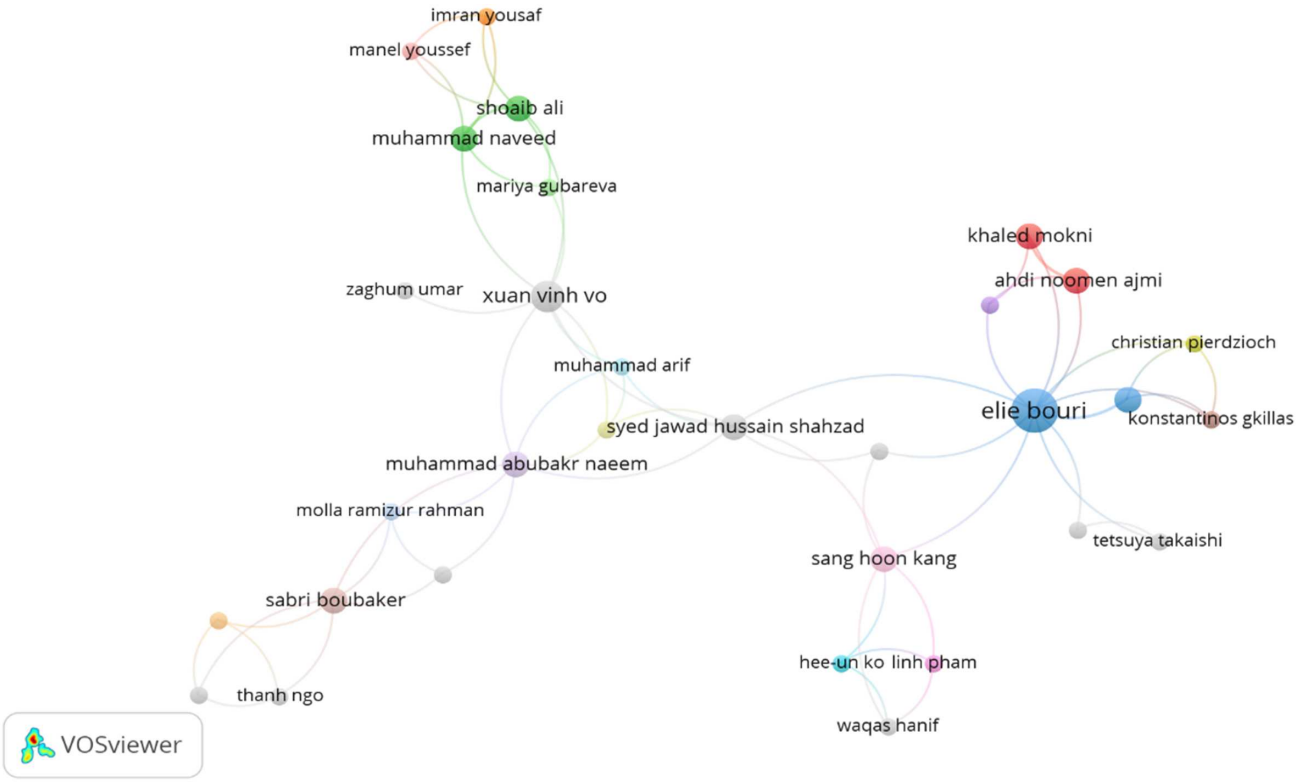
Table 4
Co-authorship and author related to cryptocurrency and financial sector (ranked by number of documents)

Author	Documents	Citations	Total link strength
Elie Bouri	6	196	14
Qusay H. Mahmoud	5	96	14
Horst Treiblmaier	3	170	2
Xuan Vinh Vo	3	86	8
Shouyang Wang	3	33	9
Giulia Fanti	3	30	6
Pramod Viswanath	3	30	6
Shaileshh Bojja Venkatakrishnan	3	30	6
Parthajit Kayal	3	29	1
Muhammad AbuBakr Naeem	3	24	8
Simarjeet Singh	3	9	7
Antoinette Schoar	3	8	3
Igor Makarov	3	8	3
Null Oleks	3	4	10
Clément Fontan	3	2	6
Joakim Sandberg	3	2	6
Louis Larue	3	2	6
Chris Berg	3	1	17
Gavin K. Brennen	3	1	17
Jason Potts	3	1	17

Table 4 sorts out the co-authorship ranked by the number of documents in the dataset. With six publications and 196 citations, "Elie Bouri" has a comparatively high TLS of 14, indicating significant co-authorship relationships within the dataset.

Despite having fewer documents and citations, authors such as "Horst Treiblmaier," "Maribel Guerrero," "Raj V. Mahto," "Saurabh Ahluwalia," and others have a TLS score of 2, suggesting a degree of co-authorship or bibliographic coupling within this group.

Figure 9
Bibliometric map of co-authorship (network visualization)



Some of the 1000 items in the network are not connected to each other. The largest set of connected items consists of 33 items, as shown by the co-authorship (network visualization) in Figure 9.

Finally, the bibliometric data was further analyzed using bibliometric coupling, starting with bibliometric coupling according to TLS (Table 5), then according to citations (Table 6), and a network visualization of this bibliometric coupling (Figure 10).

All things considered, this chart sheds some light on the academic research on the best location for distributed generators. We can better understand which articles are most influential and which papers are most related to the larger body of academic literature by examining both citations and overall link strength.

Table **5** summarizes the bibliometric coupling according to TLS. A total of 321 papers and 270 related items were found using the minimal number of citations for a document, which was 3. Based on the TLS, the research of "Parthajit Kayal (2021)" has the highest TLS of 702, followed by the study of "Muhammad Owais Qarni (2021)" with a TLS equal to 484. The paper of "Helder Sebastião (2021)" has a TLS of 478 and "Led Saiedi (2020)" with a TLS of 380. Completing the top 10 are "Yun Joo An (2021)" and "Ozdemir (2022)," with TLS of 313.

Even if the TLS result showed that fewer instances of bibliometric coupling are seen, the results show that bibliometric coupling, such as co-authorship, needs to be addressed. The first and second-highest instances of bibliometric connection were recorded in the years 2022, 2021, and 2020. It can also mean that, rather than maintaining single authorship, researchers should still learn the value of bibliometric coupling and how to work together.

The Bibliometric coupling according to citations as given by Table **6**. With 563 citations, Muhammad Salek Ali's 2019 article has

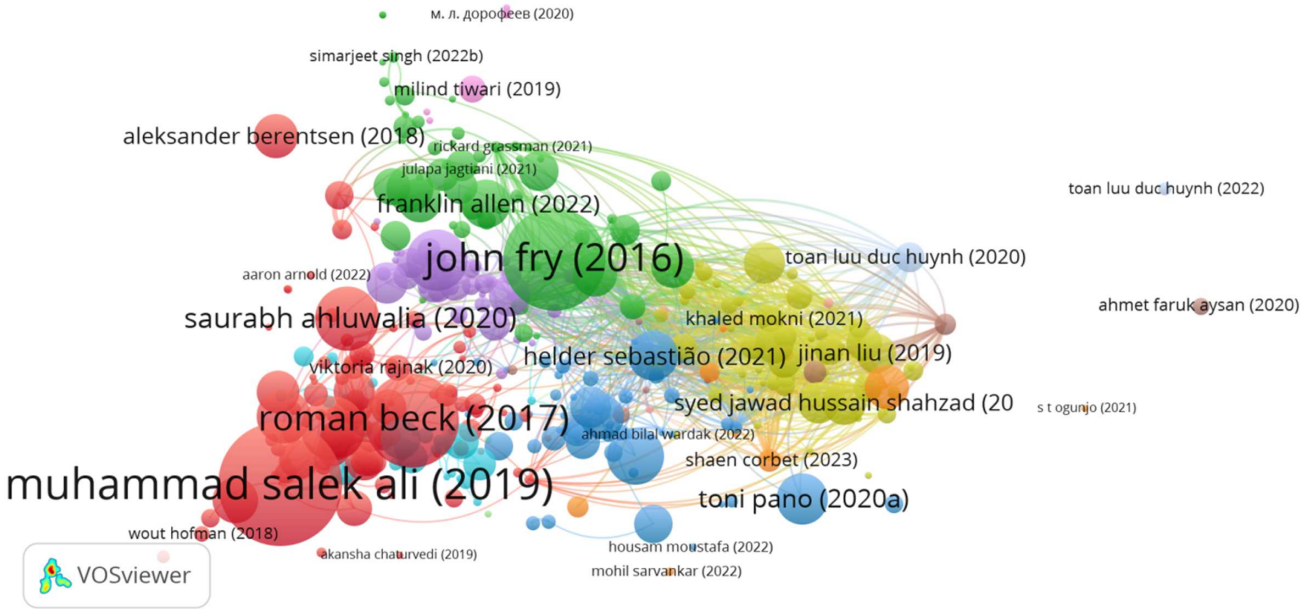
Table 5
Bibliometric coupling according to TLS

Document	Citations	Total link strength
Parthajit Kayal (2021)	24	601
Muhammad Owais Qarni (2021)	21	411
Helder Sebastião (2021)	94	374
Ed Saiedi (2020)	64	331
Etienne Harb (2022)	3	317
Noshaba Zulfiqar (2021)	12	297
Stefan Cristian Gherghina (2023)	9	291
Nikolaos A. Kyriazis (2019)	57	287
Yun Joo An (2021)	9	269
Xiaochun Guo (2020)	11	263
Toan Luu Duc Huynh (2020)	34	258
Onur Özdemir (2022)	30	251
Khaled Mokni (2021)	29	248
Ozkan Haykir (2022)	17	242
Hihed Majdoub (2021)	17	237
Obryan Poyser (2018)	74	232
Syed Jawad Hussain Shahzad (2021)	73	229
Waqas Hanif (2023)	15	222
Theodore Pelagidis (2022)	5	222
David Y. Aharon (2021)	63	221

Table 6
Bibliometric coupling according to citations

Document	Citations	Total link strength
Muhammad Salek Ali (2019)	563	137
John Fry (2016)	384	173
Roman Beck (2017)	324	16
Irem Önder (2018)	153	4
Saurabh Ahluwalia (2020)	152	58
Winifred Huang (2019)	137	72
Mohil Maheshkumar Patel (2020)	121	21
Morgen E. Peck (2017)	116	0
José Parra Moyano (2017)	108	11
Toni Pano (2020a)	98	37
Helder Sebastião (2021)	94	374
Franklin Allen (2022)	90	16
Martin Zeilinger (2016)	80	12
Salem T. Argaw (2020)	80	2
Obryan Poyser (2018)	74	232
Mohammed Mudassir (2020)	74	48
Wessel Reijers (2016)	74	17
Valeriia Denisova (2019)	74	0
Syed Jawad Hussain Shahzad (2021)	73	229
Werner Kristjanpoller (2020)	71	196

Figure 10
Bibliometric map of bibliometric coupling (network visualization)



the most citations, followed by John Frey (2016) with 384 citations. Roman Beck (2017) has 324 citations.

5. Conclusion and Recommendations

Using bibliometric analysis of the Lens database, this study has analyzed a 10-year global search pertaining to cryptocurrencies. The findings demonstrate a favorable trend in terms of citations and publications, with an increase in publications and significance in recent years. Cryptocurrency and business are the two primary fields of study that include principles relevant to cryptocurrencies. The subsequent thematic areas are computer science, computer security, and economics.

This study adds to the body of knowledge already available on the relationship between cryptocurrency and the financial system. In order to better understand the relationship between the

cryptocurrency and financial sector, we first examine the historical development of cryptocurrencies; next, we investigate notable authors, nations, journals, and institutions associated with the topic; third, we show how co-authorship network analysis, bibliographic coupling, and keyword co-occurrence analysis help us understand the network; and fourth, we identify four main research areas and highlight the most significant findings from each.

The study may have limitations because we reviewed the literature using only the VOSviewer database. We suggest going back to this process in a few years and including another database. Performing database analyses is crucial to obtain more proof of the correlation between cryptocurrencies and the stock market. In light of this, we suggest, if software is available, doing an analysis of the bibliometric citations between cryptocurrencies and financial systems utilizing additional databases, like Google Scholar, Web of Science (WoS), and Scopus.

Cryptocurrency is still in its early stages but holds significant potential to transform global finance. Regarding the future outlook and impact on the financial sector, it is widely recognized that cryptocurrency is here to stay and will disrupt traditional financial systems in both positive and negative ways. Businesses utilizing cryptocurrency could bypass the costly cross-border and SWIFT transactions offered by banks, resulting in significant cost savings. The widespread availability and more competitive pricing of cryptocurrencies would also disrupt credit card transactions, making them cheaper. Additionally, services such as PayPal and Western Union could be implemented using cryptocurrency, allowing direct peer-to-peer transactions worldwide.

Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

The data that support the findings of this study are openly available in the Lens at https://www.lens.org.

Author Contribution Statement

Karima Sayari: Conceptualization, Methodology, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration, Funding acquisition. **Mayssa Ben Belgacem:** Conceptualization, Methodology, Writing – review & editing, Visualization.

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