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A Bibliometric and Content Analysis of Cryptocurrency

Ansa Sikandar[1], Fareeha Ijaz[2], Saif Ur Raman[3], Sadia Idress[4]

Abstract
The findings of our extensive review of the cryptocurrency literature from 2010 to 2022 are presented in this report. We cover the definitions, history, uses, and distinctive activities of the cryptocurrency business in our overview. We initially conducted a bibliometric analysis on articles acquired from the Scopus database using the VOSviewer bibliometric and R package tool in order to identify the two main streams of cryptocurrency literature. Then, we conducted content analyses on pertinent publications from reputable sources. We also found gaps in the literature and suggested seven research areas that should be addressed in follow-up studies to improve understanding of the cryptocurrency sector. Researchers researching at the numerous sides of cryptocurrencies to increase our understanding of this industry may find the findings of this paper to be a helpful resource.
Keywords: Cryptocurrency, Review study, Bibliometric analysis, content analysis, VOSviewer

1. Introduction

Cryptocurrencies have been a major and contentious topic in economics literature for more than 5 years. It is a fascinating area to study for academics and industry professionals due to its macroeconomic implications and institutional-level importance. Virtual currency, such as cryptocurrency, has carved out a unique niche for itself in the international financial markets since its rapid rise and dissemination. The market capitalization of cryptocurrencies extended to 798 billion U.S. dollars till December 2022 where it was only closed to 1 billion U.S. dollars in 2013. Due to this circumstance, the impact of crypto markets on empirical finance has received a lot of attention in recent years from academics, the press, governmental agencies, and the financial industry etc.

Despite their significant volatility, cryptocurrencies are growing in acceptance on the international financial markets (Colon et al., 2021). According to Katsiampa (2017) The price movement of cryptocurrencies is quite volatile because of the enormous incentives. You may safeguard yourself with Bitcoin against a variety of risks, including those associated with the market efficiency, foreign exchange, and commodities. Cryptocurrency can also have an important influence on market efficiency and monetary policy (Noda, 2021, Kakinaka and Umeno, 2022, Corbet et al., 2014, Claeys et al., 2018). Cryptocurrencies' operation depends on a number of variables, such as market efficiency and monetary policy perspectives, before it can ever be said that they are secure (Stevens, 2017, Nelson, 2018, Wei, 2018, Zhang et al., 2020b). According to Sahoo and Sethi (2022) , the inclusion of cryptocurrencies in an investor's portfolio will help it become more diversified.

Our goal was to document the variety of viewpoints and defences presented in the literature on cryptocurrency. As a result, our main goals were to analyse the evolution and structure of cryptocurrency research, discover the key study areas, and compile the most pertinent information at this time. Inconsistencies in earlier investigations are also presented, along with potential causes. Finally, we point out gaps in the literature on cryptocurrencies and discuss the necessity for additional research. On the bitcoin articles we gathered, bibliometric and content analysis were performed.The bibliometric analysis of cryptocurrency research reveals the most frequent keywords as well as the most significant studies, authors, and sources. We offer key points from each of the two distinct study streams that our content analysis of the cryptocurrency literature identified. That is, we conducted a bibliometric analysis on the relevant literature we had received from the Scopus database first, and then we conducted a content analysis on the most important and relevant articles that had been identified. Due to the dearth of review studies on the literature related to cryptocurrency, this study adds to it. Because it offers both bibliometric and content analyses of cryptocurrency research from 2010 to 2022, this review is unique. It also adds to the field by pointing out seven research issues that need to be solved in next cryptocurrency studies.

The remaining paragraphs of the article are organised as follows: The section under "An explanation of cryptocurrency" provides a general overview in addition to details on the terminology, history, and goals of the cryptocurrency sector. In the second half of the study, the "methodological approach" is explained, and in the third section, the results of the "bibliometric analysis" are presented. In the fifth section, we introduce "Content analysis," review each research stream, and provide summaries of the key articles for that stream. Each of the extra seven research subjects is fully explained in the "Content analysis" section. In the "Conclusion" section, we offer our comments on the cryptocurrency market and potential directions for scholarly research.

2. An explanation of cryptocurrency

2.1. The meanings of cryptocurrency

The definition of cryptocurrency varies among academics. Although there is debate over the use of "virtual currency" as a synonym for "cryptocurrency," many people still use terminology like "virtual money," "crypto-assets," "virtual assets," "virtual tokens," etc. as alternatives (Стойка, 2021).

A decentralized kind of currency known as cryptocurrency uses cryptographic operations to carry out financial transactions (Doran, 2014). Dibrova (2016), the only distinction between Virtual Currency (VC) and the utility is that the latter is a digital version, while the former is not. This digital currency can be transmitted, saved, and used in electronic transactions; it is not linked to a particular national currency and is intended to be accepted as payment by some people. Cryptography, not people or trust, is typically the foundation for cryptocurrencies' security (Narayanan et al., 2016). For instance, "Elliptic Curve Cryptography" is a technique that Bitcoin employs to protect the security of its transactions (Wang et al., 2020).

[1] MS-Scholar, Faculty of Economics and Commerce, The Superior University, Lahore, Pakistan, ansasikandar6@gmail.com
[2] MS- Scholar, Faculty of Economics and Commerce, The Superior University, Lahore, Pakistan, ijazfareeha123@gmail.com
[3] Associate Professor, faculty of Economics and Commerce, Superior University, Lahore, Pakistan, saifrao12@gmail.com
[4] School of Economics, Banking and Finance, Universiti Uatra Malaysia, midrees485@gmail.com

2.2. Development of cryptocurrencies

David Chaum, a cryptographer, is the first person to mention virtual currency. He created the cryptography technology known as eCash in 1983. He created another system, called DigiCash, twelve years later that used cryptography to protect the privacy of financial transactions. However, the concept or phrase "cryptocurrency" was first used in 1998. Wei Dai started considering creating a new payment system that utilised a cryptographic technology and whose primary feature was decentralisation that year. The first cryptocurrency, Bitcoin, was developed in 2009 by a person whose identity is still unknown. His goal was to develop a new form of payment that could be used globally, was autonomous, and was not supported by any financial institutions.

A general-purpose digital currency created to serve as a means of exchange? Twenty years ago, this was unheard of and considered to be practically impossible; but, now, 3 in 4 people use cryptocurrencies, and between 2.9 and 5.8 million Americans alone have invested with the hope of enhancing their financial status in the future. The creation of the digital currency, the first digital money in history, marked the beginning of cryptocurrencies. Since its inception, cryptocurrency's value has surged and it has been dubbed "digital gold" by its users. Its fundamental goal was to provide a safe and private method of exchanging money between individuals. In order to maintain the currency's secrecy, a software developer going under the nickname Satoshi Nakamoto originally created Blockchain, the electronic record of Bitcoin transactions. At this point, Satoshi Nakamoto had to invent something fresh. A little while later, a real-time gross settlement system called Ripple was unveiled. Money can be moved between two people almost rapidly and directly because to the currency's design. Any form of money, including fiat money, gold, and even airline miles, can be traded. They claim they may transact in cryptocurrencies outside of exchanges without incurring fees or standing in queue. This digital asset is presently utilised by banks all over the world as a result of its growing prominence in the sector.

Cryptocurrency has been described differently by many academics. Although there is debate concerning the use of "virtual currency" as a synonym for "cryptocurrency," many people still use words like "virtual money," "crypto-assets," "virtual assets," and "virtual tokens" in place of the word "cryptocurrency." etc (Стойка, 2021).Dibrova (2016), the only distinction between Virtual Currency (VC) and the utility is that the former is a digital version, while the latter is not. This digital currency can be transmitted, saved, and used in electronic transactions; it is not linked to a specific national currency and is intended to be accepted as payment by some people.

2.3. Activities and Functions of Cryptocurrency

There are two main purposes for crypto. Similar to traditional money, it can be used as a valid method of payment for products and services. It also serves as an investment as a secondary purpose. Both roles have advantages and disadvantages. In a transaction, money is moved between two digital wallets. These transactions are accepted by the public ledger, which is awaiting confirmation. The transactions are carried out with the aid of an encrypted electronic signature. The cryptographic signature, often known as an electronic signature, is a piece of encrypted data. It offers a mathematical justification for the transaction being processed from the owner's wallet. While the miners are engaged in their mining activity, the confirmation process takes about 10 minutes. The transaction is verified by the mining process, which also adds it to the public ledger (Soni, 2020). A cryptocurrency exchange is a marketplace where cryptocurrencies may be bought and sold. Crypto exchanges provide storage for crypto as well as trading services and price discovery through trading activity.

3. Methodology

Our method of reviewing the literature on cryptocurrency includes bibliometric and content analysis. Numerous literature review studies have used the bibliometric analysis method (Naatu and Alon, 2019, Jalal et al., 2021, García-Corral et al., 2022, Alsmadi et al., 2022). In business, economics, and finance literature, the content method of analysis is frequently used (Lohmer et al., 2022, Kumar et al., 2023, Sitthipon et al., 2023, Xie et al., 2019). Jeris et al. (2022) earlier used the similar combined approaches strategy.

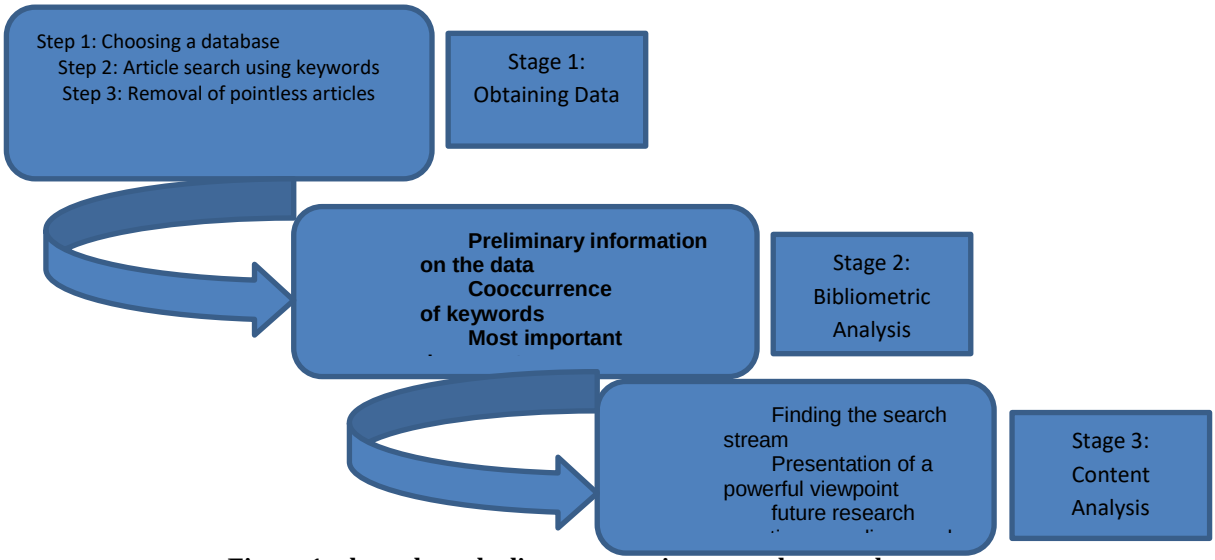


Figure 1: shows how the literature review procedure works

In Figure 1, the methodology for this study's literature review is shown. We divided the review into three phases. First, we gathered the 7473 papers that the SCOPUS database returned when we searched for "cryptocurrency" because it is a huge archive of published research with peer review (Zhang et al., 2020a, Burnham, 2006, Mongeon and Paul-Hus, 2016). After filtering the papers according to title and importance and adapting the SCOPUS Excel document, we discovered 541 publications in the literature of the cryptocurrency area of economics. We manually searched the SCOPUS journals for economics to make sure no important papers were missed and to validate that articles that were screened out were, in fact, unrelated to our research. Bibliometric examination of the 541 papers was the focus of stage two of our review procedure, which used the VOSviewer software. Van Eck and Waltman (2010) and R Package bibliomatrix Aria and Cuccurullo (2017) created the bibliometric analysis tool VOSviewer and R Package bibliomatrix that lets you generate and view bibliometric maps. It may present such maps in a variety of methods, every one of which highlights various characteristics. This tool has been previously used by Donthu et al. (2020), Feng et al. (2020), Gutiérrez-Nieto and Serrano-Cinca (2019), Niñerola et al. (2019), Castillo-Vergara et al. (2018). We use it to look at six aspects of the literature on cryptocurrency. We did content analysis as part of the third step of the review process and manually identified two distinct research streams based on pertinent keywords and a careful reading of the abstracts. The techniques, which are clearer covered concurrently with the results in the portions that follow, are covered in more detail.

3.1. Bibliometric analysis

We looked at how often each keyword appeared in the literature on cryptocurrencies. We also looked at the sources, authors, and papers that received the most citations. Furthermore, in order to identify shared sources amongst publications, we used bibliographic coupling. The sections that follow include the findings of the bibliometric analysis.

3.2. Preliminary information on the data

The final sample of 541 publications had 1117 authors and was produced in 193 journals, with an average of 25.79 citations per article. Figure 2 presents the total publications and figure 3 citations related to the cryptocurrency over the years. The number of papers published has been growing, with the most prolific year being 2022 Additionally, it is noticed that articles received most citations in 2016.

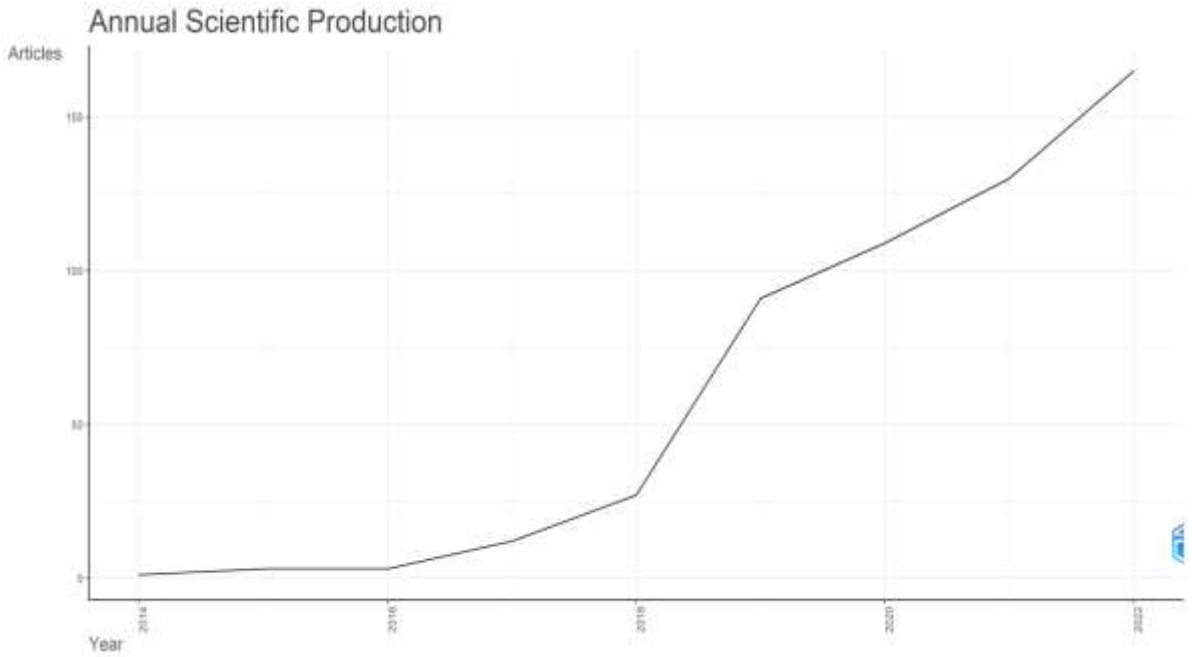


Figure 2: Annual Scientific Productions

3.3. Co-occurrence of keywords

We filtered them by imputing 10 as the minimum number of occurrences of a term, and 28 of the 1456 keywords met the threshold. The field of cryptocurrency literature is well-diversified, and there are around 1456 keywords regularly used in the literature over time. In Figure. 4, the number of nodes corresponds to the frequency of the keyword (Van Eck and Waltman, 2010, Van Eck and Waltman, 2014). The figure hence shows that the word “Cryptocurrency” was the most commonly used of the 28 keywords recognized. Other frequently used terms include “monetary policy,” “market efficiency,” “investment,” “fintech,” “stock market,” “blockchain,” “financial market,” “COVID – 19,” “currency market,” “garch,” “electronic market,” “digital currency,” “liquidity, ”and “money laundering.” The outcomes additional exposed that the strongest link was between the terms “cryptocurrency” and “bitcoin.” Additionally, “cryptocurrency” was found to have strong links with “blockchain,” “currency,” “volatility,” “investment,” “COVID – 19,” and “market efficiency.” These results recommend that the blockchain ,bitcoin and market efficiency are the most common concerns regarding the cryptocurrency.

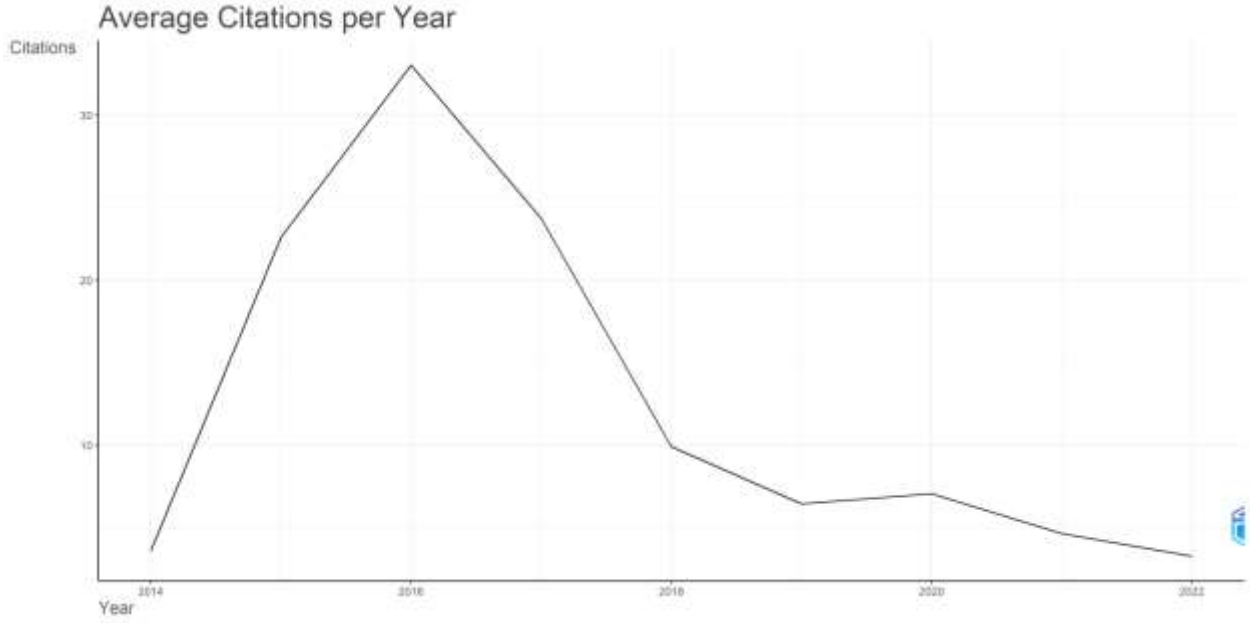


Figure 3: Average Citation per year

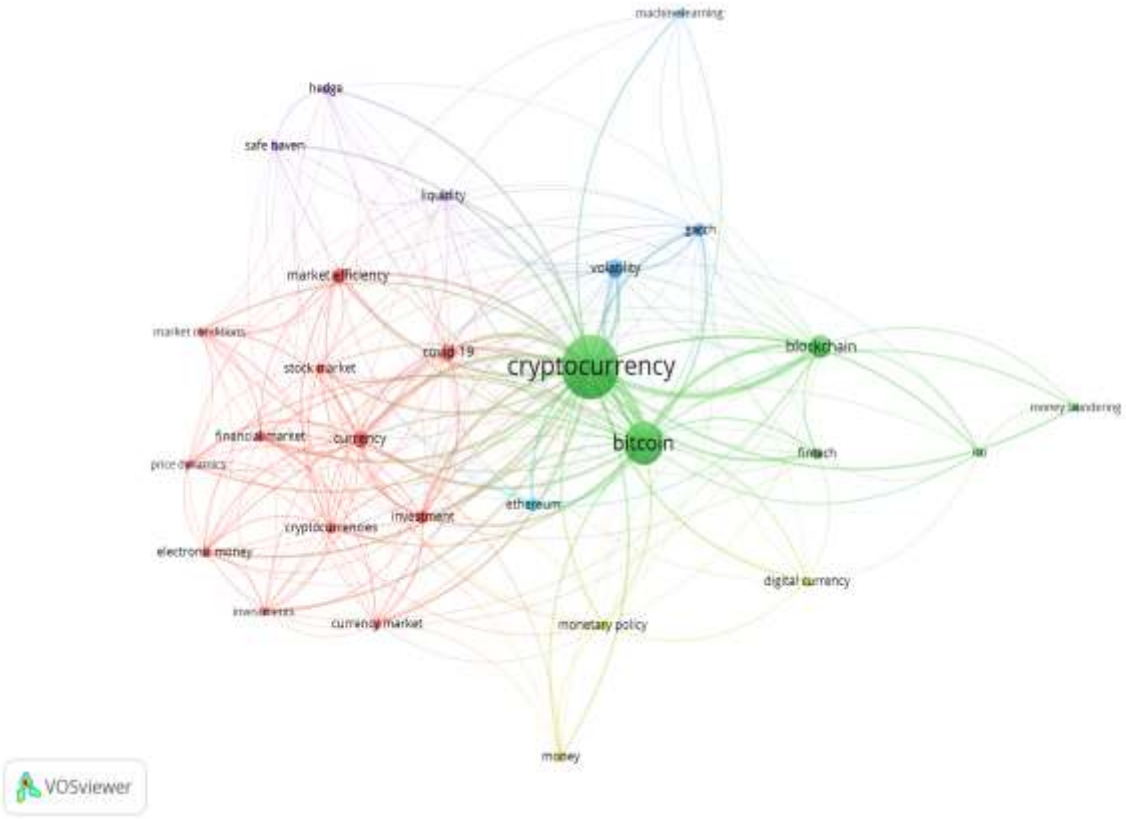


Figure 4: shows a network map of all the keywords' co-occurrences. Source: Authors' best judgment

Table 1: highest-cited cryptocurrency documents

References	Number of citations	References	Number of citations
Urquhart (2016)	702	Yi et al. (2018)	222
Bouri et al. (2017)	651	Urquhart (2017)	218
Katsiampa (2017)	527	Polasik et al. (2015)	208
Dwyer (2015)	402	Wei (2018)	198
Conlon et al. (2020)	274	Phillip et al. (2018)	196

3.4. Most important documents

In order to discover the most frequently mentioned publications in the cryptocurrency literature, we restricted the analysis to bringing back documents that were cited at least 15 times. 10 of the 218 articles meet the criteria. Table 1 displays these 10 articles from the literature on cryptocurrencies. The diagram of networks generated from the most frequently referenced articles is shown

in Figure 5. We discovered that Urquhart (2016) publication had the highest citations; yet, it is not linked to the group of 218 related papers depicted in Figure 5. Also, Bouri et al. (2017) Acharya et al. (2013), Katsiampa (2017), Dwyer (2015), and Conlon et al. (2020) are not included in the related collection either, despite being one of the top 10 most mentioned documents.

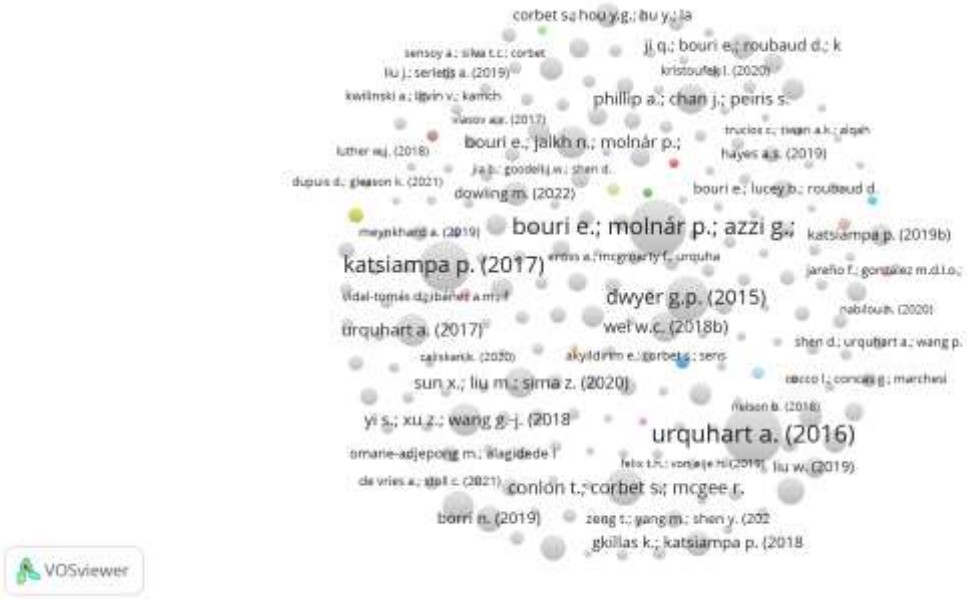


Figure 5: A network map of the cryptocurrency documents with the highest citation counts. Source: Authors' best judgment

3.5. Most significant journals

The most influential journals were identified using the R Package software. We classified the top five journals into 2 groups: those that published the most articles on the subject (Table 2) and those that received the most citations (Table 3). In the case of the highest number of articles published, the most influential journal was Finance Research Letters with 75 articles covering 13.86% of the total publications, followed by economics letters (26, 4.81%), research in international business and finance (23, 4.245%) and international review of financial analysis (19, 3.51%). In terms of highest citations received, Finance Research Letters and economics letters again remained top 2 most influential journals with 3374 and 2534 citations respectively.

Table 2: most published Journals

Rank	Source	Publication
1	FINANCE RESEARCH LETTERS	75
2	ECONOMICS LETTERS	26
3	RESEARCH IN INTERNATIONAL BUSINESS AND FINANCE	23
4	INTERNATIONAL REVIEW OF FINANCIAL ANALYSIS	19
5	APPLIED ECONOMICS	14

Table 3: most published Journals

Rank	Source	Citation
1	FINANCE RESEARCH LETTERS	3374
2	ECONOMICS LETTERS	2534
3	RESEARCH IN INTERNATIONAL BUSINESS AND FINANCE	813
4	INTERNATIONAL REVIEW OF FINANCIAL ANALYSIS	666
5	JOURNAL OF FINANCIAL STABILITY	487

3.6. Most influential authors

The most influential authors of the research are presented in Table 4. Corbet s was the most productive author, published 16 articles and **Articles Fractionalized** 4.52. Followed by, Grobys K published 9 documents with **Articles Fractionalized** 4.42. Bouri E,Lucey B,Roubaud D and Urquhart A had 8 documents each although Urquhart A had the **Articles Fractionalized** 3.75 among them.

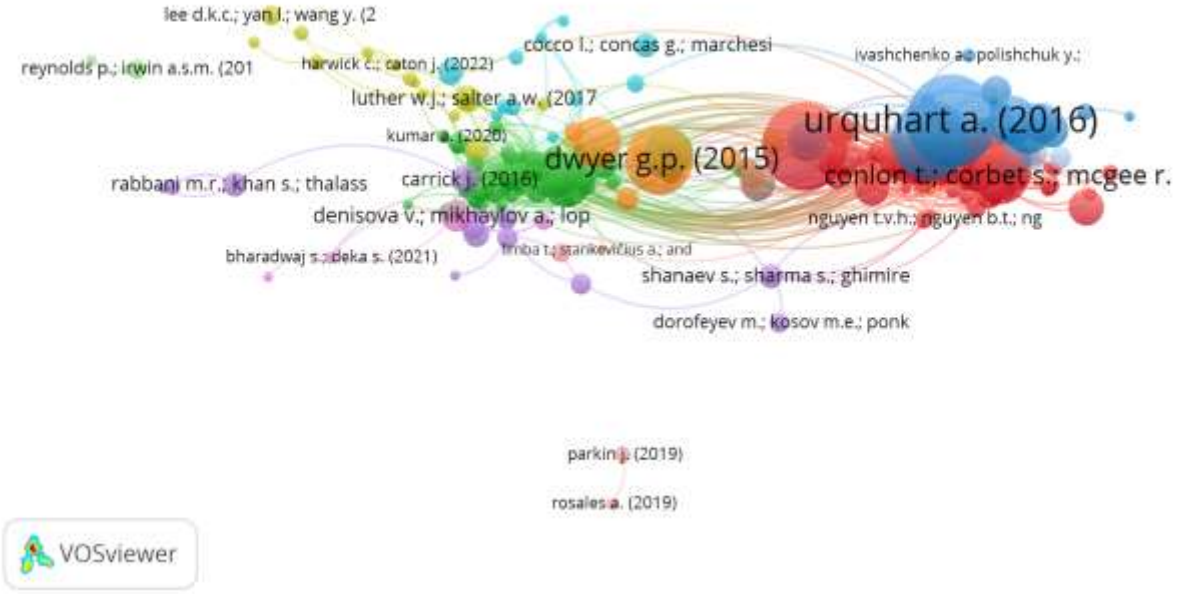
3.7. Bibliographic document coupling

The developers of VOSviewer suggest that bibliographic coupling results represent the overlap of references between publications. The strength of the connection between two papers increases with the number of shared references between them. We limited this study to only include publications with at least 10 citations, which produced 277 articles. Only 260 articles were discovered in the related collection, though. The figure 6 displays a visualization of the bibliographic coupling of papers in the cryptocurrency network. Flori (2019a) was identified as having the highest total bibliographic coupling connection strength. (516 with 11 citations). The following are the top 5 additional articles. The first value is the total link strength for each article, while the second

number represents the total number of citations. Flori (2019b) [382,14], Panagiotidis et al. (2019) [278,68], Katsiampa (2019) [269,66], Huynh et al. (2020) [256,27], Eross et al. (2019) [236,53].

Table 4: most influential authors

Rank	Author	Publication	Articles Fractionalized
1	CORBET S	16	4.52
2	GROBYS K	9	4.42
3	BOURI E	8	2.20
4	LUCEY B	8	2.37
5	ROUBAUD D	8	2.20
6	URQUHART A	8	3.75
7	KATSIAMPA P	7	4.67
8	ZHANG S	7	2.33
9	SAPKOTA N	6	2.42
10	LARKIN C	5	1.15



The figure 7: shows the network visualization of the linking of papers' bibliographies. Source: Authors' best judgment

4. Content analysis

4.1. Main study streams

We ensured that no significant document was omitted from the conversation by ranking the documents according to their applicability to our problem during the content analysis phase. By scanning the subject study abstracts for the thematic keywords mentioned in the previous studies, we were able to pinpoint three key research areas in the cryptocurrency literature. It helps to visualize the aspects of cryptocurrency that have been investigated during the course of its development to group the study streams. However, given the interdisciplinary nature of cryptocurrency research, we agree that certain works belong to numerous streams. Tables 4, 5, and 6 provide summaries of the key arguments in each stream. The next three parts include descriptions of the articles and their findings.

4.2. Determinants of cryptocurrency

The first empirical investigation on the factors that influence cryptocurrency was carried out by Teichmann and Falker (2020). The outcomes were then put to a quantitative test. The unique Liechtenstein blockchain statute is then addressed in depth, along with how the legislation can help create a global standard for blockchain regulation. In that study, a qualitative study involving 10 suspected money launderers and Eighteen prevention specialists was done to look into the specific techniques that money launderers employ. Fasanya et al. (2020) identified linear correlations between several macroeconomic indices and cryptocurrencies. The authors show that there is a sizable difference between the volatility spillover indexes and return indices for bitcoin portfolios over time. The authors find evidence of reliance among cryptocurrency holdings using the spillover indices. While the return spillover index demonstrates improved integration among currency portfolios, the volatility spillover index displays enormous bursts during significant market crises. Return spillovers and volatility spillovers, in particular, show some interesting trends and bursts. Ahmed et al. (2020) discussed the effect of technical trading profitability and other factors on the function of cryptocurrencies in funding the short-term and long-term crypto markets. The "privacy function" is displayed by the top ten cryptocurrencies. Simple moving average trading strategies are examined. These five coins' daily price data are used. Our examination of the 2016–2018 time frame demonstrates that a variable moving average strategy works well in specific circumstances. Sukumaran et al. (2022) performed another study on cryptocurrencies in Malaysia, this time using the decision of

adopting cryptocurrencies as the dependent variable. There were two independent variables: perceived value and perceived risk. Dupuis and Gleason (2020) also debated that the technique for analyzing significant recent events, the availability of "fintech" crime-fighting tools, and the analysis of recent significant events is a literature review focusing on the application of the regulatory dialectic to advancements in current crypto-asset markets that make them alluring to money launderers. Corbet et al. (2020) Furthermore, it was found that trade volumes and returns had significantly increased, indicating that major cryptocurrencies have performed the function of a store of value throughout this extremely stressful period for the financial markets. Hou et al. (2020) discovered that a sizable part of price spikes is contemporaneously and highly anticorrelated with volatility jumps. Sabah (2020) investigated that a key factor in the volatility of cryptocurrencies is the number of emerging markets. Additionally, sites in Europe, North America, and Oceania as well as those that don't reveal the nature of their operation raise the volatility of cryptocurrencies. The essential points in the literature on the determinants of cryptocurrency are presented in Table 5.

Table 5: Key literature on determinants of Cryptocurrency

References	Journal	Country	Key opinions/outcomes
(Teichmann and Falker, 2020)	Journal of Money Laundering Control	Switzerland	Money launderers continue to often employ cryptocurrencies like Bitcoin as tools for financial crime. The Blockchain Act of Liechtenstein could serve as a template for policymakers working to address the issue globally.
(Fasanya et al., 2020)	International Journal of Managerial Finance	South Africa	The authors demonstrate that there is a significant discrepancy between the return and volatility spillover indexes for bitcoin portfolios over time. Given the spillover indices, the authors discover evidence of dependency among cryptocurrency holdings. The volatility spillover index shows huge bursts during big market crises, while the return spillover index shows enhanced integration among currency portfolios. It's interesting to see that trends and bursts can both be seen in the return and volatility spillovers.
(Ahmed et al., 2020)	Finance Research Letters	Finland	Our technical trading rules show that, overall, basic technical trading rules do not provide gains above a buy-and-hold strategy when all 10 privacy coins are used combined.
(Sukumaran et al., 2022)	Risks	Malaysia	According to the results, adoption of cryptocurrencies was found to be significantly influenced by perceived value. Nevertheless, perceived danger had little bearing on Malaysian investors' acceptance of cryptocurrencies.
(Dupuis and Gleason, 2020)	Journal of Financial Crime	Sharjah	The authors look at recent "closed doors," evaluate how cryptocurrencies are being used illegally using Kane's rules logic paradigm, name several crypto-to-fiat exchange options that are still open to those looking to use digital coins as tools for money laundering, and offer suggestions for how to regulate the crypto-related markets to help make them less appealing to potential criminals.
(Corbet et al., 2020)	Economics Letters	Ireland	We discover evidence of a considerable increase in returns and trading volumes, suggesting that major cryptocurrencies served as a store of value during this period of extreme financial market stress. Furthermore, it is discovered that the unfavourable mood surrounding COVID-19 has a considerable impact on cryptocurrency returns. Results indicate that these digital assets served as a safe haven during historical crises, comparable to how precious metals served as a safe haven, in addition to offering investors benefits from diversification.
(Hou et al., 2020)	Journal of Financial Econometrics	Sweden	We demonstrate that a considerable share of price jumps are contemporaneously and negatively linked with volatility jumps. Our paper includes ground-breaking analysis of BTC option pricing. We demonstrate how the pricing system suggested emphasizes the significance of spikes in CC markets.
(Sabah, 2020)	Finance Research Letters	United States	We discover that a key factor in the volatility of cryptocurrencies is the number of new venues. Additionally, venues in Europe, North America, and Oceania as well as those that don't reveal the nature of their operation raise the volatility of cryptocurrencies. Our conclusions are supported by Granger-causality, VAR estimation, and a nearly natural experiment.

4.3. Cryptocurrency and monetary policy

Corbet et al. (2014) investigate how modifications in global monetary policy impact bitcoin returns, a GARCH (1.1) estimate model was used. The results demonstrate that interest rate-based monetary policy decisions made by the Federal Open Market Committee have a significant influence on bitcoin returns. After correcting for global conditions, we find compelling evidence that the announcements of quantitative easing from the US, EU, UK, and Japan had an impact on volatility. Sauer (2016) suggested that the popularity of virtual currencies is primarily driven by two causes. First, as a protest against monetary policy decisions

made by authorities, and second, as a remedy for shortfalls in some monetary systems brought on by political unrest or other factors. Krivoruchko et al. (2018) empirically examined financial regulators should be aware of the potential for cryptocurrency contagion in order to protect public confidence and promote the creation of public goods. Central bankers generally have not come to a consensus over how to handle cryptocurrencies, despite the fact that this is their primary role. Fama et al. (2019) studied the fact that the public and private sectors are paying more and more attention to cryptocurrencies and the underlying technologies behind them suggests that they may have the power to fundamentally alter the way we think about money. Nguyen et al. (2019) analyses the asymmetric effects of monetary policies on cryptocurrency returns under regimes of monetary tightening vs easing. Interestingly, we find that four main cryptocurrencies, including Bitcoin, significantly respond to Chinese monetary policy tightening; nevertheless, U.S. monetary policy has little effect on cryptocurrency returns. Table 6 presents the main points made in important works on cryptocurrencies and monetary policy.

Table 6: Key literature on Cryptocurrency and monetary policy

References	Journal	Country	Key opinions/outcomes
(Krivoruchko et al., 2018)	Journal of Reviews on Global Economics	Russia	Private cryptocurrencies have grown to be an essential component of the financial industry. With regard to cryptocurrencies, central banks took a range of attitudes, from outright rejection to non-intervention. We discovered a common and predominating pattern in the central bank's strategy to steer the advancement of cryptocurrency through limitations, stringent monitoring, and licensing.
(Corbet et al., 2014)	Investment Management and Financial Innovations	Ireland	According to the findings, the Federal Open Market Committee's monetary policy decisions in the US have a big impact on bitcoin returns. These decisions are based on interest rates. After adjusting for global factors, we discover strong evidence of volatility effects triggered by quantitative easing statements from the US, EU, UK, and Japan. These findings demonstrate that, in spite of its nature and goals, bitcoin appears to be vulnerable to the same economic dynamics as conventional fiat currencies and is not completely immune to the effects of governmental policy.
(Nguyen et al., 2019)	Research in International Business and Finance	Viet Nam	We observe strong responses of four main cryptocurrencies, including Bitcoin, to China's tightening monetary policies; however, U.S. monetary policies do not significantly affect cryptocurrency returns.
(Fama et al., 2019)	International Journal of Political Economy	Italy	The ability of the cryptocurrency to function as a reliable payment method is now badly impacted by a number of problems. It raises questions about a wide range of political, technical, and social factors as to whether this experience can pave the way for the creation of new and more democratic monetary tools, as the essay discusses.
(Sauer, 2016)	International Advances in Economic Research, 2016	Germany	Virtual currencies are in vogue mainly due to two factors. First, as a protest against authority-driven monetary policy decisions and second, as alternatives to deficits in some monetary systems arising out of political instability or other causes. Assuming that virtual currencies indeed (partially) replace national currencies as payment vehicles, we attempt, in this article, to integrate the virtual currency supply and demand into the Keynesian money market framework. This article presents a few results for the central banks and outlines problems that may result for monetary policy formulation. Since this is the first such attempt to model a national money market as a combination of nationally-issued currency and globally-issued virtual currency, certain simplistic assumptions have been made. Nevertheless, the model offers directions on the impact of virtcurrencies on the monetary and the national money market.

4.4. Cryptocurrency and market efficiency

Hu et al. (2019) discussed that lack of empirical support for the hypothesis in the panel evidence points to market inefficiencies in cryptocurrency. Shynkevich (2020) suggested that Trading of the inefficiently priced fund's shares looks to be even more emotionally charged than the already turbulent and intense trading of bitcoin, and it also shows a significant tendency towards herding. Yaya et al. (2021) discover that markets for Bitcoin and the majority of the altcoins we studied are both highly efficient and volatile, particularly during the current post-crash era. Volatilities are more likely to last for a shorter time than they did before the catastrophe. As a result, our work provides crucial information to portfolio managers and cryptocurrency market players. López-Martín et al. (2021) We employ a set of five tests that are applied in both a static setting and a dynamic context to examine the efficiency of these markets. Le Tran and Leirvik (2020) that conflicts with other, more recent findings on the subject, as

suggested. We utilise a larger sample size than in other studies, which is one factor. Another crucial factor is that we use a reliable efficiency metric that allows us to know whether or not an efficiency is substantial. Ripple is typically the least efficient cryptocurrency, with Litecoin being the most efficient. Table 7 presents the main points made in important works on cryptocurrencies and market efficiency.

Table 7: Key literature on Cryptocurrency and market efficiency

References	Journal	Country	Key opinions/outcomes
(López-Martín et al., 2021)	Eurasian Economic Review	Spain	The methodology utilized to assess the return's predictability and the length of the analysis period both affect the results. However, a number of conclusions might be drawn. First, it becomes clear that efficiency levels typically increase with time. Second, although it appears that the efficiency market is evolving over time, changes in the prices of Bitcoin, Litecoin, and Ethereum show that efficiency has evolved from lower to higher. In Ripple, Stellar, and Monero, times of efficiency alternate with periods of inefficiency, which is consistent with the adaptive market hypothesis.
(Shynkevich, 2020)	Applied Economics Letters	United States	The purpose of this study is to determine whether pricing inefficiency, or inaccurate tracking of a bitcoin fund's net asset value (NAV), has a substantial effect on the fund's market efficiency in comparison to the retail bitcoin market. We take into account two bitcoin funds whose shares are traded on markets with stricter transparency requirements than cryptocurrency markets. The fund is determined to be weak-form efficient if its shares have not been trading at a considerable premium or discount compared to its NAV. The fund is deemed inefficient since its returns exhibit a consistent, large positive autocorrelation and have been trading at a significant premium to NAV.
(Yaya et al., 2021)	International Journal of finance and economics	Nigeria	In this study, we examine the market effectiveness and volatility persistence of 12 cryptocurrencies before and after crashes. By considering dependable fractional integration strategies in both linear and nonlinear circumstances, the work contributes to the conversation of how well cryptocurrencies trade in the face of volatility. We find that, particularly in the present post-crash period, the markets for Bitcoin and the bulk of the altcoins we investigated are both extremely efficient and volatile. Volatilities are probably going to last less time now than they did before the disaster. Therefore, our research offers essential data to bitcoin traders and portfolio managers.
(Hu et al., 2019)	Finance Research Letters,	New Zealand	The Efficient Market Hypothesis is revisited for 31 of the largest cryptocurrencies by market capitalization in this study using a variety of panel tests. In order to guide the use of tests for non-stationarity later on, we first examine cross-sectional dependence in panels for these cryptocurrencies. The efficiency of cryptocurrencies is then simultaneously evaluated using panel unit root/stationarity tests that account for panel structural flaws and accommodate cross-sectional dependence. The panel evidence's lack of empirical backing for the hypothesis suggests that the bitcoin market is inefficient.
(Le Tran and Leirvik, 2020)	Finance Research Letters	Norway	This runs counter to other, more recent findings in the area. We employ a larger sample size than in previous studies, which is one of the factors. Another crucial element is the use of a reliable efficiency metre that enables us to judge whether or not an efficiency is substantial. Overall, Litecoin is the most effective cryptocurrency, and Ripple is the least effective.

5. Discussion and future research questions

The constantly expanding cryptocurrency literature covers a wide range of research areas. There are still some cryptocurrency themes that are open-ended and highly explorable, though. As a result, we here support cryptocurrency research. Future study should address seven research themes that we identified from our review of the cryptocurrency literature in order to improve understanding and awareness of cryptocurrency.

5.1. Why does cryptocurrency prevail in economies?

The popularity of cryptocurrencies is rising quickly in both developed and developing countries. According to the coin market cap, it recovered fast from its 2019-2020 slump and surpassed its size (general measure) in terms of its part of the global GDP in 2021. However, the factors influencing economies to engage in cryptocurrency activities have not yet been adequately defined in the research. Given the dearth of studies on the subject, there may be need for additional investigation of the variables influencing the creation of cryptocurrencies. As recommended by Wei (2018) that the market effectiveness and return certainty of new cryptocurrencies are significantly influenced by liquidity. In keeping with Claeys et al. (2018), Our research implies that an effective replacement to the government's official currency could put pressure on them to adopt better policies. However, the widespread use of cryptocurrencies in place of fiat money might inadvertently produce parallel currencies.

5.2. What aspects of cryptocurrencies pose the greatest threat to market efficiency?

Regulatory bodies are quite concerned about the impact cryptocurrency has on market efficiency. The literature, however, does not go into great detail on the issue of which crypto sector components will have the most market efficiency for the economy. Studies examining the effects on market efficiency of particular crypto components could improve our knowledge of cryptocurrencies and the market efficiency connected to them. Future unpredictability with bitcoin is by far its biggest drawback. Extreme volatility, cyberattacks during digital transactions, and other dangers are always a possibility. It is only one of the explanations you should stay away from cryptocurrency investments in 2023. Fischer et al. (2019) results from a study market microstructure is the most notable factor that could adversely affect returns. Trading the bid-ask bounce unintentionally in a backtest results in substantial and statistically significant returns that might not yet reflect reality. Arsi et al. (2022) addressed the key conclusions demonstrate that any failure of technology tends to increase people's uncertainty and mistrust about cryptocurrency technology. This reality may be further tarnished by fraud schemes and fictitious trading volume.

5.3. How ought cryptocurrency to be regulated?

A system of regulation for cryptocurrencies is another subject that hasn't received enough attention in literature. The findings of the debate between regulators and academics about the existence and regulation of the digital currency business are unclear. Many scholars support the banning of cryptocurrency users who do not fall under the regulatory safeguards and safety nets provided by central banks. Others contend that the cryptocurrency market has to be more efficiently controlled in light of its unique features so that the benefits can be realized without raising a systemic threat in the economy (Feinstein and Werbach, 2021, Hughes, 2017). The ties between the cryptocurrency business and the central bank also need to be more effectively regulated in order to prevent systemic financial stacking and ensure the satisfaction of liquidity needs. A macroprudential framework designed to avoid spillover and contagion in both regular and emergency scenarios should also constantly monitor the connections between the various cryptocurrency sector participants. Scholarly and regulatory institutions will be extremely appreciative of studies on regulatory reforms and proposals as the need for them is growing.

5.4. What are the consequences of cryptocurrency on monetary policy?

Cryptocurrency usage is expanding quickly all across the world, despite repeated allegations that it violates government regulations. Cryptocurrency literature has not yet reached a clear conclusion regarding how cryptocurrencies will affect global monetary policy. There is evidence supporting and opposing this sector, provided by conflicting hypotheses and mixed findings. All of these might be regarded as important pioneers in the field of study on the effects of cryptocurrencies on monetary policy. Due to the fact that they provide an alternate payment method and a store of value, cryptocurrencies may surpass traditional fiat currencies in terms of competitiveness. This might put pressure on central banks to keep their currencies stable and valuable in order to stay competitive (Bech and Garratt, 2017).

5.5. What metrics should be used to gauge cryptocurrency market efficiency?

The efficient market hypothesis (EMH) states that price variations are unpredictable because investors' rational expectations based on pertinent information are swiftly reflected in market prices. This has been tried in emerging markets, including those for stocks, bonds, and foreign exchange. There are a lot of popular cryptocurrencies available, but the easiest method to determine how popular a certain cryptocurrency is is to look at its market capitalization. Based on the current price and the total number of outstanding tokens in circulation, this is the calculation of the total value of cryptocurrencies (Wei, 2018).

5.6. How does cryptocurrency progress influence traditional banks?

In the financial system, traditional banks and cryptocurrencies are closely linked. Academics continue to question the validity of empirical research and theoretical talks on the influence of cryptocurrencies on traditional banks due to their conflicting findings. With the use of cryptocurrencies, a business may be able to boost financial liquidity and obtain fresh capital. A company may be loaned cryptocurrency without being subject to the exact same constraints that could be associated with getting a loan of actual cash from a traditional bank (Othman et al., 2020)**.**

5.7. What dangers and weaknesses does a cryptocurrency investor face?

The hazards and weaknesses that cryptocurrency investors confront may have an impact on other economic sectors as a result of their large role in the global economy. Additionally, the economy as a whole may suffer if cryptocurrency investors were to acknowledge the risks and flaws they face. Trading cryptocurrencies can occasionally be risky because they are frequently thought of being volatile. Despite how certain things may seem, there is always a danger that your investment could lose value because the cryptocurrency market has a history of experiencing price volatility (Bunjaku et al., 2017). Khan and Hakami (2022) discussed the characteristics of cryptocurrencies, such as their price turbulence, significant energy consumption during mining, and use in illegal activities.

6. Conclusion

Our present project used a bibliometric method to track the growth and development of the literature on cryptocurrency. It identified the most well-known knowledge in the field of cryptocurrencies, presented it, and made an effort to combine the most important theoretical and empirical discoveries. The bibliometric tool used, VOSviewer and R Packages, is trustworthy, scientific, and has already been used in practice by a number of authors, including Ejaz et al. (2022), Radha and Arumugam (2021), Derviş (2019) and Jalal (2019) to name a few. As a result, our methodologies reflect the current direction of cryptocurrency research, and the conclusions we reach are therefore verifiable.

Content analysis was used to divide the information into three distinct streams, each of which is investigated in context and provides summaries of the important points. The information was first divided into the significant publications, sources, and authors in the literature on cryptocurrencies.

The fact that the Scopus database was the sole source of data for the bibliometric analysis, however, places limitations on this study. More databases (such Dimensions and Web of Science) can be used to map the virtual currency research network in greater detail. By conducting more detailed research of individual cryptocurrency components and addressing interconnectedness across cryptocurrency entities in different geographic regions, we will also advance towards more precise findings. Further, we realize

that as numerous articles discuss the industry without using the term "cryptocurrency," restricting the data collected to the outcomes of a single search query "cryptocurrency" may have made it more difficult to give an in-depth view of the industry. Future research can be expanded by including new search terms like "market efficiency," "stock market," and "fin tech." In order to keep up with the rapid proliferation of cryptocurrency literature and the cryptocurrency sector itself, similar study should also be conducted on a regular basis to update the findings and keep increasing our understanding. We propose that solving the seven research questions raised in this study will help us develop a more profound with greater precision understanding of the cryptocurrency industry and come to more educated decisions about how to manage this financial innovation for the benefit of national and worldwide good.

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