


**TREND AND KNOWLEDGE STRUCTURE OF CRYPTOCURRENCY RESEARCH
IN THE SCOPUS DATABASE**

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ARTICLE INFO	<u>ABSTRACT</u>
<p>Article history:</p> <p>Received 20 February 2023</p> <p>Accepted 18 May 2023</p>	<p>Purpose: This study aims to utilize the bibliometric method to investigate the most important characteristics and key research topics in the literature on cryptocurrency research.</p> <p>Theoretical framework: This study used a text mining framework based on domain-level and knowledge structure analysis.</p>
<p>Keywords:</p> <p>Cryptocurrency Research; Bibliometrics; Scientometrics; Biblioshiny; Knowledge Structure; Research Trends.</p> <div data-bbox="172 1014 480 1261" style="text-align: center;">  </div>	<p>Design/methodology/approach: Based on domain-level and knowledge structure analysis, this study used data from the Scopus database, which included 1,685 published articles from 2018 to 2023 on cryptocurrency research. Data analytics and visualization may be accomplished with the bibliometrix package in R software.</p> <p>Findings: The result found that, there has been a fifty percent annual growth in cryptocurrency research since 2018. Studying the most frequently used terms and phrases in the research makes it possible to see which research areas have the greatest impact. According to the results, (1) cryptocurrency market, (2) market efficiency, (3) herding behavior, (4) COVID pandemic, (5) safe haven, (6) stock markets, (7) financial markets, and (8) volatility spillovers should be the emphasis of future research.</p> <p>Research, Practical & Social implications: This article will be useful to scholars and practitioners looking for research directions. Based on the trending topics and knowledge structure of cryptocurrency research, this research also suggests potential new study topics for the future.</p> <p>Originality/value: The value of these findings revealed an increase and a new aspect of cryptocurrency research in the business field related to the continued expansion of empirical research documents, researchers/authors, global collaboration, and co-citations.</p> <p>Doi: https://doi.org/10.26668/businessreview/2023.v8i5.1640</p>

**TENDÊNCIA E ESTRUTURA DE CONHECIMENTO DA PESQUISA SOBRE CRIPTOMOEDAS NA
BASE DE DADOS SCOPUS**

RESUMO

Objetivo: Este estudo tem como objetivo usar o método bibliométrico para investigar as características mais importantes e os principais tópicos de pesquisa na literatura sobre pesquisa de criptomoedas.

Estrutura teórica: Este estudo usou uma estrutura de mineração de texto baseada em nível de domínio e análise de estrutura de conhecimento.

Projeto/metodologia/abordagem: Com base no nível de domínio e na análise da estrutura do conhecimento, este estudo usou dados do banco de dados Scopus, que incluiu 1.685 artigos publicados de 2018 a 2023 sobre pesquisa de criptomoedas. A análise e a visualização dos dados podem ser realizadas com o pacote bibliometrix no software R.

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Conclusões: O resultado constatou que houve um crescimento anual de 50% nas pesquisas sobre criptomoedas desde 2018. O estudo dos termos e frases usados com mais frequência na pesquisa nos permite ver quais áreas de pesquisa têm o maior impacto. De acordo com os resultados, (1) mercado de criptomoedas, (2) eficiência do mercado, (3) comportamento de pastoreio, (4) pandemia de COVID, (5) porto seguro, (6) mercados de ações, (7) mercados financeiros e (8) repercussões de volatilidade devem ser a ênfase de pesquisas futuras.

Implicações sociais, práticas e de pesquisa: Este documento será útil para acadêmicos e profissionais que buscam direções de pesquisa. Com base nos tópicos de tendência e na estrutura de conhecimento da pesquisa sobre criptomoedas, esta pesquisa também sugere possíveis novos tópicos de estudo para o futuro.

Originalidade/valor: O valor dessas descobertas revelou um aumento e um novo aspecto da pesquisa sobre criptomoedas no campo de negócios relacionado à expansão contínua de artigos de pesquisa empírica, pesquisadores/autores, colaboração global e citações.

Palavras-chave: Pesquisa sobre Criptomoedas, Bibliometria, Cientometria, Bibliografia, Estrutura do Conhecimento, Tendências de Pesquisa.

TENDENCIA Y ESTRUCTURA DEL CONOCIMIENTO DE LA INVESTIGACIÓN SOBRE CRIPTOMONEDA EN LA BASE DE DATOS SCOPUS

RESUMEN

Propósito: Este estudio pretende utilizar el método bibliométrico para investigar las características más importantes y los principales temas de investigación en la literatura sobre la investigación de la criptomoneda.

Marco teórico: Este estudio utilizó un marco de minería de textos basado en el nivel de dominio y el análisis de la estructura del conocimiento.

Diseño / metodología / enfoque: Basado en el nivel de dominio y el análisis de la estructura del conocimiento, este estudio utilizó datos de la base de datos Scopus, que incluyó 1,685 artículos publicados de 2018 a 2023 sobre la investigación de cryptocurrency. El análisis y la visualización de datos se pueden realizar con el paquete bibliometrix en el software R.

Conclusiones: el resultado encontró que hubo un crecimiento anual del 50% en la investigación sobre criptomonedas desde 2018. El estudio de los términos y frases más utilizados en la investigación permite ver cuáles son las áreas de investigación con mayor impacto. Según los resultados, (1) mercado de criptomonedas, (2) eficiencia del mercado, (3) comportamiento gregario, (4) pandemia COVID, (5) refugio seguro, (6) mercados de valores, (7) mercados financieros y (8) efectos indirectos de la volatilidad deberían ser el énfasis de futuras investigaciones.

Implicaciones sociales, prácticas y de investigación: Este documento será de utilidad para académicos y profesionales que busquen orientaciones de investigación. Basándose en los temas de tendencia y en la estructura de conocimientos de la investigación sobre la criptomoneda, esta investigación también sugiere posibles nuevos temas de estudio para el futuro.

Originalidad/valor: El valor de estos resultados revela un aumento y un nuevo aspecto de la investigación sobre criptomoneda en el ámbito empresarial relacionado con la continua expansión de artículos de investigación empírica, investigadores/autores, colaboración global y co-citaciones.

Palabras clave: Investigación sobre Criptomoneda, Bibliometría, Cientimetría, Bibliografía, Estructura del Conocimiento, Tendencias de Investigación.

INTRODUCTION

Digital or virtual assets supported by cryptography technologies are known as cryptocurrency. Cryptocurrency is a digital asset based on cryptography to secure transactions, control the creation of additional units, and verify the transfer. The ecosystem for digital assets is quickly changing, presenting new possibilities for investors and business owners (Yousaf & Yarovaya, 2022). Due to their significant volatility (Makarov & Schoar, 2020), high risk of cyberattacks, and lack of reliable information or generally accepted regulation (Corbet et al.,

2019), cryptocurrencies are frequently viewed as speculative and harmful assets. However, cryptocurrency like Bitcoin has a safe-haven quality, which is generally defined by its relationship with other securities through periods of market volatility (Smales, 2019). Portfolio diversification across various cryptocurrencies could enhance investment efficiency (Liu, 2019). Using cryptocurrency in a portfolio of traditional assets has the effect of increasing diversity.

In recent years, the field of cryptocurrency research has expanded. From a technological perspective, blockchain is a paradigm-shifting technology. Instead of centralized validation, it introduces the idea of distributed sentiment validation. The majority of recent financial and economics investigation focuses on examining all of its financial characteristics for a variety of reasons. Due to its trading volume, to initiate. Furthermore, it behaves differently from conventional assets like bonds, stocks, or currencies. Finally, the fact that cryptocurrencies trade around the clock makes research on algorithmic trading extremely interesting and presents fresh difficulties in figuring out how to effectively process a continual flow of big data (Merediz-Solà & Bariviera, 2019). Big data provides significant obstacles to data processing systems. Since cryptocurrency is a recent subject of research, there is a wealth of opportunity to use both traditional and novel approaches to understand the key elements of this ecosystem (Bariviera & Merediz-Sola, 2021). As research on cryptocurrency has significantly increased in the past few years, it is required to create a situational analysis of the field and comment on knowledge gaps and future directions. This study specifically intends to serve as a research guideline in this sense. We created our two complementing steps for the paper. To begin with, we used bibliometric analysis to extract the most significant elements from text mining analysis of (1) published papers and citations; (2) authors, affiliations, countries, and resources of influence; (3) conceptual frameworks of the subjects; (4) a framework for the study of a variety of connected subjects; and (5) a social framework of the associated research topics including scholarly collaboration. We then conducted a thorough study of 1,685 articles from the most significant journals indexed in the Scopus database collected in the first stage.

Bibliometric analysis offers exceptional potential to contribute to theory and practice. Using bibliometric methodologies, eminent journals and academics from multiple disciplines have produced a large number of profound pieces that explore the complexities of the evolution of diverse subjects and identify new trends. The fundamental goal of bibliometrics is to quantitatively analyze the metadata of publications, with a primary emphasis on articles pertinent to specific observations. Bibliometric assesses academic production and productivity

through time in order to comprehend the emergence and development of a subject of study (Rejeb et al., 2022). Furthermore, bibliometric investigations are important on a substantially broader scale than only within institutions. They could aid brand-new academics in comprehending the depth, emerging patterns, and historical development of a subject. It differs from a traditional literature study in this area (Merediz-Solà & Bariviera, 2019) because bibliometric approaches offer the potential to present a transparent and reproducible review process as opposed to traditional literature reviews, which are subject to the researcher's bias and discipline (Zupic & Čater, 2015).

There have previously been attempts to explore the literature on cryptocurrency and offer insights into this area of study, but there have not been many studies that employ bibliometrics to systematically describe the field, although some articles are somewhat close to ours. For instance, Jalal et al. (2021) conducted a bibliometric review of the literature on cryptocurrencies as a financial asset. A bibliometric review is a type of research that uses quantitative methods to analyze and summarize the characteristics of a body of literature on a particular topic. In this case, the authors used bibliometric techniques to analyze the literature on cryptocurrencies, with a focus on how they are being used and perceived as a financial asset. Jeris et al. (2022) conducted a thorough analysis of the relationship between cryptocurrencies and the stock market by examining 151 articles from the Scopus databases utilizing bibliometric and content analysis using the VOSviewer program, whereas Bariviera & Merediz-Sola (2021) developed a dual analysis, consist of a bibliometric examination and a close literature review of all cryptocurrencies' scientific development. Patel, Migliavacca & Oriani (2022) used a combination of a bibliometric review and a content analysis of the academic literature on blockchain in banking and finance. Moreover, Merediz-Solà & Bariviera (2019) examined the metadata for all articles with the keyword "Bitcoin" indexed in the Web of Science core collection. This study attempts to utilize the bibliometric method to investigate the most important characteristics and key research topics in the literature on cryptocurrency in an effort to add to the body of knowledge currently existing. It is carried out to give a thorough picture of the outcomes and gaps of the earlier investigations so far. This paper employed the R package "bibliometrix" to undertake an analytic study of the publications in the sample (Cuccurullo, Aria & Sarto, 2016; Aria & Cuccurullo, 2017). We used the Scopus database to gather data for our bibliometric analysis. In total, 1,685 papers were reviewed systematically in this study, highlighting the most significant aspects of the body of research and the major study streams.

By highlighting some unresolved research concerns, we hope to contribute to the literature and provide a solid starting point for future research.

The remaining parts of the article are presented in the following order: In Section 2, we will talk about the analytics procedures used, and in Section 3, we will discuss how we analyzed bibliometric results. The significance, limitations, knowledge gaps, and opportunities for future study are covered in Section 4, while the conclusion is covered in Section 5. It is possible to use hybrid methods that combine the existing bibliometric and semantic approaches (e.g., bibliographic coupling with latent semantic indexing) to identify emerging topics in scientific research. These hybrid methods are quickly becoming the preferred basis for the mapping and visualization of science.

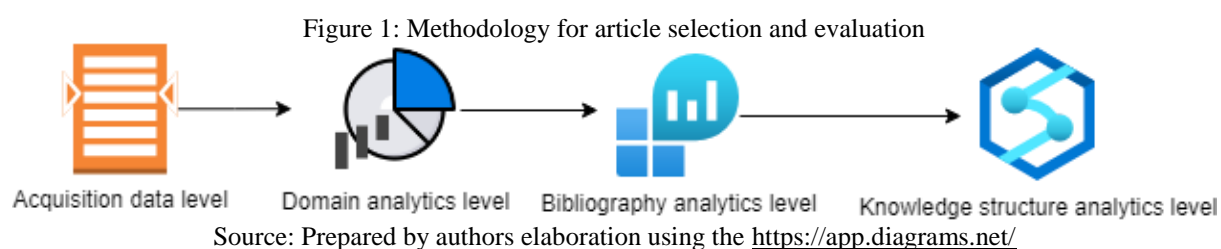
DATA AND METHODOLOGY

The general steps to conduct a bibliometric analysis are as follows (Paul and Criado, 2020; Khan et al., 2021; Mukherjee et al., 2022; Patel et al., 2022): 1.) Define the research question 2.) Identify relevant databases 3.) Search for relevant literature 4.) Select relevant articles 5.) Extract and analyze data, and 6.) Write the research result. Structured reviews, model/framework reviews, meta-analysis, theoretical examination, future hybrid research, frameworks, and bibliometric reviews are some of the bibliometric methodologies covered in this article (Al Mamun & Boyle, 2022). This study used a bibliometric methodology and examined the literature on the effectiveness of cryptocurrency researchers. Bibliometric analysis is a well-recognized and widely employed scientific technique. It is an evaluation using mathematical and statistical approaches (Cabeza et al., 2020). The bibliometric method based on citation mapping may be utilized to quantitatively summarize a study topic and provide insight into its key research streams (Zupic & Čater, 2015).

We used the Scopus database to gather and examine the documents required for this investigation. There are more research publications in the Scopus database on themes spanning multiple disciplines (Cabeza, Chàfer & Mata, 2020; Archambault et al., 2009). Furthermore, there is a good interconnection between the aggregated articles and citations from the Web of Sciences and Scopus databases, and the results of the bibliometric study are not significantly different (Zhao et al., 2018). The study's time frame runs from 2018 to 2023 and begins in 2018. TITLE-ABS-KEY ("cryptocurrency" OR "cryptocurrencies") AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR

LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018)) AND (LIMIT-TO (LANGUAGE , “English”)) AND (LIMIT-TO (SUBJAREA , “ECON”) OR LIMIT-TO (SUBJAREA , “BUSI”)) were used as search criteria to ensure that no important information was missed. Figure 1 displays the methodology (Khan et al., 2020) for selecting documents and procedures used during the study.

The bibliometric study was conducted using an R application named “Biblioshiny” (Aria & Cuccurullo, 2017). Figure 1 shows the point in this analysis when the search phrase ‘cryptocurrency OR cryptocurrencies’ was first used, producing 7,607 results. Then, 3,261 English-language documents were removed from this list. Based on the bibliometric analysis, which comprised 1,685 articles, it was also decided to omit findings that were inappropriate for the subject area in ‘Economics, Econometrics and Finance’ and ‘Business, Management and Accounting’ included information gaps.



An analysis of five key elements was performed to identify knowledge-based research gaps in the field of cryptocurrency. These elements were: (i) published articles and citations; (ii) authors, affiliations, countries, and resources of influence; (iii) conceptual frameworks of the subjects; (iv) a framework for the study of a variety of related subjects; and (v) a social framework of the related research topics involving scholarly collaboration. The number of publications, citations, co-citations, keywords, and the most prolific authors, sources, countries, and affiliations were considered while assessing each component.

RESULTS

The Main Information

There are 3,190 authors among the 1,685 documents chosen for this study. However, only 300 of them are single-authored documents. An average of 0.528 authors contribute to each document; 15.29 citations per document demonstrate how well-recognized these are in academia. These data suggest that given the interdisciplinary nature of the issue, cooperation

amongst researchers from many areas is crucial. The broad details of the papers studied for this study are included in Table 1.

Table 1: Summary of descriptive information

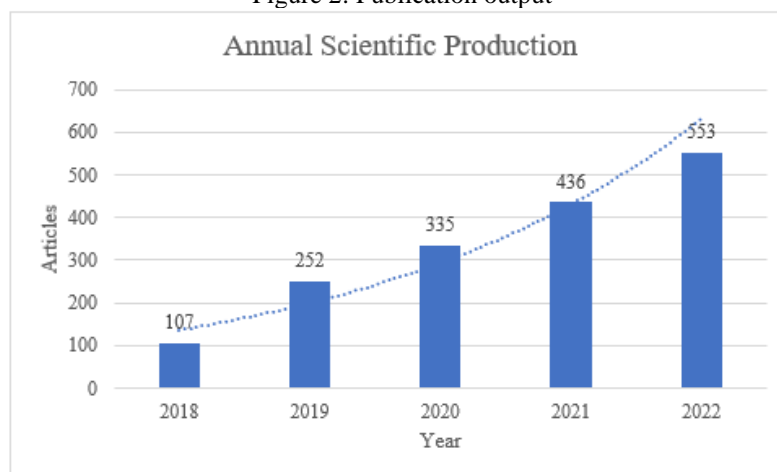
Description	Result	Description	Result
Main Information		AUTHORS	
Timespan	2018:2023	Authors	3190
Sources (Journals, Books, etc.)	469	Author Appearances	4491
Documents	1685	Authors of single-authored documents	300
Average years from publication	1.36	Authors of multi-authored documents	2890
Average citations per document	15.29	AUTHORS COLLABORATION	
Average citations per year per doc	5.068	Single-authored documents	349
References	63414	Documents per Author	0.528
DOCUMENT TYPES		Authors per Document	1.89
Article	1685	Co-Authors per Document	2.67
DOCUMENT CONTENTS		Collaboration Index	2.16
Keywords Plus (ID)	1469		
Author's Keywords (DE)	3428		

Source: Prepared by authors elaboration using the bibliometrix R Package

Publication output

As shown in Figure 2, the number of research publications published over the last decade has significantly increased, indicating the academic community's growing interest. The annual growth rate increased from 107 to 553 papers as time went on. The fact that more than 100 new studies have been published every year since 2018 leads us to believe that the study of cryptocurrency is still in its infancy. The Scopus database contains 7,607 documents spanning only over a decade. This pattern is anticipated to carry on through 2022 and into the foreseeable future.

Figure 2: Publication output



Source: Prepared by authors elaboration using the MS Excel

Discipline-wise analysis

Research on cryptocurrency has been covered in depth in *Finance Research Letters* (207), *Research in International Business and Finance* (61), and the third most relevant journal is *Economics Letters* (50), as seen in Figure 3 (except for other journal groups).

The value of the papers published by each journal is ranked in Figure 3. The chart indicates the importance of the articles with research on cryptocurrency. In addition, the information presents a ranking, from 0 to 10, of the most regularly published journals and articles.

Figure 3: Distribution of documents across titles

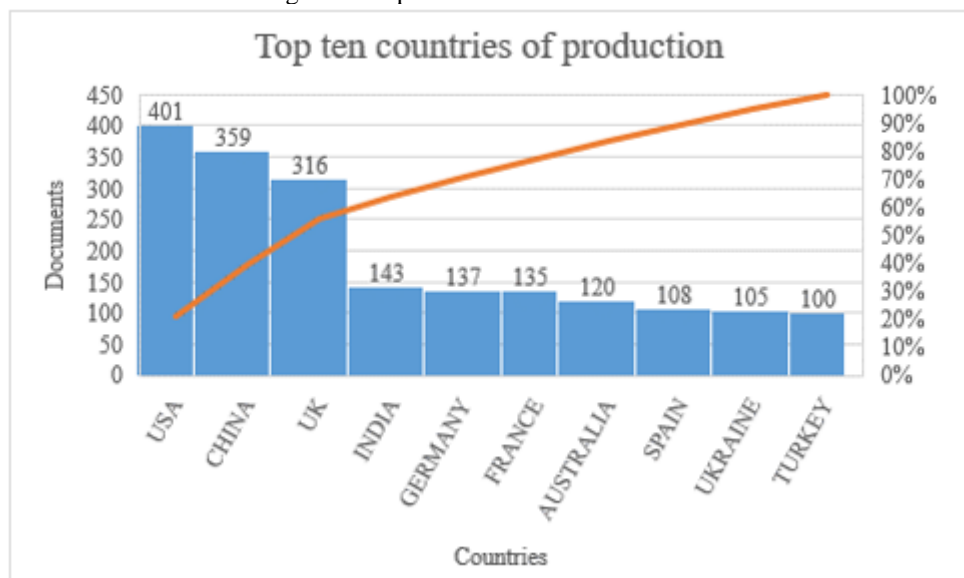


Source: Prepared by authors elaboration using the MS Excel

The leading countries and affiliations

As part of our analysis, we evaluated most of the major countries and organizations worldwide. It was discovered that the United States of America (USA) is the most productive country, producing 401 total publications (TPC). China is second, followed by the United Kingdom (UK) (TPC, 359) (TPC, 316), respectively. Figure 4 provides a ranking of countries that are tied for second place. The University of Economics Ho Chi Minh City in Vietnam currently holds first place among the top ten educational affiliations, with a total publication index (TPI) of 48. In second place is Dublin City University in Ireland, with a TPI of 32, and in third place is Trinity College Dublin in Ireland as well, with a TPI of 30. Table 2 also includes entries for many other illustrious affiliations.

Figure 4: Top 10 countries and affiliations



Source: Prepared by authors elaboration using the MS Excel

Table 2: Top 10 affiliations with published articles

Affiliations	Articles
UNIVERSITY OF ECONOMICS HO CHI MINH CITY	48
DUBLIN CITY UNIVERSITY	32
TRINITY COLLEGE DUBLIN	30
MONTPELLIER BUSINESS SCHOOL	28
SOUTH URAL STATE UNIVERSITY	26
UNIVERSITY OF SOUTHAMPTON	25
TIANJIN UNIVERSITY	22
LEBANESE AMERICAN UNIVERSITY	19
UNIVERSITY OF SFAX	19
UNIVERSITY OF WAIKATO	19

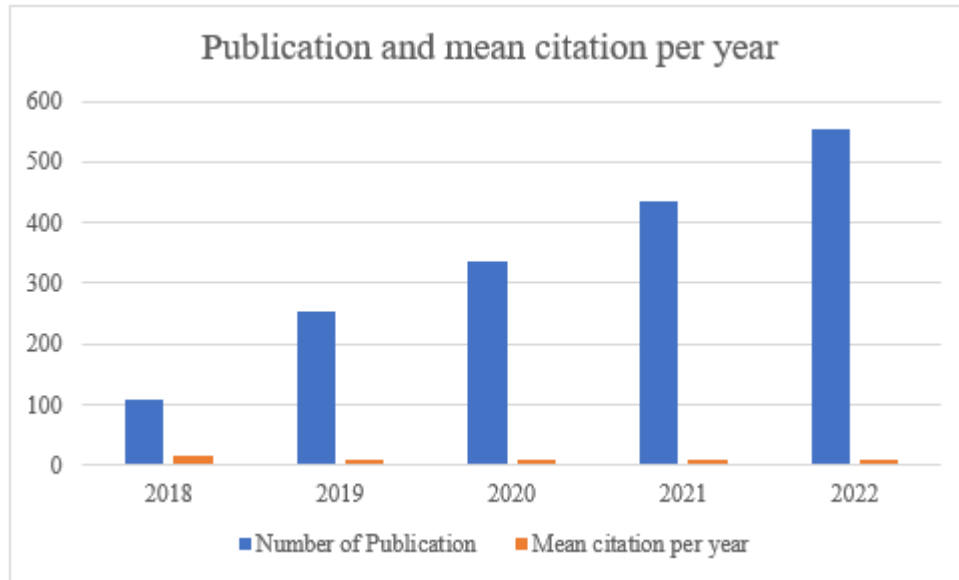
Analyses of Bibliographic Performance

The publication and citation trend

According to the Scopus database, the first article published on the topic of “Bitcoin: Benefit or Curse?” was written by Hurlburt and Bojanova in 2014 (Hurlburt & Bojanova, 2014). They found that the new world of mobile devices offers a reasonable likelihood that virtual currency will prevail on a global scale. Currently, the Bitcoin cryptocurrency model appears to be a forerunner. Some form of virtual currency, even if a successor to Bitcoin, seems to have a path forward. Although this is not our core area of interest, they recommended incorporating it into this research. During the last five years (2018–2022), there was an increase in the number of publications at an annual average rate of 50 percent. The civil rights movement demonstrates that there may be unacknowledged pleasant views buried in cryptocurrency research. This was

a crucial motivator for the field's early researchers since it revealed that implicit favorable attitudes might be embedded in cryptocurrency research.

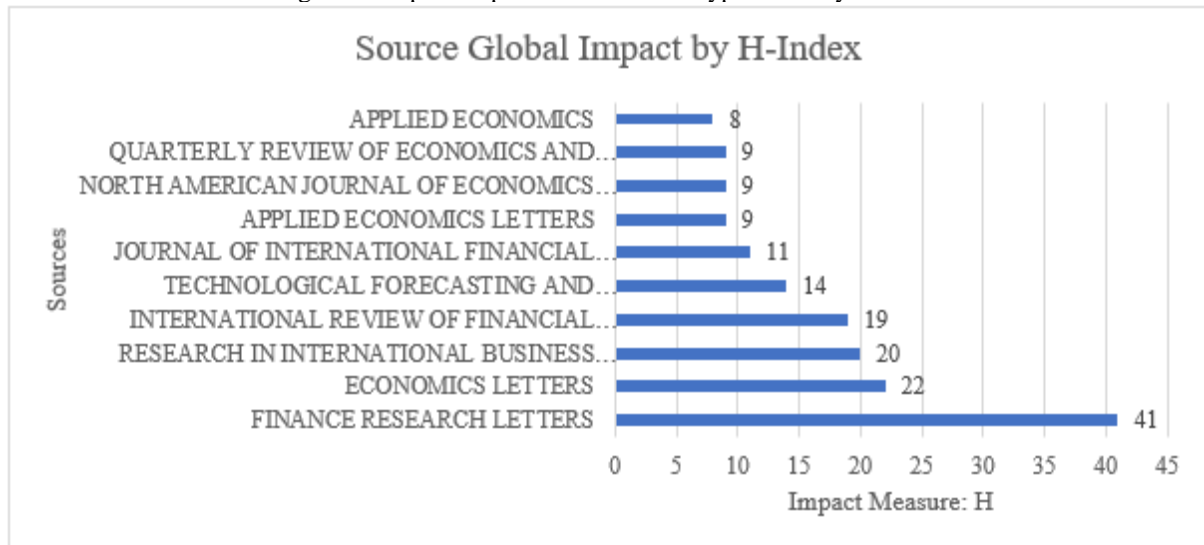
Figure 5: Publication and citation history on cryptocurrency research



Source: Prepared by authors elaboration using the MS Excel

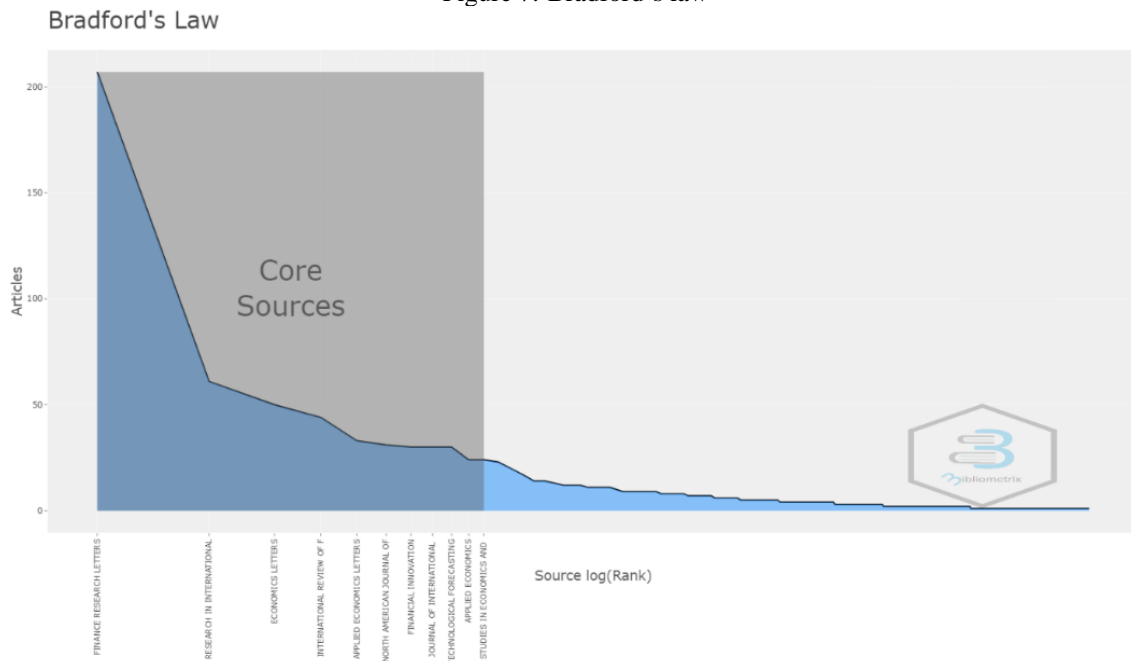
Figure 5 illustrates the overall number of publications and the average number of citations received for each document and year. Since it was first published in 2014, the number of papers in the journal has dramatically expanded in response to the growing demand for cryptocurrency research between 2018 and 2022. There is an explanation for the roughly tenfold increase in scholarly publications on this topic during the past five years. During this period, the focus of studies was mainly on field research, which led to an increase in the number of scholarly publications (Brown & Hirschl, 1995; Halleröd, 1995; Abbott, 1995; Room, 1995). The highest average number of citations for a single text was recorded in 2018, and since then, the document's popularity has been gradually declining. It is possible that this is due to an increase in similar papers during the past several years, or it could be that a few studies have made significant contributions to the volume of materials available. This implies that research in this area grew significantly at one point, but it has since stalled out due to research gaps in the wrong spot. However, after 2021, the yearly average value of the citations began to fluctuate.

Figure 6: Top 10 impactful sources of cryptocurrency research



Source: Prepared by authors elaboration using the MS Excel

Figure 7: Bradford's law



Source: Prepared by authors elaboration using the bibliometrix R Package

The impact of the source

This section discusses the most significant and effective sources of cryptocurrency research. Figure 6 illustrates the distribution of the top ten most impactful sources by the H index. According to the number of publications, *Finance Research Letters* (41) is ranked at the top, followed by *Economics Letters* (22). According to Bradford's law, only 11 journals depicted in Figure 7 (zone 1) are the primary sources of cryptocurrency research publications (Venable et al., 2016). In total, zone 1 has 11 articles published yearly (2.50%). If all

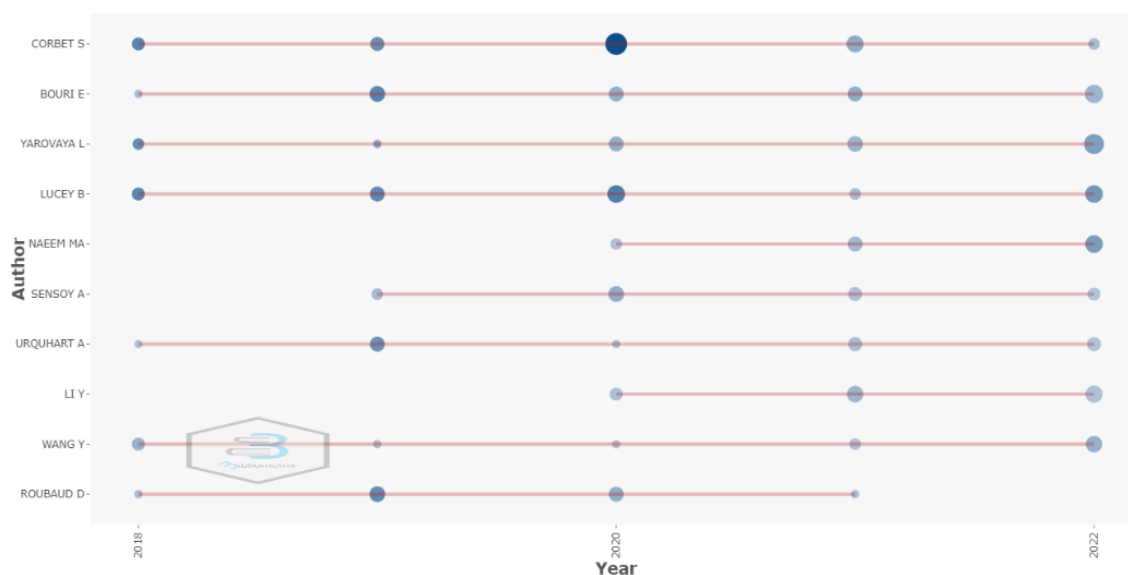
bibliometric characteristics are considered, the *Finance Research Letters* journal is found to be an excellent source, as shown in Table 3. Considering the m-index, *Finance Research Letters* takes first place. It is revealed that journals such as *Economics Letters*, *Research in International Business and Finance*, *International Review of Financial Analysis*, and *Technological Forecasting and Social Change* began publication earlier than most other journals on this subject.

Table 3: The impact of the source

Element	h-index	g-index	m-index	TC	NP	PY start
FINANCE RESEARCH LETTERS	41	69	8.200	5652	173	2018
ECONOMICS LETTERS	22	47	4.400	2508	47	2018
RESEARCH IN INTERNATIONAL BUSINESS AND FINANCE	20	37	4.000	1418	54	2018
INTERNATIONAL REVIEW OF FINANCIAL ANALYSIS	19	40	3.800	2174	40	2018
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	14	24	4.667	654	24	2020
JOURNAL OF INTERNATIONAL FINANCIAL MARKETS, AFFILIATIONS AND MONEY	11	21	2.750	586	21	2019
APPLIED ECONOMICS LETTERS	9	14	1.800	216	21	2018
NORTH AMERICAN JOURNAL OF ECONOMICS AND FINANCE	9	16	2.250	291	25	2019
QUARTERLY REVIEW OF ECONOMICS AND FINANCE	9	18	1.800	327	19	2018
APPLIED ECONOMICS	8	19	1.600	395	20	2018
IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT	8	13	2.667	192	14	2020
INTERNATIONAL REVIEW OF ECONOMICS AND FINANCE	8	10	2.667	183	10	2020
JOURNAL OF BEHAVIORAL AND EXPERIMENTAL FINANCE	8	11	2.000	312	11	2019
FINANCIAL INNOVATION	7	15	1.750	243	22	2019
INTERNATIONAL JOURNAL OF FINANCE AND ECONOMICS	7	8	3.500	89	13	2021
BUSINESS HORIZONS	6	6	1.500	643	6	2019
COMPUTER LAW AND SECURITY REVIEW	6	8	1.200	195	8	2018
JOURNAL OF MONEY LAUNDERING CONTROL	6	9	1.200	84	10	2018
ECONOMIC MODELLING	5	7	1.667	190	7	2020
ELECTRONIC COMMERCE RESEARCH AND APPLICATIONS	5	5	1.250	182	5	2019

(Notes: TC = Total Citations, PY Start = Publication Year Start)

Figure 8: Top 10 impactful authors of cryptocurrency research
Top-Authors' Production over the Time



Source: Prepared by authors elaboration using the bibliometrix R Package

The most impactful authors

Bibliometric citation analysis is a helpful method for measuring an author's productivity in document publication. Figure 8 depicts the top authors' works on cryptocurrency study analysis over the years. The color intensity in Figure 8 is related to the year of the citation, and the bubble size represents the individual authors' relative annual productivity. For instance, CORBET S received around 108 citations per year in 2018 and was published 540 times between 2018 and 2022. The three authors that have made the most significant contributions to the field over the years are YAROVAYA L, LUCEY B, and URQUHART A.

Additionally, CORBET S is the most popular author in this field of research, with an h-index of 23, a g-index of 34, and a total of 2,878 citations. Following that are LUCEY B (h-index 17, g-index 422, total citations 2,369) and BOURI E (h-index 16, g-index 22, total citations 1,287).

The most impactful documents

Document analysis identifies the intellectual structure of a knowledge field by assessing the volume and authority of referenced literature. Table 4 lists the top ten most-cited publications in Scopus, with worldwide citation counts ranging from 238 to 540. Corbet and colleagues (Corbet et al., 2018), Gomber and colleagues (Gomber et al., 2018), and Corbet and colleagues (Corbet et al., 2019), receive the most global citations, with 540, 368, and 360, respectively, and are listed as the top three most referenced publications. According to a study

conducted by Corbet and colleagues (Corbet et al., 2018) on the dynamic relationships between cryptocurrencies and other financial assets, cryptology may offer diversification benefits for investors with short investment horizons. They discovered evidence of these assets' relative isolation from the financial and economic assets. Time variation in the linkages reflects external economic and financial shocks. Gomber and colleagues (Gomber et al., 2018) reported on research conducted in the Fintech revolution. Their studies confirmed that the financial services industry has been experiencing the emergence of new technological innovations and process disruptions. Many fintech startups are looking for new pathways to successful business models. Financial services are due to major improvements in efficiency, customer centricity, and informedness. Corbet and colleagues (Corbet et al., 2019) used a novel methodology to study cryptocurrencies as a financial asset using a systematic analysis. The result of an exploratory shows that despite astonishing price appreciation in recent years, cryptocurrencies have been accused of experiencing price bubbles central to the trilemma that exists between regulatory oversight and the potential for illicit use. Each influences the perception of the role of cryptocurrencies as a credible investment asset class and legitimate value.

Table 4: Top 10 cited documents of cryptocurrency research

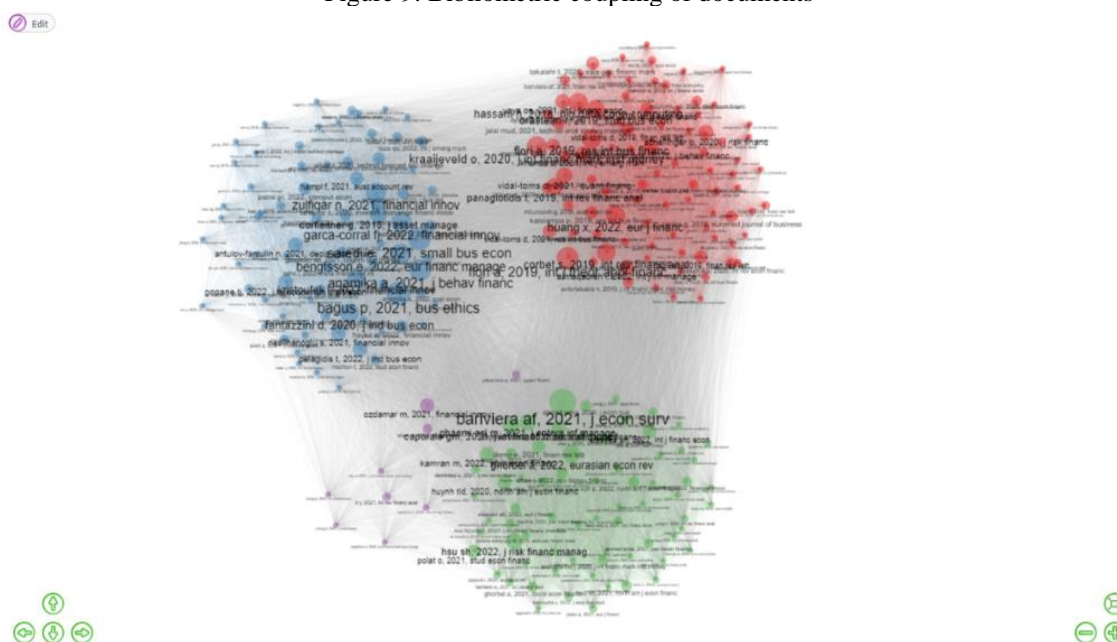
Paper	DOI	Total Citations	TC per Year	Normalized TC
CORBET S, 2018, ECON LETT-a	10.1016/j.econlet.2018.01.004	540	108.000	9.013
GOMBER P, 2018, J MANAGE INF SYST	10.1080/07421222.2018.1440766	368	73.600	6.142
CORBET S, 2019, INT REV FINANC ANAL	10.1016/j.irfa.2018.09.003	360	90.000	11.917
CORBET S, 2020, FINAN RES LETT	10.1016/j.frl.2020.101554	335	111.667	16.935
KLEIN T, 2018, INT REV FINANC ANAL	10.1016/j.irfa.2018.07.010	307	61.400	5.124
CORBET S, 2018, FINAN RES LETT	10.1016/j.frl.2017.12.006	294	58.800	4.907
MIN H, 2019, BUS HORIZ	10.1016/j.bushor.2018.08.012	289	72.250	9.566
DEMIR E, 2018, FINAN RES LETT	10.1016/j.frl.2018.01.005	283	56.600	4.723
GANDAL N, 2018, J MONET ECON	10.1016/j.jmoneco.2017.12.004	275	55.000	4.590
JI Q, 2020, INT REV FINANC ANAL	10.1016/j.irfa.2020.101526	238	79.333	12.031

Bibliometric coupling of documents

Bibliometric coupling evaluates prior researchers' writings on a subject, identifies main ideas, and illustrates the scholarly argument's character. Figure 9 depicts a scientific map identifying critical documents (impact) and their relationships (centrality) using k-means

clustering. This study selected all 1,685 documents with a cluster frequency of coupling of at least 10%, as determined by references. The impact of the document was quantified by the number of global citations. Three clusters have been created based on the topic's importance and significance: each with a distinct color scheme of red, green, and blue. Among these, the red cluster (1), with a centrality of 0.463, an impact of 2.532, and 91 documents, Corbet and colleagues (Corbet et al., 2019) proposed that despite astonishing price appreciation in recent years, cryptocurrencies have been subjected to accusations of pricing bubbles central to the trilemma that exists between regulatory oversight, the potential for illicit use through its anonymity within a young under-developed exchange system, and infrastructural breaches influenced by the growth of cyber criminality. Urquhart & Zhang (Urquhart & Zhang, 2019) also investigated whether Bitcoin can act as a safe haven or hedge against world currencies. They found that Bitcoin can be an intraday hedge for the CHF, EUR, and GBP, as well as a diversifier for the AUD, CAD, and JPY. Demir and colleagues (Demir et al., 2018) used the Bayesian Graphical Structural Vector Autoregressive model, the Ordinary Least Squares, and the Quantile-on-Quantile Regression estimations; the paper revealed that the EPU has predictive power on Bitcoin returns. This paper analyzed the prediction power of the economic policy uncertainty (EPU) index on the daily Bitcoin returns. Fundamentally, Bitcoin returns are negatively associated with the EPU. However, the effect is positive and significant at both lower and higher quantiles of Bitcoin returns and the EPI.

Figure 9: Bibliometric coupling of documents



Source: Prepared by authors elaboration using the bibliometrix R Package

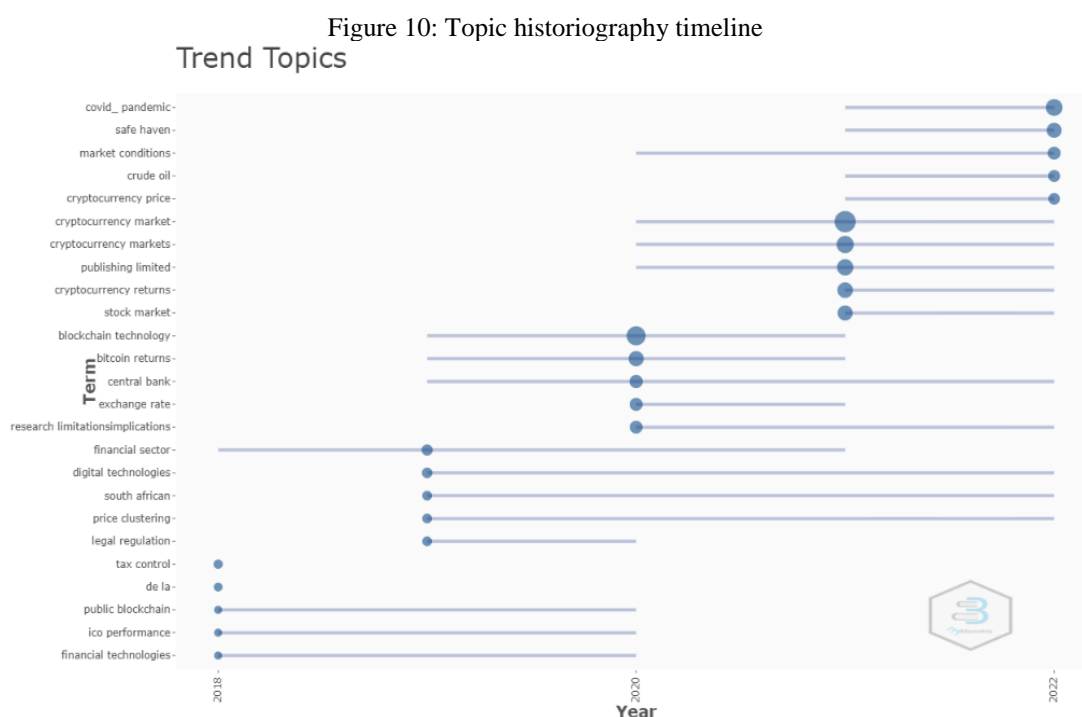
White and colleagues (White et al., 2019), Corbet and colleagues (Corbet et al., 2020), and Poyser (Poyser, 2019) were found to be the prominent authors in the blue cluster (2) with a centrality of 0.300, an impact of 2.047, and 78 documents. Their research interests included the following: Bitcoin's behavior resembles a technology-based product, an emerging asset class, or a bubble event. Increases in positive news after unemployment and durable goods announcements result in a decrease in Bitcoin returns. Conversely, the percentage of negative news surrounding these announcements is linked with increased Bitcoin returns. Firstly, to answer the question of whether Bitcoin is a currency, a technology-based product, or something else (White et al., 2019), cryptocurrencies such as Bitcoin have become prevalent, with over 2,000 Bitcoin-like cryptocurrencies now in use. Most jurisdictions have not regulated cryptocurrencies. They found that Bitcoin's behavior more closely resembles a technology-based product, an emerging asset class, or a bubble event. Secondly, they examined the relationship between news coverage and Bitcoin returns. After announcements about the unemployment rate and durable goods, there is a decline in Bitcoin returns. On the other hand, an increase in the proportion of negative news of these announcements is related to a rise in Bitcoin returns (Corbet et al., 2020). Lastly, the paper explored the association between Bitcoin's market price and a set of internal and external factors by employing the Bayesian structural time series (BSTS) approach. The results show that Bitcoin's price is negatively associated with the price of gold as well as the exchange rate between the Yuan and the US dollar (Poyser, 2019).

Klein and colleagues (Klein et al., 2018), Conlon and colleagues (Conlon et al., 2020), and Yi and colleagues (Yi et al., 2018) were found to be the prominent authors in the green cluster (3) with a centrality of 0.434, an impact of 2.848, and 71 documents. Their research interests included the following: an examination of Bitcoin's volatility, correlation, and portfolio performance reveal that it is not the new gold. Eight typical cryptocurrencies' volatility connectedness (VAR) fluctuates cyclically and has shown an apparent upward trend since the end of 2016. Firstly, cryptocurrencies such as Bitcoin are establishing themselves as an investment asset. Gold plays an important role in financial markets with flight-to-quality in times of market distress. As of now, Bitcoin does not reflect any distinctive properties of gold other than the asymmetric response in variance (Klein et al., 2018). Secondly, the COVID-19 pandemic provided the first widespread bear market conditions since the inception of cryptocurrencies. Bitcoin and Ether are not safe haven for most of the examined international equity markets. Only Chinese CSI 300 index investors realized modest downside risk benefits

from exposure to Bitcoin or Ether (Conlon et al., 2020). Lastly, the volatility connectedness (VAR) of eight typical cryptocurrencies fluctuates cyclically and has shown an obvious rise trend since the end of 2016. “Mega-cap” cryptocurrencies are more likely to propagate volatility shocks to others. Some unnoticeable cryptocurrencies (e.g., MaidSafeCoin) are also significant net transmitters of VAR (Yi et al., 2018).

Trend topics

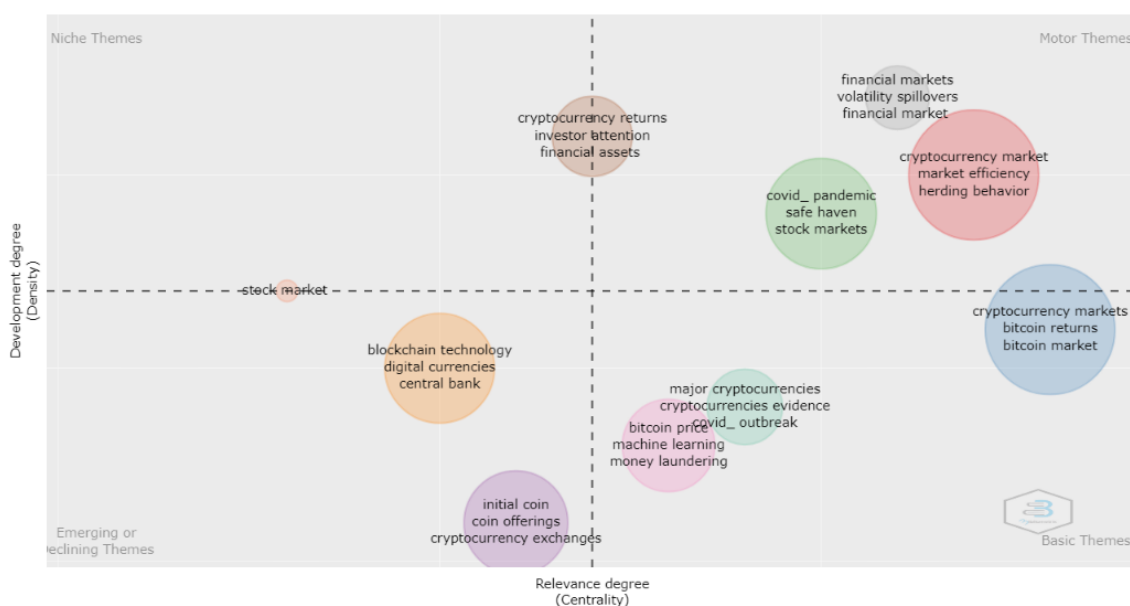
Topics emerged as a result of the phrase frequency observed in this cryptocurrency study. According to the timeline below, these are the most often referenced subjects. The most frequently used keywords are at the top of the list, and their occurrences are represented on the timeline. Figure 10 illustrates the topic’s evolution from 2018 when it was published. According to the timeline, tax control, public blockchain, ico (Initial Coin Offering) performance, and financial technologies were the most discussed topics in 2018. Legal regulation, price clustering, south African, digital technologies, and financial sector were in the spotlight in 2019. In 2020, blockchain technology, Bitcoin returns, central bank, exchange rate, and research limitations implications were often discussed topics. Research topics on cryptocurrency markets, publishing limited, cryptocurrency returns, and stock market all gained popularity in 2021. Between 2022 and 2023, COVID pandemic, safe haven, market conditions, crude oil, and cryptocurrency price are fascinating topics.



Thematic map

As seen in the graphic below, this research analyzed a theme map by first separating it into four subject quadrants based on the density and centrality of the topics. The problems located in the upper-right quadrant require a closer look at them, as well as more in-depth research on them. In contrast, the upper-left quadrant features a separate subject that is uncommon and developing quickly. This subject has a high density but a low centrality. The lower-left quadrant contains motifs that are descending in density. In contrast, the lower-right quadrant contains essential themes with a high degree of centrality but a low level of density. The timeline in Figure 11 demonstrates that the highest potential topics for future research include cryptocurrency market, market efficiency, herding behavior, COVID pandemic, safe haven, stock markets, financial markets, and volatility spillovers because of their large populations.

Figure 11: Thematic map



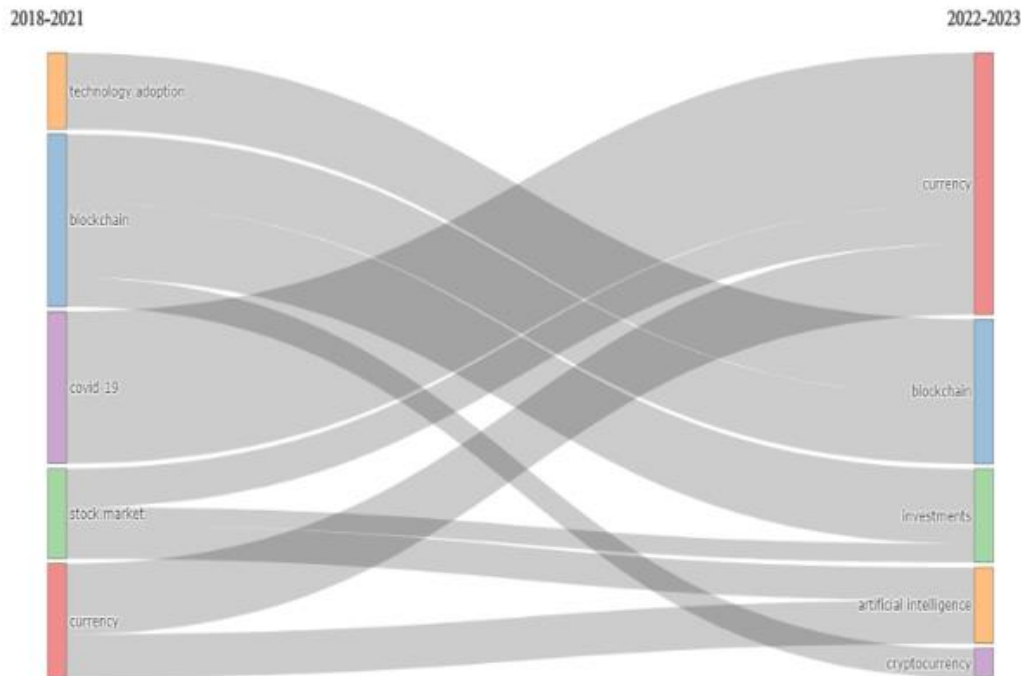
Source: Prepared by authors elaboration using the bibliometrix R Package

Foundations of research and conceptual framework

Thematic evolution in bibliometrics is becoming important for providing a historical view of research and a science-based paradigm for directing future research prospects (Moral-Munoz et al., 2018). It highlights the most critical research issues and shows how they have evolved by providing a glimpse into the field's potential future (Chen et al., 2019). Figure 12 shows the development of the 10 most commonly used terms in cryptocurrency research sources from 2018 to 2023 based on the co-occurrence network. The word network cluster, which represents domain-specific themes, was clustered together to create a map of thematic

progression. A cut-off date of 2022 or 2023 was selected based on the volume of public documents.

Figure 12: Thematic evolution of authors' keyword



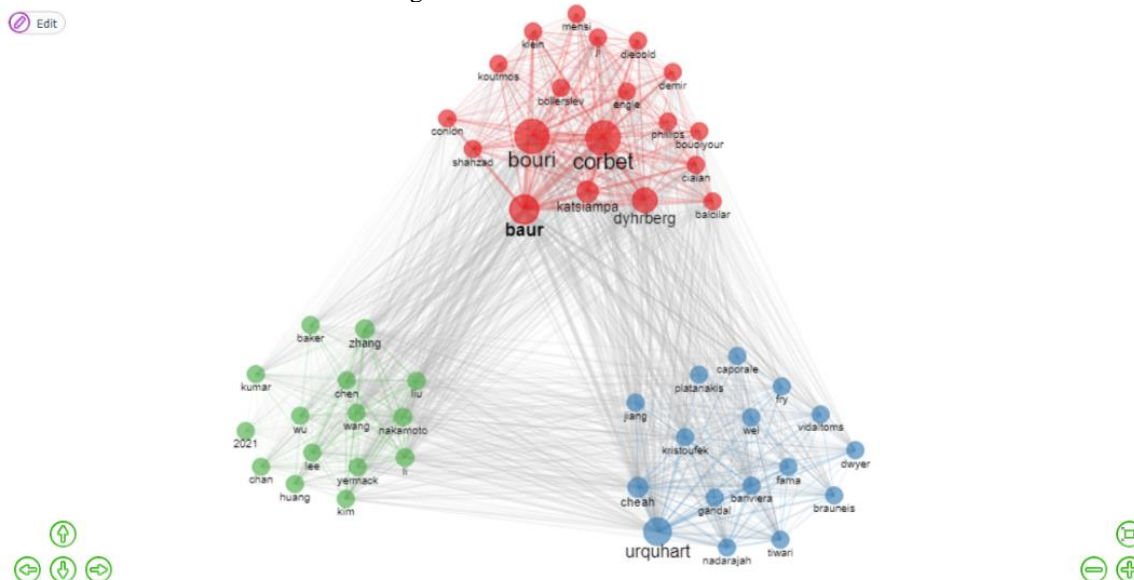
Source: Prepared by authors elaboration using the bibliometrix R Package

The size of the boxes in Figure 12 indicates the frequency of keywords' appearance and themes. From 2018 to 2021, the most popular words were 'technology adoption', 'blockchain', 'COVID-19', 'stock market', and followed by 'currency' which were then merged into the next time slice (2022–2023) as 'currency', 'blockchain', 'investments', 'artificial intelligence', and 'cryptocurrency' respectively. This demonstrates that 'technology adoption' and 'blockchain' have shifted to a new well-known form, 'blockchain', owing to the authors' ongoing interest in these topics. The 'currency' was separated into two branches in the following time slice (2022–2023). 'COVID-19' and 'stock market', whereas 'currency' was classified into two branches: 'currency' and 'artificial intelligence'. These keywords have been a big subject since 2018. Throughout history, the word 'blockchain' has appeared in various contexts. However, the subject evolution map shows that 'stock market' was the primary focus of scientists' research during the time slice 2018–2022, followed by 'blockchain' and 'currency'.

Co-citation networks analyses

The co-citation map depicts the scientific structure of any body of literature by showing the frequency that two publications are mentioned jointly in a third document (Mumu et al., 2021). [Note: the co-citation map is also called the cross-reference map.] This research looked at a total of 63,414 citations from different sources on the topic of cryptocurrency. The co-citation analysis was performed on 50 different articles from the cryptocurrency research field. The researchers identified citations that had been referenced a minimum of five times throughout the study. In order to show the structure and theoretical foundations of the cryptocurrency research study (Šubelj, Van Eck & Waltman, 2016), the Louvain technique was employed to cluster the selected citations. The node's size in the graph indicates the normalized number of citations associated with that node. In contrast, the thickness of the lines connecting nodes indicates the degree of co-citation connections between the nodes. The link that connects two things, as well as their proximity, demonstrates the connection that exists between them. According to Figure 13, the first author's name and year of publication of the article were labeled accompanying each box. The color of the box denotes which cluster the article belongs. The nodes that share the same color are grouped in this manner.

Figure 13: Co-citation network of references



Source: Prepared by authors elaboration using the bibliometrix R Package

Co-citation networks revealed in Table 5 are divided into three distinct clusters. The categorization is based on most references included in the selection process. Cryptocurrency

research serves as the theoretical framework for all three groups, as can be shown by the fact that it links all three together.

Table 5: Co-citation clusters as theoretical fundamentals

Cluster	Relevant citations
Cluster 1 (Red)	Corbet et al., 2018 (10.1016/j.econlet.2018.01.004), Bouri et al., 2019 (10.1016/j.frl.2018.07.008), Baur et al., 2018 (10.1016/j.frl.2017.10.012)
Cluster 2 (Blue)	Urquhart & Zhang, 2019 (10.1016/j.irfa.2019.02.009), Kristoufek, 2020 (10.1016/j.eneco.2019.104588), Bariviera & Merediz-Solà, 2021 (10.1111/joes.12412)
Cluster 3 (Green)	Zhang et al., 2018 (10.1080/00036846.2018.1488076), Liu and Tsyvinski (2021) (10.1093/rfs/hhaa113), Wang et al., 2022 (10.1108/CFRI-09-2021-0191)

The first cluster (red) shows the extent of cryptocurrency research by Corbet and colleagues (Corbet et al., 2018), analyzing the time and frequency domains, the relationships between three popular cryptocurrencies, and a variety of other financial assets. Bouri and his colleagues (Bouri et al., 2019) studied herding behavior in cryptocurrencies. The results provide us with helpful information on portfolio and risk management, trading strategies, and market efficiency. According to Baur’s research (Baur et al., 2018), Bitcoin is substantially different from gold and the US dollar. This task tries to find the same results using the same sample and econometric models. It shows that exact replication is not possible. They discovered that other statistical methods produce more reliable results but also quite distinct. The second cluster (blue) represents the direction that underwent a dramatic change in 2018 as a result of major price corrections and growing concerns about its impact on the environment and sustainability. Urquhart and Zhang (Urquhart & Zhang, 2019) proposed an investigation into whether Bitcoin can act as a hedge or safe haven against world currencies. Kristoufek (Kristoufek, 2020) studied Bitcoin and its mining on the equilibrium path. The result shows that after exploding its price twenty times only in the twelve months of 2017, the tone changed dramatically in 2018 after major price corrections and increasing concerns about its mining energy consumption and overall sustainability. Bariviera & Merediz-Solà (Bariviera & Merediz-Solà, 2021) used a bibliometric and literature review of the most important economic topics studied on cryptocurrencies. It is based on a combination of machine learning (bibliometric analysis) and close reading (of papers). This literature review has a dual goal: to propose this hybrid methodology and provide an updated review for new and experienced researchers. The last cluster (green) indicates the cryptocurrency returns, which are influenced and predictable by factors specific to cryptocurrency markets. There is a strong time-series momentum effect, and investors’ interest in cryptocurrencies is a strong predictor of future returns. Some of the biggest

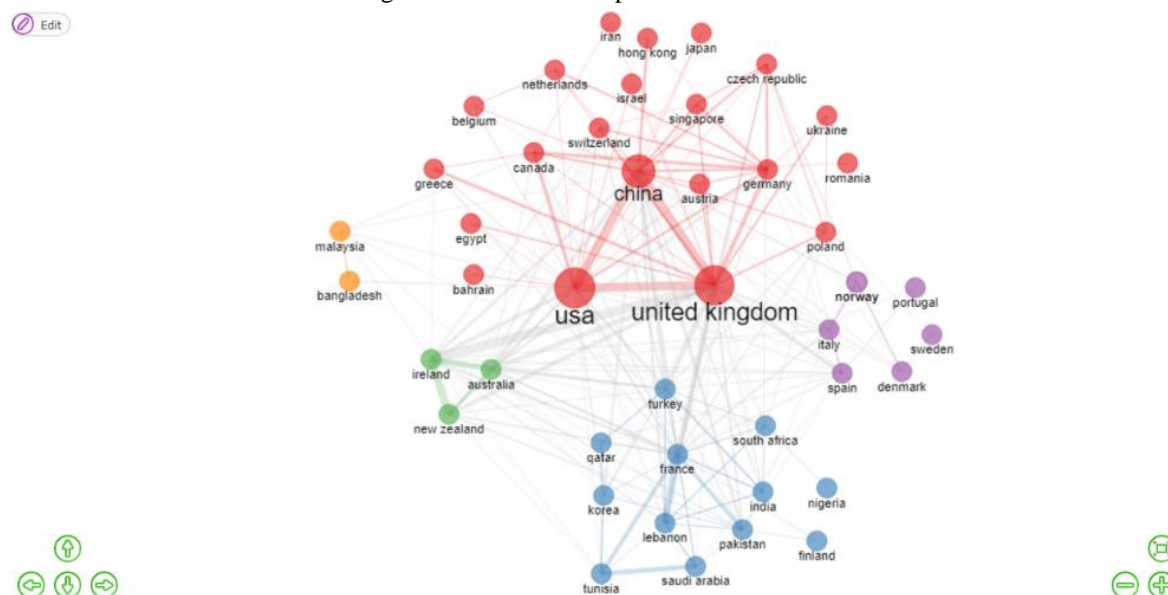
complaints about cryptocurrencies are that they use a lot of energy and release a lot of CO₂. Zhang and colleagues (Zhang et al., 2018) examined the stylized facts of eight forms of cryptocurrencies representing almost 70% of the cryptocurrency market capitalization. The empirical results show that heavy tails exist for all the returns of cryptocurrencies. A power-law correlation exists between price and volume and strong volatility clustering and leverage effects. Liu and Tsyvinski (2021) said that cryptocurrency returns are driven by and can be predicted by factors unique to cryptocurrency markets. They made the network factors to show how many people use cryptocurrencies and the production factors to show how much it costs to create cryptocurrencies. There is a strong time-series momentum effect, and investors' interest in cryptocurrencies strongly predicts future returns. High energy consumption and CO₂ pollution issues regarding cryptocurrencies have become some of the main areas of criticism, raising questions about the sustainability of cryptocurrencies. Wang and colleagues (Wang et al., 2022) gathered many news stories around cryptocurrency environmental concerns—i.e., >778.2 million news items from the LexisNexis News & Business database. This research gives us a practical new way to stand in for cryptocurrency and strong empirical evidence for future studies on how environmental problems affect cryptocurrency markets.

Author collaboration network

Understanding research direction in a wide range of study areas requires knowledge of the author's cooperation network (Mumu, Tahmid & Azad, 2021). This collaboration frequently leads to the creation of academic hubs that promote the development and future expansion of research fields. The co-author network shown in Figure 14 depicts the connections between academics on a country-by-country basis (Donthu, Kumar & Pattnaik, 2020). The countries that have made the most enormous and significant contribution to the growth of the field of cryptocurrency research are shown in Figure 14, based on co-authorship. With a cut-off of 5 publications and 5 citations, 50 distinct countries achieved the threshold with 3 clusters, 57 links, and a total link strength of 55. The circle's diameter corresponds to the total number of publications in a particular nation. The level of participation is indicated by the line thickness and circle spacing. The quantity of documents created by authors representing two or more countries determines the overall strength of a country's ties. The presence of a particular nation in a cluster, cluster edge strength, or cluster position indicates the nation's contribution to the multi-country research community.

Cryptocurrency research is conducted by researchers from countries all over the world. The volume and quality of published papers from various nations have increased over time. The volume of papers has increased steadily and peaked in 2020, while the quality of publications has improved. The USA has the largest number of publications, followed by China and the UK. The USA has the highest quality of publications, followed by the UK, and China. The USA, China, the UK, Canada, and Australia have the highest number of co-authorships. The USA has the most significant number of co-authorships with China, the UK, Canada, Australia, and Singapore. China has the highest number of co-authorships with the USA, followed by the UK, Canada, and Australia. The UK has the most significant number of co-authorships with the USA and China, followed by Canada and Australia.

Figure 14: Co-authorship based on countries



Source: Prepared by authors elaboration using the bibliometrix R Package

Three main networks have evolved in the study of cryptocurrency, led by the United Kingdom, China, and the USA (red cluster), France (blue cluster), Australia (green cluster), Spain (purple cluster), and Malaysia (yellow cluster). Race-related power relations within these countries have resulted in a situation where Asian Americans experience extreme social, economic, and political marginalization, if not outright exclusion. The UK (page rank 0.108) is the most significant country in collaborative cryptocurrency research, followed by China (page rank 0.083). The number of co-authorships between the USA and China has increased rapidly in recent years, with a total of 362 co-authorships between the two countries in 2017. This

increase is likely due to the growing interest in cryptocurrency and blockchain technology in both countries. The USA is also the most significant country in collaborative cryptocurrency research with France, with a total of 205 co-authorships between the two countries in 2017.

DISCUSSION

The study's findings have a wide range of practical and theoretical implications. First, the publication initially presents a comprehensive historical narrative of cryptocurrency studies during the past 18 years. Second, it highlights the literature's most significant and productive authors, publications, and countries. This list is an excellent starting point for scientists who want to figure out ideas for further study and journals to submit their work. Third, scholars will be able to focus on the most important and influential articles as well as the most recent ones. Lastly, academics working with social developers and data scientists could use the results of this study to find research topics that fill the gaps that were found. For example, a broader study is required to conduct comprehensive assessments of financial literacy and access to financing that are integrated with cryptocurrency studies. The documents show a lack of research as relative cryptocurrency is a dynamic, multi-faceted, and regional problem. Taking multidimensional measurements of each site and developing long-term procedures that fit them are critical in the new era. The study of cryptocurrency from a long-term and economic viewpoint has also been the subject of a few recent publications dealing with these issues. Nevertheless, there is a research gap in this area and more in-depth studies on cryptocurrency research.

Additionally, an integrated knowledge management framework that transcends any particular subject or technique is needed when addressing a large-scale public issue like cryptocurrency. From the perspective of bibliometrics' descriptive nature, this will provide a conceptual overview that is highly beneficial in making sense of the research environment. According to the 3D creativity framework (Vuong et al., 2022), information is input for generating innovations. Therefore, to increase the probability of generating innovations, one has to increase the number of useful insights, which can be achieved by increasing the amount of information processed and the processing speed.

On the other hand, this research has severe limitations; one of them is its sole reliance on the Scopus database for pertinent documents. In addition, additional documents were disregarded because they did not include sufficient relevant information. In upcoming research initiatives, it may be advantageous to use other prominent academic repositories, such as

Dimension and PubMed, to carry out various evaluations and provide a more thorough qualitative and quantitative assessment of the research front on this problem. The procedures' strengths in scope are not enough to compensate for their weaknesses in terms of the examination that they perform in-depth. It is challenging to conduct a more in-depth analysis of the research topic without first studying various methodologies and models. For this reason, bibliometric methods emphasize the output rather than the article's content.

In this research, we proposed a systematic bibliometric analysis of cryptocurrency. We identified the top journals, conferences, and countries in this field. In addition, we conducted a ranking of the top researchers in this area and evaluated the research trends. We identified the top collaborators and their topics of interest. The results from this study will help researchers in this field to identify potential collaborators, new research areas, and relevant journals for their submissions.

CONCLUSION

Through ongoing study and development, the issue of cryptocurrency will expectedly be resolved in many aspects. The rise in volume, diversity, and truthfulness of efforts to support cryptocurrency has led to situations that have overcome the world's cryptocurrency limitations. Before starting research on cryptocurrency promotion, it is a good idea to undertake a bibliometric analysis using cryptocurrency research documents from the Scopus database, an excellent source of information. Based on an analysis of the most recently published documents (1,685) and the most recent period of research (2018–2022), this bibliometric method defines state of the art in cryptocurrency study as future development in the field. Various bibliometric methods were used to investigate the most productive and influential authors, affiliations, countries, sources, and publication patterns on the subject over time.

According to the findings of various scientific mappings of bibliometric data, such as co-citation network, bibliometric coupling network, and co-authorship network, the subject of cryptocurrency study may be broken down into eight primary subfields: (1) cryptocurrency market, (2) market efficiency, (3) herding behavior, (4) COVID pandemic, (5) safe haven, (6) stock markets, (7) financial markets, and (8) volatility spillovers. Like the research results of Novak and colleagues (2022), they study financial and economic security in financial markets at the stage of European integration. Insawan and his team (2022) present their research about the effect of the COVID-19 pandemic on the profitability of an Indonesian sharia-compliant investment portfolio. Moreover, Krishnan & Periasamy (2022) assessed the effectiveness of the

semi-strong form by analyzing the stock market's reaction to dividend announcements. Additionally, the findings show that *Finance Research Letters* is the most significant journal on cryptocurrency research, followed by *Research in International Business and Finance* and *Economics Letters*. According to citations and publications, Corbet and colleagues (Corbet et al., 2018) (*Exploring the dynamic relationships between cryptocurrencies and other financial assets*) is the most productive author in this field, taking into account the h-index and g-index, as well as the amount of time spent contributing to this research domain. The USA is the most productive country in this area regarding publications and citations, followed by China and the UK. With 10 links and 14 link strengths, the UK is the most collaborative country, followed by China with 12 link strengths. Additionally, this assessment indicates that the USA and Australia, the UK and Spain, China and France, and the UK and Malaysia shared their documents.

The bibliometric method employed in this study can be used to investigate any problems in cryptocurrency and to further develop solutions to those problems. The technique, for instance, can be applied to investigate the impact of the coronavirus pandemic on cryptocurrency, as well as seek solutions to the cryptocurrency volatility issue. Additionally, the bibliometric approach can be used to study the relationships between cryptocurrency and other financial assets and assist in identifying solutions to the problem of market efficiency.

Given this information, some potential directions for future research in the field of cryptocurrency could include:

1. Investigating the impact of the COVID-19 pandemic on cryptocurrency markets and identifying potential solutions to address any challenges that arose as a result of the pandemic.
2. Examining the relationship between cryptocurrency and other financial assets, with a focus on identifying ways to improve market efficiency.
3. Analyzing the factors that contribute to cryptocurrency volatility and seeking ways to mitigate or manage this risk.
4. Conducting further research on the identified subfields of cryptocurrency research (e.g. market efficiency, herding behavior, etc.) in order to deepen understanding and identify potential solutions to challenges in these areas.
5. Exploring the potential use of cryptocurrency in various industries and contexts, such as supply chain management, international trade, and charitable giving.

6. Examining the regulatory landscape surrounding cryptocurrency and identifying potential ways to address any challenges or gaps in regulation.
7. Investigating the potential risks and benefits of using cryptocurrency as a safe haven asset, and identifying ways to mitigate potential risks while maximizing the benefits.

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