

Systematic and bibliometric reviews of cryptocurrency market regulation: trends, influential contributions, and future directions

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Abstract

Purpose – This study aims to analyse the academic literature on cryptocurrency regulation using a combined bibliometric and systematic literature review approach, focusing on research trends, influential contributions and thematic clusters from 2018 to 2024.

Design/methodology/approach – This study reviews 62 journal articles published between 2018 and 2024. A combined bibliometric and systematic literature review approach is used to analyse key articles, journals, authors and countries contributing to the field. Thematic clusters such as crowdfunding, FinTech, blockchain vulnerabilities, Central Bank Digital Currencies (CBDCs) and economic forecasting in developing countries are identified.

Findings – The analysis reveals emerging trends and significant advancements in cryptocurrency regulation, highlighting key contributors in the field. Thematic clusters show a focus on blockchain vulnerabilities, the rise of CBDCs, and regulatory challenges in developing economies. These themes represent the most pressing areas in cryptocurrency market regulation.

Practical implications – The findings offer insights for policymakers, researchers and industry practitioners to shape effective regulatory frameworks, addressing critical issues such as blockchain security and central bank digital currencies.

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Social implications – This research contributes to the development of robust regulatory frameworks, promoting market stability and transparency, which will ultimately benefit global financial markets and stakeholders in the cryptocurrency ecosystem.

Originality/value – To the best of the authors' knowledge, this study is the first to integrate bibliometric and systematic literature review methods to examine cryptocurrency regulation, providing a comprehensive overview of the research landscape.

Keywords Cryptocurrencies, Blockchain, Monetary policy, Digitized world, Global, Regulation, Bibliometrics

Paper type Literature review

1. Introduction

The regulation of cryptocurrency is a constantly changing and complex area, shaped by a confluence of factors such as technological advancements, economic forces and legal frameworks (Stensås *et al.*, 2019; Walton and Johnston, 2018). Scholars have been diligently delving into several facets of cryptocurrencies and blockchain technology, furnishing invaluable perspectives on their possible advantages and obstacles (Sladić *et al.*, 2021; Mavilia and Pisani, 2020). The potential of Bitcoin as a hedge, safe haven asset or diversifier in investment portfolios has been the subject of research (Stensås *et al.*, 2019). In addition, the perception of Bitcoin adoption via virtual communities has been studied (Walton and Johnston, 2018). The potential of blockchain technology extends far beyond the financial sector. Researchers have explored its potential applications in securing real estate transactions (Sladić *et al.*, 2021), promoting financial inclusion in developing economies (Mavilia and Pisani, 2020) and facilitating business financing within the agricultural industry (Rijanto, 2021). The environmental and economic impacts of cryptocurrency mining have also been a subject of study (Alonso Náñez *et al.*, 2021). Furthermore, an inquiry has been conducted by scholars into the potential of blockchain technology to enhance the administration of academic records in developing countries (Alnafrh and Mouselli, 2021). A growing body of research is analysing the interplay between cryptocurrency adoption, regulatory strategies and achieving sustainable development goals (Mbaidin *et al.*, 2023; Rizwan and Mustafa, 2022). These scholarly inquiries significantly enrich our comprehension of cryptocurrency regulation by equipping stakeholders and policymakers with insights into this intricate and evolving domain.

This paper uniquely contributes by conducting a comprehensive bibliometric and systematic literature review (SLR) on the regulation of cryptocurrencies, aiming to fill crucial research gaps overlooked in prior studies. Unlike other FinTech/Crypto/Blockchain reviews, which often focus on specific themes or a narrow subset of publications, this study synthesizes a broad spectrum of literature across multiple years and scholarly sources, thus offering a holistic perspective on cryptocurrency regulation research and highlighting previously unexplored areas. Regulation in the cryptocurrency market is the main topic of this paper, which is about how to regulate cryptocurrencies in an ever-evolving landscape. To gain a comprehensive understanding of this area and identify potential research gaps, the study uses a mixed methodology, combining qualitative and quantitative approaches. This approach integrates bibliometric analysis tools and SLR principles (Liberati *et al.*, 2009; Afeltra *et al.*, 2022, 2023). Academics support this method, emphasizing its efficacy in offering comprehensive reviews of scientific fields, promoting a deeper comprehension of ongoing debates and identifying areas requiring further research (Saxena and Kumar, 2023; Caputo *et al.*, 2018). The study follows well-known best methods for SLR. According to Afeltra *et al.* (2022) and Aladayleh *et al.* (2023), we developed a detailed plan that included

well-thought-out research questions, the choice of relevant databases and terms, and strict screening criteria to identify and review suitable academic papers. The final data set comprised 62 peer-reviewed journal articles published between 2018 and 2024, retrieved from the finance and economics section of the Scopus database, ensuring the inclusion of the most up-to-date literature relevant to the cryptocurrency regulatory domain.

To analyse the data, the study used VOSviewer, developed by [Van Eck and Waltman \(2011\)](#), and the Bibliometrix R package ([Aria and Cuccurullo, 2017](#)). These tools are widely recognized for their ability to conduct robust bibliometric analyses ([Lamboglia et al., 2021](#); [Gillpatrick et al., 2022](#)). Through this analytical approach, the paper contributes an unprecedented mapping of key authors, journals, research clusters and country-specific contributions within the cryptocurrency regulation domain. VOSviewer facilitated identifying important authors, articles, journals and countries in the study domain. As noted by [Aria and Cuccurullo \(2017\)](#), [Lamboglia et al. \(2021\)](#) and [Bellucci et al. \(2022\)](#), Bibliometrix enabled the creation of scientific maps using trend topic analyses and phrase co-occurrence analyses, representing essential research themes in cryptocurrency regulation and suggesting new research directions. The study specifically addresses the following research questions:

Practical implications of this research are crucial in guiding policymakers, financial institutions and industry stakeholders in understanding how to effectively regulate cryptocurrencies in various jurisdictions. By synthesizing a broad spectrum of literature, the study offers actionable insights into the development of coherent, sustainable and adaptable regulatory frameworks for the cryptocurrency market. This research serves as a practical tool for creating regulatory policies that can support both innovation and stability within the financial markets, reducing the potential risks associated with cryptocurrencies such as fraud, market manipulation and illegal activities. On the theoretical side, this study advances our understanding of how cryptocurrency regulation intersects with broader economic, technological and legal systems. It provides a nuanced perspective on the regulatory approaches that have been adopted globally and how these affect the adoption of cryptocurrencies in diverse sectors. The theoretical framework derived from the literature also offers avenues for further academic inquiry, highlighting gaps in the existing literature, such as the need for more research into the socio-political dimensions of cryptocurrency regulation.

- What are the prominent themes within relevance research in cryptocurrency regulation, and how are they characterized?
- What are the emerging directions for future relevant research in cryptocurrency regulation?

This paper offers an advanced contribution to the literature by surpassing traditional narrative review approaches often limited to specific topics or a small corpus of articles ([Massaro et al., 2016](#)). It establishes a new benchmark in cryptocurrency regulation research by delivering a multi-faceted overview of past, present and potential future research. Additionally, this study provides an unbiased synthesis of research trends within cryptocurrency regulation through a quantitative-qualitative hybrid methodology. By combining the strengths of rigorous quantitative bibliometric analysis with the qualitative depth of a SLR, this approach allows for a comprehensive and unbiased overview of research streams within the field, avoiding the limitation of solely focusing on particular sub-areas ([Cooper et al., 2018](#)).

Furthermore, the paper identifies several promising areas for future research on relevance within cryptocurrency regulation. Recent study suggests these promising avenues include

investigations into the impact of economic factors on cryptocurrency markets (Alqudah *et al.*, 2023), exploration of blockchain technology's role in financial inclusion and sustainable development (Mavilia and Pisani, 2020; Mbaidin *et al.*, 2023), examination of the adoption and regulatory challenges surrounding cryptocurrencies in different regions (El Maknouzi and Sadok, 2021; Atiyah *et al.*, 2023), studies on the potential of Central Bank Digital Currencies (CBDCs) (Sun and Li, 2024) and understanding the dynamics of cryptocurrency markets, such as price volatility and shock transmission (Touijrat *et al.*, 2021; Niyitegeka and Zhou, 2023). In this paper, Section 2 details the research methodology, Section 3 presents the bibliometric analysis results, Section 4 discusses the thematic clusters identified through the analysis, Section 5 outlines new research directions, and Section 6 concludes with some final thoughts.

2. Methodology

The method used in this study is a mix of bibliometric analysis and SLR. This methodology draws upon the frameworks established by various scholars (Janssens *et al.*, 2008; Raan, 2008; Caputo *et al.*, 2021; Momani *et al.*, 2023). The rationale behind this approach is to achieve a more comprehensive understanding of the concept of "value relevance" by incorporating both quantitative and qualitative elements from each methodology (Pritchard, 1969; Gómez-Núñez *et al.*, 2016; Pizzi *et al.*, 2020). Merging these methods helps mitigate potential biases and strengthens the overall scientific rigour of the study's findings (Pizzi *et al.*, 2021; Oliveira *et al.*, 2023).

The research began with a SLR following well-defined protocols established by Moher *et al.* (2015), Caputo *et al.* (2018), Qudah *et al.* (2023) and Mancini *et al.* (2021). This approach ensured a robust and repeatable research process, adhering to the principles outlined by Petticrew and Roberts (2008, p. 44). We established a comprehensive research protocol that included a clearly defined and justified research question, along with detailed explanations of the intended methods. Furthermore, it elaborated on strategies for identifying, evaluating and synthesizing various types of studies, providing a clear roadmap for the subsequent investigation.

Recent works by Petticrew and Roberts (2008), Trindade *et al.* (2023), Bellucci *et al.* (2022) and Momani *et al.* (2023) have laid out recognized SLR methods that this study follows. During the initial phase, there were several important steps:

- The first step involved defining the specific area of investigation and formulating research questions. These questions guided the direction of the study.
- We selected suitable academic databases and identified relevant keywords to facilitate an effective literature search.
- We then refined the search results by applying specific criteria, such as subject area, document type, publication stage, source type and language. This ensured that the retrieved literature directly addressed the research questions.
- We conducted a rigorous screening process to evaluate each paper's eligibility for inclusion in the final review sample. We assessed the papers against the predefined criteria to ensure their relevance to the study.

Following the initial literature search, the study used a bibliometric analysis to investigate deeper into the target research field. This methodology offers a distinct advantage: its ability to objectively and systematically handle large data sets using descriptive statistics and similarity measures (Touijrat *et al.*, 2021; Niyitegeka and Zhou, 2023; Momani *et al.*, 2023). Bibliometric analysis goes beyond simply identifying relevant literature. It allows

researchers to pinpoint influential publications, journals and scholars, thereby providing valuable insights into the intellectual landscape of the field (Sharifi *et al.*, 2023). This method also facilitates the creation of “science maps”. These visual representations depict the evolution and structure of specific research domains, ultimately enhancing the study’s scientific integrity and replicability (Touijrat *et al.*, 2021; Niyitegeka and Zhou, 2023; Santos *et al.*, 2017).

The bibliometric analyses conducted in this phase strictly adhered to established protocols outlined by Moher *et al.* (2015), Caputo *et al.* (2018), Sharifi *et al.* (2023), Singh *et al.* (2023) and Yang *et al.* (2023). These protocols ensure a rigorous focus on the quantitative aspects of the literature directly relevant to the research topic:

- This stage uses metrics like publication counts, citation frequencies and authorship structures to provide a quantitative picture of the research domain.
- This phase uncovers the core themes and develops patterns driving the field by evaluating common keywords and their relationships.
- This study sheds light on the field's future trajectory by identifying emerging research focus points and regions of growing emphasis. This enables researchers to identify possible development areas and customize their study appropriately.

2.1 Phase 1: Systematic literature review

Following established research protocols, the initial phase involved formulating specific research questions to guide our investigation:

- RQ1. What are the key themes that characterize relevant research in the field cryptocurrency market adoption and the associated regulatory challenges?
- RQ2. What distinguishes these themes from each other? And how are research trends evolving within the domain of relevant research on cryptocurrency market adoption and regulatory challenges?

To ensure a comprehensive and representative data set, we meticulously selected relevant papers from the Scopus database. Renowned for its extensive coverage, Scopus surpasses other options like Web of Science (WoS) and is considered the preferred platform for in-depth literature reviews (Janssens *et al.*, 2008; Raan, 2008; Caputo *et al.*, 2021; Yang *et al.*, 2023). This choice not only guarantees a broader search but also facilitates data collection, organization and further analysis. We used a Python script using the pybliometrics.scopus library to automate the search process within the Scopus database. The search query encompassed a range of terms related to cryptocurrencies, blockchain technology, financial markets, regulation and development (see code snippet below):

```
all = (("cryptocurrency" OR "crypto currencies" OR "cryptocurrencies" OR "crypto-currency"  
OR "digital currency" OR "virtual currency" OR "bitcoin" OR "Ethereum" OR "distributed  
ledger technology" OR "blockchain" OR "altcoins" OR "tokenization" OR "crypto-assets")  
AND ("Emerging markets" OR "developing markets" OR "marketplaces" OR "Regulation" OR  
"Regulatory framework" OR "Law" OR "Legal aspects" OR "Forecasting" OR "Market  
efficiency" OR "Monetary Fund" OR "IMF" OR "financial inclusion" OR "financial literacy"  
OR "financial technology" OR "FinTech" OR "payment systems" OR "remittances" OR  
"microfinance" OR "inclusive finance") AND ("developed countries" OR "high-income" OR  
"industrialized nations" OR "first-world countries" OR "wealthy nations" OR "developing  
countries" OR "low-income" OR "third-world countries" OR "less developed countries" OR  
"emerging economies" OR "underdeveloped nations"))
```

This study adheres to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) standards to guarantee transparency and reproducibility throughout the research process. The PRISMA guidelines offer a robust framework for conducting and reporting systematic reviews (Thakur *et al.*, 2023). This framework proved invaluable in meticulously tracking the flow of information through the various stages of the review, including identification, screening, eligibility and inclusion of studies (Helbach *et al.*, 2023; Cala *et al.*, 2023). By following PRISMA, we aimed to minimize bias and enhance the reliability of our findings, thus ensuring a comprehensive and objective analysis of the academic literature on cryptocurrency market regulation.

This refined approach ensured that our data set encompassed a diverse range of perspectives on the intricate interactions between finance, law, and technology within the study area. To guarantee the data set's relevance and focus, we implemented rigorous filters during the search process. These filters targeted critical subject areas such as "Business, Management, and Accounting" and "Economics, Econometrics, and Finance", as well as document types ("article"), publication stages ("final"), source types ("journal") and language ("English"). Notably, the most cited paper delved into the role of cryptocurrency as a diversification, hedging, or safe haven tool, thereby thoroughly examining cryptocurrency regulation within its overall context. This study offers a thorough examination of the academic literature, highlighting the crucial role of regulation in the cryptocurrency market. It uses a robust approach, utilizing both bibliometric and SLR methods to uncover key insights.

The analysis examines 62 journal articles published between 2018 and 2024. Starting the analysis in 2018 makes sure that the academic literature is looked at during a key time of significant growth and change in the regulatory landscape for cryptocurrencies. This time frame includes the start of important regulatory frameworks, technological advances and market trends, giving us a basic idea of how the field is changing. We also made sure that the most recent and important scholarly contributions were included by only searching for peer-reviewed English journal articles released up to March 2024 and finishing data collection in early April 2024. This focus on recent papers makes the study's results more up-to-date and reliable. The initial search yielded 190 articles. We then employed a two-level screening process (Lamboglia *et al.*, 2021; Tranfield *et al.*, 2003), where each author independently assessed titles, abstracts and full articles (if necessary) for relevance to the research objectives. Regular discussions among the authors addressed any disagreements and uncertainties. This careful screening excluded articles irrelevant to the field (63 articles), those falling outside the review scope (7 articles), book chapters (35), duplicates (4) and articles without abstracts (19). This meticulous process resulted in a final data set of 62 journal articles, as shown in Figure 1.

The dynamic and rapidly evolving nature of the cryptocurrency and blockchain sectors led to the decision to exclude studies published before 2018. While foundational research prior to 2018 provided critical insights into the technology's potential and early challenges, the regulatory environment for cryptocurrencies has transformed dramatically in recent years. Key developments such as advancements in blockchain technology, the emergence of decentralized finance (DeFi) and the implementation of stricter global regulatory frameworks have fundamentally reshaped the landscape. These changes have introduced new complexities and challenges that were not as prominent or even present in earlier discussions.

By focusing exclusively on publications from 2018 onward, this study ensures that it captures the most up-to-date and relevant perspectives on the regulation of cryptocurrencies. This more recent literature reflects the current state of the industry, including how regulators are responding to the growing integration of cryptocurrencies into mainstream financial systems. Furthermore, excluding studies before 2018 allows for a sharper focus on the

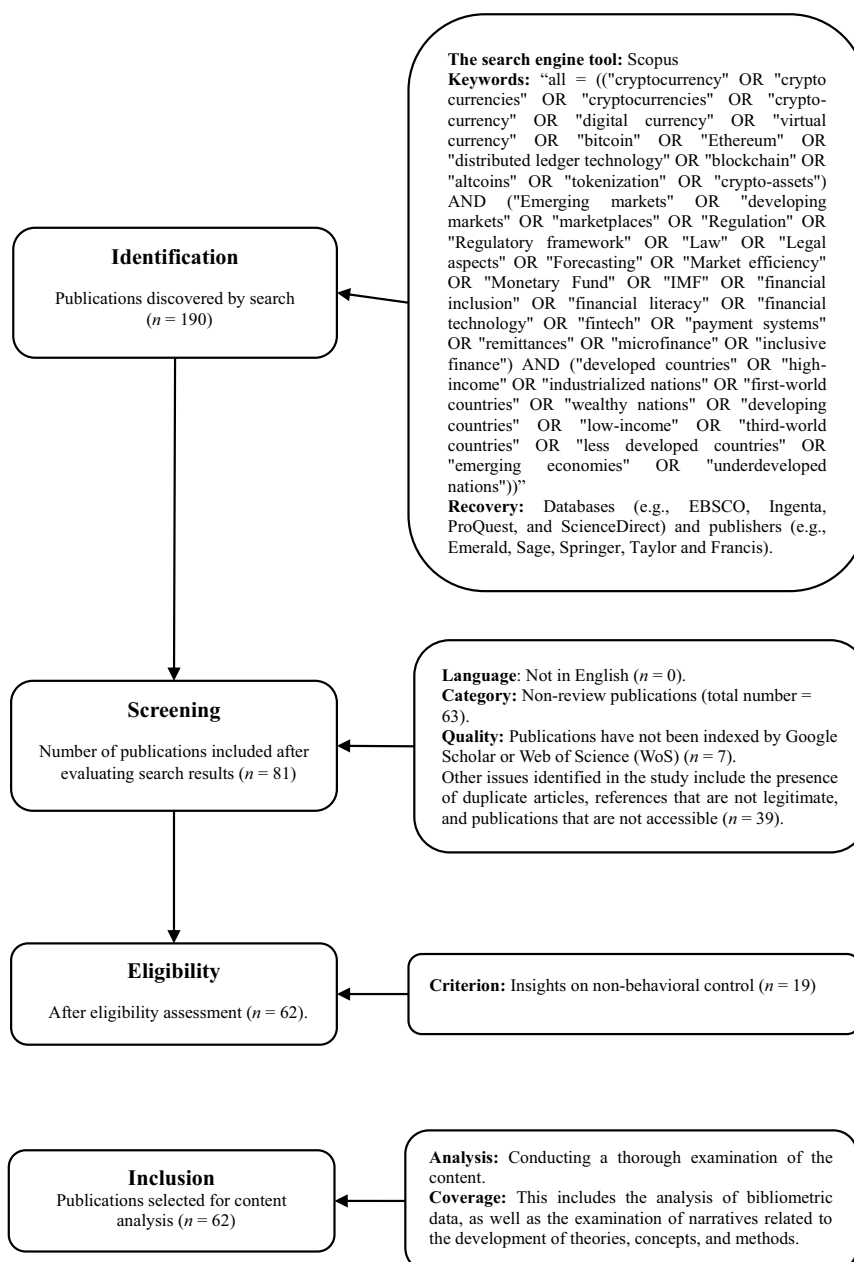


Figure 1. PRISMA review protocol flowchart for publications selection
Source(s): Authors' own work

pressing issues of today, such as the rise of DeFi platforms, the environmental impact of blockchain technologies and the increasing alignment of regulatory approaches across jurisdictions. In essence, the exclusion of pre-2018 studies is not a dismissal of their value but rather a recognition that the rapid evolution of the field necessitates an emphasis on contemporary research. This approach ensures that the analysis remains aligned with the realities of the current regulatory environment and provides actionable insights for shaping future strategies.

To increase the transparency of our methodological process, we used keyword normalization procedures to standardize terms and ensure consistency across the data set. This involved the normalization of synonymous terms and variants, such as “cryptocurrency”, “cryptocurrencies” and “digital currency”, to a consistent set of keywords. In addition, we implemented clustering criteria to group related themes within the articles, enhancing our ability to identify core topics and emerging trends.

Furthermore, a sensitivity analysis was conducted to test the robustness of the clustering methods employed in the study. This analysis critically examined thresholds, including probability levels, to determine whether different settings could produce significantly varied results. By adjusting these thresholds and observing their impact on the cluster outcomes, we ensured that the findings were robust and reliable, and that no important themes were missed due to overly strict or lenient clustering parameters.

2.2 Phase 2: Bibliometric analysis

Bibliometric studies begin with a critical initial phase: performance analysis (Donthu *et al.*, 2021, p. 287). This widely recognized and essential step lays the groundwork for subsequent analyses (Abbas *et al.*, 2022; Caputo *et al.*, 2018; Saxena and Kumar, 2023). Its objective is to evaluate the research field’s performance across various components, including authors, countries and journals. To do this, performance analysis uses different indicators, mostly from bibliographical citations, to make descriptive statistics (Dol *et al.*, 2024). This comprehensive overview provides valuable insights into the field’s research volume and impact (Sharifi *et al.*, 2023; Singh *et al.*, 2023; Yang *et al.*, 2023). To explore the development of valuable research on cryptocurrency adoption and its associated regulatory challenges, the study examined the distribution of articles over time. It also evaluated their impact through citation analysis and citations per year (CPY) analyses (Massaro *et al.*, 2016). Citation analysis, a frequently used bibliometric technique, involves compiling lists of the most cited papers or authors, offering insights into research prominence and productivity (Farooq, 2024). This approach rests on the assumption that scholars typically cite influential works relevant to their research (Singh *et al.*, 2023; Otitolaiye and Abd Aziz, 2024).

Following this methodology, the study identified the most influential journals, authors and corresponding countries (Caputo *et al.*, 2018; Lamboglia *et al.*, 2021; Aladayleh *et al.*, 2023). The VOSviewer software, renowned for its utility in bibliometric analysis, facilitated this process (van Eck and Waltman, 2010, 2011, 2013, 2017; Waltman *et al.*, 2010; Wong, 2018). VOSviewer enables the objective and user-friendly visualization of significant publications, authors, journals, research groups and countries within the field (van Eck and Waltman, 2010, 2011, 2013, 2017; Waltman *et al.*, 2010). Science mapping, which was the main part of the bibliometric analysis, used first- and second-generation relational indicators to look into the structure and organization of research on cryptocurrency adoption and regulatory challenges (Massaro *et al.*, 2016; Wong, 2018). This analysis encompassed two primary techniques: keyword co-occurrence and trend topic analyses.

Keyword co-occurrence analysis, a form of content analysis, examined the keywords within articles to delineate the field's conceptual landscape. It identified key thematic clusters by analysing how frequently specific keywords appeared together in articles. Frequent co-occurrences indicate stronger connections and a higher likelihood of articles sharing the same research theme (Afeltra *et al.*, 2022; Lamboglia *et al.*, 2021). Unlike other bibliometric tools linking documents through citations or co-authorship, this method uses the actual content of papers to establish a similarity measure and identify thematic clusters (ALShanti *et al.*, 2024). By examining the frequency of authors' keyword usage over time and distinguishing between terms commonly used in the past and those more recently, trend topic analysis aimed to identify new research directions (Abbas *et al.*, 2022). The R package Bibliometrix facilitated these analyses (Alqudah *et al.*, 2023; ALShanti *et al.*, 2024). This software enables comprehensive bibliometric studies by categorizing various elements as sources, authors, records, and conceptual, social, and intellectual structures. It used clustering algorithms like "walktrap" and "leading eigenvalues" to create network graphs illustrating co-occurrences among bibliographic metadata (Aria and Cuccurullo, 2017).

Bibliometrix software played a crucial role in visualizing the relationships between keywords. Aria and Cuccurullo (2017) and ALShanti *et al.* (2024) used the leading eigenvalues algorithm to create a co-occurrence network map for the keyword co-occurrence analysis. This map visually depicts clusters of keywords corresponding to specific research themes, represented by distinct colours. We used the same software for trend topic analysis. Here, we produced a scatter plot with axes representing time and topic (Aria and Cuccurullo, 2017; Gerged *et al.*, 2023; ALShanti *et al.*, 2024). This facilitated the identification of the reference year for each topic by analysing the median of its keyword occurrences throughout the studied period.

The set of raw keywords was carefully normalized with a thesaurus before the science mapping studies occurred (ALShanti *et al.*, 2024). This process ensured data accuracy by eliminating duplicates, standardizing spelling variations and merging synonyms. Bibliometrix then automated the assignment of articles to thematic clusters with a specific probability level. We classified articles with a high probability (0.8 or above) as highly likely to belong to a specific cluster, and those with a moderate probability (between 0.4 and 0.8) as likely. To enhance transparency, we critically examined and adjusted the threshold levels for clustering, conducting a sensitivity analysis to test the robustness of clustering methods. This ensured that the probability levels used for clustering (e.g. 0.8) were robust enough to accurately reflect the thematic content of the articles. To ensure the reliability of these classifications, manual content analysis complemented the automation process. Researchers distributed articles with a probability below 0.8 for independent reading and analysis of titles, abstracts and keywords. Panel meetings and discussions addressed any disagreements or uncertainties, guaranteeing accurate cluster attribution (Van Eck and Waltman, 2014; Waltman and van Eck, 2013). We held a final meeting to review and reach consensus on the final cluster formation. We conducted a critical review of the most relevant contributions within each cluster, deeming formal reliability checking unnecessary due to the achieved step-by-step agreement. This review aimed to discuss key insights and complement the bibliometric analysis outcomes. It also served to highlight emerging research directions and suggest opportunities for future research endeavours.

3. Results

3.1 Descriptive analysis

This section is a technique to summarize and interpret data, uncovering patterns, trends and valuable insights. This method, in the context of cryptocurrency market regulation research, offers several advantages. Firstly, it helps to illustrate the rapid growth of academic interest

in this field. Secondly, it allows us to identify key topics and influential studies that are shaping the field. Finally, it highlights the contributions from various authors and journals, providing a broader picture of the research landscape. Furthermore, this section achieves this by examining publication counts, citation rates and the geographical distribution of research outputs.

3.2 Articles

Regulating cryptocurrencies is scrambling to keep up with their global rise. Research in this area has boomed, jumping from just three publications in 2018 to 16 in 2023 (see Figure 2). This reflects a growing interest in managing this evolving financial landscape in the current year. Early research focused on understanding cryptocurrencies’ role, like Bitcoin’s diversification potential and public perception (Walton and Johnston, 2018). Newer studies explore the wider regulatory implications of blockchain technology, including its use in property (Sladić *et al.*, 2021) and agricultural finance (Rijanto, 2021). Research on blockchain’s market impact (Garanina *et al.*, 2022; Jeribi and Ghorbel, 2021) underlines the need for robust regulations. However, this body of work does not sufficiently address the potential contradictions between blockchain’s regulatory framework and its vulnerabilities. While blockchain’s transparency and decentralization are seen as strengths, these attributes may also contribute to vulnerabilities in FinTech adoption, which has not been thoroughly explored in the existing literature. This surge in publications highlights the urgency for informed policies as cryptocurrencies gain influence (Nasirtafreshi, 2022; Urban and Mbeki, 2022). Despite the growing body of research, unresolved gaps remain regarding the interaction between blockchain vulnerabilities and the acceleration of FinTech adoption, suggesting that future research needs to explore this relationship in greater detail. Overall,

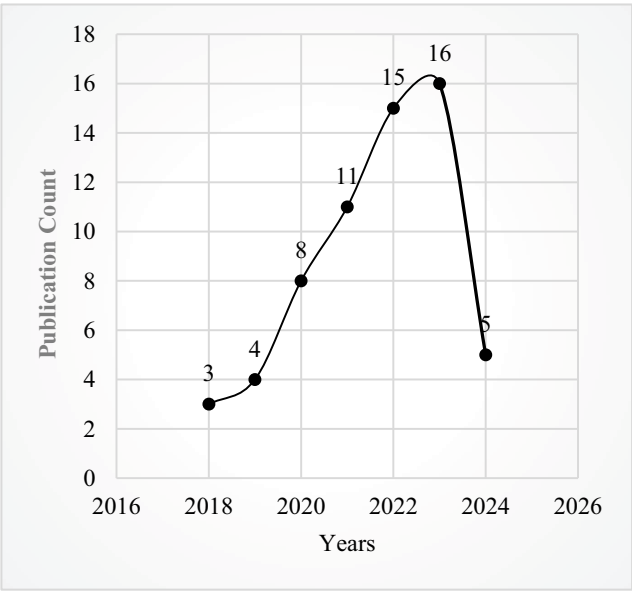


Figure 2. Publication count
Source(s): Authors’ own work

this research suggests a maturing approach to both understanding and regulating these digital assets.

A key study on Bitcoin's role in investment portfolios, "Can Bitcoin be a diversifier, hedge, or safe haven tool?" by [Stensås *et al.* \(2019\)](#), is the most cited article on Scopus as of April 1, 2024, with 83 citations (see [Table 1](#)). This highlights strong interest in understanding Bitcoin's investment potential. However, while the study emphasizes Bitcoin's potential as a diversifier, the broader literature presents contradictions, with some scholars questioning its effectiveness in times of market stress (e.g. [Baur *et al.*, 2018](#)). Opinions on cryptocurrency regulation are divided. Proponents of stricter rules argue it's essential to reduce risks like fraud and manipulation, protect investors and ensure market stability. On the other hand, those who favour lighter regulation believe it encourages innovation and avoids hindering this young industry. Despite these differing opinions, experts generally agree that increased regulation is coming, aiming to address security concerns, investor protection, and overall stability in the cryptocurrency market ([Hutson *et al.*, 2023](#); [Mavilia and Pisani, 2020](#); [Walton and Johnston, 2018](#)). A crucial gap in the existing literature is the interaction between blockchain vulnerabilities and the adoption of FinTech. While blockchain's decentralized and transparent nature is often highlighted as a strength, these same characteristics may exacerbate FinTech adoption risks, such as security and scalability issues, which remain underexplored in the context of regulatory discussions.

The article with the highest average annual citations by [Garanina *et al.* \(2022\)](#), boasting an impressive citation count of 26 (see [Table 2](#)). This research likely attracts significant attention due to its exploration of blockchain technology's impact on accounting, a field increasingly influenced by digital innovations ([Mavilia and Pisani, 2020](#)). However, while

Table 1. The ten articles with the most citations on Scopus as of 1 April 2024

#	Reference	Article	# Citation
1	Stensås <i>et al.</i> (2019)	Can bitcoin be a diversifier, hedge or safe haven tool?	83
2	Walton and Johnston (2018)	Exploring perceptions of bitcoin adoption: the South African virtual community perspective	67
3	Sladić <i>et al.</i> (2021)	A blockchain solution for securing real property transactions: a case study for Serbia	65
4	Mavilia and Pisani (2020)	Blockchain and catching-up in developing countries: the case of financial inclusion in Africa	64
5	Rijanto (2021)	Business financing and blockchain technology adoption in agroindustry	54
6	Garanina <i>et al.</i> (2022)	Blockchain in accounting research: current trends and emerging topics	52
7	Jeribi and Ghorbel (2021)	Forecasting developed and BRICS stock markets with cryptocurrencies and gold: generalized orthogonal generalized autoregressive conditional heteroskedasticity and generalized autoregressive score analysis	49
8	Alonso Náñez <i>et al.</i> (2021)	Cryptocurrency mining from an economic and environmental perspective. Analysis of the most and least sustainable countries	47
9	Alnafrah and Mouselli (2021)	Revitalizing blockchain technology potentials for smooth academic records management and verification in low-income countries	45
10	Rodima-Taylor and Grimes (2019)	Virtualizing diaspora: new digital technologies in the emerging transnational space	42

Source(s): Authors' own work

Table 2. The ten articles with the most citations annually (CY) as of 1 April 2024

#	Reference	Article	# Citation
1	Garanina et al. (2022)	Blockchain in accounting research: current trends and emerging topics	26
2	Sladić et al. (2021)	A blockchain solution for securing real property transactions: a case study for Serbia	21.67
3	Rijanto (2021)	Business financing and blockchain technology adoption in agroindustry	18
4	Stensås et al. (2019)	Can bitcoin be a diversifier, hedge or safe haven tool?	16.6
5	Jeribi and Ghorbel (2021)	Forecasting developed and BRICS stock markets with cryptocurrencies and gold: generalized orthogonal generalized autoregressive conditional heteroskedasticity and generalized autoregressive score analysis	16.33
6	Mavilia and Pisani (2020)	Blockchain and catching-up in developing countries: the case of financial inclusion in Africa	16
7	Alonso Nández et al. (2021)	Cryptocurrency mining from an economic and environmental perspective. Analysis of the most and least sustainable countries	15.67
8	Alnafrah and Mouselli (2021)	Revitalizing blockchain technology potentials for smooth academic records management and verification in low-income countries	15
9	Walton and Johnston (2018)	Exploring perceptions of bitcoin adoption: the South African virtual community perspective	11.17
10	Rodima-Taylor and Grimes (2019)	Virtualizing diaspora: New digital technologies in the emerging transnational space	8.4

Source(s): Authors' own work

[Garanina et al. \(2022\)](#) focus on blockchain's potential to enhance accounting transparency and security, other studies argue that the technology's vulnerabilities – such as susceptibility to cyberattacks and scalability issues – may hinder its widespread adoption in critical sectors like accounting ([Böhme et al., 2015](#)). The growing prominence of cryptocurrencies and blockchain in financial sectors, including accounting, has led to a surge in interest regarding their implications and the need for regulatory frameworks ([Walton and Johnston, 2018](#)). This surge points to an unresolved gap: while blockchain is lauded for its security features, concerns persist about its ability to address vulnerabilities within the regulatory space, particularly as FinTech adoption accelerates. Therefore, the article's comprehensive analysis of blockchain's role in accounting, along with its relevance to evolving cryptocurrency regulations ([Alonso Nández et al., 2021](#)), likely contributes to its high citation rate. The relationship between blockchain vulnerabilities and FinTech adoption, particularly how regulatory measures could mitigate these vulnerabilities, requires further exploration in the existing literature.

3.3 Authors and journals

[Table 3](#) shows the top 10 authors in the field according to their citation rates per year. This analysis considers the number of articles published, total citations received and average citation points per author. For 2023, [Agarwal et al. \(2023\)](#) and [Pandey \(2024\)](#) are particularly noteworthy. Each published two articles, with Agarwal et al. receiving two citations and Pandey achieving 3.5 citations per article. However, despite publishing fewer articles,

Table 3. Top ten authors who have received the highest rate

#	Author	Year	# Article	# Citation	Citation points
1	Agarwal A	2023	2	2	1
2	Pandey Kn	2024	2	2	3.5
3	Rodima-Taylor D	2019	1	20	1
4	Alagidede Ip	2020	1	13	0
5	Omane-Adjepong M	2020	1	13	4.5
6	Omane-Adjepong M	2021	1	13	2.6
7	Aldanmaz O	2022	1	11	3.667
8	Al-Adaileh R	2023	1	9	2.6
9	Adel Hm	2023	1	7	3.25
10	Rodima-Taylor D	2021	1	6	1

Source(s): Authors' own work

Pandey's work seems to have gained more traction in the academic community compared to Agarwal *et al.*, which suggests a potential gap in understanding the factors influencing citation rates beyond just article volume. On the other hand, Rodima-Taylor and Grimes (2019) have garnered a remarkable 20 citations for a single article they published in 2019, which stands out. This highlights a potential contradiction: while more frequent publishing may increase citations, the impact of individual papers also seems to depend heavily on their thematic relevance and timing, particularly in fields like cryptocurrency and blockchain (Walton and Johnston, 2018). Alagidede and Omrane-Adjepong (with several co-authored works) are also prominent, with 13 citations each (Omane-Adjepong and Alagidede, 2020; Omrane-Adjepong *et al.*, 2021). These statistics collectively illuminate the scholarly impact of various researchers in the field, highlighting their contributions and the average reception of their work within academia. The findings underscore the importance of thematic clusters – particularly the relationship between blockchain vulnerabilities and FinTech adoption – as crucial areas for future exploration. While some authors' works focus heavily on one aspect (such as blockchain's potential in accounting), others, like Pandey (2024), seem to take a broader, more innovative approach that could help address unresolved gaps in the current literature.

Table 4 highlights the ten most-cited journals in cryptocurrency regulation research. This analysis takes into account citation counts, the number of articles published in each journal, the average normalized impact per article and SJR rankings. Interestingly, Cogent Economics and Finance and Sustainability (Switzerland) take the top spot with three citations each. However, it is important to note that these journals also have a higher number of articles published: 97 and 48, respectively. This raises an important question about whether the volume of publications within these journals has led to an inflated citation count, or if the content is simply more relevant and aligned with current trends in cryptocurrency regulation. Their average normalized impact per article (ANG) values are also significant, at 32.3 and 16.0. These high ANG values suggest that, despite the larger number of publications, the individual articles in these journals may have had a considerable impact on the field, likely contributing to ongoing regulatory debates (Mavilia and Pisani, 2020). The *International Journal of Emerging Markets* comes in close behind with two citations and 30 articles (Jeribi and Ghorbel, 2021). While this journal shows a relatively lower citation count, the focus on emerging markets and cryptocurrency regulation in developing economies is an underexplored area in the broader literature, indicating potential gaps in research that warrant further investigation. These findings show that various disciplines,

Table 4. The ten most cited journals

Sources	# Article	# Citation	Average norm. impact	SJR ranking
<i>Cogent Economics and Finance</i>	3	97	32.3	Q3
<i>Sustainability</i>	3	48	16.0	Q2
<i>International Journal of Emerging Markets</i>	2	30	15.0	Q3
<i>African Journal of Science, Technology, Innovation and Development</i>	1	30	30.0	Q2
<i>Accounting, Auditing and Accountability Journal</i>	1	26	26.0	Q1
<i>Asia-Pacific Financial Markets</i>	1	13	13.0	Q3
<i>Data and Knowledge Engineering</i>	1	11	11.0	Q2
<i>Economics – Innovative and Economics Research Journal</i>	1	11	11.0	Q3
<i>Banks and Bank Systems</i>	1	8	8.0	Q3
<i>Development Studies Research</i>	1	6	6.0	Q2
Source(s): Authors’ own work				

including economics, finance and sustainability, publish valuable insights into cryptocurrency regulation research. However, an unresolved gap emerges in how these thematic clusters – such as blockchain vulnerabilities, FinTech adoption and regulatory concerns – interact within different contexts. It appears that while some journals emphasize the regulatory and economic aspects, others focus on the technological innovations of blockchain, suggesting differing research priorities and areas that could benefit from deeper exploration and integration.

3.4 Developed and developing countries

In the field of cryptocurrency regulation, research output appears to be higher in developed countries like Norway, Italy and the USA, as evidenced by the number of citations and articles published (see Table 5). This trend aligns with previous studies that highlight the greater availability of resources and institutional support in developed nations, enabling a more robust research environment (Walton and Johnston, 2018). This contrasts with developing nations such as South Africa, Serbia, Indonesia and Tunisia. However, the disparity in output between these regions points to the significant challenges developing economies face, including limited access to data and regulatory uncertainty (Jeribi and Ghorbel, 2021). However, there are signs of a growing discourse in developing economies. For instance, Jeribi and Ghorbel (2021) investigate the use of cryptocurrencies and gold for stock market forecasting in both developed and developing economies, including BRICS nations, emphasizing the necessity of regulatory frameworks in diverse economic contexts. This study not only highlights the necessity of regulation but also underscores the need to tailor these frameworks to the unique economic and technological conditions found in emerging markets. Similarly, Festa et al. (2022) examine the influence of FinTech ecosystems on entrepreneurial intentions in Tunisia, showcasing research interest in developing countries. While the growing focus on FinTech adoption in developing countries is promising, it also raises questions about the interplay between blockchain vulnerabilities

Table 5. Developed and developing countries of the most cited authors

Developed countries				Developing countries			
Country	# Citation	# Article	Average norm. impact	Country	# Citation	# Article	Average norm. impact
Norway	83	3	27.67	South Africa	66	13	5.08
Italy	49	6	8.17	Serbia	37	5	7.4
USA	33	12	2.75	Indonesia	28	4	7
United Arab Emirates	30	3	10	Tunisia	23	3	7.67
Finland	26	2	13	Lebanon	16	5	3.2
Spain	22	3	7.33	Tanzania	13	1	13
Ireland	16	1	16	Pakistan	10	2	5
New Zealand	12	1	12	Russia	9	1	9
Netherlands	6	1	6	Egypt	7	2	3.5
Austria	2	3	0.67	India	7	1	7
Japan	1	1	1	Mexico	6	1	6

Source(s): Authors' own work

and FinTech adoption, which remains an underexplored area. The interaction between these two factors is crucial in understanding how FinTech can be both a driver of innovation and a source of regulatory risk. The observed difference in research output likely reflects the varying stages of regulatory maturity and economic development between developed and developing countries (Mavilia and Pisani, 2020). This discrepancy suggests the need for a more unified global approach to cryptocurrency regulation, especially as the vulnerabilities inherent in blockchain technology are compounded by the challenges of FinTech adoption in less mature markets.

3.5 Keyword co-occurrence analysis

Figure 3 presents a network map summarizing the results of a keyword co-occurrence analysis, as explained by Lamboglia *et al.* (2021). This visualization provides valuable insights into the most frequently occurring keywords within cryptocurrency regulation research, highlighting the major themes and their interconnections. The circles represent keywords, with connecting lines indicating how often these keywords appear together in the analysed research. The thicker lines between keywords suggest stronger thematic relationships, underscoring the close connection between certain areas of study, such as blockchain vulnerabilities and FinTech adoption. The size of each circle reflects the keyword's importance, with larger circles signifying more frequent occurrences (methodology by Aria and Cuccurullo, 2017). This approach helps pinpoint central concepts in the field, with larger circles likely representing topics that have seen more attention in recent research. The thickness of the lines corresponds to the strength of the relationship between keywords, based on their frequency of co-occurrence. Interestingly, the map reveals key areas where blockchain vulnerabilities intersect with FinTech adoption, which could point to an unresolved gap in the literature. While these areas are frequently mentioned together, the interactions between them have not been fully explored in depth. In addition, the positioning of the circles indicates their thematic affinity. Keywords that are closer together suggest a higher degree of relatedness (Aria and Cuccurullo, 2017; Lamboglia *et al.*, 2021). This positioning further reveals clusters of interconnected research, shedding light on which aspects of cryptocurrency regulation, such as security concerns or investor protection, are closely linked to FinTech developments. Finally, nodes with the same colour belong to

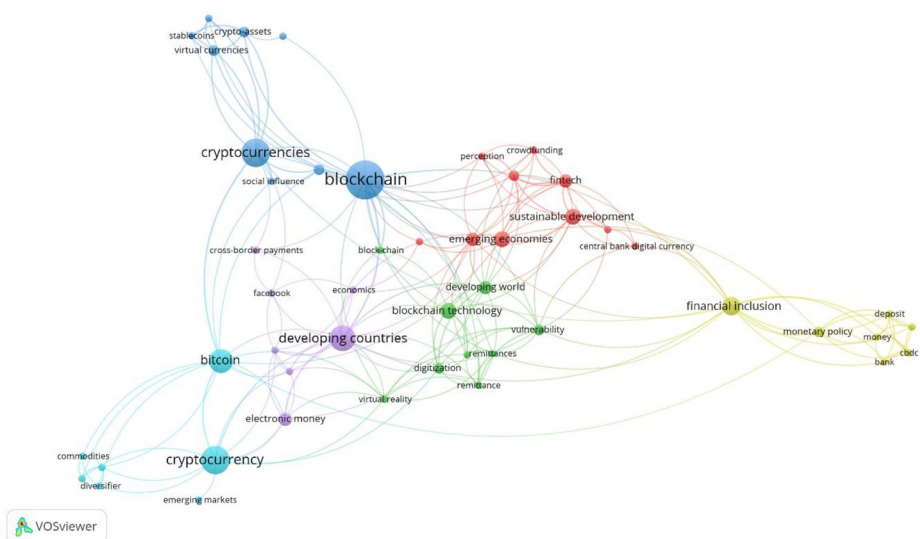


Figure 3. Co-occurrence network map for keyword analysis. Bibliographic information is extracted from the Scopus data set
Source(s): Visualization generated with VOSviewer using bibliographic information from the Scopus data set

the same thematic cluster, visually highlighting interconnected areas of valuable research within the field. The clustering highlights the need for further investigation into how different aspects of blockchain and FinTech, particularly in developing economies, interact and influence regulatory strategies.

We created a co-occurrence network map to visualize the relationships between frequently occurring keywords in the research, building on the methodology of Lamboglia *et al.* (2021). To improve clarity, the map excludes isolated nodes (keywords with no connections to others). This filtering resulted in a network map with 49 keywords, organized into six distinct thematic clusters.

Using keywords to make attractive titles is important for getting people to notice key areas of focus and capturing the main ideas and goals of research clusters. A well-crafted title should convey the essence of the research, its scope and its potential implications. For instance, the “Navigating Financial Frontiers” title for the Red Cluster effectively reflects the exploration of crowdfunding, FinTech and their role in sustainable development. Similarly, the Green Cluster’s title, “Examining Blockchain Vulnerabilities in a Digital World: A Global Perspective”, emphasizes the critical examination of blockchain’s vulnerabilities within a rapidly digitizing global context. All clusters employ this method: “Cryptocurrencies and Beyond: Unleashing Blockchain’s Potential” discusses broader applications of the technology, “Banking Evolution: Central Bank Digital Currencies (CBDCs), Monetary Policy, and Financial Inclusion” explores the evolution of banking, and “Economic Forecasting in Developing Countries: The Role of Cross-Border Payments and Electronic Money” explores innovative approaches to economic forecasting. By using clear and concise language that reflects the research focus, these titles effectively serve as concise summaries of each cluster’s key themes and objectives.

3.6 Trend topics analysis

Figure 4 presents the results of the trend topic analysis. This analysis identifies the evolving focus of academic research within the cryptocurrency regulation field, specifically examining keywords that appear at least five times (twice annually) between 2018 and 2024, with a maximum of three keywords considered per year. The methodology draws inspiration from similar approaches employed by Alqudah *et al.* (2023) and AlShanti *et al.* (2024). This technique allows for tracking shifts in scholarly attention over time, highlighting the most consistent and relevant themes. The figure uses a scatter plot to depict the top seven relevant keywords identified during this period. Each bubble represents a specific topic, with its size reflecting the keyword's frequency of occurrence. Notably, larger bubbles indicate topics that have experienced a significant surge in interest, suggesting their growing importance in both theoretical and practical discussions. The grey bar signifies the first and third quartiles of the distribution. Larger bubbles indicate keywords that appear more frequently, while longer bars suggest topics that have been of scholarly interest for a longer duration. This method emphasizes the sustained engagement with specific topics, such as blockchain vulnerabilities and FinTech adoption, over multiple years. Aria and Cuccurullo's (2017) methodology is in line with this approach.

An analysis of hot topics within the Scopus data set reveals interesting trends in academic research focus over the years (2018–2024). In 2018 and 2019, virtual reality and diaspora studies were notable areas of interest, which, although emerging, were not directly linked to the core themes of cryptocurrency regulation. This highlights a disconnect between early research trends and the growing importance of blockchain-related topics in later years. Vulnerability and banking gained momentum in 2020, with three publications on vulnerability and two on banking. These topics, particularly vulnerability, align with growing concerns about blockchain security and the need for robust regulatory frameworks to protect against potential threats in financial markets. These topics maintained relevance through 2022. This sustained attention suggests that vulnerability, particularly in the context of blockchain's security challenges, continues to be a critical area of concern, which aligns with the expanding research on blockchain's role in FinTech adoption. Developing countries

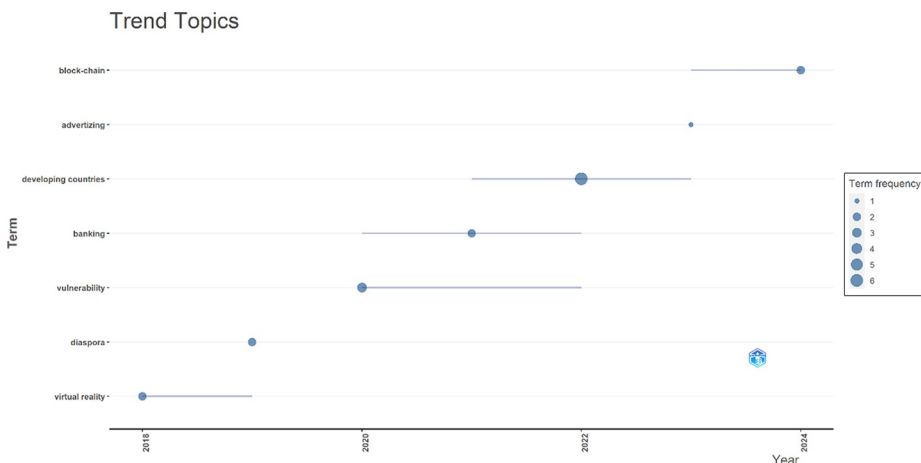


Figure 4. Analysis of hot topics bibliographic data obtained from the Scopus data set

Source(s): Visualization generated with VOSviewer using bibliographic information from the Scopus data set

became a key research subject from 2021 to 2023, with six notable publications highlighting sustained scholarly interest. The increasing focus on developing countries could point to a gap in understanding how these economies are adapting to blockchain and cryptocurrency innovations, particularly regarding regulation and market adoption. In 2023, a single publication mentioned advertising, and in 2024, two publications continued to explore blockchain, indicating a growing focus on this technology within academic discourse. This shift towards blockchain-centric research reflects its increasing integration into FinTech ecosystems and its expanding influence across diverse industries. However, unresolved gaps remain in understanding the full implications of blockchain vulnerabilities and the intersection of these vulnerabilities with FinTech adoption in both developed and developing countries.

4. Discussion and emerging research directions

This section, based on the results of the common keyword and trend topic analyses, looks at the most important findings from reading the most important papers in each of the thematic clusters found in the keyword analysis (see [Figure 3](#)). We formed these thematic clusters by linking the frequently appearing keywords together. By drawing on evidence from both the trend topic analysis and a content analysis of the most relevant contributions within each cluster, we can identify emerging research trends and potential opportunities for future studies. This approach allows us to not only understand the current state of research within each thematic area but also pinpoint promising avenues for further exploration.

[Table 6](#) provides a summary of the primary keywords, pertinent articles and future research inquiries derived from emerging research directions within each cluster.

In our research, we used a co-occurrence network map in [Figure 2](#) to visually represent the relationships between frequently occurring keywords. Inspired by this technique, our network map revealed six distinct thematic clusters. Each cluster represents a key area of research focus. These clusters are as follows:

4.1 Red cluster: “navigating financial frontiers: crowdfunding, FinTech and sustainable development”

The Red Cluster investigates the intersection of crowdfunding, FinTech and sustainable development within the financial landscape. This topic is particularly timely due to the rapid growth of the crowdfunding and FinTech markets, which are projected to reach trillions in value over the next few years, creating both significant opportunities and challenges. This cluster encompasses research on various topics, including cryptocurrency regulation, blockchain technology adoption and the implications of financial innovations for sustainable development ([Marmora, 2022](#)). Cryptocurrency regulation emerges as a central theme within this cluster, particularly due to its importance for crowdfunding platforms that often leverage cryptocurrencies or blockchain technology. The significance of regulation lies in its ability to ensure investor protection and compliance with laws governing fundraising activities, thereby fostering trust and confidence in crowdfunding platforms ([El Maknoui and Sadok, 2021](#); [Andreyanovich, 2022](#)). However, while regulatory measures can enhance market integrity, there remains debate over their potential to hinder innovation, which necessitates a deeper exploration of this complex balance. By analysing both trending topics and content analysis from the cluster, researchers can identify emerging trends and opportunities for further study ([Stensås et al., 2019](#); [Bag et al., 2023](#)). This exploration is critical for understanding how regulations can be shaped to support innovation while maintaining investor protection.

Table 6. Overview of research clusters

Cluster	Key keywords	Most important articles	Future research opportunities and emerging research directions
Red cluster	Crowdfunding, Fintech, sustainable development	“Navigating financial frontiers: crowdfunding, FinTech, and sustainable development” (El Maknouzi and Sadok, 2021)	1. Explore the integration of AI and machine learning in crowdfunding platforms for more efficient project evaluation and risk assessment. 2. Investigate the role of decentralized finance (DeFi) in enhancing financial inclusivity and sustainability through crowdfunding initiatives. 3. Examine the impact of crowdfunding on specific Sustainable Development Goals (SDGs) and identify strategies to maximize its contribution to global sustainability efforts
Green cluster	Blockchain vulnerability, cybersecurity, regulatory challenges	“Blockchain vulnerability in a digitized world: global perspectives” (Rijanto, 2021)	1. Develop frameworks for assessing the environmental footprint of blockchain technologies and formulating sustainable practices for cryptocurrency mining. 2. Investigate the use of advanced encryption techniques and consensus mechanisms to enhance blockchain security and resilience against cyber threats. 3. Explore the role of regulatory sandboxes in fostering innovation while ensuring compliance with cybersecurity standards and data privacy regulations
Blue cluster	Cryptocurrencies, blockchain, sustainable development	“Cryptocurrencies and beyond: unleashing blockchain’s potential” (Sladić <i>et al.</i> , 2021)	1. Examine the potential of tokenization and asset-backed cryptocurrencies in unlocking new sources of capital for sustainable development projects. 2. Investigate the impact of decentralized finance (DeFi) protocols on financial intermediation and access to capital in underserved regions. 3. Analyse the role of blockchain-based identity systems in enhancing financial inclusion and empowering marginalized communities
Yellow cluster	CBDCs, monetary policy, financial inclusion	“Banking evolution: CBDCs, monetary policy, and financial inclusion” (Sun and Li, 2024)	1. Explore the use of smart contracts and programmable money in CBDC ecosystems to automate compliance with regulatory requirements and enhance transparency. 2. Investigate the interoperability of CBDCs with other digital payment systems and cross-border remittance platforms to facilitate seamless international transactions. 3. Analyse the potential socio-economic impacts of CBDC adoption on income inequality, wealth distribution, and access to financial services in developing economies

(continued)

Table 6. Continued

Cluster	Key keywords	Most important articles	Future research opportunities and emerging research directions
Purple cluster	Economic forecasting, cross-border payments, e-money	“Economic forecasting in a developing countries: cross-border payments and electronic money” (Mhlanga, 2023)	1. Develop predictive models for cross-border payment flows using blockchain analytics and machine learning techniques to improve economic forecasting accuracy. 2. Investigate the role of central bank digital currencies (CBDCs) in promoting financial inclusion and reducing the cost of remittances for migrant workers in developing countries. 3. Analyse the impact of regulatory sandboxes on fostering innovation in electronic money systems and promoting responsible financial services in emerging markets
Light blue cluster	Bitcoin, diversification, emerging markets	“Bitcoin and Diversification: hedge strategies for emerging markets” (Stensås et al., 2019)	1. Explore the use of decentralized finance (DeFi) platforms for asset tokenization and fractional ownership to democratize access to investment opportunities in emerging markets. 2. Investigate the adoption of blockchain-based supply chain solutions in emerging markets to enhance transparency, traceability, and sustainability in global trade networks. 3. Analyse the socio-economic implications of cryptocurrency adoption for financial inclusion, economic development, and poverty alleviation in emerging market economies
Source(s): Authors’ own work			

The literature within the Red Cluster also explores the adoption of blockchain technology and its implications for sustainable development, particularly in developing countries (Mbaidin *et al.*, 2023). This adoption presents both challenges and opportunities, especially within the banking sector, where blockchain could promote financial inclusion and advance sustainable development goals globally. Real-world case studies, such as those from Kenya, demonstrate how blockchain can improve access to financial services, even in rural and underserved areas, showing how it could bridge the gap in financial inclusion (Bayram *et al.*, 2022). Moreover, studies within this cluster investigate how FinTech can drive sustainable finance and address socio-economic challenges (Bayram *et al.*, 2022). For example, in Turkey, policy lessons highlight how FinTech innovations are contributing to sustainable development, particularly by improving access to capital for underrepresented groups. These cases show that FinTech could provide a practical solution to improving economic resilience and sustainability.

Furthermore, research within the Red Cluster investigates the impact of crowdfunding platforms on sustainable development in developing countries (Rizwan and Mustafa, 2022). Crowdfunding has been identified as an important tool for facilitating access to finance, especially for small businesses and entrepreneurs who face challenges in obtaining traditional financing. This is especially pertinent in economies like India, where crowdfunding has been used successfully to promote local sustainable projects. This highlights how crowdfunding can foster economic growth and alleviate poverty, but also underlines the need for regulatory frameworks that balance innovation and risk management. The adoption of cryptocurrencies for financial transactions in high-risk contexts is another area explored, particularly its implications for sustainable development (Dabbous *et al.*, 2022). Cryptocurrency adoption could reshape financial systems in developing economies, offering new opportunities but also posing risks related to volatility, security and lack of infrastructure. The debate continues on whether cryptocurrencies could exacerbate economic inequality by providing benefits primarily to those with access to advanced technologies, or whether they could democratize financial services and foster greater economic equity.

The research also examines the societal impacts of cryptocurrency adoption, including its potential effects on economic inequality, privacy concerns and environmental sustainability. While cryptocurrencies have been lauded for their potential to enable financial inclusion, they also raise concerns about privacy violations, as blockchain transactions are often pseudonymous but traceable. Moreover, the environmental impact of cryptocurrency mining, particularly in relation to energy consumption, has sparked significant debate. Researchers are increasingly exploring how blockchain's environmental footprint can be mitigated, especially as the technology is integrated into FinTech applications (Ehret and Olaniyan, 2023).

Studies within this cluster also look at how blockchain adoption interacts with FinTech in developing economies, especially considering the vulnerabilities inherent in blockchain technology. For example, the security risks associated with blockchain, such as vulnerability to hacks and fraud, must be addressed to ensure FinTech solutions remain sustainable. Understanding the relationship between these vulnerabilities and FinTech adoption is crucial, as it can guide the design of robust regulatory frameworks that ensure the secure integration of blockchain technology into financial systems. This connection between blockchain vulnerabilities and FinTech adoption is essential for ensuring both security and innovation coexist in financial ecosystems.

Overall, the research in the Red Cluster emphasizes the importance of robust regulatory frameworks, innovative technologies and long-term financial strategies to promote financial inclusion, equity, and sustainability. By advancing knowledge in this critical area,

researchers can contribute to the design and implementation of policies that foster a more inclusive, innovative and sustainable global economy, addressing not only financial growth but also the wider societal and environmental impacts.

4.2 Green cluster: “blockchain vulnerability in a digitized world: global perspectives”

The Green Cluster investigates the potential weaknesses and security risks surrounding blockchain technology in our rapidly digitizing world (Papadaki and Karamitsos, 2021). This topic is especially relevant as the blockchain market continues to grow, with investments in the sector expected to surpass hundreds of billions by the end of the decade. This cluster explores various aspects, such as cybersecurity threats, regulatory challenges, and the implications of adopting blockchain technology across different sectors (Volosovych and Baraniuk, 2018). A central theme within this cluster is cryptocurrency regulation, which directly addresses the vulnerabilities and risks associated with blockchain technology. Regulatory bodies are particularly concerned with security breaches, fraudulent activity and ensuring compliance with data protection laws – critical measures in safeguarding financial stability and consumer protection. By analysing both trending topics and a content analysis of key contributions in this cluster, researchers can identify emerging research trends and potential opportunities for future studies (Stensås *et al.*, 2019; Bag *et al.*, 2023). This approach facilitates a deeper understanding of the current research landscape, helping researchers pinpoint promising areas for future exploration. These include developing more robust blockchain security protocols, creating comprehensive regulatory frameworks and exploring blockchain’s application in diverse sectors like healthcare and supply chain management. Moreover, this research can shed light on the socio-economic impacts of blockchain adoption on developing economies.

The literature within this cluster underscores the need for strong regulatory frameworks to address blockchain technology’s vulnerabilities (Rijanto, 2021). Researchers examine how regulatory interventions can mitigate risks like money laundering, terrorist financing and illicit activities facilitated by cryptocurrencies. For example, in countries like Nigeria, where cryptocurrencies are becoming increasingly popular, regulatory measures are crucial to prevent financial crimes while enabling innovation. Furthermore, studies explore the economic and environmental implications of cryptocurrency mining (Alonso Nández *et al.*, 2021). Cryptocurrency mining is energy-intensive, raising concerns about its environmental impact, especially in countries like China and Kazakhstan, where large-scale mining operations are causing significant carbon emissions. Researchers assess the sustainability of cryptocurrency mining globally and examine the environmental impact of these operations (Campbell-Verduyn *et al.*, 2021). One key finding suggests that transitioning to renewable energy sources could alleviate some of these concerns, demonstrating the potential for more sustainable mining practices.

In addition, this cluster covers research on blockchain adoption in various sectors, including finance, supply chain management and governance (Mavilia and Pisani, 2020; Gillpatrick *et al.*, 2022). Scholars investigate the challenges blockchain faces, such as scalability issues and concerns around interoperability between different blockchain platforms. These challenges are particularly significant in developing economies, where limited technological infrastructure may hinder the implementation of blockchain solutions. For instance, in India, blockchain technology is being tested in the supply chain to improve traceability and reduce fraud, but scalability remains a significant barrier. The literature also examines the role of FinTech ecosystems in promoting blockchain adoption and addressing cybersecurity risks (Festa *et al.*, 2022; Rusakova and Inshakova, 2021). As FinTech grows, its collaboration with blockchain presents both opportunities and risks. Researchers explore

how FinTech innovations can enhance cybersecurity and mitigate threats posed by malicious actors in digital transactions. In Brazil, for instance, FinTech solutions integrated with blockchain are improving security in digital payments, offering a model for other emerging economies.

Moreover, studies within this cluster analyse the impact of blockchain technology on financial inclusion and sustainable development in developing countries (Mbaidin *et al.*, 2023; Niyitegeka and Zhou, 2023). Researchers assess the challenges and opportunities of blockchain adoption for promoting inclusive financial systems and advancing sustainable development goals globally (Baidoun *et al.*, 2023). For example, in Sub-Saharan Africa, blockchain is being used to facilitate financial inclusion by offering unbanked populations access to secure financial services. This is particularly relevant in regions where traditional banking infrastructure is limited. Blockchain-based solutions are enabling access to microloans and other financial services, directly contributing to poverty alleviation and economic empowerment. The research findings in this cluster show the importance of addressing blockchain's vulnerabilities by establishing strong regulations, enhancing safety measures and supporting sustainable development (Rawhouser *et al.*, 2024; Mhlanga, 2023). This highlights the need for policy interventions that balance innovation with security. By advancing knowledge in this critical area, researchers can contribute to the development of resilient and secure digital ecosystems, fostering trust, innovation and socio-economic progress worldwide. The integration of blockchain and FinTech has the potential to create a more inclusive financial system, but careful attention must be given to both its societal and environmental impacts.

4.3 Blue cluster: “cryptocurrencies and beyond: unleashing blockchain’s potential”

Cryptocurrency regulation plays a critical role in fostering innovation while maintaining the integrity of the market and protecting consumers (El Maknoui and Sadok, 2021). As the cryptocurrency market grows exponentially, understanding the legal and regulatory frameworks that govern these assets becomes crucial for mitigating risks and ensuring the stability of financial markets. By analysing both trending topics and a content analysis of the most relevant contributions in this cluster, researchers can identify emerging research trends and pinpoint promising opportunities for further studies (Stensås *et al.*, 2019; Bag *et al.*, 2023). This approach enables a deeper understanding of the current research state within each thematic area, ultimately revealing potential avenues for further exploration and innovation.

The research within this cluster highlights the transformative potential of blockchain technology across various sectors, including finance, supply chain management and governance (Sladić *et al.*, 2021; Rijanto, 2021). Blockchain solutions offer improved transparency, efficiency and trust in digital transactions, helping to address operational challenges faced by businesses and governments globally. This potential becomes increasingly significant as more organizations explore blockchain for solutions to longstanding operational inefficiencies. Studies within this cluster also examine the impact of blockchain adoption on economic development and financial inclusion in developing countries (Mavilia and Pisani, 2020; Gillpatrick *et al.*, 2022). In regions like Sub-Saharan Africa, blockchain-based solutions are being used to enhance access to banking services, address property rights issues and facilitate cross-border payments, helping bridge gaps in financial inclusion. Furthermore, this cluster encompasses research on the role of FinTech ecosystems in driving entrepreneurial intentions and sustainable finance (Festa *et al.*, 2022; Bayram *et al.*, 2022). In emerging economies, FinTech innovations, including blockchain

technology, are empowering individuals and businesses to access capital and pursue sustainable ventures, demonstrating blockchain's potential to foster economic growth.

The literature also explores the environmental and economic implications of cryptocurrency mining and blockchain technology (Alonso Nández *et al.*, 2021; Rusakova and Inshakova, 2021). Cryptocurrency mining operations are energy-intensive, raising concerns about their sustainability. Researchers are analysing the energy consumption of these operations and examining the potential for blockchain-based solutions to promote responsible practices and mitigate environmental impacts. For example, in countries like Iceland and Norway, where renewable energy is abundant, cryptocurrency mining operations are shifting toward more sustainable practices to reduce their carbon footprint. As the scrutiny over environmental sustainability intensifies, the integration of blockchain in these practices will play a critical role in shaping the future of cryptocurrency technologies. The research findings within this cluster underscore the transformative potential of blockchain in reshaping financial systems, enhancing transparency and fostering sustainable development (Mbaidin *et al.*, 2023; Niyitegeka and Zhou, 2023). By analysing emerging trends and identifying research gaps, scholars can contribute to advancing knowledge in this rapidly evolving field, driving positive social, economic and environmental outcomes. In practice, this could include blockchain's use in tracking carbon footprints in industries or facilitating the responsible sourcing of materials, helping businesses meet sustainability goals. In addition, as blockchain adoption grows, it is important to consider its impact on issues like economic inequality, privacy concerns and environmental sustainability. For example, while blockchain could provide financial inclusion in developing economies, it could also exacerbate privacy issues or lead to environmental degradation if not carefully managed.

4.4 Yellow cluster: “banking evolution: CBDCs, monetary policy and financial inclusion”

The Yellow Cluster dives into the evolving world of banking, with a particular focus on CBDCs, monetary policy and financial inclusion. As central banks around the world explore the implementation of CBDCs, the importance of regulation cannot be overstated. Regulation will be essential for managing potential risks and impacts on existing monetary systems. CBDCs, digital currencies issued by central banks, overlap with the realm of cryptocurrencies (Volosovych and Baraniuk, 2018). This overlap necessitates careful regulation to address the legal and regulatory framework surrounding their implementation and their interaction with other cryptocurrencies, ensuring that CBDCs do not undermine the stability of the existing financial system (Kochergin, 2020; Kochergin, 2022). A significant theme within this cluster is the exploration of CBDCs and their implications for monetary policy and financial inclusion (Sun and Li, 2024). Researchers are investigating how CBDCs could revolutionize traditional banking systems by enhancing payment efficiency and enabling access to financial services for underserved populations. For instance, the Bahamas' Sand Dollar is an example of a CBDC that aims to provide financial inclusion in underserved rural areas (Harkushenko, 2022). Such real-world case studies provide valuable insights into how CBDCs can be implemented in practice, particularly in developing economies where traditional banking infrastructure is lacking.

Drawing on evidence from both trending topics and a content analysis of relevant contributions within the cluster, researchers can identify emerging research trends and opportunities for future studies (Stensås *et al.*, 2019; Bag *et al.*, 2023). Given the potential for CBDCs to significantly impact global financial landscapes, understanding these trends is crucial for policymakers, financial institutions and regulators. This comprehensive approach facilitates a deeper understanding of the current state of research and highlights promising avenues for further exploration.

Furthermore, studies within this cluster examine the regulatory challenges and policy implications associated with the adoption of CBDCs (El Maknoui and Sadok, 2021). Scholars are analysing regulatory frameworks and governance mechanisms that ensure the stability, integrity and security of CBDC systems while addressing concerns related to privacy, cybersecurity and financial stability. In addition, there is growing interest in how CBDCs can influence monetary policy transmission mechanisms and overall financial stability (Chen and Siklos, 2023). Scholars are investigating how central banks can leverage CBDCs to implement monetary policy more effectively, manage liquidity and mitigate systemic risks associated with digital currency adoption. As an example, China's Digital Yuan, or e-CNY, is being studied for its potential to enhance the People's Bank of China's ability to monitor monetary conditions and control inflation.

In addition, research within this cluster explores the role of FinTech innovations, such as mobile payment systems and blockchain technology, in facilitating the adoption and integration of CBDCs into the broader financial ecosystem (Ehret and Olaniyan, 2023). Researchers are exploring how technological advancements can enhance the functionality, accessibility and interoperability of CBDCs. This would allow CBDCs to work seamlessly alongside other forms of digital payments, thereby promoting financial inclusion, especially in developing economies where access to banking is limited.

Furthermore, research within this cluster investigates the socio-economic implications of CBDC adoption for emerging markets and developing economies (Niyitegeka and Zhou, 2023). As many developing economies consider CBDCs to enhance financial stability and inclusion, understanding these socio-economic implications is crucial for their successful implementation. For example, CBDCs could help reduce transaction costs, improve access to financial services and promote cross-border remittances, which are essential for economic development in countries with large migrant populations (Kochergin, 2020; Kochergin, 2022). In practice, CBDCs can significantly reduce the cost and time associated with remittance transfers, benefiting both senders and recipients in emerging economies.

Overall, the research findings within this cluster underscore the transformative potential of CBDCs in reshaping the banking landscape, enhancing monetary policy effectiveness and promoting financial inclusion globally (Mhlanga, 2023; Balasubramanian *et al.*, 2023). By advancing their knowledge in this critical area, researchers can contribute to the design and implementation of policies and strategies that harness the power of digital currencies to promote sustainable and inclusive economic development. However, societal impacts must be considered, including issues such as economic inequality, privacy concerns and environmental sustainability. For instance, while CBDCs could reduce financial exclusion, they might also lead to concerns over privacy, as governments could potentially track every transaction. In addition, the environmental impact of the digital infrastructure required to support CBDCs, particularly energy consumption, must also be addressed.

4.5 Purple cluster: "economic forecasting in developing countries: cross-Border payments and electronic money"

The Purple Cluster explores the intersection of economic forecasting, cross-border payments, and electronic money in developing countries (Sommerhuber *et al.*, 2022). As cross-border payments grow in significance due to globalization and digitalization, understanding the regulations surrounding cryptocurrency use becomes increasingly crucial for maintaining secure and efficient transactions. A prominent theme within this cluster is cryptocurrency regulation as it pertains to cross-border payments and electronic money use. This highlights the importance of regulations governing cryptocurrency transfers across

borders, anti-money laundering measures and compliance with international financial standards.

Research within this cluster examines the regulatory landscape surrounding cryptocurrency adoption and its implications for cross-border transactions and electronic money systems (El Maknoui and Sadok, 2021). Scholars explore the role of regulations in ensuring the security, transparency, and integrity of digital financial transactions, particularly for developing countries striving to leverage the benefits of emerging financial technologies. For example, Kenya's M-Pesa system, which leverages mobile money platforms, demonstrates the potential for electronic money systems to drive financial inclusion, particularly in economies with limited banking infrastructure.

Moreover, studies within this cluster analyse the impact of cryptocurrency regulation on economic development, financial inclusion and cross-border trade (Mhlanga, 2023). As emerging markets navigate the complexities of cryptocurrency regulations, the balance between fostering innovation and ensuring security remains a critical area of research. Researchers investigate how regulatory frameworks can foster innovation, facilitate financial access and promote economic growth while mitigating the risks associated with illicit financial activities and regulatory arbitrage. For instance, the regulatory sandbox approach, seen in countries like Singapore, offers an environment where businesses can test cryptocurrency-based services in a controlled and regulated manner, allowing for innovation while managing risks.

Furthermore, research within this cluster explores the socio-economic implications of cryptocurrency adoption for developing countries, including its potential to enhance financial inclusion and promote economic empowerment (Ehret and Olaniyan, 2023). Scholars examine how digital payment systems and blockchain technology can enable greater access to financial services for unbanked and underserved populations (Sommerhuber *et al.*, 2022), thereby contributing to poverty alleviation and sustainable development. For example, the Philippines' efforts to integrate blockchain for remittances could drastically reduce the cost of sending money back home, which is a major issue for many migrant workers in the country. In addition, studies within this cluster investigate the role of FinTech innovations, such as mobile payment systems and blockchain technology, in facilitating cross-border payments and electronic money transfers (Balasubramanian *et al.*, 2023). Researchers explore how these technologies can improve the efficiency, affordability and accessibility of financial services, particularly in regions with limited banking infrastructure and high remittance costs. The use of blockchain for cross-border payments, like the Ripple network, is already lowering transaction fees and transaction times, benefiting developing nations that rely on remittances.

Moreover, research within this cluster investigates the challenges and opportunities associated with the adoption of cryptocurrency and blockchain technologies in the banking sector of developing countries (Mbaidin *et al.*, 2023). Scholars examine the potential benefits of blockchain adoption for sustainable development, financial inclusion and regulatory compliance while also addressing concerns related to cybersecurity, data privacy and compliance. In practical terms, blockchain could improve transparency in public spending, reduce corruption and ensure that aid reaches its intended recipients, as seen in various pilot programmes in countries like Kenya and Uganda. Overall, the research findings within this cluster underscore the importance of regulatory frameworks in shaping the future of cross-border payments and electronic money in developing countries (Narayanaswamy and Karthika, 2018). By advancing knowledge in this critical area, researchers can contribute to the design and implementation of policies and strategies that harness the potential of digital

financial technologies to promote inclusive and sustainable economic development in developing countries.

The societal impacts of cryptocurrency adoption must also be thoroughly examined. The adoption of cryptocurrencies could potentially exacerbate economic inequality if access to digital technologies is limited to wealthier populations, leaving the most vulnerable behind. Moreover, privacy concerns arise as the transparency of blockchain, while beneficial in some aspects, could expose personal financial details if not adequately secured. Environmental sustainability is another concern, as the energy-intensive process of cryptocurrency mining contributes significantly to carbon emissions. To mitigate these issues, sustainable blockchain solutions like Proof of Stake (PoS) could be prioritized over traditional Proof of Work (PoW) models.

Thematic clusters interact by examining the interconnectedness of cryptocurrency adoption, blockchain vulnerabilities and FinTech innovations. While FinTech solutions can improve financial access and efficiency, they are also vulnerable to cybersecurity risks, which could undermine the stability of digital financial systems. For example, vulnerabilities in blockchain networks, such as the 51% attack, could compromise the security of transactions and undermine the trust in digital currencies, highlighting the importance of robust regulatory measures and technological safeguards. By addressing these interconnected challenges, policymakers and researchers can better understand the broader implications of cryptocurrency adoption on global financial systems and society.

4.6 Light blue cluster: “bitcoin and diversification: hedge strategies for emerging markets”

The Light Blue Cluster investigates the role of Bitcoin and other cryptocurrencies as investment tools for diversification and risk mitigation in emerging markets (Volosovych and Baraniuk, 2018; Nalluri and Chen, 2024). With the increasing volatility of traditional markets and the rapid rise of cryptocurrency adoption, understanding the investment potential of cryptocurrencies in emerging markets is becoming increasingly relevant. This cluster’s key theme is the impact of cryptocurrency regulation on investment strategies and risk management practices in these economies (de Andrade *et al.*, 2021). Regulatory frameworks influence the adoption, trading and investment strategies involving cryptocurrencies, shaping their role as alternative assets for investors. Research within this cluster explores the potential of Bitcoin and other cryptocurrencies to function as diversifiers, hedges or safe havens in emerging markets (Stensås *et al.*, 2019). For example, studies on Bitcoin’s performance in countries like Argentina and Venezuela, where traditional currencies have faced severe devaluation, suggest that cryptocurrencies can act as a hedge against inflation and a store of value. Scholars study cryptocurrencies’ risk-return profiles and their effectiveness in mitigating portfolio risk (Nalluri and Chen, 2024). They analyse the dynamic relationship between cryptocurrencies and traditional assets, such as stocks and bonds, in emerging market contexts, highlighting the diversification benefits and risk management implications of incorporating cryptocurrencies into investment portfolios (Sommerhuber *et al.*, 2022). In markets such as Nigeria, where the local currency is prone to volatility, cryptocurrencies have been shown to provide investors with a way to mitigate risk while offering returns that are uncorrelated with traditional market movements.

Moreover, studies within this cluster analyse the impact of regulatory uncertainty on investor behavior and market dynamics in emerging markets (Walton and Johnston, 2018). As regulatory clarity improves, it may significantly influence investor confidence and the overall market landscape. For instance, regulatory shifts in India, where cryptocurrency regulations have fluctuated, directly impacted market liquidity and investor sentiment,

highlighting the importance of stable and clear regulatory environments. These studies shed light on the challenges and opportunities associated with cryptocurrency adoption and investment. Researchers investigate how regulatory developments and policy changes affect investor sentiment, market liquidity and price volatility in emerging cryptocurrency markets, influencing investment strategies and risk management practices. In countries like South Africa, regulatory clarity around cryptocurrency taxation and anti-money laundering measures has helped improve investor confidence, paving the way for greater institutional adoption.

Furthermore, research within this cluster explores the role of blockchain technology in enhancing financial inclusion and promoting sustainable development in emerging markets (Mavilia and Pisani, 2020). Scholars examine how blockchain-based solutions can improve access to financial services, facilitate cross-border payments and support economic growth and development in emerging economies, offering new opportunities for inclusive finance and poverty alleviation. For example, in Colombia, blockchain technology has been implemented to streamline remittance payments, reducing transaction costs and ensuring faster transfers for underserved communities. In addition, studies within this cluster examine the economic and environmental implications of cryptocurrency mining in emerging markets, highlighting the challenges and opportunities associated with cryptocurrency production and consumption (Alonso Náñez *et al.*, 2021). Researchers assess the environmental footprint of cryptocurrency mining activities and explore potential strategies for promoting sustainable mining practices in emerging market contexts, addressing concerns related to energy consumption, carbon emissions and resource depletion (Marmora, 2022). In regions like Kazakhstan, where a large portion of cryptocurrency mining takes place, there has been growing pressure to transition to renewable energy sources to mitigate the environmental impact.

Moreover, research within this cluster investigates the adoption and diffusion of blockchain technology in emerging market banking sectors (Rijanto, 2021). This research explores the potential of blockchain-based solutions to enhance financial services, improve operational efficiency and reduce transaction costs. Scholars investigate the factors that influence financial institutions' adoption of blockchain technology in emerging markets, identifying barriers to adoption and opportunities for innovation and growth (Marmora, 2022). In countries like Kenya, blockchain adoption in the banking sector is helping reduce transaction times and costs, benefiting customers in rural areas who previously faced significant barriers to financial access. Overall, the research findings within this cluster underscore the importance of regulatory frameworks, technological innovations and sustainable practices in shaping the role of Bitcoin and other cryptocurrencies as diversification and hedge tools in emerging markets (Omane-Adjepong and Alagidede, 2020; Arauz, 2021). By advancing knowledge in this critical area, researchers can contribute to the development of effective investment strategies, risk management practices and policy interventions. These interventions can harness the potential of cryptocurrencies to promote financial inclusion, economic development and sustainable growth in emerging markets.

The societal impacts of cryptocurrency adoption must also be thoroughly examined. The adoption of cryptocurrencies could exacerbate economic inequality, as access to digital technologies and knowledge of crypto markets remains limited in many developing economies. Privacy concerns also emerge as cryptocurrencies, while offering anonymity in some cases, are not entirely private, and the blockchain's transparency can potentially expose users to surveillance and identity theft risks. Environmental sustainability is another pressing issue, as the high energy consumption associated with cryptocurrency mining raises concerns about carbon emissions and resource depletion, particularly in countries with high

fossil fuel dependency. To address these concerns, many experts advocate for a shift to more energy-efficient consensus mechanisms like PoS as an alternative to the energy-intensive PoW model.

Thematic clusters interact by examining the interconnectedness of cryptocurrency adoption, blockchain vulnerabilities and FinTech innovations. While FinTech solutions can improve financial access and efficiency, they are also vulnerable to cybersecurity risks, which could undermine the stability of digital financial systems. For example, vulnerabilities in blockchain networks, such as the 51% attack, could compromise the security of transactions and undermine the trust in digital currencies, highlighting the importance of robust regulatory measures and technological safeguards. By addressing these interconnected challenges, policymakers and researchers can better understand the broader implications of cryptocurrency adoption on global financial systems and society.

5. Conclusions

This study breaks new ground in the field of cryptocurrency regulation by combining two powerful research methods. The first is a quantitative approach called bibliometric analysis, which uses statistical methods to analyse large data sets of scholarly publications. The second approach is a SLR, a qualitative method that carefully reviews and evaluates the relevant literature. Previous reviews in this area have typically relied on more traditional narrative methods or focused on specific niches within the broader cryptocurrency regulation landscape. This paper presents a unique contribution by offering a comprehensive and objective overview of the entire body of knowledge across various research streams within cryptocurrency regulation. This will serve as a valuable foundation for new researchers aiming to make fresh contributions to the field. To achieve this goal, the study established a robust research protocol based on best practices for SLRs. The study also used various bibliometric tools, such as VosViewer and Bibliometrix software, to perform analyses that map the field's performance and knowledge structure. We also conducted a manual content analysis of influential articles to supplement the bibliometric analysis. This allowed for a deeper discussion of key findings within each research cluster as well as the identification of potential gaps in current knowledge.

This study investigated the field of relevance within regulation in the cryptocurrency market by examining 62 journal articles published throughout the research period. The findings reveal a significant rise in research impact, with the number of articles published growing from just 3 in 2018 to 16 in 2023. A key turning point came in 2021, following the widespread adoption of cryptocurrency regulation by many countries. In addition, recent years have seen a growing emphasis on the importance of non-financial information in investor decision-making. The analysis reveals that a few top journals, including *Cogent Economics*, *Finance* and *Sustainability*, dominate the debate on relevance. Notably, *Cogent Economics* and *Finance* alone account for nearly a third of all citations, likely due to the contributions of influential scholars like Agarwal A, Pandey Kn and Rodima-Taylor D. This study's central contribution lies in identifying the six main thematic clusters that represent the primary knowledge pathways in value-relevant research. We identified these clusters through keyword analysis. (1) Red Cluster: "Navigating Financial Frontiers: Crowdfunding, FinTech, and Sustainable Development", (2) Green Cluster: "Blockchain Vulnerability in a Digitised World: Global Perspectives", (3) Blue Cluster: "Cryptocurrencies and Beyond: Unleashing Blockchain's Potential", (4) Yellow Cluster: "Banking Evolution: CBDCs, Monetary Policy, and Financial Inclusion", (5) Purple Cluster: "Economic Forecasting in Developing Countries: Cross-Border Payments and Electronic Money" and (6) Light Blue Cluster: "Bitcoin and Diversification: Hedge Strategies for Emerging Markets".

While there is a wealth of research on cryptocurrency regulation within the Red Cluster, a significant gap remains in our understanding of the specific regulatory hurdles faced by crowdfunding platforms that leverage cryptocurrencies or blockchain technology. Future research could investigate the intricacies of the regulatory frameworks governing these platforms, addressing issues such as investor protection, adherence to fundraising laws and fostering trust in crowdfunding mechanisms. Although cybersecurity threats and regulatory challenges in the Green Cluster have received considerable attention, research remains limited regarding the development of comprehensive frameworks for assessing and mitigating the environmental impacts of blockchain technology and cryptocurrency mining. Future studies could investigate sustainable mining practices, energy-efficient consensus mechanisms and the ecological footprint of blockchain networks. This research could offer valuable insights into mitigating blockchain's environmental footprint while promoting its advantages.

While the transformative potential of blockchain technology is a major focus within the Blue Cluster, a research gap exists regarding the socio-economic implications of blockchain adoption for marginalized communities and vulnerable populations in developing countries. Future research could explore how blockchain-based solutions can empower underserved groups, enhance financial inclusion and contribute to poverty alleviation and sustainable development in these regions. Real-world case studies, particularly in regions such as Sub-Saharan Africa or Southeast Asia, can offer concrete examples of blockchain's role in fostering economic empowerment and providing financial services to unbanked populations.

Despite the examination of CBDCs implications for monetary policy and financial inclusion within the Yellow Cluster, research remains limited regarding the cultural and behavioral factors influencing CBDC adoption and usage patterns in diverse socio-economic contexts. Future studies could explore consumer attitudes, trust perceptions and adoption barriers related to CBDCs. This research could provide insights into designing user-centric digital currency systems that cater to diverse societal needs and preferences.

While research exists on the regulatory landscape surrounding cryptocurrency adoption in developing countries within the Purple Cluster, a gap exists in understanding the socio-economic impacts of regulatory interventions on marginalized communities and informal economies. Future research could investigate how regulatory frameworks influence access to financial services, economic empowerment and social inclusion for vulnerable populations. This research could shed light on the potential unintended consequences of regulatory measures on the most disadvantaged groups. For example, a case study of regulatory impacts on the informal economy in Latin American countries could offer practical insights.

The Light Blue Cluster has explored Bitcoin and cryptocurrencies as investment tools in emerging markets, but research on the ethical and social implications of cryptocurrency mining activities on local communities and environments remains limited. Future studies could investigate community perceptions, environmental justice issues and regulatory responses to address the social and environmental externalities of cryptocurrency mining. This research could offer insights into promoting responsible mining practices and the equitable distribution of benefits in emerging market contexts.

This study offers practical insights for policymakers, regulators and industry stakeholders involved in cryptocurrency regulation. By identifying key thematic clusters and research gaps, stakeholders can prioritize areas for further investigation and policy development. For example, regulators can focus on refining frameworks for crowdfunding platforms and mitigating the environmental impacts of blockchain technology. Industry players, on the other hand, can leverage emerging trends such as CBDC adoption and sustainable mining practices to enhance compliance and innovation strategies, fostering a more robust

regulatory environment conducive to sustainable growth and innovation. Real-world applications, such as the implementation of CBDCs in countries like China and the Bahamas, provide useful case studies for regulators.

To expand upon this study, researchers could conduct empirical investigations to validate findings and explore specific regulatory challenges identified within each thematic cluster. Interdisciplinary collaborations among academics, practitioners, and policymakers could facilitate holistic approaches to addressing the multifaceted issues in cryptocurrency regulation. In addition, longitudinal studies tracking regulatory developments and their impacts on industry dynamics would provide valuable insights into the evolving landscape of cryptocurrency regulation, offering a more nuanced understanding of the regulatory challenges and opportunities.

Building on the identified research gaps, policymakers should prioritize initiatives aimed at enhancing regulatory clarity, fostering innovation and promoting sustainable practices in cryptocurrency regulation. Regulators need to engage in proactive dialogue with industry stakeholders to develop adaptive regulatory frameworks that balance innovation with investor protection and environmental sustainability. Regulators can help the cryptocurrency ecosystem stay legitimate and successful in the long run by creating an atmosphere that supports responsible innovation while also protecting consumers' rights and the economy. In developed countries, lawmakers should work on improving regulatory frameworks to keep up with changes in technology while also protecting consumers' interests and keeping the economy stable. Developing countries should prioritize capacity-building efforts to enhance regulatory enforcement and promote inclusive access to digital financial services. Collaboration between developed and developing countries could facilitate knowledge sharing and regulatory harmonization, thereby fostering global financial inclusion and innovation. By adopting an inclusive approach to cryptocurrency regulation, policymakers can harness the transformative potential of digital currencies to promote sustainable economic development and financial inclusion on a global scale.

To solve the complicated problems that come up in this changing field, new researchers who want to study how to regulate cryptocurrencies should use methods from different fields and build networks of people who can work together. Keeping up with new regulations and rising trends is crucial. Researchers can then find special areas to study, which helps to build on what is already known in a field that is changing quickly. In addition, forging partnerships with industry stakeholders and policymakers can enhance the relevance and impact of research findings, ultimately driving positive change in the cryptocurrency regulatory landscape.

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