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Research Article

Cryptocurrency Regulation Knowledge Map: A Global and Indonesian Bibliometric Analysis (2016–2025)

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Abstract: This study maps the regulatory landscape of financial technology (fintech), focusing on cryptocurrency regulation at both global and Indonesian levels. Cryptocurrency, one of the fastest-growing fintech instruments, functions as a virtual currency secured by cryptography. Despite lacking physical form, it is widely used for investment, transactions, and speculation, with trust supported by blockchain's transparency and immutability. However, regulatory frameworks remain fragmented across countries. The research applies a bibliometric approach, using Bibliometrix (R Studio) for descriptive analysis and VosViewer for keyword network visualization. Data were retrieved from Scopus with the keywords "cryptocurrency regulation" and "fintech regulation," covering 2016–2025. Findings reveal 1,178 documents from 484 sources, contributed by 4,693 authors, with an average of 7.43 authors per document and an international collaboration rate of 24.79%. The annual growth rate reaches 44.31%, with an average of 14.01 citations per document. Keyword analysis identifies four main clusters: financial regulation, green finance and sustainability, decentralized finance (DeFi), and blockchain cybersecurity. This study provides a knowledge map of regulatory evolution from conventional finance to blockchain-based fintech, offering insights for academics, regulators, and industry to balance innovation, consumer protection, and financial stability.

Keywords: Bibliometric Analysis; Blockchain; Crypto Currency Regulation; Fintech Regulation; VosViewer

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1. Introduction

Over the last ten years, blockchain has rapidly grown as a buzzword for new economic imaginaries among a range of disparate actors. These include the reactionary, cyberlibertarian right and "effective altruists' of Silicon Valley to more prosaic figures such as big city mayors, regional governors, national leaders, and international organisations. Paired with a discourse of innovation that associates it with Web 3.0, industry 4.0, or the Fourth Industrial Revolution, smart cities, artificial intelligence (AI), and the Internet of Things (iot), the technology has been envisaged, albeit quite speculatively, as a potential solution to a range of problems including urban and regional development. Consequently, there has been a global expansion of projects seeking to localise services and activities associated with it. These range from cryptocurrency mining, coin offerings and exchanges, to other financial, industrial, and administrative applications of digital ledger technology. In East and Southeast Asia, many of these initiatives make use of spatially selective(Doucette & Lee, 2025).

The development of cryptocurrencies, particularly Bitcoin, has brought innovations and challenges to the global economic order. While these digital assets offer opportunities for investment diversification and new financial access, they also raise a number of issues. One of the most highlighted negative impacts is the environmental aspect. Research shows that "Bitcoin mining requires significant energy and water consumption, negatively impacting environmental sustainability, especially in the upper quantile(Magdalena et al., 2025). This has led to criticism that Bitcoin is an environmentally unfriendly investment instrument. In addition, cryptocurrencies are often associated with illicit activities, especially money laundering. The pseudonymous nature of Bitcoin transactions allows criminals to disguise fund flows. As highlighted in a recent study, "Bitcoin's pseudonymity is used for illegal activities such as goods transport and banking transactions (Asiri & Somasundaram, 2025) This condition further emphasizes the urgency of strict regulation in the crypto sector to prevent misuse.

Amid these risks, public interest in cryptocurrency investment in Indonesia continues to rise. A recent survey noted that "the number of national crypto asset holders increased from 18.25 million in 2023 to 20.16 million in 2024, with more than half of investors under the age of 30(Chandra et al., 2025) This trend signals a generational shift in financial behavior, as younger Indonesians become increasingly engaged with digital assets. From a regulatory perspective, Indonesia remains in an adaptive phase. Bank Indonesia strictly prohibits the use of Bitcoin as a means of payment, while Bappebti recognizes it as a commodity that can be traded on futures exchanges. Legal scholarship notes that "the regulatory framework for crypto in Indonesia remains unclear, creating legal uncertainty for individuals and businesses (Arminanto & Firmansyah, 2022). When compared globally, there are clear variations in approach. The European Union, through mica, pursues a balance between transparency and privacy; Russia opts for centralized control; while the United States remains in the research phase. A comparative analysis underscores that "jurisdictions differ significantly in enforcement capacity, privacy protection, and governance transparency (Stern, 2025)

This systematic review aimed to identify the current trends to telemedicine adoption in the 2016 until 2025. Data sources: A systematic literature search using one database (Scopus) was performed to identify articles on barriers to cryptocurrency regulation adoption published until 2025. Additional studies were included through hand searching and reference list checking. Study selection was performed independently using pre-specified inclusion and exclusion criteria. This review aims to identify the current trending topics to cryptocurrency regulation adoption in the recent years especially in Indonesia.

The growing attention toward blockchain and cryptocurrency adoption cannot be separated from the broader dynamics of global digital transformation. Over the past decade, technological change has been increasingly tied to narratives of modernization and competitiveness. Governments and international organizations view blockchain as both an opportunity and a challenge: an opportunity to expand access to finance, increase efficiency, and foster innovation, but also a challenge due to its disruptive potential for monetary sovereignty, fiscal stability, and regulatory governance. For instance, while some countries actively promote the adoption of central bank digital currencies (cbdcs) as a state-controlled response to cryptocurrencies, others remain cautious, highlighting risks of financial instability and speculative bubbles.

In Indonesia, these tensions are even more pronounced. As an emerging economy with a large young population and rapid digital adoption, Indonesia is particularly fertile ground for cryptocurrency markets. The demographic profile—where younger generations are more tech-savvy and open to alternative investments—creates strong demand for digital financial instruments. Yet, this enthusiasm is not matched with a fully developed legal and regulatory framework. The dual position of the state—prohibiting cryptocurrencies as payment instruments while allowing them to be traded as commodities—creates a fragmented regulatory landscape. This has implications not only for investors but also for the broader economy, as regulatory ambiguity may affect trust, market stability, and international credibility.

Globally, the urgency of regulation is also reinforced by the interconnected nature of cryptocurrency markets. The volatility of Bitcoin and other digital assets, their potential role in cross-border capital flows, and their vulnerability to speculative shocks highlight the risks of insufficient governance. Moreover, environmental concerns linked to crypto mining add another layer of complexity, particularly in the context of global commitments to sustainability and climate change mitigation. The critique of Bitcoin as an "environmentally unfriendly investment instrument" (Magdalena et al., 2025) resonates strongly in an era where sustainable finance and ESG (environmental, social, and governance) considerations are becoming central to investment strategies.

Thus, the study of cryptocurrency regulation, particularly in the Indonesian context, holds both theoretical and practical significance. Theoretically, it contributes to the growing literature on the political economy of digital finance, regulation, and sustainability. Practically, it provides insights for policymakers, regulators, and investors on how to navigate the trade-offs between innovation, risk management, and sustainable development. By situating Indonesia's experience within broader global trends, this review underscores the importance of adaptive yet coherent regulation to ensure that the benefits of blockchain and cryptocurrencies can be harnessed while mitigating their risks.

2. Literature Review

Research on cryptocurrency regulation has grown significantly over the past decade, reflecting the rapid global adoption of digital assets and the regulatory challenges that follow. Much of the international literature highlights the tension between fostering innovation and preventing illicit activities. For instance, studies emphasize that cryptocurrencies such as Bitcoin are often associated with environmental concerns due to their excessive energy and water consumption, which poses risks to sustainability goals (Magdalena et al., 2025). These findings are consistent with a broader stream of scholarship that situates cryptocurrency within debates on the environmental costs of digitalization, where blockchain technologies are criticized for their heavy reliance on energy-intensive mining systems. This perspective situates cryptocurrencies not only as financial instruments but also as environmental challenges, linking the discussion to global discourses on climate change and sustainable development.

In parallel, regulatory discussions also underline the vulnerability of cryptocurrencies to misuse in illicit financial flows. Recent findings show that "Bitcoin's pseudonymity is used for illegal activities such as goods transport and banking transactions (Asiri & Somasundaram, 2025), highlighting the need for robust anti-money laundering (AML) frameworks. This concern is echoed in other comparative studies that point out how the borderless and decentralized nature of cryptocurrencies complicates traditional financial oversight. Because transactions can occur across jurisdictions without centralized intermediaries, regulatory bodies face significant hurdles in monitoring suspicious flows. Literature also notes that beyond money laundering, cryptocurrencies have been linked to terrorism financing, ransomware payments, and shadow markets, which adds urgency to the development of comprehensive international regulatory mechanisms.

Globally, jurisdictions have taken different approaches. The European Union, through the Markets in Crypto-Assets (mica) regulation, pursues a balanced framework between transparency, enforcement, and privacy protection, while Russia has opted for centralized control, and the United States remains in an exploratory phase (Stern, 2025). These variations demonstrate how political priorities and institutional capacities shape regulatory frameworks. Scholars emphasize that the EU's approach represents a "middle path" model, seeking to create a harmonized market while maintaining investor protections, whereas Russia reflects a more state-centric perspective, aiming to safeguard sovereignty over financial flows. In contrast, the United States illustrates regulatory fragmentation, as policies vary across states and federal agencies, reflecting both the diversity of institutional actors and ongoing debates about innovation versus control. Comparative research further shows that the effectiveness of regulation is influenced not only by formal laws and policies but also by the institutional strength and enforcement capacity of each jurisdiction.

Meanwhile, in Indonesia, the regulatory landscape remains evolving. Bank Indonesia prohibits cryptocurrencies as a means of payment, while Bappebti recognizes them as tradable commodities. As noted in prior research, "the regulatory framework for crypto in Indonesia remains unclear, creating legal uncertainty for individuals and businesses (Arminanto & Firmansyah, 2022). This dual stance reflects both caution and pragmatism: caution in preserving monetary stability and preventing systemic risks, and pragmatism in acknowledging the growing role of crypto assets as investment commodities. The literature on Indonesia often highlights this regulatory ambiguity, pointing out that the coexistence of prohibitive and permissive policies generates confusion among market actors. Moreover, scholars have raised concerns about investor protection, particularly given the increasing number of retail investors who may lack sufficient knowledge about the risks of digital asset trading.

In addition to legal perspectives, recent scholarship also documents rising public interest in cryptocurrency investment. In Indonesia, the number of investors has grown rapidly, with "crypto asset holders increasing from 18.25 million in 2023 to 20.16 million in 2024, with more than half under the age of 30(Chandra et al., 2025). This demographic trend indicates a generational shift, where younger investors perceive digital assets as part of their financial independence strategies. The literature suggests that this trend is not unique to Indonesia; globally, young investors are often more willing to experiment with alternative assets and digital platforms. However, scholars also caution that this generational enthusiasm may increase exposure to market volatility and speculative bubbles, particularly in contexts where regulatory protections remain weak. Studies in behavioral finance further highlight how social media, peer influence, and the gamification of trading platforms play a role in shaping youth investment behaviors, adding another dimension to the regulatory challenge.

Despite these developments, there is still limited bibliometric work that systematically maps how cryptocurrency regulation has been studied across jurisdictions. Most of the existing literature tends to focus on single-country case studies, specific legal frameworks, or thematic issues such as environmental impact, money laundering, or investor protection. There remains a notable gap in comparative and bibliometric research that examines the intellectual structure, thematic evolution, and geographical distribution of cryptocurrency regulation scholarship. This gap underscores the need for the present study, which provides a comprehensive knowledge map of global and Indonesian scholarship between 2016 and 2025. By systematically synthesizing existing studies, this review aims to contribute to a clearer understanding of how the academic community has conceptualized and addressed the multifaceted issues surrounding cryptocurrency regulation, while situating Indonesia's evolving framework within broader global patterns.

3. Research Method

Initially, a search was carried out in the Scopus database and the evaluation of the obtained documents was divided into three phases(Figure 1): (Phase 1) definition of search criteria to identify records in the Scopus database and refinement of retrieved records(data collection phase);(Phase 2) the documents were exported to the Vos Viewer software for bibliometric analysis of publications, authors, countries, institutions journals, and areas(data visualization phase); and (Phase 3) data analysis to identify the main themes discussed in research develop about cryptocurrency regulation in Indonesia and Global.

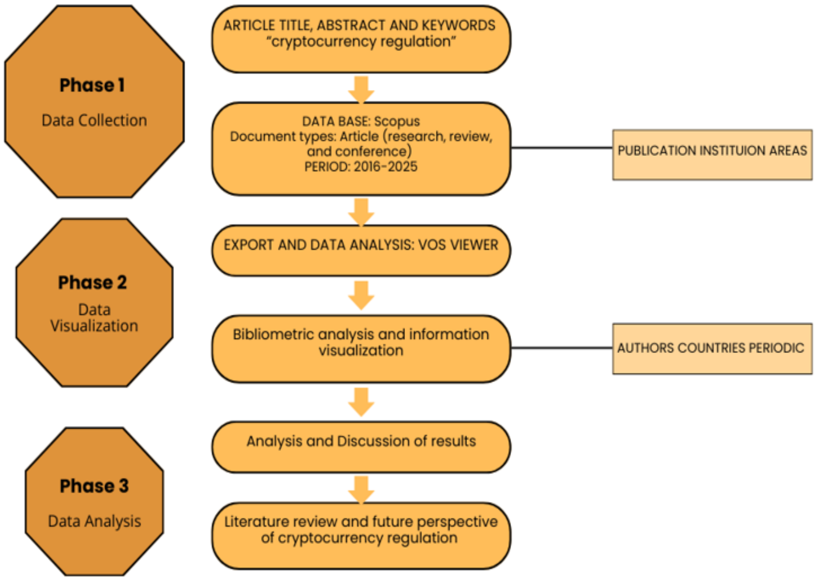

Figure 1. Methodology Phases Applied to the Present Work

This study used the bibliographic information from Scopus article database between 2016 to 2025 (Fig. 1). The sampling technique in this study was total sampling. The variables examined were title of publication, author, abstract, keywords, publication year, publisher journal, type of publication, affiliation. Data was extracted from the Scopus repository using Mendeley Desktop tools with one query English keywords: cryptocurrencies regulation.

The search results were downloaded using the Scopus export tool as csv, the synchronized with Mendeley Cite. Descriptive analysis (i.e. Annual publication, number of author publications, publisher journal) was processed using Microsoft Excel and Rstudio. The topic trend map was created using vosviewer version 1.6.20 in .csv format. The mapping I created used keyword co-occurrence analysis as the unit of analysis, including visualization of keyword mapping networks and keyword density (hotspots)

4. Results and Discussion

The image below provides a main information overview of research outputs spanning from 2016 to 2025. It includes data from 484 sources and a total of 1.178 documents, with 44,31% current annual growth rate in publications. The analysis involves 4693, with 1 contributing single-authored papers. A significant portion of the publications (24,79%)

involve international co-authorship, and there is an average of 7,43 co-authors per document. The dataset includes 4.301 distinct keywords provided by the authors and references a total of 8.304 citations. On average, the documents are 2,75 years old, and each document has received an average of 14,01 citations. This summary provides insight into collaboration patterns, research impact, and the overall development of the analysed academic field.

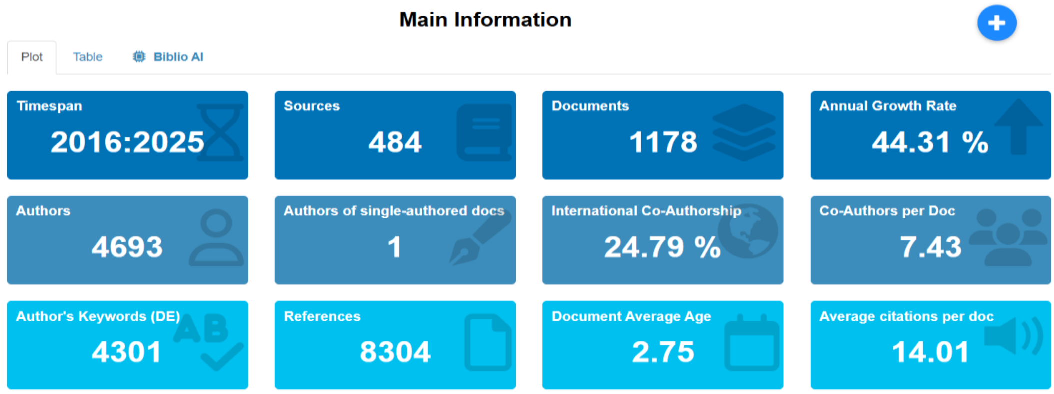

Figure 2. Main Information Overview (Using R Studio)

The dataset of this study includes 4,693 author-provided keywords, reflecting the diversity of themes and issues addressed by scholars in the field of cryptocurrency regulation. This wide variety of keywords highlights the multidimensional nature of the topic, spanning technical, legal, economic, and social perspectives. Such richness provides a solid foundation for co-word analysis to identify research trends, core themes, and emerging topics within the literature. In addition, the publications collectively cite 8,304 references, indicating a high degree of scientific connectivity. This suggests that research on cryptocurrency regulation is deeply embedded in a broad and interdisciplinary body of scholarship. The extensive referencing demonstrates how the field is evolving through the accumulation of knowledge and sustained academic dialogue, both globally and regionally.

From a temporal perspective, the documents have an average age of 2.75 years, showing that the field is relatively new and highly dynamic. The dominance of recent publications points to a surge in academic interest in the last few years. At the same time, the presence of older works remains significant, as they provide the conceptual and historical foundations for understanding the evolution of cryptocurrency regulation between 2016 and 2025. This balance reflects both historical depth and contemporary relevance, which are crucial characteristics of a rapidly developing research area.

Taken together, these findings suggest that research on cryptocurrency regulation is currently in a growth stage, marked by thematic diversification, extensive scholarly referencing, and a continuous flow of new studies. This provides fertile ground for bibliometric mapping, enabling the identification of knowledge structures, intellectual networks, and thematic evolutions within the global context as well as in the Indonesian case.

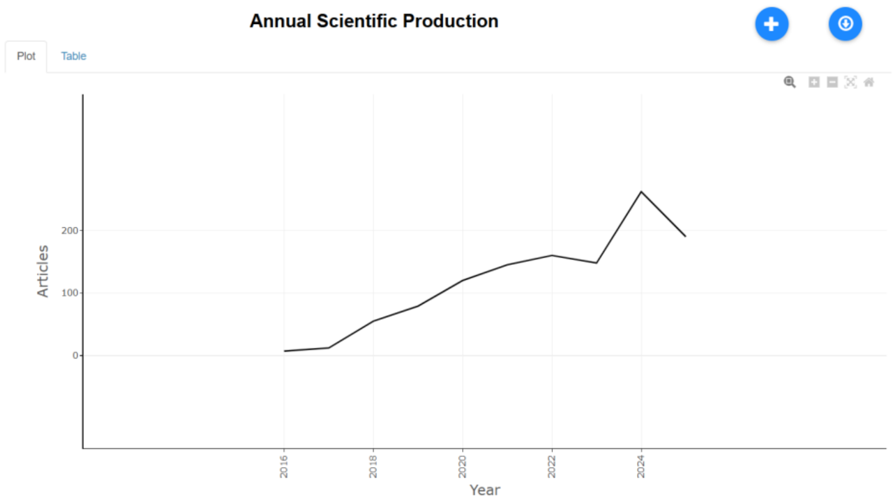

Figure 3. Annual Scientific Production (Using R Studio)

The Annual Scientific Production chart reveals a clear upward trajectory in scholarly output on cryptocurrency regulation between 2016 and 2025. During the initial stage (2016–

2017), the number of publications was minimal, reflecting the fact that the topic had not yet attracted substantial academic attention and was considered an emerging area of inquiry. However, between 2018 and 2020, there was a notable acceleration in research activity, largely driven by the dramatic rise in Bitcoin's popularity, heightened public interest in digital assets, and growing concerns among policymakers regarding the need for effective regulatory frameworks.

This momentum continued into 2021–2022, when publication levels began to stabilize, suggesting that the field had started to establish its core debates and research directions. A remarkable shift occurred in 2024, when the number of publications nearly doubled compared to previous years. This surge coincides with significant regulatory milestones, most prominently the adoption of the Markets in Crypto-Assets (mica) Regulation in the European Union, alongside increasing global scrutiny of cryptocurrencies by central banks, financial authorities, and international organizations. These developments underscored the urgency of regulatory clarity and spurred scholarly interest worldwide.

Although the number of publications showed a slight decline in 2025, it remained substantially higher than in the early years, underscoring the fact that cryptocurrency regulation had matured into a well-established and academically significant field of study. The observed trend demonstrates not only the responsiveness of academia to real-world regulatory changes but also the sustained relevance of cryptocurrency regulation as a global research agenda.

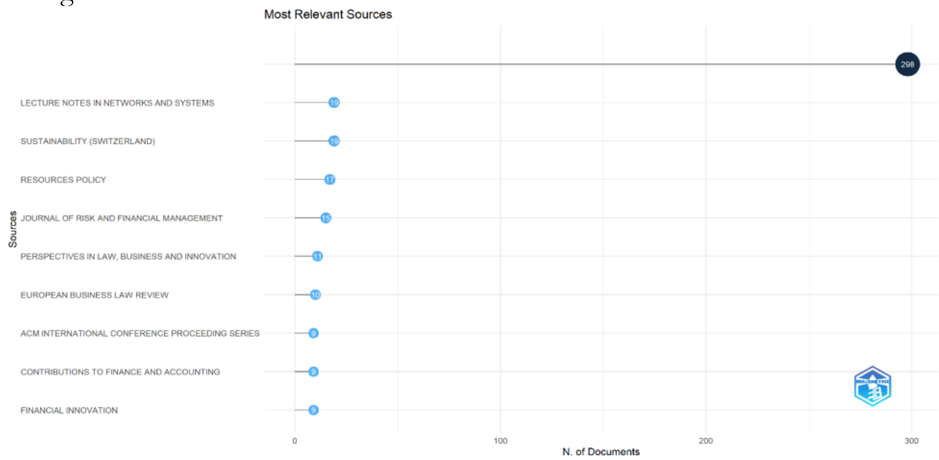

Figure 4. Most Relevant Sources (Using R Studio)

The Most Relevant Sources graph illustrates that scholarly research on cryptocurrency regulation is distributed across a wide range of academic outlets, reflecting the field's inherently multidisciplinary nature. Among these, Lecture Notes in Networks and Systems emerges as the most dominant source, contributing 298 documents. Its prominence highlights the significant role of technological and systems-based perspectives in shaping the discourse around cryptocurrency and its regulation. Following this, journals such as Sustainability (Switzerland) and Resources Policy underscore the intersection between cryptocurrency regulation and broader issues of sustainability, governance, and resource management. Their inclusion indicates that scholars are also engaging with the environmental and socio-economic implications of digital assets, particularly in relation to sustainable development goals and responsible resource allocation.

At the same time, the field is strongly represented in finance and law-oriented journals. For instance, the Journal of Risk and Financial Management focuses on the financial and risk management dimensions of cryptocurrency markets, while legal journals such as Perspectives in Law, Business and Innovation and the European Business Law Review emphasize the legal, regulatory, and institutional frameworks required to address the complexities of digital currencies. The diversity of these publication sources confirms that cryptocurrency regulation cannot be confined to a single academic discipline.

Overall, the distribution of relevant sources highlights how the subject has evolved into a cross-cutting research domain, drawing insights from technology, economics, finance, law, and sustainability studies. This multidisciplinary spread not only enriches the academic discourse but also reflects the multifaceted challenges faced by policymakers and stakeholders in regulating cryptocurrency within a rapidly changing global landscape.

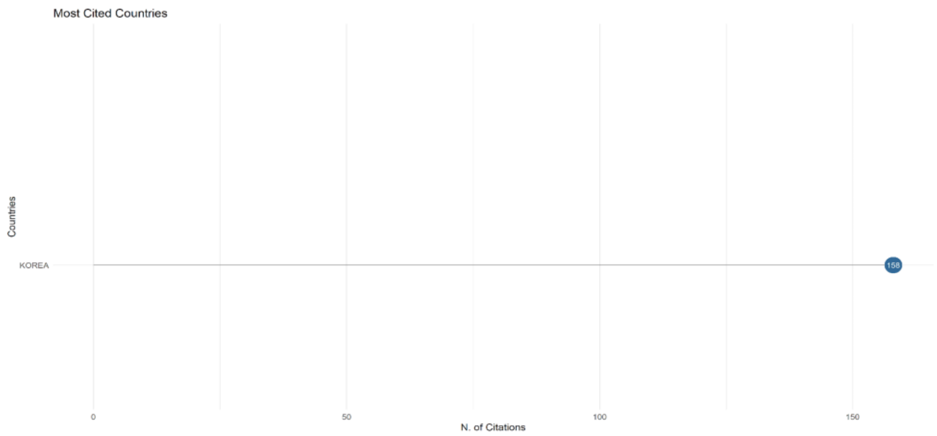

Figure 5. Most Cited Countries (Using R Studio)

This image presents the bibliometric analysis of the most cited countries, revealing that Korea is the only country represented in the ranking, with a total of 158 citations. This finding suggests that research originating from Korea holds substantial influence within the field, as it is consistently referenced by scholars worldwide. The high citation count not only reflects the academic visibility and impact of Korean contributions but also indicates the central role of Korean researchers in shaping discussions surrounding cryptocurrency regulation.

The absence of other countries from the list further emphasizes Korea's unique position within the dataset. This dominance could be attributed to the country's proactive stance on cryptocurrency regulation, as Korea has been one of the early adopters of comprehensive regulatory frameworks addressing digital assets, financial risks, and consumer protection. Such regulatory developments likely attracted scholarly attention, thereby increasing the global reach and citation impact of Korean research.

Overall, these results highlight Korea's disproportionate academic influence in the field of cryptocurrency regulation, positioning it as a key knowledge hub that significantly contributes to the evolution of the literature. This also underscores the importance of examining regional contexts, as country-specific regulatory approaches can shape not only domestic policy but also the global academic conversation.

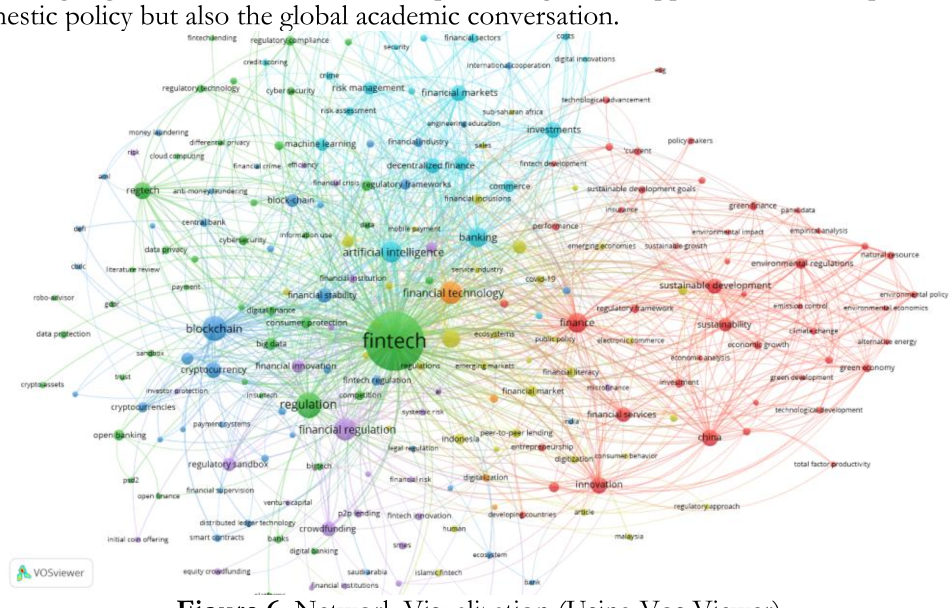

Figure 6. Network Visualization (Using Vos Viewer)

The figure presents a network visualization of keyword co-occurrence, offering insights into the conceptual structure of research at the intersection of fintech, blockchain, regulation, and sustainability. The prominence of larger nodes such as "fintech," "regulation," "blockchain," and "sustainable development" signifies their higher frequency and centrality, underscoring their role as the dominant pillars of discourse in this field. The color-coded clusters further illustrate the thematic organization of the literature, revealing how different yet interconnected domains of study converge within the broader research landscape.

The green cluster primarily revolves around fintech, financial regulation, and blockchain, reflecting scholarship that examines the rise of digital finance, the regulatory implications of cryptocurrencies, and the growing importance of cybersecurity in safeguarding financial systems. In contrast, the red cluster highlights sustainability, green finance, environmental regulation, and economic growth, thereby linking the technological aspects of fintech with broader socio-economic and environmental imperatives, including the pursuit of sustainable development goals.

Meanwhile, the blue and yellow clusters emphasize emerging and innovative areas such as artificial intelligence, decentralized finance (defi), risk management, and market innovation. These themes demonstrate how fintech research is increasingly engaging with cutting-edge technologies while simultaneously addressing the challenges of stability, resilience, and governance in financial markets.

The dense web of interconnections across clusters reveals the highly interdisciplinary character of fintech scholarship. Rather than existing in isolation, studies on fintech consistently bridge domains such as financial regulation, technological advancement, sustainability, and global economic transformation. This interconnectedness underscores the dual role of fintech: on the one hand, as a driver of technological and financial innovation; and on the other, as a framework deeply intertwined with pressing global challenges related to environmental sustainability, regulatory effectiveness, and inclusive economic growth.

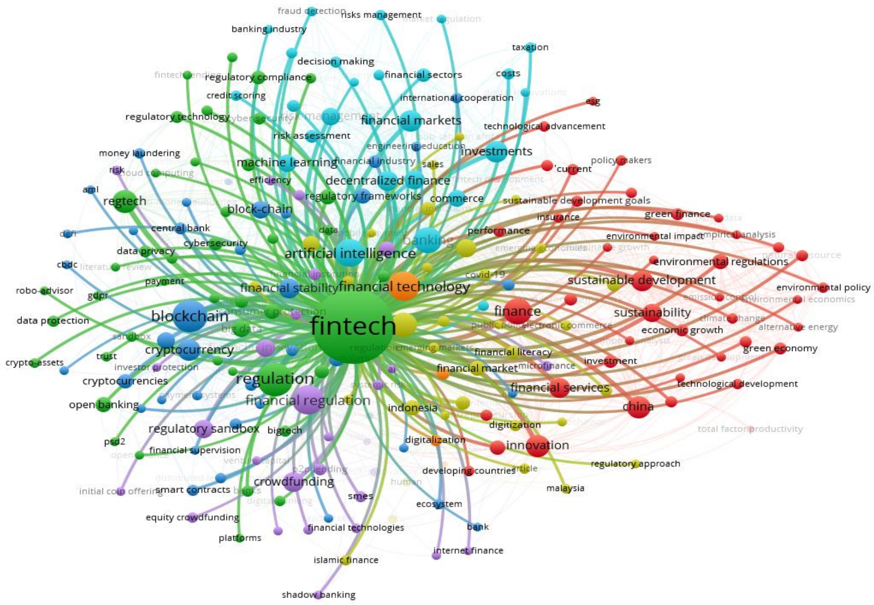

Figure 7. Network Visualization of Term Cryptocurrencies Regulation (Using Vos Viewer)

The visualization illustrates the research landscape surrounding cryptocurrency regulation within the broader domain of financial technology (fintech). Although fintech appears as the central node, the map shows that cryptocurrency regulation is strongly interconnected with several key clusters. The first cluster (blue and green) highlights the technological and regulatory aspects, where terms such as blockchain, cryptocurrencies, regtech, data protection, cybersecurity, and regulatory sandbox dominate. This reflects how discussions on cryptocurrency regulation are closely linked to issues of transparency, security, and legal frameworks.

A second cluster (red) emphasizes sustainability and green finance, showing how cryptocurrency regulation is increasingly associated with debates on environmental impacts, particularly energy consumption in crypto mining and its relation to sustainable development. The third cluster (yellow and purple) focuses on digital finance, innovation, and financial inclusion, positioning cryptocurrency regulation as a critical factor in shaping the future of decentralized finance (defi), payment systems, and global financial markets.

Overall, the map indicates that cryptocurrency regulation has evolved into a core research theme at the intersection of technology, finance, and policy. Its connections to blockchain, data security, and environmental sustainability highlight that regulation is not only about legal compliance but also about balancing innovation, consumer protection, and global financial stability

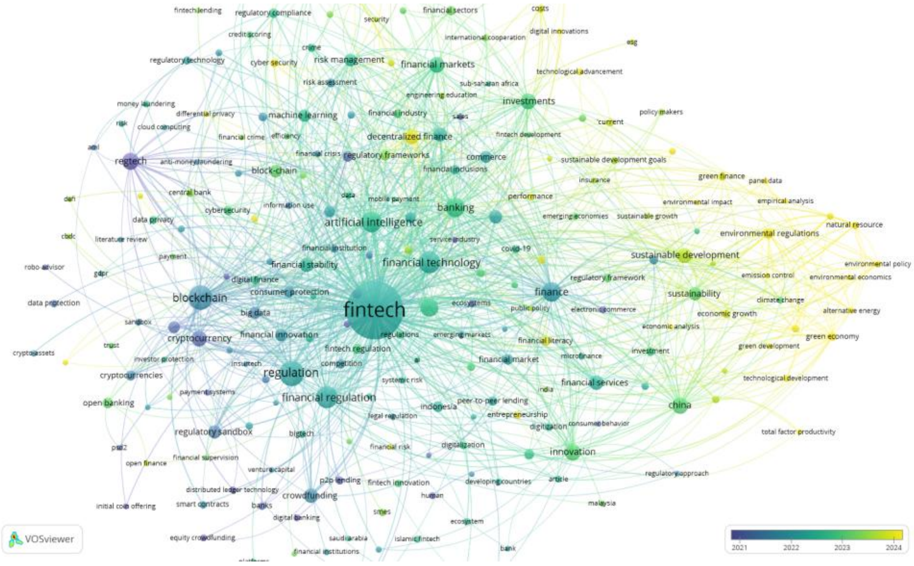

Figure 8. Overlay Visualization of Term Cryptocurrencies Regulation (Using Vos Viewer)

This overlay visualization is a bibliometric mapping typically generated with vosviewer. The network in the image illustrates the terms and concepts that frequently appear in academic studies related to financial technology (fintech). Each circle (node) represents a keyword, with larger nodes indicating higher frequency. The connecting lines between nodes show co-occurrences or relationships among terms, where thicker lines signal stronger connections. The colors of the nodes represent the timeline of research, ranging from 2021 (blue/purple) to 2024 (yellow), allowing us to trace how topics have evolved over time.

The largest and most central node is "fintech", highlighting its dominant role and its connections with other themes. In the earlier phase (2021–2022, shown in blue–purple), research focused on blockchain, cryptocurrency, regtech, open banking, cybersecurity, and data protection, reflecting concerns around regulation, compliance, and security in the fintech ecosystem. In the mid-phase (2022–2023, green), research shifted toward artificial intelligence, digitalization, peer-to-peer lending, entrepreneurship, financial inclusion, and financial services. These topics underscore the growing influence of AI, digital transformation, and inclusive finance. More recently (2023–2024, yellow), the focus has moved toward sustainable development, green finance, sustainability, environmental regulations, and the green economy. This indicates a clear trend toward integrating fintech with environmental, social, and governance (ESG) concerns and the global sustainability agenda.

Overall, this map illustrates the evolution of fintech research: beginning with blockchain and regulation, expanding into digital innovation and inclusion, and now increasingly aligned with sustainability and green finance. The overlay visualization not only highlights the thematic clusters but also reveals the temporal progression of fintech-related research at the global level.

5. Conclusions

This study provides a comprehensive bibliometric analysis of cryptocurrency regulation at the global and Indonesian levels for the period 2016–2025. Using Bibliometric and vosviewer, the research mapped the intellectual structure, thematic evolution, and geographical distribution of studies in this domain. The findings reveal a rapidly growing body of literature, marked by a consistent annual increase in publications, high levels of international collaboration, and diverse contributions across disciplines such as law, finance, technology, and sustainability.

The analysis shows that cryptocurrency regulation has evolved from a niche subject into a well-established field of academic inquiry. Early research focused on technological and legal foundations, while more recent studies increasingly integrate sustainability, environmental impacts, decentralized finance, and artificial intelligence. The network and overlay visualizations confirm the interdisciplinary nature of this scholarship, highlighting the interconnectedness of financial innovation, regulatory frameworks, and global sustainability goals.

The results also underscore the influential role of specific regions, with Korea emerging as a significant contributor in terms of citation impact, and the European Union setting important regulatory benchmarks through frameworks such as the mica Regulation. In contrast, Indonesia represents a unique case of regulatory ambiguity prohibiting cryptocurrencies as a means of payment while allowing their trade as commodities reflecting both opportunities and challenges for investors, regulators, and policymakers.

Overall, this study contributes to the literature by providing a knowledge map of cryptocurrency regulation, offering insights into how the field has developed and where it is heading. For scholars, the findings highlight emerging research fronts and thematic clusters worth exploring further. For policymakers and regulators, the results stress the importance of adaptive yet coherent regulatory frameworks that balance innovation, consumer protection, and financial stability. For practitioners and industry stakeholders, the study emphasizes the growing intersection of fintech with sustainability and governance, signaling the need for strategic alignment with global trends.

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