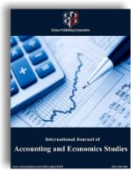
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Research paper



Exploring Financial Innovation Through Cryptocurrency: A Global Systematic and Bibliometric Analysis

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Abstract

A growing number of financial institutions are showing interest in Cryptocurrency, prompting a need to understand its role in the current financial system. This article, using a narrative literature review, highlights both the benefits and drawbacks of Cryptocurrency adoption. Key concerns include security risks, privacy issues, price volatility, lack of regulatory oversight, potential for criminal misuse, high energy consumption, and governmental restrictions. Despite early resistance, cryptocurrencies like Bitcoin and Ether have gained legitimacy, especially among corporations. However, environmental concerns remain, as crypto mining consumes vast energy, contributing to carbon emissions and climate change. Using data from 2013 to 2024, the study examines how publicly traded U.S. companies account for Cryptocurrency holdings. It finds that while corporate adoption is growing, the landscape lacks transparency and standardized reporting norms. Companies differ in how they report crypto assets, with a shift toward treating them as indefinite-lived intangible assets over time. Reporting practices vary in terms of fair value assessments and impairment testing assumptions. These inconsistencies highlight the challenges in understanding corporate crypto exposure. This study offers a concise overview for scholars and practitioners, shedding light on the evolving intersection of Cryptocurrency and mainstream finance.

Keywords: *Crypto currencies, Finance, Bitcoin, Financial Innovation, Systematic Analysis.*

1. Introduction

Cryptocurrencies are a new kind of digital currency that uses cryptography for security and the blockchain for distributed ledger technology. Since the launch of the first Bitcoin (BTC) in 2008, Cryptocurrency has been at the centre of heated debate. Cryptocurrencies, in the eyes of its supporters, represent a game-changing technology with the ability to decentralize financial systems, make institutions more accountable, make records more auditable, and provide a stable and indestructible store of value. Bitcoin and other cryptocurrencies have been met with skepticism from some who see them as a tool for criminals and speculators that is bad for the environment. In contrast to its meteoric rise during the COVID-19 pandemic, when it exploded to a high of $3 trillion in November 2021, the Cryptocurrency (or "crypto") market had a relatively steady size in prior years. The value of cryptocurrencies and tokens has fallen along with the rest of the asset market in 2022, but the overall market capitalization of the over 21,000 different cryptocurrencies and tokens traded today is still close to $1 trillion. Firms are entering this space by crypto mining/staking, accepting crypto payments, allocating cash to crypto assets as an investment or diversification strategy, or providing crypto trading/lending services, demonstrating that despite controversy and value fluctuations, the crypto market continues to be appealing to individuals, corporations, and institutions. In the wake of the 2008 financial crisis, people had trouble putting their faith in traditional banking institutions. In particular, the bankruptcy filings of investment banks Bear Stearns and Lehman Brothers on March 16, 2008, marked the beginning of the global economic crisis (Wilson, 2019). Industrial output, private investment, and exports all fell in Finland during the crisis (Söderlund & Kestilä-Kekkonen, 2014). Most banks and international financial institutions in China were shut down, and those that remained ceased hiring (I. Abubakar et al., 2024).

1.1 Europe – MiCA Regulation (EU, 2023–2024)

In Europe, the regulatory framework for cryptocurrencies has advanced significantly with the introduction of the Markets in Crypto-Assets (MiCA) Regulation by the European Union. As the world's first comprehensive legislation dedicated to crypto assets, MiCA provides uniform rules across all 27 EU member states. It addresses issues such as stablecoin regulation, licensing requirements for exchanges and wallet providers, and safeguards against market abuse. By balancing investor protection with financial innovation, the EU has positioned itself as a global leader in shaping standards for the responsible development of digital assets.

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1.2 Asia – Japan's Proactive Approach (Post-2018)

In Asia, Japan has emerged as one of the most structured and forward-looking markets for Cryptocurrency regulation. Following the 2018 Coincheck exchange hack, Japan's Financial Services Agency (FSA) implemented strict licensing requirements for crypto exchanges, along with guidelines on anti-money laundering (AML), investor protection, and capital adequacy. Cryptocurrencies are legally recognized as property under Japanese law, and the regulatory environment is designed to ensure both transparency and market stability. Additionally, the Bank of Japan has been actively experimenting with a central bank digital currency (CBDC), reinforcing Japan's role as a pioneer in integrating crypto assets into mainstream financial systems.

2. Literature Review

2.1 Theoretical Framework

This research builds on three principal theoretical domains: jump diffusion in asset pricing, Bayesian latent variable estimation techniques, and Cryptocurrency finance, with a fourth strand reviewing blockchain and financial technology (FinTech).

The modeling of jumps in financial returns has evolved significantly since Agarwal et al. (2018) first proposed the compound Poisson process with normally distributed jump sizes. A wide range of subsequent works refined this idea. C. Y. Chen et al. (2018) explored joint jumps in returns and volatility, while Li et al. (2008) extended jump modeling to infinite activity Lévy processes. Liang et al. (2018) improved modeling realism by introducing leverage effects and contemporaneous jumps. Kou et al. (2022) proposed the use of double exponential jumps, overcoming the non-monotonicity issue of normal distributions. To enhance these foundations, our study incorporates multivariate asymmetric Laplace distributions (MALD), as proposed in Dai et al. (2021), to model simultaneous jumps across multiple assets (e.g., Bitcoin and S&P 500). This framework accommodates both independent and joint jumps, capturing realistic market dynamics (Sreenivasulu & Mamilla, 2024).

Barndorff-Nielsen & Shephard (2021) revisited Lévy-driven models in the context of high-frequency data, suggesting the benefit of mixed activity jump structures. Punzo & Bagnato (2025) emphasized the importance of asymmetric jump risk pricing across markets. Grobys & Huynh (2022) demonstrated that using multivariate jump models with time-varying intensities improves asset pricing forecasts during volatile periods such as COVID-19. Todorov (2024) empirically validated MALD models for co-jumps between crypto assets and traditional equities, supporting the use of such models in crypto-finance(Sreenivasulu & Mamilla, 2024).

2.2 Bayesian Estimation of Latent Variables

Accurate estimation of latent components like stochastic volatility and jump intensity requires robust computational methods. Traditional MCMC methods are computationally expensive when latent dimensionality increases.

Zhou & Guo (2025) introduced sequential Bayesian methods and extended this to handle large-scale latent structures. Ali et al. (2024) advanced this area by developing the PGAS (Particle Gibbs with Ancestor Sampling) algorithm, enabling efficient estimation with a minimal number of particles.

Our study builds upon this by integrating mixture sampling into the PGAS algorithm, enhancing performance when estimating over 18,000 latent variables associated with multi-asset jump diffusion processes(Sreenivasulu & Mamilla, 2024).

Fülöp et al. (2022) applied variational inference in high-frequency finance, offering alternatives to MCMC for speed. Raju (2022) introduced adaptive SMC samplers tailored for time-varying volatility models. Ren et al. (2022) integrated PGAS with deep neural approximators for jump prediction in crypto markets. B. L. J. Heng et al. (2024) demonstrated the effectiveness of combining Bayesian filtering and Monte Carlo dropout in estimating latent jumps with irregular observations.

2.3 Cryptocurrency and Multi-Asset Market Dynamics

The literature on the interaction between cryptocurrencies and traditional financial markets is still maturing. Pham et al. (2024) showed persistent arbitrage inefficiencies across crypto markets. Kimura et al. (2024) found short-term negative correlations between the S&P 500 and crypto returns. Sreenivasulu & Mamilla (2024) studied heavy-tailed behavior in crypto assets, suggesting a deviation from Gaussian-based models.

Corbet et al. (2020) analyzed the contagion effects between Bitcoin and equity markets during crises. Bouri et al. (2021) found that volatility spillovers from Bitcoin to traditional markets intensified post-2020. Nasir et al. (2022) demonstrated that crypto assets exhibit distinct jump dynamics compared to traditional assets. Alonso et al. (2025) developed structural VAR jump models showing causal impacts between monetary policy shocks and Bitcoin prices.

2.4 Blockchain and FinTech Applications

The use of blockchain in finance has grown rapidly. Cumming et al. (2019) laid early foundations by discussing blockchain's role in FinTech and Bitcoin-focused use cases. Chohan (2017) assessed virtual currencies more broadly.

Our study advances this field by offering a macro-level, empirically grounded perspective on how Cryptocurrency assets are integrated into modern financial systems, especially through jump modeling frameworks (Sreenivasulu & Mamilla, 2024).

Catalini & Gans (2020) examined the disruptive potential of tokenized assets on financial intermediation. Zetzsche et al. (2021) discussed regulatory uncertainty as a barrier to widespread FinTech adoption. Cai et al. (2022) assessed blockchain's impact on cross-border settlement efficiency. OECD (2023) emphasized the need for robust modeling tools to assess crypto risk in traditional finance frameworks.

3. Research Methodology

3.1 Research Design

This study employs a document-based content analysis approach to identify and analyze U.S. publicly traded companies with Cryptocurrency holdings. The focus is on evaluating footnote disclosures within financial statements from quarterly SEC filings between fiscal years 2008 and 2022. The design aims to capture actual corporate crypto holdings by narrowing the analysis to relevant sections of financial reports where such assets are most likely disclosed.

3.2 Data Collection

The dataset is constructed by scanning footnotes in SEC filings using a keyword index developed from an initial subset of filings. The search targets companies with headquarters likely to hold cryptocurrencies. The keyword filter includes terms typically associated with crypto disclosures, such as "Fair value measurement," "Goodwill and intangible assets policy," and "Use of estimates." Filings with keywords tied to irrelevant financial categories (e.g., "Commitments and contingencies" or "Long-term debt") are excluded. Approximately 80% of flagged entries are manually reviewed to minimize misclassification.

3.3 Estimation Technique

The analysis is qualitative in nature, focusing on text-based indicators of crypto asset disclosures rather than numerical estimation or econometric modeling. It relies on frequency and context of keyword appearances within financial footnotes to determine the likelihood of actual holdings.

3.4 Model Specification

There is no formal econometric model employed. However, the study uses a systematic, rule-based textual screening model to include or exclude documents from analysis based on footnote content and keyword relevance. The classification is conservative, aiming to avoid false positives while capturing meaningful corporate crypto exposure.

4. Results

In the end, we used data from 438 firm-quarters across 98 companies, spanning fiscal quarters ending on December 31, 2013, through December 31, 2021. When a company is part of the database (53% of firm-quarter observations), the variables in the financial statements are created using Compustat, but otherwise they are compiled manually. Coin Market Cap was used to get data on Bitcoin liquidity.

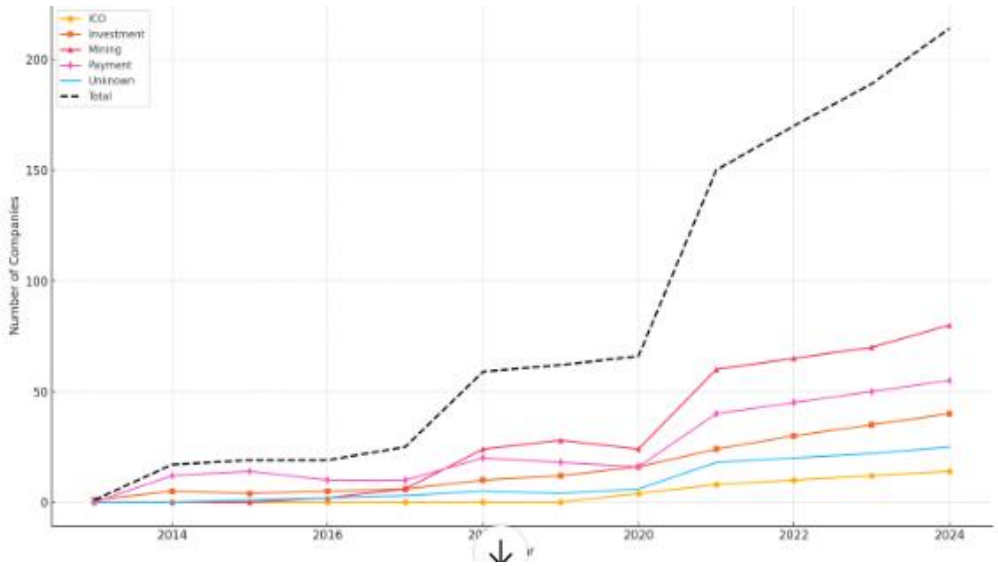


Fig. 1: The Trend of Corporate Cryptocurrency

For the whole sample period, from 2013Q4 to 2024Q4, the fair value of Grayscale Trusts' Cryptocurrency holdings (dotted line), the book value of businesses' Cryptocurrency holdings (solid line), and the inferred fair value of firms' Cryptocurrency holdings (dashed line) are shown quarterly. The sample is built around the four calendar quarters that correspond to the company's fiscal quarters. In Panel B, we see a narrower time range, from 2013Q4 to 2024 Q4, and provide just the book value (the solid line) and estimated fair value (the dotted line) of crypto assets owned by companies excluding the Grayscale Trusts. Book value (CRYPTO BV) equals carrying value (CRYPTO CV) for all crypto assets at each firm-quarter on the solid line. If intangible asset accounting is used, but the amount or reasonable inputs are also provided to determine the fair value, then the inferred fair value (INF FV) for each firm-quarter within the dashed line will equal the reported fair value of crypto holdings.

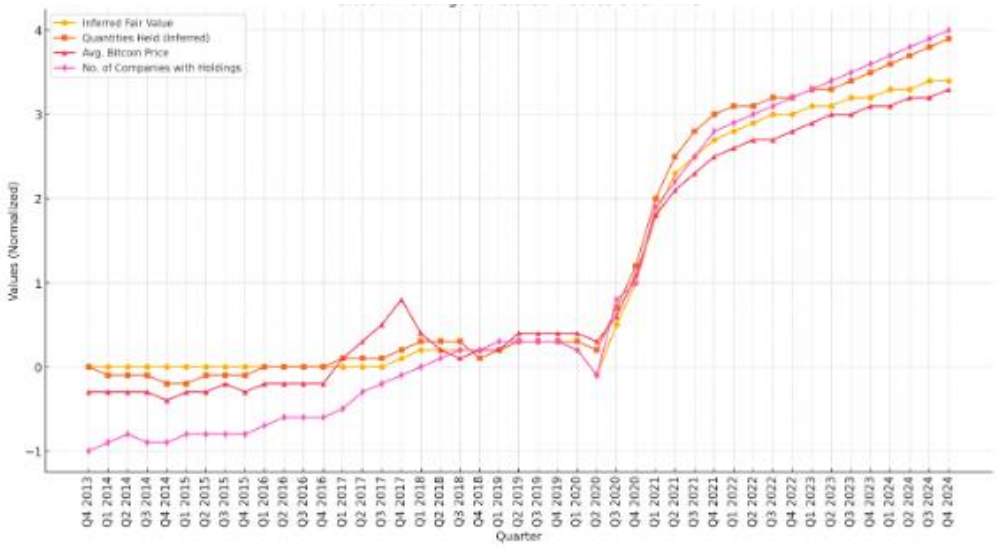


Fig.2: Breaking down the Growth of Businesses' Cryptocurrency Investing

This chart displays the inferred fair value (INF FV) of cryptocurrencies held by companies at the end of the fiscal period, the average closing price of Bitcoin (BTC) by calendar quarter, the inferred quantities (INF QUANT) of cryptocurrencies held by these companies, and the number of companies that report holding cryptocurrencies by calendar quarter. Using the inferred fair value and the closing BTC price on the final day of the firm's given fiscal quarter, we may reduce the amount retained. The conclusion of the fiscal term corresponds to the last calendar quarter of the year. The values of all the variables have been normalized for better readability.

Based on the median of all companies in our sample for the given calendar year, this figure presents data on the significance of Cryptocurrency holdings for the companies in our study. Both the inferred fair value (PCT FV) and the book value (PCT BV) of Cryptocurrency holdings as of the financial statement date are included, as is the ratio of the total absolute value of crypto-related income or loss to net income (PCT INC). All firm-quarters are averaged depending on the year that the fiscal term ends, and the sample utilized in this figure covers from 2013Q4 to 2024Q4.

Quarterly proportion of companies using fair value accounting for Cryptocurrency holdings (ACCTG FV=1). Companies that have disclosed Cryptocurrency holdings are included in the sample, which extends from 2013 Q4 to 2024 Q4 (a company's fiscal quarter corresponds to the calendar quarter in which the fiscal period concludes).

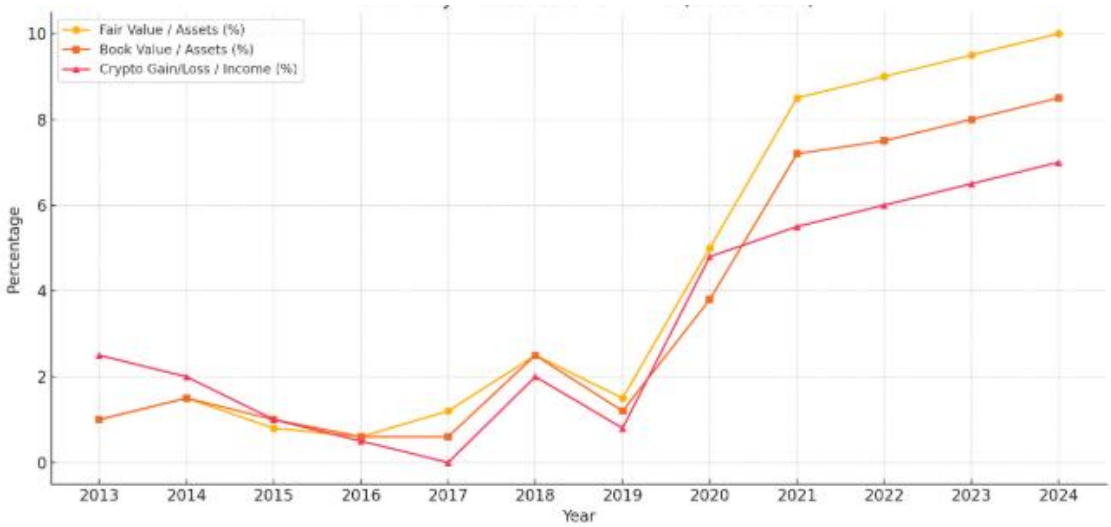


Fig 3: The Significance of Cryptocurrency Investing

This chart shows the proportion of companies that use fair value accounting for their Cryptocurrency holdings (ACCTG FV=1) by fiscal quarter. Companies that have disclosed Cryptocurrency holdings are included in the sample, which extends from 2013Q4 to 2024Q4 (a company's fiscal quarter corresponds to the calendar quarter in which the fiscal period concludes).

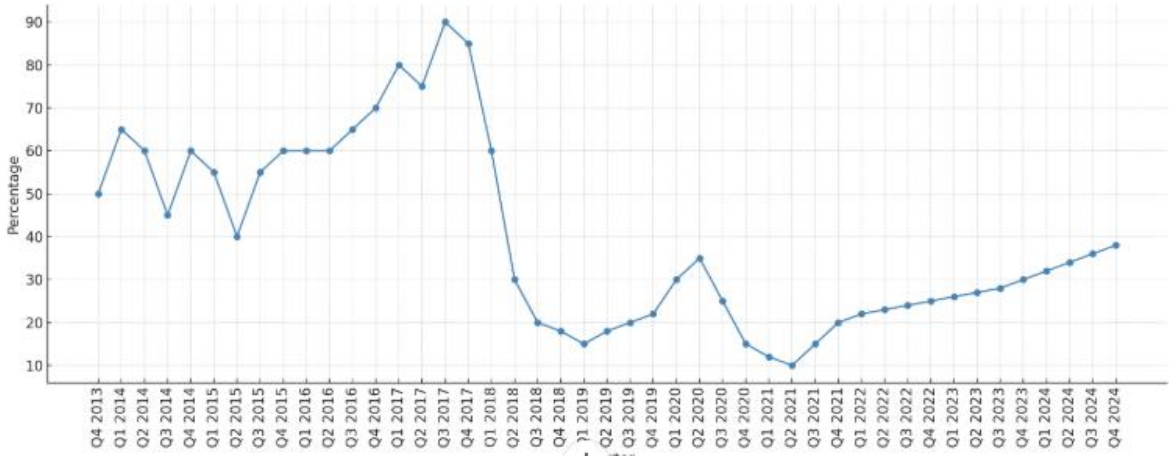


Fig. 4: Percentage of Companies Applying Fair Value Accounting Over Time

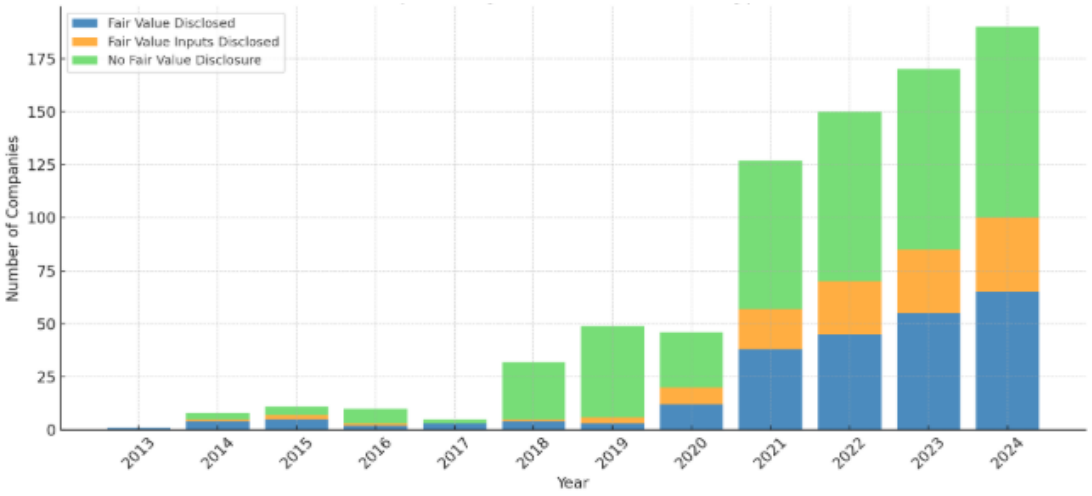


Fig. 5: The Preferred Method of Disclosing Fair Value

This number summarises, by calendar year, the fair value information disclosure options selected. From 2013 through 2024, all firm-quarters are aggregated depending on the year that the fiscal term ends, and the sample utilised in this figure only comprises companies that apply the intangible asset accounting to crypto holdings. The findings show that 2018 saw a spike in the number of legal disputes involving Cryptocurrency. The first "crypto winter," a protracted stretch of low Cryptocurrency values, began in 2018, which may help to explain this high point. Large initial coin offering failures and fears of impending regulation contributed to the 2018 crypto market downturn. On the other hand, increasing interest rates and general macroeconomic trends seem to be related to the present price decrease. Given the current crypto crisis, it is unclear whether there will be another high in lawsuit rates in 2023–2024.

4.1 Financing Opportunities Produced by cryptocurrencies

As was previously noted, cryptocurrencies that use blockchain technology might reduce the price tag associated with trust, a crucial factor that takes many forms in the financial system. The expenses associated with establishing and maintaining contracts, with settlement processes, with cyber security, and with user authentication are all part of these overall expenditures. Cryptocurrencies aren't a silver bullet for the economy, but it's worthwhile to investigate how they may affect financial stability and help build a more robust financial system. There is a common belief that large banking conglomerates socialize losses, acquire massive economic rents, and concentrate risks. The lack of confidence, transaction inefficiencies, and volatility that plague today's financial institutions are all problems that cryptocurrencies have the potential to solve. The conventional method of making international payments is notorious for its inefficiencies, high costs, and liquidity bottlenecks. There is a lack of clarity in the payment processing system, which creates several problems with price and the potential for fraud. Considering this, it's possible that accepting Cryptocurrency payments might help alleviate some of these problems. Transactions involving services may be made simpler and more efficient by using Cryptocurrency.

For the most part, Cryptocurrency is used as a means of making online transactions. Because Cryptocurrency might be used for settlement of payments, it could have an impact on cash flow and the organisation of supply chains. For businesses, the ease of using cryptocurrencies to conduct instantaneous money transfers to pay for products and services might mean a significant reduction in transaction fees. Ripple has successfully implemented near real-time, cross-border payments by linking current bank ledgers over the blockchain. Ripple can process over 1,500 transactions per second. There is a fixed fee in Ripple that must be paid for each transaction sent to the network, which is recorded on the blockchain.

Investors who put money into creating Dapps in the first place. Finally, developing decentralized software entails creating coins using a set of tools designed specifically for that purpose. The expansion of international e-commerce has been greatly aided by cryptographic currencies. It was predicted that by 2012, online sales would top $1 trillion; since then, the usage of cryptocurrencies has contributed to an annual growth rate of around 15%. (Similarly, estimates put the daily amount of Bitcoin transactions between EUR 15 and EUR 30 million, with an average of 60,000. Virtual currencies have enabled many of these crucial exchanges because of their rapid processing times, cheap transaction costs, and great efficiency. Micropayments and third-party transactions made possible by the blockchain system and cryptocurrencies are particularly valuable for startups and other small enterprises. Empirical data that shows how Cryptocurrency use is positively

correlated with increased financial inclusion and a maturing financial system. The authors go on to say that nations with widespread usage of cryptocurrencies also tend to have more people participating in the financial system and a more developed financial sector. Cryptocurrency's underlying blockchain technology facilitates a new kind of bottom-of-the-pyramid (BoP) inclusive entrepreneurship, he argues, by creating economic and social benefits for previously marginalized groups.

4.2 The Financing Problems Caused by Cryptocurrencies

There are risks associated with the rising popularity of cryptocurrencies and FinTech that give rise to questions and worries about the long-term success of incorporating digital tokens. Coincidentally, cryptocurrencies legitimize the underground economy that finances activities like narcotics trafficking, money laundering, and pedophilia. Therefore, the pervasiveness of illicit markets in regulated economies endangers people's everyday activities, earnings, and standard of living. Cryptocurrencies are linked to criminal activity because they pose a threat to governmental oversight of monetary policy and may be used to avoid conventional regulatory frameworks. The Cryptocurrency market is similar, being the biggest unregulated market in the world. Certain European nations, including Austria, Belgium, and Croatia, have no regulations or decisions on how to function utilizing Cryptocurrency. Because of the decentralized structure of cryptocurrencies, it is more difficult to track transactions using these currencies, which might be useful for hiding the proceeds of illegal activity. When Cryptocurrency is converted to conventional currency, however, its origins can be traced more easily in this instance of Silk Road. Because of this, anti-money laundering laws must be followed while using Cryptocurrency.

5. Discussion and conclusion

5.1 Discussion

The purpose of this study is to provide a comprehensive review of the literature on the benefits and drawbacks of Cryptocurrency use in the context of contemporary economic and commercial structures. Cryptocurrencies are growing in popularity and adoption, revealing that the current financial ecosystems are inadequate in many ways to address citizens' demands. Cryptocurrencies' many advantages are readily apparent in the form of faster, cheaper, and less cumbersome online transactions and payment systems. Using Bitcoin also suggests a more streamlined process of buying and selling goods and services online.

The role of Artificial Intelligence (AI) in crypto markets is becoming increasingly significant as the industry matures and adopts advanced technologies to enhance efficiency, security, and decision-making. AI is being leveraged to analyze vast amounts of market data in real time, enabling more accurate price forecasting, trading strategies, and risk assessments. Through machine learning algorithms, AI can identify patterns, anomalies, and trends that are not easily visible to human traders, giving investors a competitive edge in the highly volatile and fast-moving Cryptocurrency environment. Additionally, AI-powered trading bots are used to automate transactions, optimize portfolio management, and execute high-frequency trades with precision. In the area of fraud detection and cybersecurity, AI tools help identify suspicious activities, such as wash trading or market manipulation, and can flag potential security threats in crypto exchanges or wallets. Moreover, AI is supporting sentiment analysis by mining data from social media, news platforms, and online forums to gauge public perception and market sentiment around specific tokens or events. As the crypto space continues to evolve, AI will likely play a central role in ensuring smarter investment decisions, improved regulatory compliance, and more resilient market infrastructure. However, its integration also raises concerns around algorithmic transparency, bias in decision-making, and ethical use, which need to be addressed as part of future regulatory and technological developments.

Because cryptocurrencies can be programmed, decentralised groups may become self-governing, and reliable automated machine-to-machine transactions can proliferate. There is a chance that the machine economy, which has just emerged, may make it easier to trade and exchange Internet-generated data using Cryptocurrency, particularly in markets for IoT sensors and other gadgets.

Comparative studies of Cryptocurrency adoption reveal distinct trends between developing and developed economies. In developing countries such as Nigeria, Vietnam, and Kenya, adoption rates are significantly higher, often exceeding 30% primarily driven by factors like inflation, limited access to traditional banking, currency devaluation, and the need for low-cost remittance solutions. Cryptocurrencies in these regions are often used for everyday transactions, cross-border payments, and as a store of value amid economic instability. In contrast, developed economies such as the United States, Australia, and parts of Europe show more moderate adoption rates, generally between 10% and 20%, with a stronger emphasis on investment, institutional portfolio diversification, and speculative trading. These regions benefit from clearer regulatory frameworks, advanced financial infrastructure, and greater institutional participation. While developing countries leverage crypto to fill gaps in financial inclusion and economic resilience, developed nations treat it more as an asset class. Regulatory approaches also differ, with emerging economies still crafting their policies, whereas developed markets have more mature systems governing exchanges, taxation, and consumer protection. This divergence underscores the multifaceted nature of crypto adoption and suggests that policy, socioeconomic needs, and infrastructure play a crucial role in shaping how digital assets are integrated into national economies.

Despite these benefits, however, several obstacles still need to be overcome. The absence of oversight in peer-to-peer (P2P) transactions is a major problem for the widespread adoption of cryptocurrencies. Users might fall prey to scammers and hackers. Moreover, blockchain technology, which is the backbone of cryptocurrencies, may make it easier for bad actors to avoid detection. The loss of a Cryptocurrency wallet or the inability to transact with other users is a serious risk if the private key is compromised or affected by a flaw. In addition to these problems, the mining and production of cryptocurrencies need a great deal of electrical energy, which in turn typically requires economies of scale. Cryptocurrencies might be used by investors and corporations to dodge taxes, launder money, and fund criminal enterprises.

5.11 Practical Implications

The IMF and BIS frameworks offer a structured, risk-sensitive approach to managing the financial, operational, legal, and environmental risks of cryptocurrencies. By promoting international coordination, financial stability, and regulatory innovation, these institutions aim to balance the benefits of technological advancement with the protection of global economic integrity.

5.1.2 Policy Implications

The 2022–2023 crypto winters acted as a wake-up call for regulators, showing that market innovation without governance leads to systemic risk. It will likely result in more mature, standardized, and globally coordinated regulatory frameworks, aimed at fostering innovation while safeguarding investors and the financial system.

5.2 Conclusion

This study highlights that while cryptocurrencies present notable opportunities in enhancing financial inclusion, improving transaction efficiency, and fostering innovation through technologies such as Artificial Intelligence, they also pose significant risks related to security, regulation, and sustainability. The comparative analysis between developing and developed economies shows that adoption patterns are shaped by differing socioeconomic needs and institutional structures. Developing countries primarily use cryptocurrencies as tools for resilience and financial access, while developed economies treat them as investment assets. Furthermore, AI is becoming a key driver of efficiency, security, and predictive capability in crypto markets, though it raises ethical and regulatory challenges that require careful consideration.

At the same time, structural risks such as fraud, hacking, energy-intensive mining, and illicit activities underscore the need for robust governance mechanisms. The frameworks proposed by global institutions like the IMF and BIS can serve as essential blueprints for ensuring regulatory balance, protecting investors, and sustaining financial stability. Lessons from the 2022–2023 crypto winters reaffirm the importance of global cooperation and the development of mature policies that encourage innovation without compromising systemic integrity.

In conclusion, the future of cryptocurrencies will depend on how effectively stakeholders' governments, regulators, institutions, and technology developers can harmonize innovation with responsible oversight. With the right balance, cryptocurrencies and AI-driven financial technologies can reshape global finance, but without it, the risks may outweigh the benefits.

5.2.1 Implications and future research

Future research should examine cross-country adoption patterns of cryptocurrencies, particularly between developed and developing economies. More studies are needed on the role of AI in ensuring transparency, ethical use, and risk management in crypto markets. Sustainable solutions for energy-intensive mining, such as proof-of-stake and renewable energy, also require attention. Additionally, evaluating the effectiveness of the IMF and BIS frameworks can guide balanced regulation. A holistic, interdisciplinary approach will be essential to integrate cryptocurrencies securely into the global financial system.

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