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Unearthing Key Themes in Cryptoeconomics: A Novel Text-Mining Study with Orange

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ABSTRACT

Cryptoeconomics, an interdisciplinary intersection of cryptography, economics, and decentralized systems, has matured well past its speculative cryptocurrency roots. This study contextualizes cryptoeconomics in history by looking at topic trends over time. Arranging topic prevalence over time according to the dates of key events, provides further insights into external drivers that correlate with research priorities. Leveraging commonly accepted bibliometric resources, we conduct a mixed-method systematic literature review of 585 peer-reviewed studies (2013–2024) and a series of quantitative analyses using Document-Term Matrices (DTM), with TF-IDF weighting and Latent Dirichlet Allocation (LDA) in Orange—supplemented with LDAVis in order to render structural insights as an interactive dimension—aimed to chart the intellectual landscape of cryptoeconomics. Basic text preprocessing steps resulted in 4,638 nonnaive terms from 72,695 original ones, keeping the vocabulary within the specific domain. Given the 10-topic LDA model, we are able to highlight three major results: (1) finance still plays an overwhelming role with great focus on the valuation, volatility and regulation of cryptocurrency assets; (2) governance and sustainability have become two major clusters showing that clear institutional design and ecological awareness in the use of blockchain technologies will be crucial moving forward; (3) technical-contextual pairing, with niche words like "felsic" signaling the move on finance's potential spillover effects across resource management, supply chains, and a myriad of socio-technical ecosystems. These results on the one hand show that cryptoeconomics is at a crossroad, moving from the narrow public debate around cryptocurrencies themselves to become more a wider discussion charting a ray of financial technology, energy consumption, security and equitable governance. Applying automated topic modeling to qualitative interpretation strengthens the holistic understanding of how cryptoeconomics interacts with real-world problems. This study shines a light in potential inter disciplinary gaps and emergent themes in decentralized architecture, thereby providing a consolidated basis for a forthcoming empirical study, regulatory representatives, and technological implementations that promote alignment between decentralized architecture and human and environmental values.

Keywords: Cryptoeconomics, Latent Dirichlet Allocation (LDA), Decentralized Finance (DeFi), Interdisciplinary Research, Text Mining

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INTRODUCTION

Cryptoeconomics, an innovative mixing of cryptography, game theory, and economic incentives, has become a fundamental building block of blockchain-enabled systems since Nakamoto's (2008) conceptualization of decentralized trust. Once centering around the security of consensus mechanisms (like Proof-of-Work and Proof-of-Stake; John & Saleh, 2025), the space now propels completely new areas of innovation, such as decentralized finance (DeFi), tokenized governance, and cryptographically transparent supply chains (Astuti & Hidayati, 2023; Voshmgir & Zargham, 2020).

Emerging from previous bibliometric analyses (Alasik & Yildirim, 2024), there is no denying that cryptoeconomic research has grown at an exponential rate, for the promise of a better world through programmable incentives has never been so strong. Yet, cryptoeconomics leave many fundamental issues unaddressed: while theories reach high sophistication, empirics cannot keep up (Tull & Heller, 2023); models remain sectorial due to disciplinary silos (Davis, 2021); and potential systemic risks emerging from cryptoeconomics — such as wealth concentration and quantum threats — into largely unexamined (Brekke & Alsindi, 2021; Iliev, 2024). But as theoretical structures race ahead of practical verification, significant gaps jeopardize its transformative potential.

This trend is visible in cryptoeconomics, and the most recent research on it illustrates its increasing significance in finance, governance, and decentralized systems. Stashchuk et al., (2024) highlight cryptoeconomics as dual speculative asset class and payment mechanism, its disruptive yet volatile integration into global financial markets. Their theoretical assessment emphasizes the vital role of managerial accountants in risk mitigation through effective communication. To remedy this, Nielsen (2024) presents the notion of an "inverted cryptoeconomy" in No Man's Sky, in which blockchain technology guarantees values originating from player experience of labor instead of return of funds, reversing the classic orientation of cryptoeconomics parameters toward financial profit. All these studies are telling about conflicting nature between the financial nature of cryptoeconomics and its ability for creating communities with common interests where people are mutually empowered to create value.

Recent developments in market mechanisms and theoretical foundations provide additional definition to the evolution of the field. Kirste et al. (2024) show that AMMs in decentralized exchanges provide improved market quality than those on entity-controlled markets such as centralized exchanges, reinforcing the ability of cryptoeconomics to democratize financial participation. Iliev (2024) postulates that the failure of traditional economic theory to cope with the blockchain-driven digitalization calls for interdisciplinary effort in the innovation space to adapt to such decentralized technologies. Meanwhile, Grybniak et al. (2024) Uses system dynamics modeling to analyze the economic sustainability of decentralized networks such as Waterfall, providing policy-makers a framework for evaluating scalability and inflation. Gonak (2022) emphasizes the global implications of cryptoeconomics by associating the crypto market cap with the national GDP, especially in the case of Ukraine, and calling for

equilibrium between regulation and integration. Taken together, these works reveal the field's double purpose of technical innovation and socio-economic adaptation.

Crucially, cryptoeconomics' interdisciplinary identity is anchored in foundational theories and political economy critiques. As defined by Brekke and Alsindi (2021), the field is a combination of game theory, cryptography, and economics, and is capable of designing secure peer-to-peer systems. Another study touching on the theme of decentralization is Brekke (2021), in which hacker-engineers are shown battling against neoliberal critiques in their attempts to decentralize digital economies, as a means of prioritising privacy and security over profit-oriented ones. This emphasis on privacy aligns with the nascent research that explores the socio-political implications of cryptoeconomics: Gomes et al. (2024) document how geopolitical conflicts warp user behaviors, and Crandall (2024) examines "network states," tracking the civic code behind decentralized infrastructures at a larger geographical scale. Except as a multiyear study with incomplete data, and not as a political philosophy, these studies show cryptoeconomics' transformative potential to decouple intermediation from status, even though their findings reveal unresolved tensions between decentralization, regulation and equity.

There's a growing body of literature that has pointed out four specific challenges that infrastructure needs to overcome for cryptoeconomics to really mature. To begin with, practical deficits remain widespread. While forward-looking models, such as Future Cryptoeconomics by Harris and Wonglimpiyarat (2024), suggest ambitious systems for decentralized markets, they remain hypothetical models that the real world has yet to vet. This limitation also applies to token valuation studies (Grau, 2020) and stablecoin analyses (Dell'Erba, 2019), who both highlight the importance of data-driven approaches. Second, the scalability and sustainability trade-offs remain. Beres et al. research Bitcoin's Lightning Network privacy, network fees, and participant incentives, creating a complex balancing act that must navigate the realm of the technically feasible and economically sustainable.

Third, progress is stifled by interdisciplinary fragmentation. Survey papers like Cryptoeconomics and Tokenomics as Economics (Ito, 2024) have criticized mainstream economic models for not paying attention to blockchain-specific dynamics (e.g., miner extractable value), but sector-specific case studies, for example Alkhalaf's (2020) study of blockchain-driven journalism, remain siloed and lack generalisable frameworks. If such insights are not more broadly synthesized, they risk belonging to niche realms. Finally, decentralization — the field's ideological cornerstone — presents governance paradoxes. Golding et al. (2021), carried out a first relevant study on systemic risks arising from wealth concentration in Proof-of-Stake networks, exposing systemic risks (Batsaikhan 2017). (2020) show how opaque governance processes can reincorporate centralized control into systems that are conceptually decentralized. Many of these tensions are unresolved, highlighting the precarious balance between utopian views of trustless architectures and the practical needs of economic and social coordination.

Facing these challenges requires systematic methods for evidence synthesis. The rapid proliferation of cryptoeconomic research has prompted the adoption of AI-driven screening applications like Rayyan and AS Review, which utilize active learning algorithms to accelerate literature search (van de Schoot et al., 2021). However, as mentioned by Antons et al. (2023) and Asmussen and Møller (2019), many AI-driven tools are well suited for article summarization, but miss latent thematic structures that are especially prominent in exploratory domains like cryptoeconomics. With that being said, topic modeling (specifically Latent Dirichlet Allocation (LDA) provide a compelling alternative that explores systematic hidden patterns in large corpus of text (Mustak et al., 2021; Schmiedel et al., 2019). In this respect, r the technical barrier for non- specialists. While the review is specific to Orange (an equivalent platform for data mining and machine learning), the idea is the same: unsupervised algorithms can shed light on emergent conversations that break disciplinary boundaries (Kavvadias et al., 2020).

Such methodological innovations are in keeping with the special needs of cryptoeconomics, which straddles economics, computer science and governance. By representing large text corpora as topics readable to the human eye—such as "blockchain security," "stablecoin regulation," or "miner incentive mechanisms"—researchers can more intuitively observe how scholarly salience and focus transflect changes and trends in earthly causal reality, in particular the vicissitudes of technology and finance and how they impact society (Karlstrøm, 2014; Narayanan, 2013a, 2013b). Bibliometric studies support this view, showing how previously scattered niches are forming around common theoretical and methodological approaches (Boakye et al., 2022; M. Cheng et al., 2024). Using network analyses can reveal foundational contributions from researchers like Jing et al. (2024) and Khan et al. (2021), which on their part expose nodes with high citation density (important identifiers of a domain's theory base, Rejeb et al, 2023).

An example of this trend is research relating the global adoption of cryptocurrencies to macroeconomic indicators on a region-by-region basis, especially the regions that met high political or financial instability (Gonak, 2022). Scholars begin to acknowledge that a need for solid empirical methods and cross-disciplinary approaches emerge as cryptoeconomics goes beyond the realm of cryptocurrencies or crypto-asset and reaches into its applicability to societal issues (Keizer et al 2024; Voshmgir & Zargham 2020). For this reason, the literature calls for a more integrated structure—one that openly considers the relationship between technology, economics, and regulation while recognizing the field's grassroots foundations in distributed networks.

Objectives of the Study

Informed by the above literature, we conduct the first systematic mapping of the intellectual landscape of cryptoeconomics between 2013 and 2024 highlighting the prevailing research themes and tracking their temporal trajectory. Building on the pioneering work of Blei (2012) into what is now known as topic modeling, this research

will leverage Latent Dirichlet Allocation (LDA) to reveal latent thematic clusters in a large corpus of cryptoeconomics literature. Incorporating document-topic probabilities (theta values) in addition, it will evaluate how closely each article is aligned to specific themes—providing a granular perspective on the scholarly architecture of the field (De Araujo Gewehr & Moraes, 2023; Li et al., 2023).

One major goal is to shed light on the interdisciplinary reach of cryptoeconomics, looking at fields beyond its home in finance and economics. As Barrera and Hurder (2022), Davidson and Potts (2022), and Mosier (2025) establish, the field's spread is progressively more involved in renewable energy, digital identity management, and other thresholds. Hence, tracing these succession changes in research trajectories will reveal both established sub fields (for instance, cryptocurrency markets, blockchain security) and emerging latent but promising research strings (Barrera & Hurder, 2022; Davidson & Potts, 2022; Mosier, 2025).

Furthermore, this study contextualizes cryptoeconomics in history by looking at topic trends over time. Arranging topic prevalence over time according to the dates of key events, for instance, such as financial disruptions and legislative interventions, provides further insights into external drivers that correlate with research priorities (Karlstrøm, 2014; Narayanan, 2013a, 2013b). Leveraging commonly accepted bibliometric resources (Boakye et al., 2022; M. Cheng et al., 2024), we can offer a swiftly updated, temporally relevant point of view. Lastly, the work cites a citation network analysis to aid in the identification of impactful works and thematic clusters, as exemplified by LitMaps revealing impactful works that synthesize traditional economics, computer science, and policy (Jing et al., 2024; Khan et al., 2021; Rejeb et al., 2023). Flush with these quantitative and qualitative insights, this study establishes a rigorous evidence base for scholars, practitioners, and policymakers to build future cryptoeconomic innovations upon.

RESEARCH METHODS

Through a mixed-methods research design using a systematic literature review (SLR) and topic modeling approach, this study dissects the leading research trajectories of cryptoeconomics between 2013 and 2024. This design resolves the scalability and bias challenges of traditional SLRs, while not interfering with the interdisciplinary emphasis on complete coverage within the field (Asmussen & Møller, 2019; Snyder, 2019; van de Schoot et al., 2021). Data were collected on instances of "cryptoeconom*" (i.e. cryptoeconomics, cryptoeconomy) as a title, abstract, or keyword from Scopus, obtained January 30, 2025. Following the guidelines established by Lim et al., we prioritized Scopus due to its strict indexing criteria (interdisciplinary reach) and larger repository compared to Web of Science (Paul et al., 2021). for broad review domains (2021).

To avoid selection bias, an initial corpus of 1,058 records was created with no temporal or linguistic filters. A multi-stage screening process was then performed: (1) Title, abstract and keyword screening, comparing records against inclusion criteria — peer-reviewed, English journal articles exploring the role of cryptoeconomics in

traceability, governance, or market shaping. (2) Non-empirical (e.g., preprints, whitepapers) and non-journal publications (e.g., books, conference papers) were excluded. After deduplication and full-text review, 585 articles fulfilled all eligibility criteria and made up the final dataset. The records were then exported in Research Information System (RIS) and comma-separated values (CSV) files for further analysis.

The initial stage involved the use of LitMaps to visualize and explore citation networks for the gathered 585 articles. LitMaps visualizes how works cite or reference one another, enabling you to identify influential scholarship; thematic clusters; and areas where no research has been done. These approaches additionally echo calls for network-based analyses to illuminate the intellectual structure of research that is taking shape (Antons et al., 2023).

The corpus is text mined in an unsupervised manner in Orange, a data mining environment that integrates LDAVis for exploratory topic visualization. Following Blei et al. (2003) whilst perplexity scores and semantic coherence metrics work hand in hand in deciding the relevant parameters for Latent Dirichlet Allocation (LDA) that eventually give rise to a ten talked topics model comprising unique and impactful areas of research. Using the LDAVis tool from Orange the outputs were iteratively refined and interpreted, which helped uncover a few key themes concerning decentralized governance, stablecoin regulation and alignment of incentives.

Finally, the outcomes obtained from both network citation analysis and LDA were used together to understand what each document relates to each thematic cluster detected. With this comprehensive strategy of citation network mapping, we search for core papers at the intersection of cryptoeconomics, governance and new financial models (Alasik & Yildirim, 2024; Araújo et al., 2023, 2024; Nabben, 2023). Both the prevalence of themes over time and the density of citations are traced in the study. In that way, it creates a long-term, detailed map of the way cryptoeconomics has progressed over time, and identifies areas ripe for further empirical and conceptual efforts.

All in all, this is a compromise in terms of computational rigor and accessibility. The systematic review and the LDA pipeline with the dominant patterns in cryptoeconomics literature and LitMaps' visualization of citations provide the network-level understanding to contextualize the evolution of a field. This hybrid approach enables methodological rigor while ensuring both reproducibility and scalability, which are key to upholding the methodological standards required for interdisciplinary research in an emerging field.

RESULT AND DISCUSSION

Network of Citations and References

The coverage analysis of bibliography analysis illustrates the shifts in the underlying network of research in cryptoeconomics, elucidating important topological information regarding connecting and impact. The connectivity map demonstrates that early foundational works, such as Narayanan (2013a, 2013b), Narayanan et al. (2016) and

Karlstrøm (2014), continue to serve as crucial reference points, forming the backbone of the field. This suggests a pattern taking on high complexity in research domains that are increasing. In the second-layer connections, highly connected nodes such as H.-P. Cheng & Yen (2020) and Yen et al. (2023) suggest that these are essential points of reference in bridging retrograde theoretical frameworks with contemporary research--which confirms cryptoeconomics' cross-disciplinary nature. The density of interconnections, as illustrated in Figure 1, additionally indicates that this field has entered into a stage of intellectual maturity in which the majority of newly generated contributions build heavily on established knowledge frameworks.

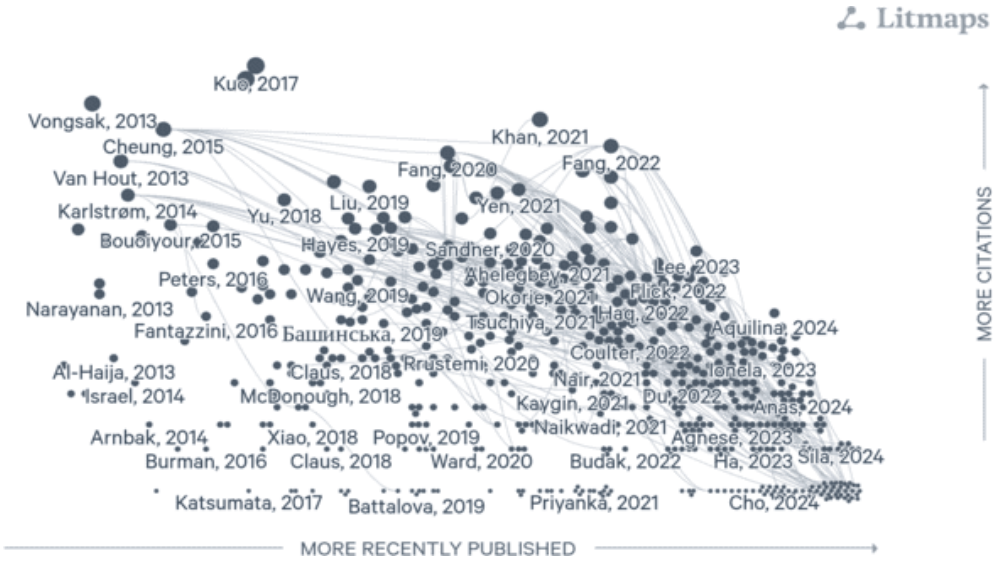


Figure 1. Network of Citations Analysis

Citation trends show how new research suggests some papers from 2021 onwards are already making their impact felt as evidenced by their citation numbers. Whereas past studies profit from cumulative advantage, this is not the case for more recent works such as Khan et al. (2021) and Fang et al. (2022), indicates a dynamic research community that readily acknowledges new contributions. This trend matches the rapid pace of blockchain tech development, where new studies focused on new challenges can instantly matter in academia and practice. The gradual expansion of citation activity over time indicates the ongoing growth, and progress of the field through cumulative citation networks of prior research and emerging work.

The distribution of reference counts offers additional perspective on our field's interdisciplinary nature. The one can see in the Figure 2, The presence of the papers with extensive references such as Howson et al. (2024) and Keizer et al. (2024), signals a movement toward more systematic literature reviews and theoretical syntheses, suggesting a merging of academic disciplines. Showing a nice mixture between the empirical studies with fewer citations and the more conceptual research with far more citations, highlights a big methodological spectrum of the cryptoeconomics work being conducted. As reference counts rise over the years, this indicates that more recent

studies are reinforcing the interdisciplinary cross-pollination between economics, finance, computer science, and law. Such a trend highlights the increasing complexity of cryptoeconomics as a field and calls for more integrative approaches to its multifaceted challenges.

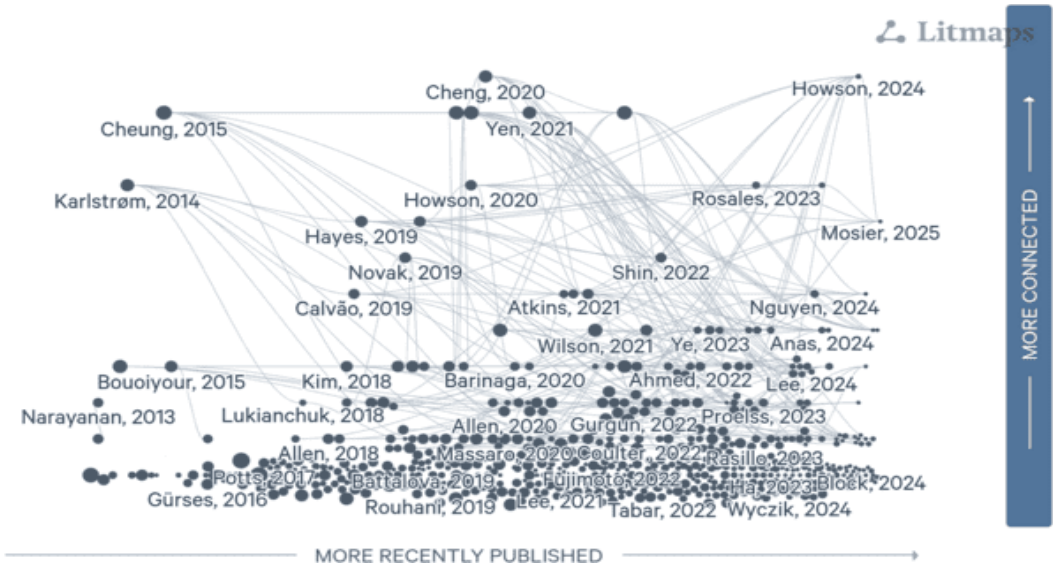


Figure 2. References Distribution Connectivity

Document-Term Matrix (DTM) and TF-IDF Overview

To find out the central themes and terms in the 585-article corpus, we first constructed a Document-term Matrix (DTM) of 72,695 raw terms. After stopword removal, lemmatization, and other text-cleaning processes, the final constitutive contents of this DTM contained 4,638 tokens of domain-specific vocabulary, closely reflecting the specialized language of cryptoeconomics. It includes important text cleaning techniques because this removes those generic or non-informative words to avoid including in the list of vocabulary, it also allows including important content based on context of the data. As such, "blockchain," "crypto," "governance" and "assets" came out as keywords in the matrix, mirroring the inter-disciplinarity of cryptoeconomics research present in other similar, machine learning–based literature reviews (Asmussen & Møller, 2019; Snyder, 2019).

Preprocessing also included the application of term frequency–inverse document frequency (TF-IDF) weighting scheme, which applied greater weight to terms that appeared frequently in certain documents and less frequently in the corpus overall. This mechanism guarantees that words that are particularly defining — words that capture the key discussions of cryptoeconomics — ascend to higher frequency. This suffices to say that words such as "token", "energy", "security" and "market" achieved relatively high scores, as clear indicators of a more specialized conversation, which may centre on topics such as the tokenization, environmental sustainability, system security or financial analysis. In contrast, general or methodological words like "study," "paper,"

or "model" scored lower. As such, the net effect of TF-IDF weighting was a vocabularium that more effectively captured the conceptual breadth of the field, consistent with recommended practices in both computational and bibliometric research (Antons et al., 2023).

Latent Dirichlet Allocation (LDA) Modeling with Orange

Using Latent Dirichlet Allocation (LDA) on top of the DTM, we attempted to extract hidden thematic structures of cryptoeconomics scholarship. Implemented in the Orange data mining environment, the LDA procedure was tuned for sparsity and number of topics with perplexity and semantic coherence metrics, in addition to visual inspections with LDAVis. This interactive feature allowed us to visualize potential topics in a two-dimensional space, ensuring that each topic statistically cluster together and are interpretable (Chang et al., 2009). Finally, 10 important topics were obtained with their 10 most decisive terms (Blei et al., 2003).

Table 1. Latent Dirichlet Allocation (LDA) Modeling

Topic	Top Terms
Topic 01	crypto, economic, assets, market, bitcoin, token, digital, accounting, analysis, economy
Topic 02	crypto, cryptocurrencies, digital, economic, data, bitcoin, blockchain, market, money, study
Topic 03	crypto, blockchain, energy, cryptocurrency, digital, study, economy, economic, bitcoin, market
Topic 04	crypto, cryptocurrency, financial, paper, currencies, money, digital, economic, cryptocurrencies, market
Topic 05	digital, assets, crypto, cryptocurrencies, currencies, cryptocurrency, monetary, financial, economic, study
Topic 06	blockchain, crypto, technology, based, security, data, study, energy, applications, bitcoin
Topic 07	crypto, cryptocurrency, financial, market, assets, digital, economic, cryptocurrencies, risk, study
Topic 08	crypto, financial, bitcoin, study, cryptocurrency, assets, economy, cryptocurrencies, market, analysis
Topic 09	blockchain, crypto, technology, economic, paper, energy, study, financial, literature, cryptocurrency
Topic 10	crypto, economic, digital, unit, blockchain, felsic, data, security, accounting, based

In the end, the topic-word distributions were very similar—especially for "crypto," "economic," "digital," "blockchain," "financial" and "market." However, all concepts did indeed capture unique keywords, allowing for more specific interpretations. For instance, energy was an important part of some clusters, which presented sustainability concerns (Astuti & Hidayati, 2023; Chen et al., 2024). At the

same time, terms such as "risk," "accounting," and "governance" bubbled up as separate topics (Golding et al., 2020; Morrison et al., 2020), signalling that the field was developing an institutional dimension. These patterns underscored the process how cryptoeconomics that was earlier trapped in prices talk (Fang et al 2022) are branching into governance, compliance, and environmental domain (Brekke & Alsindi, 2021).

Topical Profiles: Overlap and Distinction

Topics overlap indicates the integrated aspect of these exploratory results and unique secondary words reflect exploration contracts of inquiry focusing on governance, sustainability, and advanced technology (Voshmgir and Zargham, 2020). While the corpus still is very much finance focused, it also points to an increasing desire for interdisciplinary research (John & Saleh, 2025). Each of these 10 topics revealed slightly different clusters of words, despite sharing common high-frequency terms (see Table 2 below):

Table 2. The 10 Discovered Topics Exhibited Clusters

Topic Cluster	Cluster of Words
Topic 01 Market-Focused Finance	Terms like "assets," "market," "token," and "analysis" suggest scholarship centered on trading, valuation, and price dynamics. This aligns with earlier findings that cryptoeconomics initially revolved around speculation and liquidity concerns (Fang et al., 2022).
Topic 02 Cryptocurrency Economics	Emphasizing words such as "cryptocurrencies," "digital," "money," and "study," this topic indicates ongoing debates about cryptocurrencies' monetary properties and their broader implications for monetary theory (Adrian & Mancini-Griffoli, 2021).
Topic 03 Energy and Sustainability	Featuring "energy," "environment," "blockchain," and "cryptocurrency," this topic confirms a nascent but rising interest in ecological impacts, in line with critiques of proof-of-work mining (Beres et al., 2019; Chen et al., 2024).
Topic 04 Financial Instruments and Currencies	Focused on "paper," "currencies," "money," and "digital," this cluster spotlights analyses of currency design and the interplay between fiat systems and cryptoeconomics (Dell'Erba, 2019).
Topic 05 Monetary Theory and Digital Assets	Similar to Topic 4 but with added references to "monetary" and "economic," reinforcing the idea that cryptoeconomics intersects with classical monetary frameworks (Gonak, 2022).
Topic 06 Blockchain Technology and Security	"Technology," "security," "applications," and "data" cluster here, aligning with research that explores cryptographic protocols, consensus mechanisms, and data management (Buterin, 2014).

Topic 07 Risk and Market Volatility	With "risk," "financial," and "assets," this topic hints at systemic vulnerabilities, regulatory concerns, and investor sentiments—mirroring studies on stablecoin collapses and market crashes (Gonak, 2022; Iliev, 2024).
Topic 08 Bitcoin-Heavy Market Analysis	Terms like "bitcoin," "financial," and "analysis" point to a subfield specifically dissecting Bitcoin's market performance and network structure (Nakamoto, 2008).
Topic 09 Economics, Literature, and Energy	Merging "paper," "energy," "cryptocurrency," and "financial," this topic suggests deeper theoretical reflections that bridge resource consumption and economic modeling.
Topic 10 Technical-Economic Hybrid	The mention of "felsic" (likely referencing resource or geological contexts) alongside "crypto," "security," and "accounting" indicates narrow but specialized intersections—possibly supply-chain or industrial use cases that also require robust accounting frameworks (Alkhalaf, 2020).

LDAVis Visualization Insights

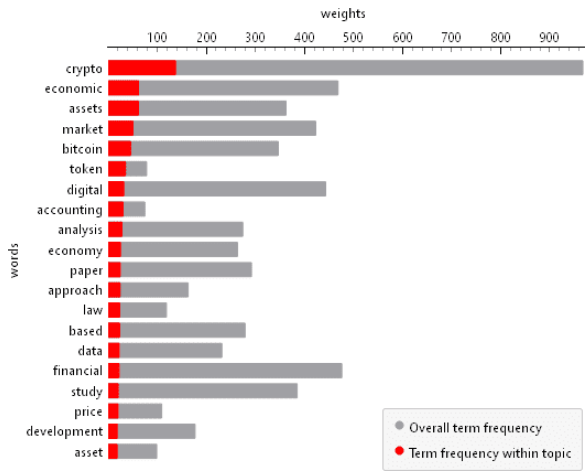
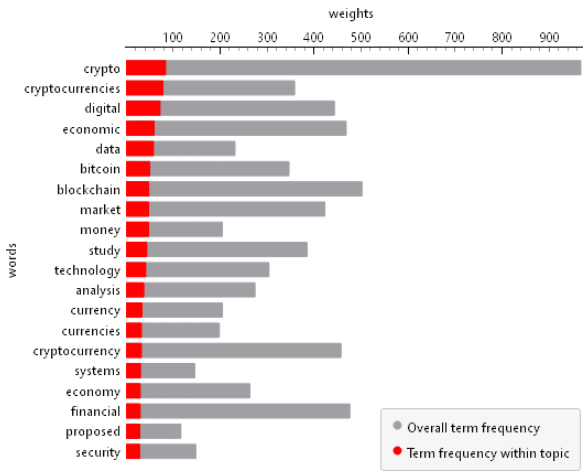
LDAVis projection shows how these 10 clusters in the semantic space. And many of them overlapped, which suggests that the scholarship on cryptoeconomics often addresses multiple dimensionsfinancial (topic 1 & 4), technical (topic 6 & 10), and social within individual studies (Brekke & Alsindi, 2021). Energy and risk-related topics (topic 3 & 7), in contrast, seemed more isolated and suggestive of narrower or emerging domains that may need more rigorous empirical investigation. For example, there were fewer articles on energy consumption than on market issues both by number and percentage. This is indeed an early-stage subfield, one which is heavily siloed at this stage of research on sustainable blockchain solutions (Chen et al., 2024). As with previous text-mining studies (see: Asmussen & Møller, 2019), combining TF-IDF weighting with interactive LDA produced a high-resolution map of the diversification of cryptoeconomics.

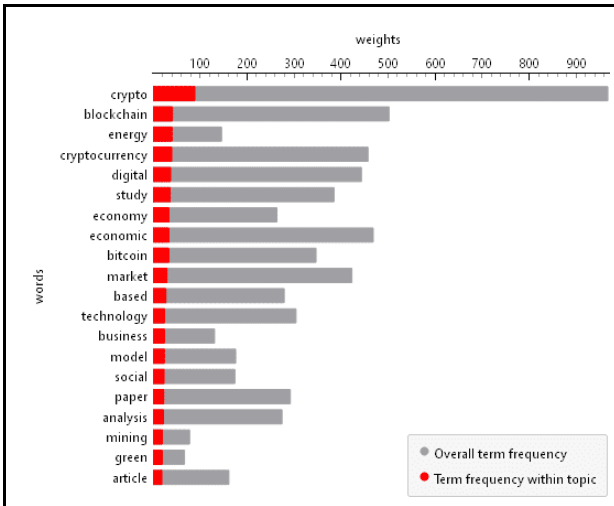
The findings of this analysis suggest that cryptoeconomics is a new field that has evolved from its early roots in questions about financial markets to a complex and nuanced in-stitution. A significant share of the literature continues to be on cryptocurrency investment, volatility, and asset classification, highlighting the enduring appeal of cryptoassets as high-risk, high-reward instruments (Fang et al., 2022). This focus on the market also extends to regulatory challenges, a recognition of the balancing act policymakers face between fostering innovation, protecting consumers, and maintaining systemic stability. As a result, the term frequency–inverse document frequency (TF-IDF) results attest that financial language still dominates various topics in the corpus.

Beyond finance, the frequencies of terms such as "governance", "risk", and "energy" suggest institutional design and sustainability are emerging focal areas of

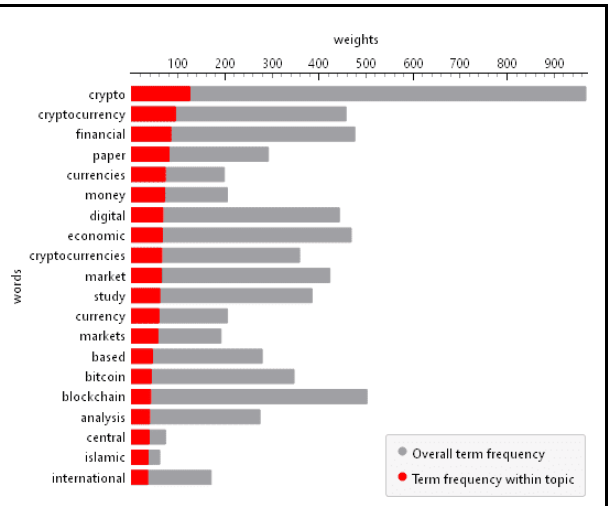
inquiry in the field of cryptoeconomics (Astuti & Hidayati, 2023; Chen et al., 2024). Researchers investigate how blockchain-induced incentives might dosteam with social imperatives—like tending to the environment and compliance with established law. Such transition indicates a shift away from the speculative models towards environmentally sustainable and transparent applications and is reflective of a more mature industry that highlights the implications of distributed ledger technologies outside the crypto bubble.

Therefore, expressions such as "felsic" hint at novel cryptoeconomic applications—covering areas such as supply chains and resource management, as well as local economies (Alkhalaf, 2020).These professional terms stress cryptoeconomics' ability to break out of the mainstream financial world and embed itself in a whole spectrum of networks with differing technical infrastructures. In essence, while crypto-economics has its origins in financial theory, it is now growing to address more and more real-world complexities—being forced to interface with social and environmental dimensions, along with regulations (Brekke, 2021). To sum it up, though cryptoeconomics is grounded in financial theory, it holds the potential to increasingly learn from real world complexities, engaging with social, environmental and regulatory facets (Brekke, 2021).

Topic 01	Topic 02
	
Topic 03	Topic 04



Topic 05



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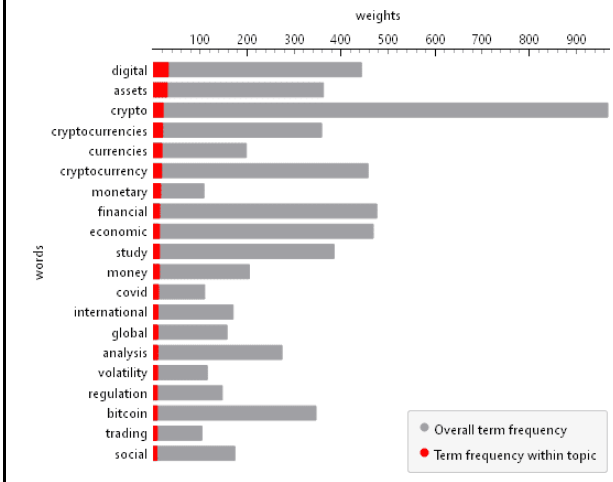
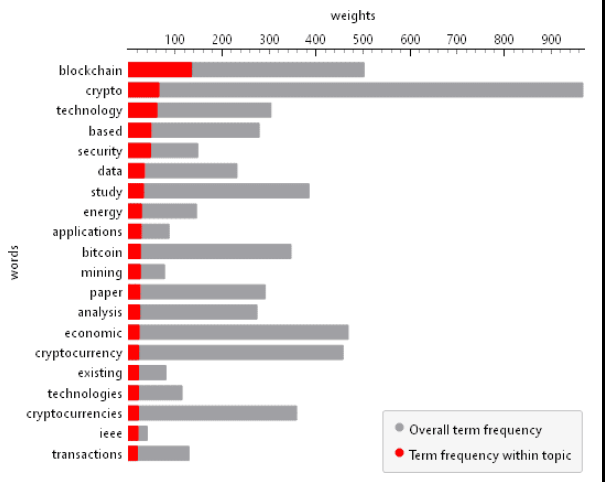
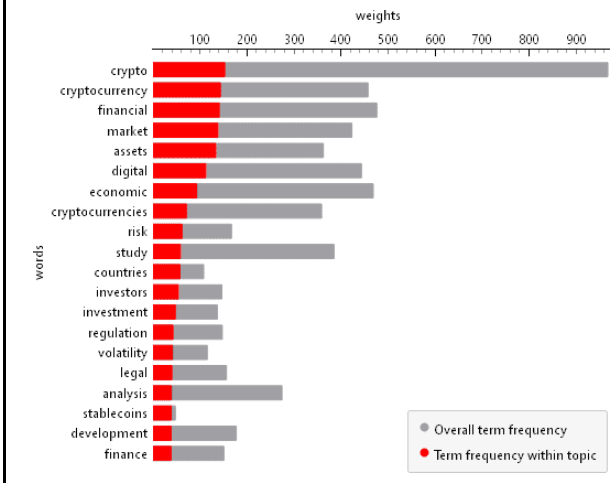


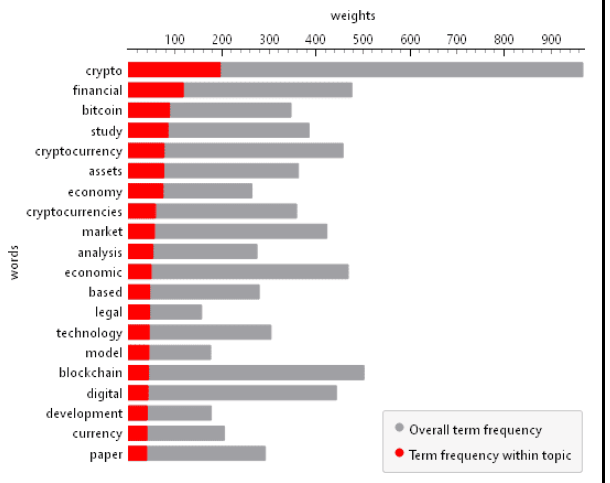
Topic 07



Topic 08



Topic 09



Topic 10

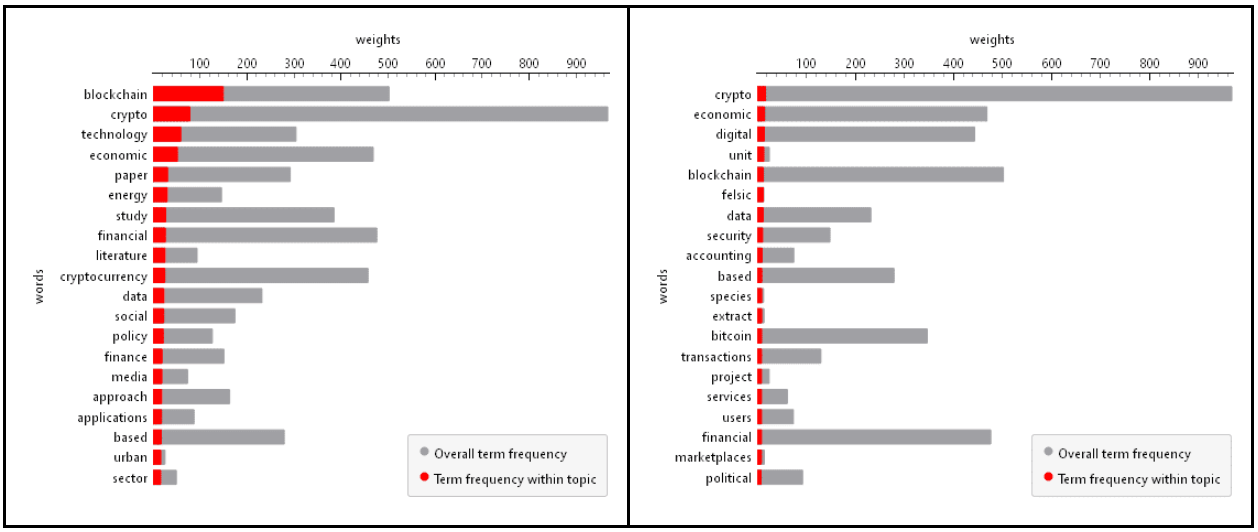


Figure 3. LDAvis Projection

Evolving Financial and Governance Foundations

The analysis, based on the previous results driven primarily by LDA, highlights that the field of cryptoeconomics is expanding from its original niche in decentralized finance (DeFi) and cryptocurrency market dynamics towards a wider interdisciplinary domain. The pioneers of blockchain (Nakamoto, 2008; Buterin, 2014) envisioned a trustless, peer-to-peer, system and early research focused on how transactions are verified and how digital assets are valued. Yet according to John and Saleh (2025), the field has now branched into various sub-areas, such as theories of sustainable blockchain applications, models for governance structures, and comprehensive techno-economic effects. Our Latent Dirichlet Allocation (LDA) model (with ten topics) trained on a 585- article corpus corroborates this one-way drift. Although many of these studies continue to be about "market risk" and tokenization, the emergent themes — such as environment sustainability, regulatory debates, and stakeholder-centric governance — are indicative of transcending cryptoeconomics from the realm of pure technical and speculative discourse to a social discipline with real-world relevance.

One of the dominant themes in the LDA analysis is the continued focus on financial theories and market-based perspectives within the scope of cryptoeconomics. Findings around multiple topics focused on words including "market," "token," "assets," and "financial," suggesting that the academic community continued to show interest in various pricing mechanisms, trading behaviour, and risk analysis of crypto- assets (Fang et al., 2022). This finding echoes the etiology of the wider narrative about the status of cryptocurrencies as speculation vehicles or hedges against macroeconomic uncertainty (Gonak, 2022). Furthermore, the volatility and security elements of crypto- financial systems and bring to the surface the fragile line between potential for disruption and systemic vulnerability (Stashchuk et al., 2024). In fact, there is emerging consensus that sound financial risk management principles need to figure prominently in cryptoeconomic design, as investor confidence in decentralized systems requires

appropriate governance models, consistent audits, and respectful regulatory approaches (Brekke & Alsindi, 2021; Adrian & Mancini-Griffoli, 2021).

A second big thrust is on governance and institutional design. Unlike earlier visions of fully trustless ecosystems, more recent studies have recognized that decentralized platforms generally must develop structured decision-making processes (Morrison et al., 2020). The insights from our LDA clearly demonstrate recurring mentions of "accounting," "security," and "governance," reflecting calls for standardized rules and transparent procedures in new decentralized networks (Golding et al., 2020). Such a pivot resonates with the epistemic paradigms presented by Voshmgir and Zargham (2020), where cryptoeconomics isn't merely about cryptocurrency but a blend of tech and economic incentives that paves pathways into DAOs, platform economies, and other decentralized applications. Hassan and De Filippi (2021) similarly emphasize that the operational precision of DAOs means they must reconcile autonomy with real-world legal obligations—an increasingly salient tension as cryptoeconomic ventures attract institutional investors as well as policymakers (Allen et al., 2020).

Environmental and Socio-Political Dimensions

In addition to accounting for the rules of governance, environmental sustainability appears to be another topic. Although shadowed in the limelight by financial subjects, the usage of "energy" and 'sustainability" by scholars (Chen et al., 2024: Beres et al., 2019) reflect a rising concern about blockchain-based systems' potential impact on ecological footprints. People have attacked the excessive electricity consumption of the Proof-of- Work (PoW) protocol and suggested that new consensus mechanisms, such as Proof-of- Stake (PoS) or some hybrid model are needed (Kirste et al., 2024). In a supply-chain realm, Astuti and Hidayati (2023) explore how cryptoeconomic incentives not only can encourage sustainable resource management and transparent logistics but also have the potential for blockchain technologies simultaneously to address operational as well as ecological challenges. Nonetheless, the relationship between cryptoeconomic growth and environmental impact is as yet little understood; there is need for adequate empirical evidence to judge whether mining, node operation, protocol updates actually do lower the carbon footprint of all this activity (Sedlmeir et al., 2020)

The socio-political dimension of cryptoeconomics research is closely intertwined with sustainability. Authors like Nielsen (2024) and Crandall (2024) track atomic-sounding novel settings-—"inverted cryptoeconomies" in a virtual world, "network states"—that challenge classical-imperial monetary or capitalist anti-foundationalists. These forays echo Iliev (2024), decrying the inadequacy of orthodox economic theory within a digitized economy, advocating instead for tools that could offer an ongoing synthesis of the interests of cryptographic-security and society at large. The familiarity of terms like "study," "paper," and "analysis" stacked across many topics indicates many researchers consider cryptoeconomics as a pragmatic approach to aid with global inequities, financial inclusion, and democratic participation (Gonak, 2022; Allen et al., 2020). This subfield of both scholarship and practice aims to ensure that the potential of

cryptoeconomic innovations does not merely replicate existing power imbalances in economic systems, e.g., through wealth concentration via token issuance or the risk of major mining pools exerting outsized influence (Barrera & Hurder, 2022).

Technical security is still an ongoing discussion point which connects back to cryptography's fundamental purpose behind blockchain protocols (Brekke & Alsindi, 2021; Atzei et al., 2017). A plurality of LDA topics regarding "blockchain," "technology," and "security" suggest ongoing preoccupations with cryptographic audit, smart contract vulnerabilities, and architectural resilience. Even though there is a drive for sophisticated cryptographic constructions (Dhillon et al., 2017), the gaps between theory and practical real-immediate setting are forced to light by high-profile exploits like the DAO hack or hash of DeFi protocols (Morrison et al., 2020). The apparent interest in integrating accounting controls into cryptoeconomic designs – as evidenced by the earlier references to "accounting" in the LDA topics – demonstrates a developing motivation for merging established financial standards with distributed ledger technologies. These developments highlight that to be accepted at the institutional level, cryptoeconomics cannot only need to innovate, but they need to adhere to the most rigorous legal, compliance and reporting benchmarks (Acheson et al., 2019).

Interdisciplinarity, and Future Outlook

As part of this translation from theory to practice, the LDA analysis suggests both to newly proposed and piloted frameworks. Research on stablecoins (Dell'Erba, 2019) for example, critiques still ongoing experiments with algorithmic monetary policy — an area in which both central banks and private entities alike probe for digital tokens to redeem to fiat or commodity reserves (Adrian & Mancini-Griffoli, 2021). Similarly, Grybniak et al. (2024) use system dynamics modeling to assess the scalability potential of cryptoeconomics, and demonstrate how strategic simulations can enrich policymakers' decisions about the trade off between growth and inflation. Economy, digital, study and other terms appearing many times throughout the topics provide evidence that cryptoeconomics is being studied from an empirical perspective rather than a purely theoretical speculation. Ranging across journalism (Alkhalaf, 2020), supply chains (Astuti & Hidayati, 2023) or even alternative resource management (Mosier, 2025), research into cryptoeconomics is consolidating a data-driven base for their innovations to emerge.

Moreover, interdisciplinary depth becomes one of the distinguishing characteristics of the cryptoeconomics ecosystem (Alasik & Yildirim, 2024). While exploring the topic modeling analysis, we found overlapping vocabularies—"crypto," "blockchain," "financial," "economic," "digital," "governance," "sustainability"—that contribute a cross-cutting lexicon that binds economists, computer scientists, sociologists, and legal scholars (Brekke 2021). This contrasted with earlier literature that tended to discuss cryptoeconomics in silos — e.g. focusing on cryptocurrency trading or consistent distributed database security — recent studies highlight the need for robust frameworks which integrate a view that environmental, institutional and user-centric

dynamics will lead to a variety of emergent behaviours that need to be formalised if we are going to reach consensus on underlying theories of system performance (Barrera & Hurder, 2022; Davidson & Potts, 2022). This synergy is in accordance with Mustak et al. (2021) and Antons et al. (2023), that favor computationally enabled techniques (e.g., LDA) used to synthesize the tonalities of large, multidisciplinary corpora. Though such breadth risks diluting cryptoeconomics' core identity, it better encapsulates the multi- faceted ecosystem-level problems that decentralized technologies raise, from network- layer protocol design to macro-level regulatory strategy (John & Saleh, 2025).

Collectively, these perspectives depict cryptoeconomics as a discipline in transition — moving from naive sibling relations to more serious exploration of policy challenges, scaling realities, and sustainability constraints. Financial speculation stays at the core, consistent with the domain's genesis in cryptocurrency markets (Fang et al., 2022; Nakamoto, 2008). But the increasing development of governance research, energy awareness, and socio-political critiques indicates a shared direction towards application and responsible innovation (Voshmgir & Zargham, 2020; Iliev, 2024). As a natural reconciliation of trustless protocols and regulatory constraints, cryptoeconomics stands at the nexus of critical discussions regarding fair digital economies and equitable access to financially innovative mechanisms (Allen et al., 2020). Conclusively, the LDA results make it clear that cryptoeconomics has arrived at a wake-up-call mile marker, moving from speculative frenzy to the multi-dimensional synergetic growth area it must become through scientific empirical iterations, cross-sectorive collaborations, and proactive regulatory frameworks. This intersection of finance, governance, sustainability and social equity could chart the course of the field for the next decade.

CONCLUSIONS

The results show that despite the preeminent themes of the past using economic and financial foundations, there are still many emerging areas—e.g., blockchain governance and smart contracts in this framework—that are already relevant but have had little research attention. Term frequency analysis and topic modeling indicate that while the vast majority of cryptoeconomics research continues to be situated within the standard financial and economic paradigms, there is a demand to further integrate technological, regulatory, and sustainability perspectives. The attempt to broaden the scope of inquiry would give scholars the opportunity to properly situate and examine the field, rather than narrowly focus and frame cryptoeconomics within existing global financial markets.

Nuanced results from this study reveal that cryptoeconomics, once demonized as a speculative playground of crypto-obsessed speculators and shrewd-market manipulators, is now an interdisciplinary field that merges economics, computer science, law and environmental studies. Though price dynamics and investment risk remain salient topics of recent reflexive and resurgent scholarship, several lines of academic inquiry now reflect a growing consensus of the need for governance, legal clarity and compliance mechanisms. Such transition demonstrates the understanding

that innovation in decentralized systems need to dual with autonomy and global standards, or financial inequities will be intensified in the new systems. Simultaneously, environmental concerns have taken center stage, forcing cryptoeconomics to confront sustainability head on. The debates serve as a reminder that for a crypto economics to be efficient, it not only has to fulfill the financial viability conditions but also undertakes environmental responsibility, two which will control and guide how researchers and practical workers before adapting picking from any particular bitcoin project.

In going forward, rigorous empirical research will be crucial for navigating cryptoeconomics from emerging optimism to sustainable impact. In addition, systematic evaluations of pilot projects that range from environmentally friendly mining methods to governance protocols for Decentralized Autonomous Organizations can elucidate the best practices and flag up pitfalls that purely theoretical frameworks (Hassan & De Filippi, 2021; Grybniak et al., 2024). Incorporating stablecoin pilots into mainstream regulatory discussions will clarify how digital currencies can satisfy existing legal requirements, close the divide between retail users and large institutions, and encourage broader institutional adoption. Ultimately, the future of cryptoeconomics hinges on its capacity to retain its decentralised ethos while confronting real-world constraints— technical complexity, environmental impact, regulatory oversight, and social inequality. If the field successfully strikes this balance, it could transform global financial and technological infrastructures and establish an unprecedented, internationally coordinated model for equitable value creation.

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