BLOCKCHAIN TECHNOLOGY AS A DIGITAL ECONOMIC ENABLER: A COMPARATIVE ANALYSIS OF DECENTRALIZED ASSET AND CRYPTOCURRENCY PROTOCOLS (BITCOIN vs. ETHEREUM)

Eka Maulana[1]*, Cries Avian[2], Dony Darmawan Putra[3]
[1,2]*Brawijaya University (Indonesia)*
[3]*Institute of Communication Engineering, National Sun Yat-sen University (Taiwan)*
*) email: ekamaulana@ub.ac.id

Abstract

The digital economy demands a new generation of infrastructure capable of facilitating trust, finality, and novel forms of value exchange without centralized intermediaries. This paper posits that blockchain technology serves as a foundational enabler for this digital economic paradigm, but its specific economic impact is profoundly shaped by the core design choices embedded within its protocols. To investigate this thesis, we conduct a comparative case study analysis of the two dominant and archetypal blockchains: Bitcoin and Ethereum. Employing an analytical framework that evaluates protocols across dimensions of primary economic function, consensus and security, programmability, governance, and tokenomics, this study contrasts Bitcoin's design as a decentralized, censorship-resistant store-of-value as a digital gold with Ethereum's design as a globally accessible, programmable platform for decentralized assets and applications of world computer. Our findings reveal a fundamental trade-off: Bitcoin's focus on security, simplicity, and predictable monetary policy creates a robust but functionally narrow economic enabler, while Ethereum's flexibility and composability foster a vast and innovative on-chain economy at the cost of greater complexity and evolving security challenges. The comparison demonstrates that there is no singular blockchain economic model; rather, protocol design dictates the scope, capabilities, and risks of the enabled digital economy. The analysis concludes by discussing the implications of this dichotomy for the future of digital assets, including the emergence of alternative layer-1 and modular blockchains, and highlighting key challenges in scalability, interoperability, and regulation that will shape the next phase of blockchain-enabled economic activity.

Keywords: blockchain technology, Decentralized Finance, digital economic, cryptocurrency, bitcoin.

1.   INTRODUCTION

The relentless evolution toward a digitally-mediated global economy has starkly revealed the structural inadequacies of legacy financial and transactional systems. These traditional infrastructures, predominantly built upon centralized trust intermediaries like banks and payment processors, inherently introduce points of failure, create significant operational friction through complex reconciliation processes, and systematically exclude broad swaths of the global population from full economic participation (Tapscott & Tapscott, 2016; World Economic Forum, 2020). Consequently, a critical imperative has emerged for a native digital paradigm as a system architected from first principles to guarantee verifiable ownership, ensure transparent and final settlement, and enable the programmable transfer of value without requisite third-party permission (Catalini & Gans, 2016). This paper posits that

distributed ledger technology, most prominently embodied by blockchain, provides the foundational architecture for this new paradigm.

However, the economic impact of blockchain technology is not monolithic. While it is established as essential infrastructure, its specific function as an economic enabler is profoundly heterogeneous and dictated by its foundational design (Zheng, Xie, Dai, Chen, & Wang, 2017). This article is grounded in the thesis that the economic landscape a blockchain fosters which encompassing the nature of assets, the complexity of applications, and the forms of user interaction is not a predetermined outcome but is fundamentally architected by the core philosophical tenets and technical choices embedded within its protocol layer. To investigate this principle, we conduct a comparative analysis of the two most significant and archetypal protocols between Bitcoin (BTC) with $126.080 ATH in October 06, 2025 and Ethereum (ETH) with $4.956 ATH in August 24, 2025. Comparison price last three years between BTC, EHT and XAU (gold) to USD is shown in Figure 1.

Figure 1. Comparison for Cryptocurrency Trend in 3 years


Source: TradingView (2026)

Bitcoin, introduced by Nakamoto in 2008 as a peer-to-peer electronic cash system, has undergone a notable evolution in perception, now widely regarded as a decentralized digital commodity or digital gold, emphasizing store of value over medium of exchange. In contrast, Ethereum was conceived by Buterin since 2013 as a world computer, a generalized, programmable blockchain that has since become the foundational settlement layer for Decentralized Finance (DeFi), non-fungible tokens (NFTs), and a vast ecosystem of smart contract-based applications. This article dissects how the divergent design decisions of these two protocols from consensus mechanisms and scripting capabilities to governance models and tokenomics translate into distinct economic functionalities and outcomes. The roadmap for this exploration is as follows: after delineating the methodological approach, we establish

a multidimensional analytical framework for protocol comparison, apply this framework in depth to both Bitcoin and Ethereum, synthesize the findings to elucidate inherent design trade-offs, and conclude by exploring the broader implications for the future trajectory of blockchain-enabled digital economies.

2.   METHODOLOGY

This study employs a qualitative comparative case study methodology, a research strategy well-suited for investigating complex, real-world phenomena within their contexts and for elucidating the causal mechanisms that link specific conditions to observed outcomes (Yin, 2018). The approach is focused on a structured, feature-based analysis of two intrinsic and paradigmatic cases: the Bitcoin and Ethereum protocols. As Baxter and Jack (2008) note, case study methodology is particularly effective for providing an in-depth exploration of how and why questions, which aligns with this paper's objective of dissecting *how* protocol design choices lead to distinct economic functionalities. This research is conceptual and analytical rather than empirical; it does not involve primary data collection or statistical hypothesis testing. Instead, it conducts a systematic dissection of protocol design and its economic implications through a critical literature synthesis and document analysis. The methodological procedures are executed through four sequential, interdependent phases as simplified in Figure 2.

Figure 2. Sequential Methodology Procedure Phase
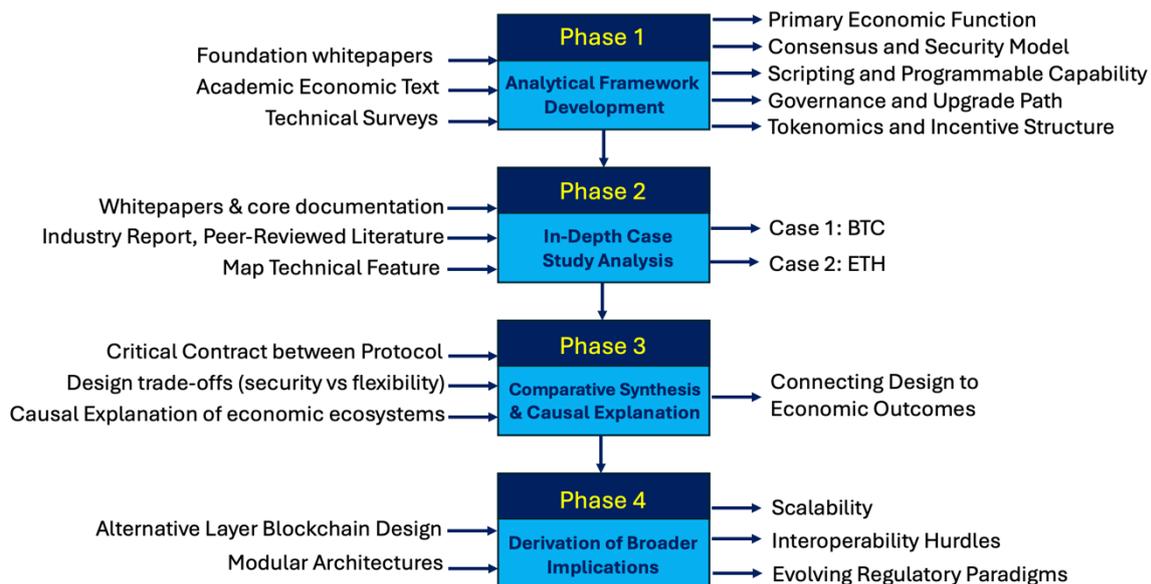
The first phase establishes the conceptual lens for the comparative analysis. This involves constructing an analytical framework grounded in a comprehensive review of seminal and contemporary literature on blockchain technology's architecture and economic principles. Sources include foundational whitepapers (Nakamoto, 2008; Buterin, 2013), key academic texts on the economics of digital ledgers (Catalini &

Gans, 2016), and technical surveys of blockchain design components (Zheng et al., 2017). Through an iterative process of thematic synthesis (Braun & Clarke, 2006), this literature review identifies five critical and interdependent dimensions that directly constitute a protocol's economic enabling capacity: (1) Primary Economic Function, (2) Consensus and Security Model, (3) Scripting and Programmable Capability, (4) Governance and Upgrade Path, and (5) Tokenomics and Incentive Structure.

In the second phase, each selected case of Bitcoin and Ethereum is subjected to a rigorous, stand-alone analysis using the framework established in Phase 1. This analysis is conducted through an intensive examination of primary source documents, including the original protocol whitepapers, official core documentation, and key technical papers detailing major upgrades like as Ethereum's Merge documentation. This primary analysis is complemented and contextualized by authoritative secondary literature from peer-reviewed journals, industry reports, and recognized scholarly books. This phase aims to build a holistic profile of each protocol, mapping its specific technical features onto the five-dimensional framework to articulate its unique economic thesis and operational logic.

The third phase involves the systematic juxtaposition of the two individual case analyses. Following the principles of comparative case study analysis as outlined by Bartlett and Vavrus (2017), this synthesis is not merely descriptive but is explicitly explanatory. It focuses on highlighting critical contrasts, potential synergies, and, most importantly, the fundamental design trade-offs evident between the two protocols (e.g., security versus flexibility, simplicity versus programmability). The goal is to move from *what* the differences are to construct a logical argument for *how and why* the distinct philosophical and technical design philosophies of Satoshi Nakamoto and Vitalik Buterin necessarily yield divergent economic ecosystems and use-case landscapes.

The final phase extends the findings from the comparative synthesis to the broader domain of digital economic enablement. This involves logical reasoning to discuss the wider implications of the Bitcoin/Ethereum dichotomy for emerging trends, such as the design of alternative Layer-1 blockchains and modular architectures (e.g., Celestia, 2023). It also involves identifying persistent, cross-cutting challenges including scalability trilemmas, interoperability hurdles, and evolving regulatory paradigms that stem from the core trade-offs identified in Phase 3. This phase connects the specific case findings to general theoretical and practical questions about the future trajectory of blockchain-based economies.

To assess the fundamental performance of Bitcoin and Ethereum as long-term assets and to compare their investment appeal beyond daily market volatility, this analysis employs the Compound Annual Growth Rate (CAGR). This metric calculates the consistent, compounded average annual growth rate required to transform a beginning value into an ending value over a specified period. By applying the CAGR formula, we can compute and compare the actual performance of BTC and ETH over

the past decade, thereby providing a clear and standardized picture of their exponential growth as well as their respective capabilities as a store of value and a utility-growth platform. The CAGR formula is presented in Equation 1.

$$\text{CAGR}(\%) = \left[\left(\frac{\text{Ending Value}}{\text{Beginning Value}}\right)^{\frac{1}{n}} - 1\right] \times 100\% \qquad (1)$$

where:
|	
Ending value	: Price at the end of the period
Beginning value	: Price at the start of the period
n	: number of years in the period.

3. FINDINGS AND DISCUSSION

A profound comparative analysis of Bitcoin and Ethereum as foundational pillars of the digital economy necessitates a structured and comprehensive framework. While often discussed within the same narrative, these two protocols are built upon fundamentally different design philosophies, initial objectives, and technical trade-offs. These differences are not merely technical but carry extensive economic implications, shaping the landscape of applications, business models, and trust paradigms they can support. To unravel this complexity and move beyond superficial discourse, this study develops and applies a five-dimensional analytical framework. Each dimension represents a critical aspect of protocol design that directly determines its capacity to enable economic activity. By examining Bitcoin and Ethereum through this multi-faceted lens, we can identify their inherent trade-offs, understand the philosophical roots of their divergence, and clearly articulate how specific design choices forge their distinct economic destinies.

3.1 Framework Development for Protocol Communication

The application of the five-dimensional analytical framework reveals profound contrasts that explain why Bitcoin and Ethereum have evolved into economic platforms with nearly antithetical characters and applications. In the dimension of Primary Economic Function, Bitcoin has consistently maintained its position as *digital gold* and a decentralized settlement layer, focused on censorship-resistant store of value and value transfer. Conversely, Ethereum has positioned itself as a programmable *world computer*, with its core function being to provide a smart contract platform that serves as the foundation for decentralized applications (dApps), decentralized finance (DeFi), and complex digital assets. This divergence in purpose is directly correlated with the Consensus & Security Model. Bitcoin, with its simple yet energy-intensive Proof-of-Work (PoW) model, sacrifices energy efficiency to achieve maximum security and decentralization through costly proof. Ethereum, following its transition to Proof-of-Stake (PoS) via The Merge, adopted a more energy-efficient model enabling broader participation through staking, albeit with different complexities and trust assumptions

regarding its validator set. The different mechanism for centralized and decentralized finance is shown in Figure 3.

Figure 3. Mechanism of Centralized Finance (CeFi) and Decentralized Finance (DeFi)
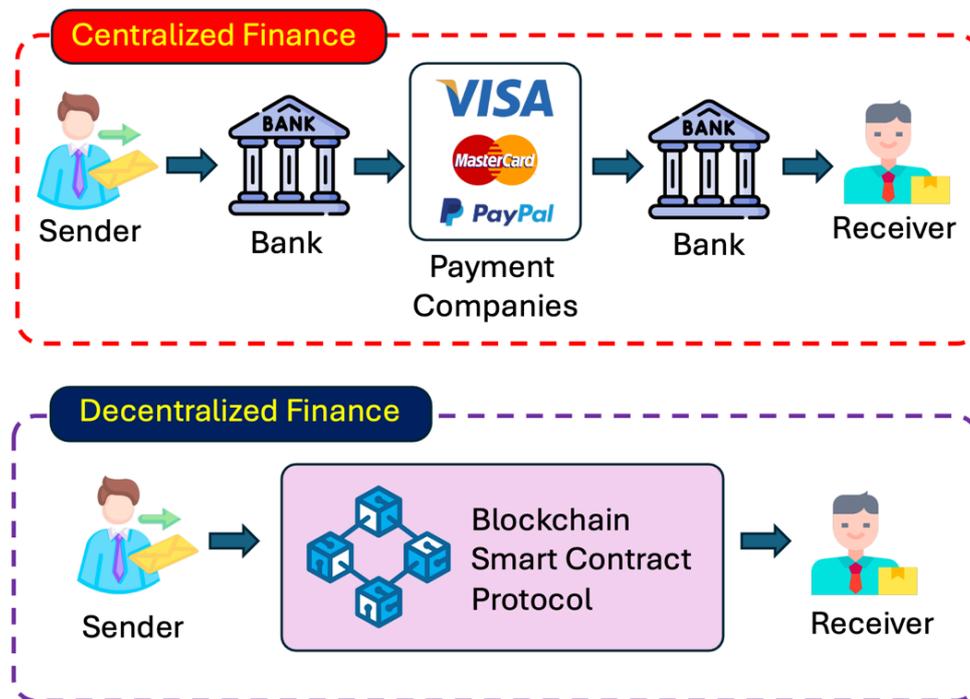
Furthermore, the most striking divergence is evident in the dimension of Scripting/Programmability. Bitcoin intentionally limits its scripting capability (via Script) for security and predictability, thereby constraining its applications to basic financial transactions. Ethereum, with its Turing-complete Virtual Machine (EVM), enables complex, conditional business logic to be executed in a decentralized manner. This innovation directly unlocked a vastly broader Tokenomics landscape on Ethereum, where its native token (ETH) functions not merely as a medium of exchange but primarily as the *fuel* (gas) for computation and as a staked asset to secure the network. Bitcoin's tokenomics (BTC) are simpler, focused on predictable scarcity and miner incentives through block rewards.

Finally, differences in Governance & Upgrade Paths reinforce each protocol's evolutionary trajectory. Bitcoin prioritizes stability and conservatism through a slow, often contentious consensus process, making protocol changes rare and monumental events. Ethereum has adopted a more agile governance model with coordinated upgrade processes (such as Ethereum Improvement Proposals/EIPs), allowing for faster iteration but with potential risks to long-term stability. These five dimensions are deeply interconnected; a choice in one dimension constrains and shapes choices in others, ultimately yielding two distinct yet equally influential *species* of digital economic infrastructure. Consensus mechanism model between PoW and PoS is shown in Table 1.

Table 1. Comparison for Consensus Mechanism

Feature	PoW	PoS
Energy use	Very High (ASICs / Miner)	Very Low (coin staking)
Speed	Slower	Faster
Security	High (proven)	High (economic)
Validator	Miner to solve complex computation	Hold and Stake (coin numbers)
Centralization	Risk of mining pool dominance	Risk of wealth concentration
Barrier to Entry	High (hardware costs)	Moderate (staking capital)
User Coin	BTC, LTC, XMR	ETH, ADA, SOL

3.2 Case Study Analysis

3.2.1 Bitcoin (BTC) Protocol

The Bitcoin protocol's design represents a radical and single-minded commitment to establishing a new, sovereign form of digital money. Anchored by the fixed supply cap of **21 million BTC** and a disinflationary issuance schedule that halves block rewards approximately every four years (the most recent "halving" occurred in April 2024, reducing the reward to 3.125 BTC), its economic model is engineered to achieve scarcity and resist inflation. This *digital gold* thesis is secured by a Proof-of-Work consensus mechanism whose security is directly tied to immense, real-world energy expenditure, creating a physical cost barrier to attack. As of early 2024, Bitcoin's network hash rate consistently exceeds 600 exa-hashes per second (EH/s), a computational power metric that reflects the billions of dollars in dedicated mining hardware and energy consumption required to compete for block rewards, making a 51% attack astronomically expensive and impractical. This, coupled with intentionally non-Turing-complete scripting and a conservative, off-chain social governance process, creates a system of remarkable security, predictability, and monetary purity.

This unwavering focus, however, creates inherent limitations that restrict Bitcoin's role as a general-purpose economic platform. The computational simplicity of its script prevents the native execution of complex, conditional smart contracts that underpin decentralized finance (DeFi) and applications. Consequently, while Bitcoin's market capitalization remains the largest among cryptocurrencies often exceeding $1 trillion the vast majority of its native activity is limited to value transfer and storage. Efforts to expand its functionality, such as the development of Layer-2 solutions like the Lightning Network or sidechain projects, exist *outside* the core protocol's security and consensus model, introducing new trust and technical assumptions. The trade-off is clear: Bitcoin's architectural choices deliver unparalleled security, brand dominance, and a pure monetary asset but intentionally sacrifice programmability and agility, effectively positioning it as a foundational *settlement layer* rather than a versatile

application layer for a broader digital economy. Key protocol difference between BTC and ETS is shown in Table 2.

Table 2. Key Protocol Differences

Feature	Bitcoin (BTC)	Ethereum (ETH)
Primary use	Store of Value, Digital Cash	Smart Contract, dApps
Max supply	21 Millions (Deflationary)	No Hard Cap (Variable)
Block Time	~10 minutes	~12 seconds
Flexibility	Rigid/ secure	Programmable
Consensus	Proof of Work	Proof of Stake
Hash Algorithm	SHA-256	Keccak-256
Transaction fee	0.0001	0.00006
Minimum Transaction	0.0001	0.0054

3.2.1 Ethereum (ETH) Protocol

The Ethereum protocol was founded on a fundamentally expansive economic thesis: to be *a world computer* that provides a globally accessible, programmable substrate for decentralized applications. This vision is technologically realized through its Turing-complete Ethereum Virtual Machine (EVM), which allows developers to write arbitrarily complex smart contracts. This programmability has unlocked unprecedented economic innovation, enabling the creation of decentralized finance (DeFi) protocols, non-fungible tokens (NFTs), and decentralized autonomous organizations (DAOs). A key economic accelerant is composability, allowing these applications to integrate seamlessly like financial *money legos*, fostering a rich ecosystem. Ethereum's governance, facilitated by a relatively formalized off-chain process through Ethereum Improvement Proposals (EIPs), has enabled significant protocol evolution. The most pivotal transition was The *Merge* in September 2022, which shifted the network from an energy-intensive Proof-of-Work (PoW) consensus to Proof-of-Stake (PoS). This move reduced Ethereum's energy consumption by an estimated **99.95%** and laid the foundation for a new security and economic model based on staking. PoW validator server is shown in Figure 4.

While Ethereum's flexible design has catalysed a massive, innovative economy which hosting the vast majority of DeFi's Total Value Locked (TVL), which often exceeds $50 billion it has also introduced significant systemic complexities and trade-offs. The very programmability that enables innovation also makes the network a target for exploits; smart contract vulnerabilities have led to billions of dollars in losses, necessitating sophisticated auditing and insurance markets. The reliance on "gas" fees to pay for computation creates a challenging user experience, with fees becoming prohibitively expensive during periods of high network congestion, even after efficiency improvements from EIP-1559 which introduced a fee-burning mechanism.

Figure 4. PoW Validator (Mining Server) Consensus Mechanism ETH before Merge

Source: Primary Data (2022)

Furthermore, the security model now depends on the economic incentives and centralization risks of staking. As of early 2024, over **31 million ETH** (worth over $100 billion) is staked to secure the network, but concerns persist regarding the concentration of staked ETH among a few major entities and liquid staking providers. Thus, Ethereum's core trade-off is clear: it has achieved unparalleled success as a platform for decentralized innovation by prioritizing flexibility and programmability, but at the cost of operational complexity, variable expenses, and a continuously evolving set of security and scalability challenges.

3.3   Comparative Synthesis

The comparative analysis between Bitcoin and Ethereum reveals that their core philosophical divergence manifests in a series of fundamental, engineered trade-offs that define their capabilities and limitations. The most critical is the security versus flexibility paradigm. Bitcoin prioritizes maximal security through its energy-intensive Proof-of-Work (PoW) and a deliberately limited scripting language, resulting in a system with a high-cost attack barrier but minimal functional scope. Conversely, Ethereum's shift to Proof-of-Stake (PoS) and its Turing-complete virtual machine introduce a more complex security landscape with reliant on economic penalties *slashing* for validator misbehaviour and the constant risk of smart contract exploits to unlock vast programmability. This leads directly to the second trade-off: simplicity versus complexity. Bitcoin's singular focus on being "digital gold" makes its value proposition straightforward for users and regulators, contributing to its widespread recognition and classification as a commodity by bodies like the U.S. SEC. Ethereum's general-purpose design fosters a powerful ecosystem but one with significant complexity, evident in user challenges like managing volatile gas fees and interacting

with non-custodial wallets, creating a steeper adoption barrier and more ambiguous regulatory status as a potential security. Synthesis analysis is shown in Table 3.

Table 3. Core Trade-Offs and Ecosystem Outcomes

Dimension	BTC Protocol	ETH Protocol
Primary Trade-Off	Security & Simplicity over Flexibility	Flexibility & Programmability over Simplicity
Security Model	Physical (Energy-Intensive PoW)	Economic (Staking-based PoS with Slashing)
Value Driver	Monetary Policy & Scarcity (21M cap)	Platform Utility & Demand (Gas, Staking)
Ecosystem Nature	Financial & Custodial	Productive & Application-Rich (World Computer)
Regulatory Perception	Primarily viewed as a commodity.	Under scrutiny as a potential security.
Key Economic Limitation	Limited native programmability.	Complexity, volatile fees, and smart contract risk.

The foundational trade-offs fundamentally shape the economic engines and resultant ecosystems of each protocol. Bitcoin's value is primarily driven by its credibly scarce monetary policy, with a hard cap of 21 million coins, positioning it as a sovereign store of value akin to digital gold. In contrast, Ethereum's value accrual is increasingly utility-driven, tied to the demand for block space (gas) and staking services within its productive economy. This creates different demand dynamics; while Bitcoin's demand is heavily influenced by macroeconomic sentiment as an alternative asset, Ethereum's is more directly linked to on-chain activity. Consequently, these paths have spawned entirely distinct economic realities. Bitcoin's ecosystem is predominantly financial and custodial, centered around trading, holding, and ETF products, with a Total Value Locked (TVL) in its DeFi ecosystem representing a tiny fraction of Ethereum's. Ethereum has cultivated a vibrant**,** application-rich on-chain economy that extends beyond finance into digital ownership (NFTs with a cumulative sales volume exceeding $42 billion), gaming, and decentralized governance through DAOs, making it the foundational settlement layer for the broader Web3 movement.

3.4 Implications And Future of Digital Economic Enablement

The foundational Bitcoin/Ethereum dichotomy serves as the central design axis for the entire blockchain ecosystem, forcing newer projects to consciously position themselves along the spectrum of trade-offs. Newer, high-throughput Layer-1 protocols like Solana and Avalanche explicitly prioritize scalability and low transaction costs, often by adopting consensus mechanisms that trade some degree of decentralization for performance. For instance, Solana's Proof-of-History (PoH) and Avalanche's novel consensus achieve thousands of transactions per second (TPS), but face recurring critiques regarding network stability and validator centralization.

Concurrently, the modular blockchain paradigm, championed by projects like Celestia (focused on data availability) and the broader *rollup-centric* roadmap of Ethereum itself, represents a direct architectural evolution from the limitations of monolithic chains. By decoupling core functions including execution, settlement, consensus, and data availability, these systems aim to escape the inherent trade-offs of a single-layer design, allowing for specialized optimization and theoretically unlimited scalability. Opportunity and Future Trajectory is Shown in Table 4.

Table 4. Implications and Future Challenges

Dimension	Opportunity	Future Trajectory
Protocol Design Spectrum	Avoiding the blockchain trilemma without unacceptable compromises.	Proliferation of specialized chains over generic monolithic L1s.
Architectural Shift	Escaping monolithic design limitations by separating core functions.	A future where execution, settlement, and data availability are provided by specialized, interoperable layers.
Scalability Imperative	Achieving scalability without sacrificing security or sufficient decentralization.	Convergence on modular scaling solutions and improved L1 efficiency.
Interoperability & Bridges	Major security risk vector.	Evolution towards more secure, trust-minimized cross-chain communication.
Regulatory Framework	How to regulate hybrid, multi-functional assets and the applications built on them.	Likely asset-specific, nuanced regulation that could fragment global markets and impact innovation.

Despite these innovations, systemic challenges inherited from and highlighted by the Bitcoin/Ethereum paradigm persist and evolve. Scalability remains the paramount hurdle for mass adoption; while modular designs and Layer-2 solutions like Optimism which collectively process millions of transactions off-chain show promise, achieving secure, decentralized, and low-cost scalability at a global scale is unproven. Interoperability which the need to connect the distinct economic "islands" of Bitcoin's immense liquidity and Ethereum's application richness is both a critical enabler and a major vulnerability. Cross-chain bridges have become a prime target for exploits, with over $2.5 billion stolen from bridge hacks in 2022 alone, underscoring the security-complexity trade-off in a multi-chain world. Finally, regulation struggles to categorize hybrid assets like ETH, which functions simultaneously as a staked investment asset, a consumptive fuel (gas), and a governance token. This ambiguity creates uncertainty, as seen in the ongoing deliberations by the U.S. SEC, which has approved Bitcoin ETF products as a commodity but continues to investigate whether ETH constitutes a security, with profound implications for its ecosystem.

Table 5. The 10 Year Comparative Performance

Metrix	Bitcoin (BTC)	Ethereum (ETH)	Gold (XAU)
Starting Price (2015)	$250	$0.75	$1,160
Ending Price ATH (2025)	$126,080	$4,956	$4,385
Total Increase	50,332%	659,733%	278.0%
CAGR (Annual)	**86.3%**	**50.9%**	**14.2%**
Volatility	Very High	Very High	Low-Moderate

Comparison as commodity asset between BTC, ETH and Gold is shown in Table 5. The data highlights a staggering performance gap. While Gold delivered a robust 278% total return (14.2% CAGR), it was dwarfed by the exponential growth of crypto-assets. Ethereum (ETH) generated the highest absolute return at 659,733%, a figure that underscores its transformation from an experimental platform to the foundational infrastructure for decentralized finance and applications. Bitcoin (BTC), despite a lower total increase of **50,332%**, achieved the highest annualized return **CAGR of 86.3%**, demonstrating remarkable consistency in its decade-long ascent as the premier digital store of value. This order of magnitude difference in returns (BTC being ~181x and ETH ~2,373x more profitable than Gold) validates the high-risk, high-reward thesis for early crypto adoption. Historically, the price of Bitcoin has tended to experience a significant increase within 12 to 18 months after a halving and the best time to invest in BTC is typically 1-2 years after the All-Time High (ATH). Investing period based on BTC halving cycle and ATH every 4 year is shown in Figure 5.

Figure 5. BTC Halving Cycle and ATH Periodical Pattern

4. CONCLUSION

This study concludes that while blockchain technology is a primary catalyst for the digital economy, its manifestation is highly dependent on protocol architecture. A comparative study of Bitcoin and Ethereum reveals that core design decisions related to consensus mechanisms, programmability, and tokenomics directly configure the scope and nature of the emerging economic ecosystem. Bitcoin's design optimizes the creation of a decentralized and secure digital commodity, solidifying its role as a fundamental store-of-value layer. Conversely, Ethereum's design enables programmable economic possibilities and the creation of complex digital assets, while accepting the consequence of higher operational complexity. Ultimately, the future landscape of the digital economy will likely not be an arena for the dominance of a single paradigm, but will evolve into a heterogeneous network of specialized and interoperable blockchains. Within this configuration, the Bitcoin/Ethereum dichotomy will continue to serve as the foundational archetype informing the evolution of every protocol.

REFERENCES

Bartlett, L., & Vavrus, F. (2017). *Rethinking case study research: A comparative approach*. Routledge.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report, 13*(4), 544-559.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101.

Buterin, V. (2013). *Ethereum whitepaper: A next-generation smart contract and decentralized application platform*. Ethereum Foundation. https://ethereum.org/en/whitepaper/

Catalini, C., & Gans, J. S. (2016). *Some simple economics of the blockchain* (Working Paper No. 22952). National Bureau of Economic Research. https://doi.org/10.3386/w22952

Celestia. (2023). *Celestia: A modular blockchain network*. Celestia Foundation. https://docs.celestia.org/

Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*. https://bitcoin.org/bitcoin.pdf

Tapscott, D., & Tapscott, A. (2016). *Blockchain revolution: How the technology behind bitcoin is changing money, business, and the world*. Penguin.

World Economic Forum. (2020). *The global governance of digital currencies: An agenda for research and action* [White paper]. https://www.weforum.org/

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage publications.

Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2017). An overview of blockchain technology: Architecture, consensus, and future trends. In *2017 IEEE International Congress on Big Data (BigData Congress)* (pp. 557–564). IEEE. https://doi.org/10.1109/BigDataCongress.2017.85