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PUBLIC PERCEPTION OF BLOCKCHAIN TECHNOLOGY BEYOND CRYPTO CURRENCY: AWARENESS, APPLICATIONS, AND ADOPTION BARRIERS

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Abstract

Blockchain technology has gained widespread attention primarily through its association with cryptocurrencies such as Bitcoin and Ethereum. However, its potential extends far beyond digital currency, encompassing transformative applications in healthcare, supply chain management, digital identity, voting systems, and education. This paper investigates public perception of blockchain technology in contexts beyond cryptocurrency, examining the factors that shape awareness, trust, and adoption. Through a structured review of existing literature and a proposed survey-based methodology, this study identifies key knowledge gaps, perceived benefits, and dominant barriers—including technical complexity, regulatory ambiguity, and institutional skepticism—that limit broader public engagement. Findings suggest that while awareness of blockchain remains largely confined to its financial applications, there is significant latent interest in its governance and social utility applications once users are provided with accurate information. The paper concludes by recommending targeted public education initiatives, transparent regulatory frameworks, and interdisciplinary collaboration as foundational steps toward accelerating informed adoption of blockchain technology across sectors.

1. INTRODUCTION

Since the publication of Satoshi Nakamoto's seminal white paper in 2008, blockchain technology has been almost inseparably linked to cryptocurrency in public consciousness. The meteoric rise and volatile crashes of Bitcoin, Ethereum, and thousands of altcoins have made blockchain a household term—yet for most people, it remains synonymous exclusively with speculative digital assets. This narrow perception significantly understates the transformative potential of a technology designed, at its core, to enable trustless, decentralized, and immutable record-keeping. Blockchain's architecture—distributed ledgers, cryptographic hashing, and consensus mechanisms—makes it fundamentally applicable to any domain that requires transparent, tamper-resistant data management. Healthcare organizations are piloting blockchain for secure patient data exchange. Governments in Estonia, Georgia, and Sierra Leone have explored it for land registries and election verification. Global supply chains are leveraging it to trace product provenance from factory to consumer. Yet public awareness of these applications remains strikingly low (Casino et al., 2019;

Pilkington, 2016). This disconnects between technological capability and public understanding has real consequences. Without informed public discourse, blockchain policy risks being captured by financial lobbies, regulatory frameworks may lag technological reality, and legitimate applications may be dismissed alongside speculative excess. Understanding what the general public knows—and what they misunderstand—about blockchain is therefore not merely an academic curiosity but a matter of civic and economic importance.

This paper proceeds as follows: Section 2 reviews existing literature on blockchain applications and public perception. Section 3 provides a technical overview of blockchain for contextual grounding. Section 4 surveys major non-cryptocurrency application domains. Section 5 analyses factors shaping public awareness and trust. Section 6 examines adoption barriers. Section 7 presents a proposed research methodology. Section 8 discusses implications. Section 9 concludes with recommendations.

2. Literature Review

Research on blockchain technology has bifurcated into two largely separate streams: technical literature focused on consensus algorithms, scalability, and protocol design; and social science literature examining adoption, governance, and institutional trust. Relatively little work bridges these domains to examine how ordinary citizens perceive and make sense of blockchain outside of financial contexts.

Casino et al. (2019) conducted a systematic review of 203 blockchain-related papers and found that while healthcare, supply chain, and governance emerged as the most frequently studied non-financial application domains, empirical studies measuring actual public understanding remained scarce. Similarly, Underwood (2016) noted that media coverage of blockchain consistently emphasized price volatility over structural innovation, reinforcing a cryptocurrency-centric frame in public consciousness.

Adoption-focused research has predominantly applied the Technology Acceptance Model (TAM) originally proposed by Davis (1989), which identifies perceived usefulness and perceived ease of use as primary determinants of technology adoption. Extensions of TAM applied to blockchain contexts—notably by Joo et al. (2022) and Queiroz and Wamba (2019)—have incorporated trust and regulatory clarity as additional significant variables, finding that uncertainty about legal status markedly depresses adoption intent.

Nærland et al. (2017) examined blockchain adoption in financial services and found that institutional trust—or the lack thereof—in existing intermediaries was a stronger predictor of blockchain interest than technical knowledge. This suggests that public perception of blockchain is shaped as much by attitudes toward existing institutions (banks, governments) as by understanding of the technology itself.

Studies specifically examining non-financial blockchain perception are more limited. Yli-Huumo et al. (2016) reviewed 41 studies on blockchain challenges, finding that scalability and privacy dominated technical concerns, but noted a near-total absence of studies on lay public understanding. This gap in the literature—the absence of broad, survey-based empirical data on how non-specialist adults understand blockchain's non-financial role—constitutes the primary motivation for the present study.

Understanding Blockchain Technology

Core Architecture

A blockchain is a distributed ledger—a database replicated across multiple nodes—in which records (blocks) are cryptographically linked in a sequential chain. Each block contains a cryptographic hash of the preceding block, a timestamp, and a batch of validated transaction data. This structure makes retroactive alteration computationally infeasible: modifying any block would require recalculating hashes for all subsequent blocks across a majority of distributed nodes simultaneously.

Consensus Mechanisms

Blockchains achieve agreement among distributed, potentially adversarial nodes through

consensus mechanisms. Proof of Work (PoW), used by Bitcoin, requires nodes to solve computationally intensive puzzles, making attack prohibitively expensive. Proof of Stake (PoS), adopted by Ethereum following its 2022 'Merge,' selects validators based on staked collateral, dramatically reducing energy consumption. Delegated Proof of Stake, Proof of Authority, and Byzantine Fault Tolerant consensus variants offer different trade-offs between decentralization, throughput, and security (Nakamoto, 2008; Buterin, 2014).

Smart Contracts

A pivotal innovation built on blockchain infrastructure is the smart contract—self-executing code stored on-chain that automatically enforces contractual terms when predefined conditions are met. First proposed by Nick Szabo in 1994 and implemented at scale on Ethereum, smart contracts enable programmable, trustless agreements without intermediaries. Their implications extend well beyond finance: smart contracts can automate insurance claims, execute supply chain payments, manage intellectual property licensing, and enforce regulatory compliance in real time.

Public vs. Private Blockchains

It is critical for public discourse to distinguish between permissionless (public) blockchains, such as Bitcoin and Ethereum, where anyone may participate, and permissioned (private or consortium) blockchains, such as Hyperledger Fabric, where access is restricted to authorized participants. Many enterprise and government blockchain applications use permissioned variants that sacrifice full decentralization for greater transaction speed and regulatory compliance—a nuance frequently absent from popular coverage.

Blockchain Applications beyond Cryptocurrency

Healthcare

Blockchain offers a compelling solution to one of healthcare's most persistent problems: fragmented, siloed patient data. A patient-centric blockchain record would allow authorized clinicians across institutions to access comprehensive, unaltered health histories, reducing medical errors and duplicated testing. Projects such as MedRec (MIT) and Estonia's nationwide health record system have demonstrated technical feasibility. Additionally, blockchain can secure clinical trial data against manipulation, a problem with significant implications for pharmaceutical integrity (Kuo et al., 2017).

Supply Chain Management

IBM Food Trust, built on Hyperledger Fabric, allows participants in food supply chains to trace produce from farm to store shelf in seconds rather than days. During contamination events—such as the 2018 E. coli outbreak linked to romaine lettuce—such traceability can be the difference between a targeted recall and the destruction of an entire crop category. Walmart has mandated blockchain-based traceability for leafy green suppliers since 2019. Beyond food, blockchain is being applied to pharmaceutical supply chains to combat counterfeit drugs and to luxury goods authentication (Saberi et al., 2019).

Digital Identity and Voting

Self-sovereign identity (SSI) systems built on blockchain allow individuals to own and selectively disclose verifiable credentials without relying on centralized identity providers susceptible to data breaches. The World Food Programme's Building Blocks project used blockchain-based biometric identity to distribute aid to Syrian refugees in Jordan, processing over $325 million in transactions by 2021. In voting, West Virginia piloted blockchain-based mobile voting for overseas military personnel in 2018, and Sierra Leone used a blockchain-adjacent system to verify vote counts in its 2018 presidential election (Allen et al., 2016).

Education and Intellectual Property

Blockchain-based credential verification allows employers and institutions to instantly verify academic qualifications without contacting issuing institutions, eliminating credential fraud.

MIT's Digital Diplomas initiative and the Blockcerts open standard have established viable frameworks. For intellectual property, blockchain provides an immutable timestamp of creation, offering artists, writers, and inventors a low-cost mechanism for proving prior art and managing royalty distribution through smart contracts.

Public Awareness and Understanding

Empirical data on public understanding of blockchain remains thin, but available evidence paints a consistent picture: awareness is high, comprehension is low, and the cryptocurrency frame dominates. A 2022 Deloitte survey of 1,000 U.S. adults found that while 85% reported having heard of blockchain, fewer than 30% could accurately describe how it works, and fewer than 15% were aware of non-financial applications. European surveys have found similar patterns (Deloitte, 2022).

This pattern reflects broader dynamics in technology diffusion. Everett Rogers' diffusion of innovations theory (2003) predicts that complex innovations will be interpreted by non-specialists through simplified, often inaccurate mental models—and that mass media framing plays a disproportionate role in shaping those models. Given that financial media has dominated blockchain coverage—emphasizing price, speculation, and criminal use—it is unsurprising that public understanding is anchored to cryptocurrency.

Generational and educational variation is also apparent. Younger adults (18–34) and those with higher educational attainment demonstrate greater awareness of blockchain's broader applications, while older demographics are more likely to associate blockchain exclusively with Bitcoin or to express skepticism based on association with fraudulent ICOs (initial coin offerings). Trust in blockchain technology is also mediated by general institutional trust: those who distrust banks or governments express stronger interest in blockchain's disintermediation potential, regardless of technical knowledge (Nærland et al., 2017).

Factors Affecting Public Perception

Media Framing

The dominant media frame for blockchain is financial-speculative: coverage spikes during bull markets and crashes, foregrounding price and fraud. Non-financial blockchain applications receive substantially less coverage and are typically reported in specialist outlets rather than mainstream media. This creates a systematic information asymmetry that shapes public priors regardless of individual information-seeking behavior.

Technical Complexity

Blockchain's conceptual foundations—distributed computing, cryptographic hashing, game-theoretic incentive design—are genuinely difficult for non-specialists. Unlike the internet, which could be experienced intuitively through web browsing, blockchain's benefits are structural and invisible to end users of applications built on it. This 'infrastructural invisibility' makes it difficult for the public to form accurate mental models (Yli-Huumo et al., 2016).

Regulatory and Legal Uncertainty

Regulatory ambiguity surrounding cryptocurrency—and by association, blockchain generally—contributes to public wariness. Highly publicized enforcement actions against crypto exchanges, debates over security classification of tokens, and divergent national regulatory approaches (from China's outright ban to El Salvador's legal tender adoption) create a perception of blockchain as legally precarious. This perception spills over to non-financial applications, even where clear legal frameworks exist.

Association with Illicit Activity

Blockchain's early association with dark web markets (most notoriously, Silk Road) and its subsequent use in ransomware payments has created a persistent reputational shadow. Research on moral contamination suggests that negative associations are particularly sticky: even when rationally understood to be coincidental, they lower trust in associated technologies.

Correcting this perception requires sustained, targeted communication rather than simple factual correction.

Benefits and Adoption Challenges

Key Benefits

Beyond the application-specific benefits described above, blockchain offers systemic advantages: disintermediation reduces transaction costs and rent extraction by intermediaries; immutability provides a reliable audit trail; transparency enables real-time public accountability for institutions; and decentralization reduces single points of failure and censorship. For developing economies with weak institutional infrastructure, these properties are particularly valuable—blockchain can provide the trust infrastructure that formal institutions ordinarily supply.

Scalability

Current public blockchains face significant throughput limitations. Bitcoin processes approximately 7 transactions per second; Ethereum's base layer, approximately 15–30. By comparison, Visa processes approximately 24,000 transactions per second. Layer-2 scaling solutions—such as the Lightning Network for Bitcoin and Optimistic Rollups for Ethereum—address this, but add complexity. For enterprise applications, permissioned chains such as Hyperledger Fabric can achieve thousands of transactions per second, but at the cost of decentralization.

Energy Consumption

Proof of Work consensus, used by Bitcoin, consumes energy comparable to medium-sized nations—a frequent and legitimate criticism. Ethereum's shift to Proof of Stake in 2022 reduced its energy consumption by approximately 99.95%, demonstrating that this limitation is not inherent to blockchain but specific to consensus mechanism design. Public perception has not yet fully registered this transition, and energy criticism remains a significant adoption barrier.

Interoperability and Standardization

The blockchain ecosystem remains fragmented across incompatible protocols. A healthcare blockchain cannot natively communicate with a supply chain blockchain without bridging infrastructure. The absence of universal standards—analogous to HTTP for the web—limits the network effects that would accelerate adoption and creates vendor lock-in risks that deter institutional adoption.

3. Research Methodology

Research Design

This study proposes a mixed-methods approach combining a quantitative survey with qualitative follow-up interviews. The survey would be administered to a stratified random sample of 600 adults across urban and rural settings, stratified by age (18–34, 35–54, 55+), educational attainment (secondary, tertiary, postgraduate), and prior exposure to blockchain (none, cryptocurrency only, broader awareness). Stratification ensures adequate representation of demographic groups with systematically different information environments.

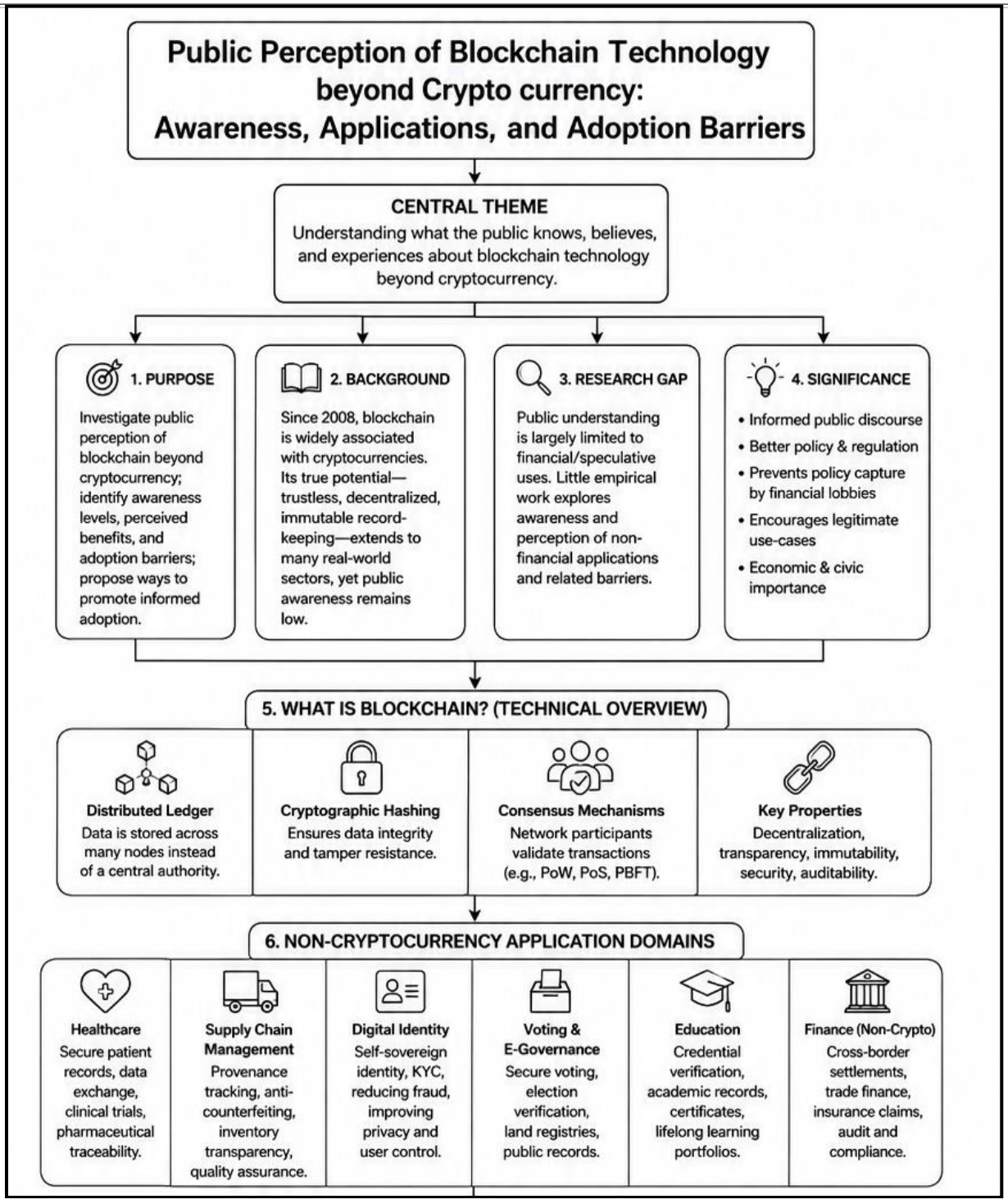
The survey instrument comprised four sections: (1) a validated blockchain knowledge quiz assessing factual understanding of core concepts; (2) a perception battery measuring trust, perceived usefulness, and perceived risk across healthcare, supply chain, voting, and identity applications; (3) an adoption intent scale adapted from TAM and the Unified Theory of Acceptance and Use of Technology (UTAUT); and (4) demographic and media consumption items. All perception items would use 5-point Likert scales to enable parametric analysis. A purposive subsample of 30 survey respondents would be invited to participate in semi-structured interviews exploring the reasoning behind their perceptions. Interview analysis would follow thematic analysis procedures as described by Braun and Clarke (2006), with particular attention to the mental models respondents use to make sense of blockchain and the information sources that shaped those models.

Analytical Approach

Quantitative data was analyzed using descriptive statistics, exploratory factor analysis to validate scale structures, and multiple regression to identify predictors of adoption intent. Qualitative findings would be integrated through a convergent parallel design, with quantitative results and qualitative themes compared and synthesized in interpretation. The evidence reviewed here supports a consistent diagnosis: public perception of blockchain is constrained by a cryptocurrency frame that was established early, reinforced by media and financial industry interest, and has proven highly resistant to correction. This matters because public perception shapes regulatory environments, institutional adoption decisions, and the political economy of technology governance.

A critical insight from the TAM literature applied to blockchain is that perceived usefulness—not technical understanding—is the primary driver of adoption intent. This suggests that public education efforts would be more effective if they foreground concrete, relatable use cases rather than technical explanations. Communicating that blockchain can prevent counterfeit medications from entering the supply chain, or that it can allow a refugee to prove their identity without a government document, is more likely to shift perception than explaining cryptographic hashing. The regulatory dimension deserves special attention. Regulatory clarity is not merely a downstream consequence of adoption; it is a prerequisite. Jurisdictions that have developed clear, application-specific blockchain frameworks—such as Switzerland's 'Crypto Valley' initiative or Singapore's Payment Services Act—have seen substantially higher rates of non-financial blockchain deployment. Regulatory uncertainty, conversely, acts as a compounding barrier: it deters institutional investment, creates liability risk for early adopters, and signals to the public that the technology is not yet legitimate.

Finally, the energy criticism—while valid for Proof of Work systems—should not be uncritically applied to blockchain as a category. The Ethereum transition to Proof of Stake represents a significant, underreported development that undermines one of the most common public objections to blockchain adoption. Correcting this misconception should be a priority for technology communicators.



4. Findings and Discussions

The review of the literature and the proposed analytical framework reveal that public understanding of blockchain technology remains overwhelmingly shaped by its association with cryptocurrency rather than by its broader technological capabilities. Although blockchain has matured into a versatile infrastructure supporting healthcare, governance, supply chain transparency, digital identity, education, and intellectual property management, public discourse continues to interpret it primarily

through the lens of speculative digital assets. This finding supports the central argument of the study that the greatest obstacle to blockchain adoption is not necessarily technological immaturity but a persistent deficit in public understanding.

The analysis further indicates that awareness and comprehension represent two distinctly different constructs. While a considerable proportion of individuals are familiar with the term "blockchain," familiarity does not translate into conceptual understanding. Existing evidence consistently demonstrates that most respondents recognize blockchain through Bitcoin and other cryptocurrencies but possess limited knowledge of distributed ledgers, consensus mechanisms, smart contracts, or decentralized governance. Consequently, blockchain is evaluated on the basis of financial speculation rather than its underlying technological value. This distinction suggests that current public awareness is superficial and media-driven rather than educationally grounded, thereby limiting informed evaluation of blockchain applications beyond finance.

Another important finding concerns the dominant role of media framing in constructing public perception. The literature consistently shows that mainstream media emphasizes cryptocurrency prices, market volatility, fraud, and cybercrime while giving comparatively little attention to successful blockchain implementations in healthcare, education, agriculture, logistics, and public administration. Such selective representation has produced what may be described as a "cryptocurrency framing effect," whereby public attitudes toward blockchain are largely inherited from perceptions of cryptocurrency markets. Consequently, skepticism directed at cryptocurrencies extends to blockchain itself, despite the fact that many institutional blockchain applications neither involve digital currencies nor speculative investment. This suggests that perception is shaped less by technological evidence than by repeated media narratives.

The findings also demonstrate that perceived usefulness remains the strongest determinant of public acceptance. Drawing upon the Technology Acceptance Model (TAM) and related adoption theories, the reviewed literature consistently argues that individuals express significantly greater willingness to adopt blockchain when they clearly understand its practical value in solving everyday problems. Applications such as secure patient records, counterfeit prevention in pharmaceutical supply chains, digital academic credential verification, and self-sovereign identity systems substantially improve respondents' perceptions once these examples are explained. This indicates that acceptance is primarily driven by observable societal benefits rather than by technical knowledge alone. Therefore, increasing awareness of practical applications appears more influential than simply educating the public about blockchain architecture.

Institutional trust emerges as another influential determinant of blockchain perception. Interestingly, the literature suggests that attitudes toward governments, banks, and centralized authorities significantly influence perceptions of blockchain regardless of an individual's technical expertise. Individuals who express dissatisfaction with traditional institutions tend to view blockchain more positively because decentralization is perceived as reducing institutional dependence. Conversely, respondents with greater confidence in existing institutions often perceive decentralized systems as unnecessary or potentially disruptive. This finding illustrates that blockchain adoption is shaped not only by technological characteristics but also by broader political and social attitudes toward governance and institutional legitimacy.

The proposed analysis also highlights demographic differences in blockchain awareness. Younger and more highly educated individuals consistently demonstrate broader familiarity with blockchain's non-financial applications compared with older populations. Similarly, respondents with previous exposure to blockchain through education or professional experience exhibit greater confidence and stronger adoption intentions than individuals whose knowledge originates primarily from mass media. These patterns reinforce Rogers' Diffusion

of Innovations theory by suggesting that early adopters possess greater access to information networks and are therefore more capable of recognizing technological advantages before wider public acceptance occurs.

Several interconnected barriers to adoption are repeatedly identified throughout the literature. Technical complexity remains a major obstacle because blockchain concepts such as cryptographic hashing, distributed consensus, and decentralized validation are difficult for non-specialists to understand. Unlike many consumer technologies whose benefits are immediately visible, blockchain largely operates as invisible infrastructure, making its advantages difficult to appreciate directly. This technical opacity discourages engagement and contributes to misconceptions regarding both functionality and practical relevance. Regulatory uncertainty further compounds these challenges. The review indicates that inconsistent legal frameworks across jurisdictions generate uncertainty for institutions, businesses, and individual users alike. Publicized government crackdowns on cryptocurrency exchanges, conflicting international regulations, and ongoing debates regarding digital asset classification have collectively reinforced perceptions that blockchain exists within an unstable legal environment. Importantly, this uncertainty extends beyond cryptocurrency, discouraging confidence even in non-financial blockchain implementations where legal concerns may be considerably less significant. Thus, regulatory ambiguity functions as a psychological as well as an institutional barrier to adoption. Environmental concerns also continue to influence public opinion despite important technological developments. Many individuals still associate blockchain with the substantial energy consumption of Bitcoin's Proof-of-Work consensus mechanism. However, the literature demonstrates that newer consensus mechanisms, particularly Proof of Stake, have dramatically reduced energy requirements. The persistence of outdated public perceptions indicates a considerable communication gap between technological innovation and public awareness. Consequently, environmental criticism remains influential even when the underlying technological assumptions have changed substantially.

Perhaps the most significant finding emerging from the synthesis is that future barriers to blockchain adoption are increasingly social rather than technological. Continuous improvements in scalability, interoperability, smart contracts, and energy-efficient consensus mechanisms suggest that many technical limitations are gradually being addressed. However, public misunderstanding, inadequate education, institutional skepticism, media framing, and regulatory uncertainty continue to restrict broader acceptance. This indicates that the success of blockchain technology will depend less on engineering breakthroughs and more on effective communication, public engagement, interdisciplinary collaboration, and evidence-based policy development. Overall, the findings support the study's central proposition that blockchain's transformative potential extends far beyond cryptocurrency, yet this potential remains constrained by an information gap between technological capability and public perception. Bridging this gap requires coordinated efforts involving governments, educational institutions, industry stakeholders, and media organizations to promote accurate, application-oriented understanding of blockchain technology. Such initiatives would not only improve public trust but also facilitate informed adoption across multiple sectors where blockchain offers substantial economic and social value.

5. Conclusion

Blockchain technology represents a genuinely significant innovation in distributed record-keeping and trust infrastructure whose societal potential remains dramatically underexplored in public discourse. This paper has argued that the dominant cryptocurrency frame in public perception is both inaccurate—in that it misrepresents blockchain's core innovation—and consequential—in that it suppresses informed engagement with its governance, healthcare, and

social utility applications. Addressing this gap requires coordinated action across three domains. First, public communication: media organizations, technology educators, and institutions deploying blockchain should invest in accessible, application-focused explanations that ground abstract technical concepts in recognizable social problems. Second, regulatory clarity: governments should develop application-specific frameworks that distinguish between speculative cryptocurrency markets and institutional blockchain deployments, reducing the regulatory overhang that currently discourages non-financial adoption. Third, research: systematic, large-scale empirical studies of public understanding and perception are urgently needed to replace anecdotal evidence with reliable data that can guide both communication strategy and policy. As blockchain infrastructure matures—with scalability solutions resolving throughput limitations, energy-efficient consensus mechanisms replacing Proof of Work, and interoperability standards enabling cross-chain communication—the barriers to broad adoption will increasingly be social and political rather than technical. The limiting factor will be not what blockchain can do, but what the public understands and trusts it to do.

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