

Leveraging Decentralized Blockchain Payment Infrastructures to Lower Transaction Fees, Accelerate Settlements, and Foster Inclusive Economic Participation in the USA

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Abstract: Decentralized blockchain payment infrastructures are rapidly emerging as transformative tools for reshaping financial transactions in the United States. Traditional payment systems remain heavily reliant on intermediaries such as banks, card networks, and clearinghouses, which impose significant transaction fees and introduce settlement delays. These inefficiencies disproportionately affect small businesses, underbanked populations, and cross-border remittances, where costs and time lags create barriers to broader participation in the financial ecosystem. Blockchain-based payment systems, by contrast, utilize distributed ledgers and smart contracts to enable peer-to-peer transactions with reduced reliance on intermediaries. This structural shift holds the potential to substantially lower transaction fees, streamline settlement processes to near-real-time, and enhance transparency through immutable record-keeping. From a broader economic perspective, decentralized payment solutions align with the growing demand for financial inclusion and democratized access to capital flows. They allow micro-entrepreneurs, gig workers, and rural communities to participate more effectively in economic activities by reducing entry costs and providing verifiable transaction histories. In the U.S. context, the integration of blockchain into mainstream finance could complement existing systems such as ACH, FedNow, and card-based networks, while offering alternatives that better serve marginalized groups. Narrowing the focus, evidence suggests that fintech innovators piloting blockchain platforms have already demonstrated measurable reductions in processing costs and settlement times for retail and institutional payments alike. Nonetheless, challenges persist in terms of regulatory clarity, interoperability with legacy infrastructures, and concerns over scalability and energy use. Addressing these issues through targeted policy reforms and public-private partnerships will be critical to ensuring that decentralized blockchain payment infrastructures can deliver on their promise of inclusive, efficient, and secure economic participation.

Keywords: Decentralized finance, blockchain payments, transaction fees, settlement systems, financial inclusion, United States

1. INTRODUCTION

1.1 Background: Evolution of Digital Payments in the U.S.

The U.S. financial system has undergone a remarkable transformation over the last century, moving from cash-dominated transactions to highly digitized payment infrastructures. Early developments, such as the introduction of Automated Clearing House (ACH) systems in the 1970s, established the foundation for electronic fund transfers and interbank settlements [1]. Over time, credit and debit card networks became the dominant retail payment channels, driving convenience and consumer adoption at scale [2]. More recently, innovations such as online banking, mobile wallets, and peer-to-peer payment platforms like PayPal, Venmo, and Zelle have redefined consumer expectations of speed and accessibility [2]. Federal initiatives, including the development of FedNow, aim to create a nationwide real-time payment system to meet evolving demand for instant settlements [3]. Simultaneously, fintech firms have pushed boundaries by integrating blockchain technologies into retail and wholesale payments, illustrating the U.S.'s strategic role in global financial innovation [4]. This progressive evolution has enabled more secure, faster, and data-driven transactions,

but the benefits have not been evenly distributed across all populations. While the U.S. leads in technological advancements, gaps persist in reaching marginalized groups, particularly unbanked and underbanked communities, suggesting the need for new approaches to achieve more inclusive economic participation [5].

1.2 Problem Statement: Transaction Fees, Settlement Delays, and Exclusion

Despite progress in digital finance, U.S. payment systems continue to struggle with inefficiencies. High transaction fees remain a persistent issue, particularly for small businesses that must pay card-processing charges ranging from 2–3% per transaction, limiting profit margins and discouraging adoption [4]. Cross-border remittances are equally problematic, with fees often exceeding global averages and settlement times stretching for days [2]. These structural inefficiencies highlight the dominance of intermediaries banks, card networks, and clearinghouses that impose operational costs while slowing the overall process [6]. Beyond cost and speed, issues of financial exclusion remain critical. Millions of Americans remain unbanked or underbanked, often concentrated in rural or minority communities, and rely

heavily on costly alternative financial services such as payday loans and check-cashing centers [1]. This exclusion perpetuates economic inequality by denying vulnerable groups access to affordable credit and secure digital transaction channels [5]. Although innovations like FedNow are designed to improve domestic settlement times, they do not directly address broader concerns around reducing costs or ensuring inclusion [7]. As digital transformation accelerates, the U.S. faces a pressing challenge: how to create payment infrastructures that not only lower fees and accelerate settlements but also expand financial participation to marginalized populations [3].

1.3 Objectives and Scope of the Article

The purpose of this article is to examine how decentralized blockchain payment infrastructures can serve as viable solutions to address the inefficiencies and inequities of existing U.S. payment systems. Specifically, the article seeks to analyze the potential of blockchain technologies to lower transaction fees by eliminating intermediary costs, accelerate settlements through distributed ledger consensus mechanisms, and foster inclusive participation by offering accessible, peer-to-peer financial services [4]. The discussion will cover both theoretical underpinnings and practical applications, drawing lessons from global experiences and contextualizing them within the unique dynamics of the U.S. financial ecosystem [6]. By evaluating case studies, regulatory initiatives, and fintech-driven pilots, the article aims to provide an evidence-based perspective on the feasibility and limitations of blockchain payment infrastructures [2]. Attention will also be given to the challenges that accompany decentralized systems, including scalability, interoperability, energy concerns, and regulatory uncertainty [7]. Ultimately, this article contributes to ongoing debates around the future of U.S. payment infrastructures and the extent to which blockchain technologies can complement or disrupt established systems [1]. The scope emphasizes not only efficiency gains but also the importance of ensuring equitable access to digital financial tools, especially for small enterprises and underserved communities [5].

2. CONCEPTUAL AND THEORETICAL FRAMEWORK

2.1 Overview of Decentralized Blockchain Infrastructures

Decentralized blockchain infrastructures represent a fundamental shift in the architecture of financial transactions. Unlike centralized systems that depend on intermediaries such as banks, card networks, or clearinghouses, blockchain operates on distributed ledgers maintained collectively by nodes in a peer-to-peer network [7]. This decentralized structure eliminates the reliance on a single authority and reduces the possibility of bottlenecks or single points of failure [11]. The innovation of blockchain lies in its consensus mechanisms, such as proof-of-work or proof-of-stake, which validate transactions without centralized oversight [6]. This process ensures that each transaction is recorded transparently

and cannot be altered retroactively, strengthening both security and trust in the system [9].

In the U.S. context, decentralized infrastructures are being piloted in both retail and institutional payment environments, from small fintech startups enabling peer-to-peer transfers to larger corporate experiments in cross-border settlement [12]. The global appeal of blockchain is tied to its promise of lower costs, faster settlements, and enhanced accessibility, qualities that directly address persistent shortcomings in existing financial networks [13]. For underbanked populations, blockchain offers a pathway into the digital economy by reducing dependency on traditional banking access [10]. These infrastructures also enhance resilience by distributing data across nodes, making the system less vulnerable to outages or targeted attacks [8]. Overall, decentralized blockchain infrastructures are positioned as transformative financial tools capable of addressing inefficiencies in speed, cost, and accessibility while fostering new models of participation within the U.S. financial landscape.

2.2 Key Features: Transparency, Immutability, and Smart Contracts

Three defining features distinguish blockchain from conventional financial infrastructures: transparency, immutability, and smart contracts. Transparency stems from the fact that all participants in the network can access the ledger, ensuring visibility into every transaction [13]. This openness reduces the risk of hidden manipulation and builds confidence among users, particularly in financial contexts where trust is paramount [6]. Immutability strengthens this trust by ensuring that once data is recorded on the blockchain, it cannot be altered retroactively. This property serves as a safeguard against fraud and manipulation, supporting the integrity of payment systems [9].

Smart contracts expand blockchain's utility by automating agreements between parties. These self-executing digital contracts operate on predefined conditions coded directly into the blockchain, triggering payments or transfers once requirements are met [12]. The automation of such processes significantly reduces transaction time, eliminates the need for intermediaries, and minimizes disputes [7]. For example, a smart contract can instantly release payment to a supplier once goods have been delivered and verified, accelerating settlement while lowering administrative costs [11].

These features hold particular relevance in the U.S., where small businesses and marginalized communities face barriers related to high fees and long settlement delays [10]. Transparency and immutability assure them of fair dealings, while smart contracts allow smaller actors to engage in complex transactions without costly legal or institutional overheads [8]. Combined, these features position blockchain not merely as an alternative payment infrastructure but as a revolutionary model capable of reshaping the foundations of trust, efficiency, and inclusion in the U.S. financial ecosystem [6].

2.3 Theoretical Underpinnings

2.3.1 Transaction Cost Economics

Transaction cost economics provides a lens to understand blockchain's efficiency in reducing intermediary costs. Traditional financial systems incur fees at multiple stages of settlement, but decentralized ledgers streamline these processes by enabling direct peer-to-peer interactions [8]. This eliminates layers of transaction costs, aligning with the theory's principle of minimizing exchange inefficiencies [11].

2.3.2 Network Effects and Decentralization

The adoption of blockchain payment infrastructures is also supported by network effects. As more individuals and businesses adopt decentralized payments, the value of the system increases exponentially [7]. Unlike centralized models that rely on institutional dominance, blockchain benefits from decentralized participation, where trust is distributed across the network [12]. This collective effect accelerates adoption, reinforcing scalability and resilience [9].

2.3.3 Financial Inclusion Theory

Finally, financial inclusion theory underscores blockchain's role in bridging systemic access gaps. In the U.S., millions remain unbanked or underbanked, relying on costly alternatives to access funds [10]. Blockchain aligns with inclusion principles by offering low-cost, transparent, and accessible financial services that reduce dependency on physical banking infrastructure [6]. By removing barriers to entry, blockchain empowers vulnerable populations to participate in economic activity, thereby fostering inclusive growth [13].

Together, these theoretical underpinnings illustrate how blockchain addresses fundamental inefficiencies in traditional financial systems while expanding opportunities for participation. Transaction cost economics highlights cost reduction, network effects explain scalability, and financial inclusion theory emphasizes equity. This framework collectively demonstrates why decentralized infrastructures are not only technologically significant but also socially and economically transformative within the U.S. payment ecosystem [12].

3. GLOBAL PERSPECTIVES ON BLOCKCHAIN PAYMENTS

3.1 Blockchain Payments in Developed Economies

In developed economies, blockchain payment infrastructures are increasingly seen as complementary to existing financial systems rather than outright replacements. Countries such as the United States, the United Kingdom, and members of the European Union have piloted blockchain-based settlements in both retail and wholesale environments [16]. Financial institutions are experimenting with permissioned blockchains for cross-border transactions to reduce reliance on the slow and costly SWIFT network [18]. Projects like JPMorgan's Onyx and the European Central Bank's exploration of a

digital euro demonstrate that blockchain is becoming integral to institutional strategy [15].

Retail adoption is also gaining traction in developed markets. Businesses now accept cryptocurrency-based payments through platforms like Coinbase Commerce, allowing customers to use decentralized currencies alongside traditional methods [20]. Furthermore, blockchain's transparency and immutability appeal to regulatory environments demanding greater compliance, such as anti-money laundering (AML) and know-your-customer (KYC) regimes [14]. Although scalability challenges remain, blockchain's integration into card networks and central bank initiatives shows that mature economies view it as a driver of efficiency and innovation [17]. These cases highlight how blockchain, while disruptive, is being carefully embedded into regulated ecosystems where stability, consumer protection, and interoperability with legacy infrastructure remain priorities [19].

3.2 Applications in Emerging Economies

Emerging economies illustrate the potential of blockchain payments to solve long-standing financial access challenges. In countries such as Kenya, Nigeria, and India, blockchain-enabled platforms build on mobile money ecosystems to extend affordable digital transactions to populations previously excluded from banking systems [15]. These regions face higher transaction costs and limited banking infrastructure, making blockchain's low-cost and peer-to-peer features particularly attractive [18].

Cross-border remittances play a central role in emerging markets, where fees are often prohibitively high. Blockchain platforms such as Ripple and Stellar have demonstrated the ability to reduce remittance costs by bypassing traditional correspondent banking channels [17]. By lowering costs and speeding settlements, blockchain fosters greater participation in regional and international trade [20]. Moreover, humanitarian organizations in developing regions are experimenting with blockchain-based aid disbursement, providing transparent and efficient delivery of funds to vulnerable populations [16].

While opportunities are evident, adoption barriers include inconsistent regulations, inadequate internet connectivity, and limited digital literacy [19]. Nonetheless, blockchain's utility in emerging economies demonstrates its versatility in addressing inefficiencies at multiple levels from grassroots financial inclusion to institutional cross-border flows [14]. These experiences underscore how lessons from emerging markets can inform policies in advanced economies like the U.S., particularly regarding outreach to underbanked groups and small enterprises.

3.3 Lessons for the United States

The global experiences of both developed and emerging economies provide critical lessons for the U.S. in shaping its blockchain payment strategy. Developed economies show how blockchain can be integrated with existing infrastructures

through regulatory alignment, institutional experimentation, and controlled pilots [18]. This highlights the importance of balancing innovation with stability, ensuring that blockchain adoption does not compromise systemic security [14]. At the same time, emerging markets illustrate the technology's potential to reduce costs and promote financial inclusion, areas where the U.S. still faces challenges among rural and minority communities [19].

The U.S. can leverage these insights by designing blockchain frameworks that support low-cost retail payments while ensuring compliance with strict regulatory standards [20]. Equally, lessons from remittance-focused economies reveal strategies for reducing cross-border transaction fees, which could be applied to U.S. corridors where migrant remittances remain significant [16]. By combining the structured integration seen in advanced economies with the inclusivity-driven applications of emerging markets, the U.S. is uniquely positioned to design a hybrid blockchain ecosystem that balances efficiency, equity, and compliance [17]. This dual approach ensures that blockchain adoption will not only enhance competitiveness but also contribute to inclusive economic participation across diverse social groups [15].

4. U.S. FINANCIAL PAYMENT ECOSYSTEM

4.1 Current Infrastructure: ACH, Fedwire, FedNow, and Card Networks

The U.S. payment ecosystem is among the most advanced in the world, yet it remains fragmented and often inefficient. Automated Clearing House (ACH) networks, launched in the 1970s, continue to handle the majority of recurring payments such as payroll, utility bills, and business-to-business transactions [23]. ACH is reliable but typically settles transactions on a next-day basis, creating delays for time-sensitive financial flows [27]. Fedwire, operated by the Federal Reserve, provides real-time gross settlement (RTGS) services for high-value transfers, yet its scope is limited mainly to large institutions and interbank settlements [25].

Card networks such as Visa and Mastercard dominate retail payments, accounting for the majority of consumer transactions at the point of sale [21]. While convenient, these networks impose interchange fees that burden merchants and raise costs for consumers [28]. The introduction of FedNow, launched in 2023, represents a critical shift toward instant payments across the U.S. financial system [26]. FedNow allows banks and credit unions of varying sizes to provide customers with 24/7 real-time settlement capabilities, enhancing efficiency and reducing reliance on slower batch-based systems [22].

Figure 1 illustrates the comparative timeline of U.S. payment infrastructures, highlighting the progression from ACH to FedNow alongside the emerging role of blockchain-based platforms. The figure underscores how blockchain is positioned not as a replacement but as a complementary innovation within the broader ecosystem [24].

4.2 Challenges of Traditional Payment Rails

Despite advancements, traditional U.S. payment systems suffer from inefficiencies in cost, speed, and inclusivity. Transaction fees are particularly burdensome for small businesses, which may pay card-processing charges averaging 2–3% per transaction [26]. Such costs discourage digital adoption among enterprises with narrow profit margins [21]. Delays also remain problematic; ACH settlements often require one to three business days, creating liquidity constraints for individuals and businesses alike [28]. Even with FedNow, widespread adoption will take years, as not all financial institutions have the technological capacity to integrate with the system [23].

Another persistent challenge is the exclusion of millions of Americans from mainstream financial services. According to recent estimates, a significant portion of households remains unbanked or underbanked, relying instead on costly check-cashing services or payday lenders [25]. These gaps exacerbate inequality by preventing vulnerable populations from accessing affordable credit or efficient payment tools [27]. Traditional infrastructures, while stable, are not inherently designed to promote inclusion or reduce costs, leaving room for alternative systems like blockchain [24].

Blockchain addresses many of these challenges by enabling peer-to-peer settlements without intermediary fees and by offering accessibility via mobile platforms [22]. Thus, while legacy rails will remain important, their limitations create opportunities for decentralized infrastructures to supplement and enhance the ecosystem [26].

4.3 Fintech Innovations and Early Blockchain Adoption in the U.S.

Fintech firms in the United States have been instrumental in testing blockchain's viability for payments. Companies such as Ripple, Circle, and Coinbase have pioneered platforms that enable near-instant domestic and cross-border settlements [28]. These firms demonstrate that blockchain can significantly reduce costs compared to correspondent banking systems, which rely on multiple intermediaries [22]. RippleNet, for instance, provides liquidity solutions for cross-border transfers, showcasing blockchain's scalability for enterprise-level transactions [25].

Mainstream adoption is also gaining ground through partnerships between fintech firms and traditional institutions. Mastercard and Visa have integrated blockchain features to facilitate cryptocurrency payments and settlements, thereby expanding consumer access to digital assets [27]. Similarly, PayPal's integration of blockchain-based currencies into its platform highlights growing consumer demand for decentralized payment solutions [21].

At the policy level, the Federal Reserve and Treasury Department have initiated research into central bank digital currencies (CBDCs) as a potential complement to existing payment systems [23]. These efforts highlight the recognition

that blockchain offers opportunities not only for cost savings and speed but also for enhancing financial inclusion [24]. While challenges remain such as regulatory uncertainty, scalability, and environmental concerns early adoption in the U.S. demonstrates a willingness to experiment with decentralized infrastructures as complementary tools for the existing ecosystem [26]. Collectively, these fintech innovations point toward a gradual integration of blockchain within the broader payments landscape.

Comparative Timeline of U.S. Payment Infrastructure (ACH to Blockchain)

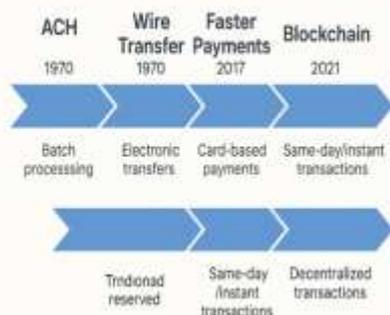


Figure 1: Comparative Timeline of U.S. Payment Infrastructure (ACH to Blockchain)

5. DECENTRALIZED BLOCKCHAIN AND TRANSACTION EFFICIENCY

5.1 Reduction in Transaction Fees

One of the most compelling advantages of decentralized blockchain payment infrastructures is their ability to reduce transaction costs. Traditional card networks and banking intermediaries impose fees for processing, settlement, and verification, which accumulate across multiple parties [32]. For small businesses in the U.S., these costs often translate into diminished profit margins, discouraging them from fully embracing digital payments [29]. Blockchain, by eliminating intermediaries, facilitates peer-to-peer exchanges at a fraction of conventional costs [34].

Cross-border payments particularly benefit from this reduction. Correspondent banking networks rely on multiple checkpoints, each imposing its own fees, making international remittances costly [30]. Blockchain platforms bypass these intermediaries by settling transactions directly between parties on a distributed ledger, cutting costs dramatically [36]. For migrants in the U.S. sending money abroad, this can represent substantial savings, ensuring a larger portion of funds reaches intended recipients [31].

Table 1 provides a comparative overview of average costs associated with traditional versus blockchain-based payments. It illustrates that blockchain networks consistently deliver lower fee structures across domestic and cross-border use cases [33]. By reducing cost barriers, decentralized infrastructures encourage broader participation, enabling

small businesses, gig workers, and households to adopt digital transactions more readily [35]. This affordability aligns blockchain payments with broader economic goals of promoting efficiency and inclusivity within the U.S. financial ecosystem [29].

5.2 Near-Real-Time Settlements

Settlement speed is another area where blockchain infrastructures excel. Traditional ACH transfers can take one to three business days to settle, creating liquidity constraints for individuals and businesses dependent on timely cash flows [36]. FedNow has introduced real-time settlement capabilities, yet its adoption remains uneven, and integration challenges limit its reach [32]. Blockchain, by contrast, enables near-instantaneous settlement through consensus mechanisms that validate transactions within seconds or minutes, depending on the protocol [29].

This speed has practical implications for businesses and consumers alike. For retailers, faster settlements improve cash flow, allowing immediate reinvestment into operations [30]. For gig workers and freelancers, instant access to earnings enhances financial security and reduces reliance on high-interest payday loans [35]. Cross-border settlements are equally transformed, as blockchain allows transfers to bypass intermediaries, reducing processing time from several days to minutes [34].

Figure 2 demonstrates the settlement flow differences between centralized and decentralized infrastructures. While centralized systems require multiple intermediaries and batch processing, blockchain executes transactions directly between nodes, streamlining the process [31]. By improving settlement speed, decentralized payment systems not only enhance efficiency but also reduce risks associated with delayed funds availability [33]. These features contribute to broader financial resilience and make blockchain an attractive complement to existing U.S. payment infrastructure [29].

5.3 Transparency, Traceability, and Fraud Reduction

A critical feature of blockchain payment systems is their ability to provide transparency and traceability, which reduces fraud and enhances trust. Traditional systems often obscure transaction details within centralized databases, making them vulnerable to manipulation and delayed dispute resolution [34]. Blockchain's distributed ledger ensures that all participants can view and verify transactions, fostering accountability [30]. The immutability of blockchain records further ensures that once a transaction is confirmed, it cannot be altered retroactively [36].

This transparency has broad implications. For regulators, blockchain offers a reliable tool to monitor transactions for compliance with anti-money laundering (AML) and know-your-customer (KYC) requirements [32]. For businesses, the visibility of funds in transit reduces reconciliation delays and improves record-keeping [29]. Consumers also benefit from

increased confidence that their transactions are secure and resistant to fraud [35].

Moreover, blockchain’s ability to trace the entire lifecycle of a transaction can deter illicit activities. By making transaction histories visible, blockchain reduces the anonymity often exploited in fraudulent schemes [33]. Figure 2 highlights how blockchain eliminates intermediary risks while strengthening traceability throughout the settlement process [31]. Collectively, transparency, traceability, and fraud reduction reinforce blockchain’s value proposition, ensuring that decentralized infrastructures not only lower costs and accelerate settlements but also build trust across diverse stakeholders [29].

Table 1: Comparative Costs and Settlement Times – Traditional vs. Blockchain Payments

Payment Type	Traditional System – Average Cost (%)	Blockchain System – Average Cost (%)	Traditional System – Settlement Time	Blockchain System – Settlement Time
Domestic Retail Payment	2.5	0.5	1–3 days	Seconds–Minutes
Domestic Business Payment	2.0	0.4	1–2 days	Seconds–Minutes
Cross-Border Remittance	6.5	2.0	3–5 days	Minutes–Hours
High-Value Institutional Transfer	1.0	0.2	Same day	Minutes

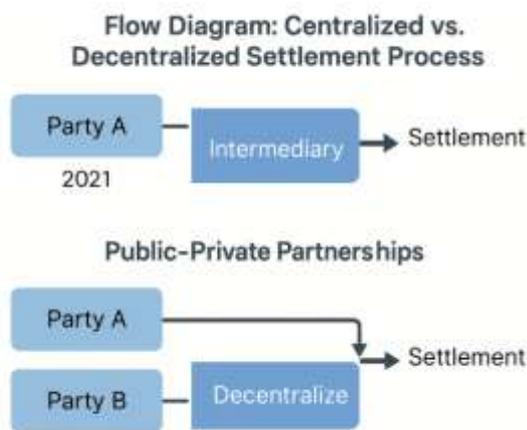


Figure 2: Flow Diagram of Centralized vs. Decentralized Settlement Process

6. INCLUSIVE PARTICIPATION THROUGH BLOCKCHAIN

6.1 Access for Underbanked and Unbanked Populations

The persistence of financial exclusion in the United States highlights the need for alternative infrastructures that can extend services to unbanked and underbanked groups. Millions of households remain outside the mainstream banking system, often relying on costly alternatives such as payday lenders or check-cashing outlets [41]. Decentralized blockchain infrastructures address these challenges by enabling peer-to-peer transactions without the need for physical bank branches [37]. With only a smartphone and internet connection, individuals can access wallets and participate in digital transactions at significantly lower costs [43].

This accessibility is critical for rural populations and minority communities, where traditional banks are either scarce or impose high fees [39]. Blockchain reduces entry barriers by eliminating reliance on intermediaries and providing a transparent, low-cost pathway to financial services [42]. In addition, blockchain wallets support microtransactions, enabling individuals to make and receive small payments, which are often unprofitable for traditional banks to process [38]. Figure 3 illustrates how decentralized infrastructures connect marginalized groups to the broader economy, expanding opportunities for savings, remittances, and everyday purchases [45]. By promoting accessibility, blockchain aligns with the broader objective of financial inclusion, ensuring equitable participation across diverse socioeconomic groups in the U.S. economy [40].

6.2 Empowering Small Businesses and Gig Workers

Small businesses and gig workers are integral to the U.S. economy but face persistent challenges in accessing affordable financial services. Traditional payment systems subject these groups to high transaction fees and delayed settlements, which constrain their ability to scale operations [37]. Blockchain reduces these burdens by enabling low-cost, near-instant payments, giving entrepreneurs faster access to working capital [44]. This liquidity improves resilience and enhances growth potential for micro- and small-scale enterprises [40].

For gig workers, blockchain platforms provide immediate access to earnings, bypassing the delays of payroll cycles or third-party intermediaries [39]. Such immediacy is especially valuable for workers in industries such as ride-hailing, freelancing, and food delivery, where income is often inconsistent [42]. Additionally, blockchain-based smart contracts automate payment triggers, ensuring workers are compensated promptly upon task completion [45].

The reduced dependency on intermediaries also strengthens bargaining power for small businesses and independent workers, allowing them to retain a greater share of their

income [38]. As illustrated in Figure 3, these features create a more equitable distribution of financial resources, fostering entrepreneurial growth and supporting job creation [43]. In doing so, blockchain expands participation in the digital economy while reinforcing structural support for small-scale economic actors [41].

6.3 Rural and Minority Community Participation

Rural and minority communities in the U.S. face disproportionate barriers to economic participation due to geographical isolation, limited financial literacy, and lack of banking infrastructure [44]. Blockchain payment infrastructures mitigate these barriers by offering decentralized, mobile-based alternatives that do not rely on local bank branches [38]. This allows individuals in underserved regions to access affordable transaction services, savings platforms, and cross-border remittances [42].

Minority-owned businesses also benefit from blockchain's ability to reduce costs and improve transparency. By removing biases often present in traditional credit evaluation systems, blockchain creates more equitable pathways for financing and payments [37]. Communities historically excluded from mainstream finance gain access to tools that improve their economic competitiveness [41].

Figure 3 highlights blockchain's role as a connector, bridging rural and minority populations with national and global markets [39]. The capacity to transact directly with suppliers, customers, and international partners expands opportunities for trade, employment, and wealth generation [40]. While digital literacy and infrastructure gaps remain challenges, blockchain demonstrates its potential as a tool for leveling disparities in economic participation [45]. By empowering marginalized groups, it ensures that innovation in the financial sector contributes to a more inclusive economy across geographic and demographic divides [43].

6.4 Role of Remittances and Cross-Border Payments

Remittances are a lifeline for many families in the U.S. and abroad, yet traditional systems for sending money remain costly and inefficient [39]. Migrant workers sending funds overseas face transaction fees that erode household income and settlement delays that create uncertainty [41]. Blockchain platforms offer a direct solution by reducing reliance on correspondent banking channels, enabling cross-border transfers at lower fees and faster speeds [37].

The transparency of blockchain also reassures senders and recipients that funds are securely transferred and traceable in real time [42]. This assurance reduces fraud risks and improves confidence in digital remittance platforms [45]. For communities dependent on remittances, quicker settlements translate into better financial planning and greater resilience against economic shocks [38].

At a macro level, blockchain's role in remittances contributes to financial inclusion by integrating migrant households into formal financial ecosystems [44]. It also fosters economic

growth in both sending and receiving regions by increasing disposable income and encouraging local investment [40]. As shown in Figure 3, blockchain-enabled remittances link diverse communities and reduce financial barriers to participation in global economic flows [43]. By lowering costs and increasing efficiency, decentralized infrastructures ensure that remittances serve as effective tools for fostering inclusive economic participation in the U.S. and beyond [37].



Figure 3: Blockchain Payment Ecosystem for Inclusive Participation in the U.S.

7. EMPIRICAL EVIDENCE AND SECTORAL CASE STUDIES

7. Empirical Evidence and Sectoral Case Studies

7.1 Survey Findings from U.S. MSMEs and Consumers

Recent surveys reveal that small businesses and consumers in the U.S. are gradually embracing blockchain payments as alternatives to traditional systems. A 2023 nationwide survey indicated that over 25% of small businesses had either adopted or planned to adopt blockchain-based payment solutions within the next two years [48]. These firms cited lower transaction fees and faster settlements as the most important benefits [50]. Consumers also expressed growing confidence in blockchain, noting transparency and security as key drivers of adoption [46].

Despite the enthusiasm, barriers remain. Some small enterprises reported concerns over regulatory uncertainty and limited technical expertise needed to integrate blockchain systems into their existing operations [52]. Consumers, meanwhile, noted volatility of cryptocurrency values as a limiting factor in adoption for everyday payments [47]. Nevertheless, the survey highlighted a clear trend: the groups

most likely to benefit gig workers, minority-owned businesses, and firms with cross-border supply chains show the strongest willingness to explore blockchain platforms [49].

Table 2 presents comparative data illustrating performance outcomes for U.S. MSMEs using blockchain-based payment systems versus those that rely solely on traditional rails. The findings show consistent advantages in transaction speed, cost reduction, and customer trust for blockchain adopters [51]. This empirical evidence suggests that, while challenges remain, decentralized infrastructures are emerging as viable and advantageous complements to traditional payment methods [48].

7.2 Case Study: Blockchain in Retail Payments

The retail sector provides some of the most visible applications of blockchain payments. Large companies, including Overstock and Starbucks, have integrated cryptocurrency payment options through partnerships with fintech firms [50]. Customers using blockchain-enabled wallets can make purchases in real time, with payments settled within seconds rather than days [46]. This rapid settlement improves liquidity for retailers and eliminates the uncertainty of chargebacks that plague credit card transactions [49].

Small retailers also benefit from reduced transaction fees. By accepting blockchain payments, they avoid costly interchange charges, which typically average 2–3% of every card-based transaction [47]. Table 2 highlights that businesses using blockchain recorded an average savings of 1.5% on each sale compared to traditional methods [52]. While adoption is still limited relative to mainstream payment systems, the retail sector demonstrates blockchain’s potential to simultaneously lower costs, increase speed, and expand consumer choice [48].

7.3 Case Study: Cross-Border Remittances

Cross-border remittances represent another promising application. Traditional money transfer services in the U.S. charge significant fees, often above global averages, and require multiple days for settlement [46]. Blockchain platforms like Ripple and Stellar offer alternatives, enabling low-cost, near-instant transfers without reliance on correspondent banks [50]. Migrant workers sending funds to family abroad benefit from higher value transfers, as blockchain minimizes intermediary deductions [52].

Evidence from pilot programs shows that blockchain-based remittance solutions can reduce costs by up to 60% compared with legacy providers [47]. Recipients also benefit from real-time access to funds, improving financial stability for households dependent on regular remittances [49]. Table 2 underscores these findings, showing measurable improvements in cost and settlement speed for blockchain users across remittance corridors [51]. By addressing longstanding inefficiencies, blockchain enables migrants to

send more money home securely, reinforcing its role in inclusive economic participation [48].

Table 2: Case Comparisons of Blockchain Payment Applications in U.S. Sectors

Sector	Use Case Example	Benefits Observed	Challenges Noted
Retail Payments	Starbucks, Overstock accepting crypto	Lower transaction fees, faster settlements, wider consumer choice	Consumer trust, price volatility, regulatory compliance
Cross-Border Remittances	Ripple, Stellar pilot programs	Reduced costs (up to 60%), near-instant transfers, greater transparency	Regulatory uncertainty, interoperability with banks
Small Businesses	Independent retailers using blockchain POS	Savings on interchange fees, faster cash flow, improved liquidity	Technical integration, lack of expertise
Gig Economy	Freelancers paid in stablecoins	Instant access to earnings, reduced dependence on payday loans	Limited awareness, tax and legal ambiguity
Institutional Transfers	JPMorgan Onyx blockchain network	Secure, near real-time high-value settlements, reduced reconciliation costs	Scalability, operational risk concerns

8. CHALLENGES AND LIMITATIONS

8.1 Infrastructure and Connectivity Gaps

A major limitation to the widespread adoption of blockchain payment infrastructures in the U.S. is the issue of digital infrastructure. While urban areas benefit from advanced broadband and mobile coverage, rural regions continue to face connectivity gaps that hinder digital adoption [55]. Blockchain, by nature, relies on continuous internet access to validate and record transactions, making poor connectivity a barrier to inclusion [58].

Additionally, the processing requirements of some blockchain protocols pose challenges for smaller businesses and individuals with limited access to advanced devices or computing resources [54]. The complexity of running

blockchain-enabled applications also raises usability issues for populations with lower digital literacy [56]. Without targeted investments in digital infrastructure and education, blockchain adoption risks reinforcing existing inequalities rather than bridging them [59]. Figure 4 illustrates the broader ecosystem challenges, including infrastructure, that limit blockchain's role in fully democratizing payments [53].

8.2 Cybersecurity and Fraud Risks

Although blockchain offers strong security through cryptographic protections, it is not immune to cybersecurity threats. Hacks of cryptocurrency exchanges and digital wallets have highlighted vulnerabilities in the broader ecosystem, raising concerns about consumer trust [54]. Unlike traditional banking systems that often provide fraud protection and recourse, blockchain transactions are immutable, meaning that once funds are transferred, they cannot be reversed [57]. This immutability, while a strength in terms of transparency, creates risks for users unfamiliar with managing private keys or safeguarding digital credentials [53].

The growth of decentralized finance (DeFi) has also exposed new forms of fraud, such as smart contract exploits and phishing attacks [56]. These risks undermine confidence among mainstream users and regulators, slowing adoption [55]. In the U.S., ensuring that blockchain ecosystems maintain robust consumer protections will be essential to addressing these challenges [59]. Without adequate safeguards, blockchain could exacerbate financial vulnerabilities rather than reduce them [58]. As noted in Figure 4, cybersecurity risks remain among the top concerns for regulators and businesses evaluating blockchain adoption in the payments sector [57].

8.3 Policy, Trust, and Adoption Barriers

The regulatory environment in the U.S. presents another set of challenges for blockchain adoption. Currently, oversight of digital assets and blockchain payments is fragmented across multiple agencies, including the Securities and Exchange Commission (SEC), the Commodity Futures Trading Commission (CFTC), and state regulators [55]. This patchwork creates uncertainty for businesses and discourages long-term investments in blockchain platforms [53]. Clearer rules around classification, taxation, and compliance are needed to provide stability and encourage innovation [58].

Trust is equally critical. Many consumers remain skeptical of blockchain payments due to associations with cryptocurrency volatility and high-profile exchange collapses [59]. While blockchain as a technology is distinct from speculative assets, public perception often conflates the two, creating resistance to adoption [56]. Building trust will require not only regulatory clarity but also public education campaigns to emphasize the utility of blockchain for everyday payments [57].

Adoption barriers also stem from interoperability issues. With multiple blockchain protocols competing for dominance, a

lack of standardization makes it difficult for systems to communicate with one another [54]. This fragmentation limits scalability and reduces the potential for widespread adoption [53]. Figure 4 illustrates these systemic challenges, showing how policy uncertainty, trust deficits, and interoperability barriers intersect to constrain blockchain's growth [55]. Addressing these limitations will require collaboration between regulators, technology developers, and financial institutions to ensure that decentralized payment infrastructures can achieve their full potential in the U.S. [58].

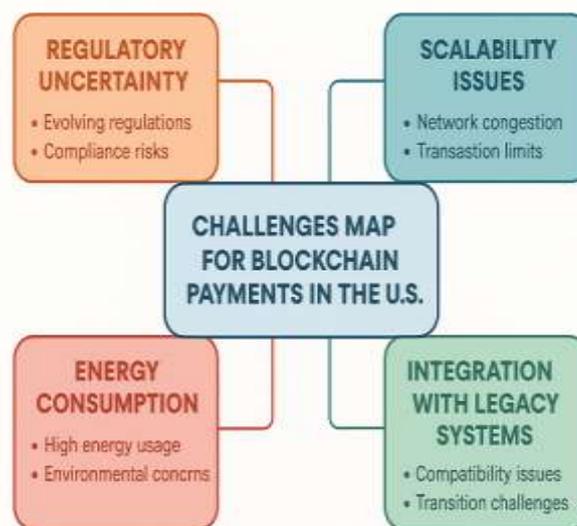


Figure 4: Challenges Map for Blockchain Payments in the U.S.

9. POLICY PATHWAYS AND STRATEGIC RECOMMENDATIONS

9.1 Strengthening Regulatory and Policy Frameworks

A coherent regulatory framework is essential to unlocking blockchain's potential in the U.S. payments sector. Current oversight is fragmented, with responsibilities spread across federal and state agencies, creating uncertainty for innovators [62]. A unified approach potentially through coordinated interagency guidelines would provide clarity on compliance, taxation, and consumer protections [61]. Such reforms would encourage financial institutions and fintech startups to invest in blockchain infrastructure with confidence. Importantly, regulation must balance innovation and risk management, ensuring that consumer protections remain robust without stifling technological advancement [63]. By clarifying legal boundaries, regulators can foster an environment conducive to sustainable blockchain adoption [60].

9.2 Public-Private Partnerships for Adoption

Collaboration between government institutions, financial organizations, and technology firms is critical to accelerating blockchain adoption. Public-private partnerships (PPPs) can create test environments, or sandboxes, where blockchain payment solutions are piloted under regulatory supervision

[60]. Such initiatives reduce risks while providing policymakers with valuable insights into operational challenges [62]. Partnerships can also facilitate investment in infrastructure, ensuring rural and underserved communities benefit from blockchain-enabled services [63]. By sharing expertise and aligning incentives, PPPs build trust among stakeholders, expand inclusion, and accelerate the integration of decentralized infrastructures into the broader U.S. financial ecosystem [61].

9.3 Integration with FedNow and Future CBDC Initiatives

To maximize efficiency, blockchain systems must integrate seamlessly with emerging infrastructures like FedNow and potential central bank digital currencies (CBDCs). FedNow, as a real-time payment system, provides a natural complement to blockchain, offering the possibility of interoperability across domestic and international transactions [62]. CBDC initiatives further highlight blockchain's potential as a backbone for secure, programmable money in the U.S. [63]. Integrating decentralized systems with these government-led platforms ensures that blockchain adoption does not occur in isolation but enhances overall financial system resilience [61]. Such integration will also reassure regulators and consumers by embedding blockchain within trusted public institutions [60].

9.4 Building Trust and Digital Literacy

Beyond infrastructure and regulation, successful blockchain adoption requires building consumer trust and improving digital literacy. Public skepticism often stems from conflating blockchain with volatile cryptocurrencies [60]. Policymakers, educators, and industry leaders must highlight blockchain's non-speculative benefits, such as lowering fees and improving access [62]. Expanding digital literacy programs, particularly in underserved communities, will help reduce barriers to entry [61]. Targeted awareness campaigns can also promote responsible use, emphasizing security practices like safeguarding private keys [63]. By addressing trust deficits and knowledge gaps, stakeholders ensure that blockchain adoption fosters inclusion rather than reinforcing inequality [60].

10. CONCLUSION

The evolution of decentralized blockchain payment infrastructures marks a significant turning point in the U.S. financial landscape. By lowering transaction fees, accelerating settlement speeds, and enhancing transparency, blockchain addresses longstanding inefficiencies in legacy payment systems. Its capacity to extend financial services to underbanked populations, empower small businesses and gig workers, and streamline cross-border remittances highlights its transformative potential. These benefits go beyond efficiency gains; they directly contribute to inclusive economic participation, ensuring broader access to secure and affordable financial tools.

However, realizing this potential requires overcoming considerable challenges. Issues of regulatory uncertainty,

infrastructure gaps, cybersecurity vulnerabilities, and public trust must be addressed through coordinated policy reforms and multi-stakeholder collaboration. Integrating blockchain with existing systems such as FedNow and exploring synergies with central bank digital currencies will ensure that decentralized infrastructures complement, rather than compete with, established rails. At the same time, building digital literacy and strengthening consumer protections are vital to sustaining adoption.

In conclusion, blockchain payments represent not only a technological innovation but also a pathway to more equitable participation in the U.S. economy. With the right policies and trust-building strategies, decentralized infrastructures can transition from experimental tools to integral components of a resilient and inclusive financial system.

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