EdinBurg Peer-Reviewed Journals and Books Publishers
Journal of Information and Technology
Vol. 5||Issue 11||pp 24-34||November||2025
Email: info@edinburgjournals.org||ISSN: 3080-9576

Integration of DeFi into Traditional Finance

Dusabimana Emmanuel[1*], KN Jonathan[2], Djuma Sumbiri[3]
[1,2,3]Department of Information Technology, Faculty of Computing and Information Sciences, *University of Lay Adventists of Kigali, Rwanda*
Corresponding Emails: dusabimana54emmanuel@gmail.com, phialn1@gmail.com, sumbirdj@gmail.com

Accepted: 06 June 2025 || Published: 03 November 2025

Abstract

Decentralized Finance (DeFi) has been identified as an emerging technology for a transformative force in financial intermediation, introducing a trustless, programmable, and inclusive financial ecosystem. This paper identifies, show, and explores the integration of DeFi into traditional finance, focusing on how DeFi platforms are redefining financial intermediation and incorporates not only the financial perspective but also an IT-systems perspective, detailing architectures, data structures, and integration frameworks that enable collaboration between DeFi platforms and traditional financial institutions. The research identifies the limitations of current financial systems, evaluates the technical and regulatory challenges of integration, and highlights how DeFi innovations can increase efficiency, transparency, and inclusivity. Key components of this integration, such as smart contracts, decentralized lending, and interoperable frameworks, are analyzed along with their potential to overcome limitations in traditional finance. The paper concludes with recommendations for a mutually beneficial model combining DeFi and traditional finance to create a robust, secure, and inclusive global financial ecosystem.

Keywords: *Decentralized Finance (DeFi), traditional finance, blockchain, smart contracts, interoperability, financial inclusion, system architecture, integration middleware, oracles, cross chain bridges.*

How to Cite: Dusabimana, E., Jonathan, K. N., & Sumbiri, D. (2025). Integration of DeFi into Traditional Finance. *Journal of Information and Technology, 5*(11), 24-34.

1. Introduction

The financial world is experiencing a major transformation due to Decentralized Finance (DeFi) and the advancing technology of Web3. Unlike traditional systems that depend on banks or middlemen (usually people or independent organizations), DeFi uses blockchain technology to let users trade directly with one another through self-executing "smart contracts" (F. Schär, 2021). By automating financial tasks such as loans or payments using code stored on blockchains, DeFi significantly reduces time delays and extra costs per transaction. For example, someone can borrow money instantly using crypto assets (like BTC) as collateral, without needing a bank's approval. This shift raises questions about whether traditional financial players will remain important in the future and challenges legacy finance models with its superior efficiency and transparency.

How is DeFi transforming financial intermediation? DeFi is reshaping intermediation by removing middlemen such as banks and brokers and automating processes like lending, trading, and settlement (Nakamoto). Platforms like Aave allow users to borrow funds directly using crypto as collateral, bypassing lengthy bank approvals and prioritizing efficiency and accessibility over centralized control. What opportunities exist for collaboration? Banks could adopt DeFi innovations, such as tokenizing assets (e.g., gold or real estate) for fractional ownership, while providing regulatory expertise to DeFi platforms (Nakamoto). Understanding this integration is crucial for building a modern financial system that serves individuals and organizations alike; DeFi's programmability allows instant services, its transparency reduces fraud, and its inclusivity opens doors for unbanked populations to access financial tools via smartphones (Chen & Bellavitis, 2020).

One key solution is building interoperable frameworks that let traditional banks use DeFi tools like lending protocols or decentralized exchanges. For example, banks could tokenize assets (stocks or bonds) to enable instant trading and lower fees compared to traditional methods (Chen & Bellavitis, 2020). Cross-chain bridges and standardized APIs would help merge banking systems with DeFi's decentralized infrastructure. Another solution involves collaborative compliance models: banks partnering with DeFi platforms to offer hybrid services such as compliant stablecoin transactions or automated loan approvals under regulatory oversight (Chen & Bellavitis, 2020). Regulatory sandboxes could allow banks to test DeFi tools in controlled environments, reducing risks while fostering trust and ensuring compliance without sacrificing DeFi's speed or transparency.

Traditional banks have been slow to adopt DeFi due to unclear regulations, legal risks, and the cost of integrating blockchain into outdated systems (Popescu, 2020). DeFi itself faces scalability issues (e.g., Ethereum's high gas fees), usability challenges for non-tech users, and trust barriers from high-profile hacks like the $600 M Poly Network exploit (Buterin, 2013). Existing research often focuses narrowly on technical or regulatory challenges, overlooking cultural and operational gaps such as banks' risk-averse cultures clashing with decentralized governance (Popescu, 2020) and offering few actionable integration frameworks (Schär, 2021). This paper proposes an innovative synergistic model combining DeFi's smart contracts and transparency with traditional finance's stability and regulatory compliance (Swan, 2015). Through hybrid platforms that adhere to AML rules via bank-led oversight, interoperable blockchains, standardized APIs, and phased adoption from tokenized bonds to cross-border CBDCs, this model aims to merge DeFi's efficiency with banks' infrastructure, ensuring seamless integration and balanced innovation**.**

2. Literature Review

The literature review analyzes academic papers, industry reports, and case studies to explore the evolution of DeFi and its relationship with traditional finance. Academic works like Schär (2021) dissect DeFi's blockchain architecture, while industry reports from institutions like the World Bank highlight systemic inefficiencies in traditional systems, such as high remittance costs and financial exclusion (F. Schär, 2021), This synthesis identifies gaps, such as the lack of scalable interoperability solutions, and underscores how DeFi's transparency and automation could address these issues.

EdinBurg Peer-Reviewed Journals and Books Publishers
Journal of Information and Technology
Vol. 5||Issue 11||pp 24-34||November||2025
Email: info@edinburgjournals.org||ISSN: 3080-9576

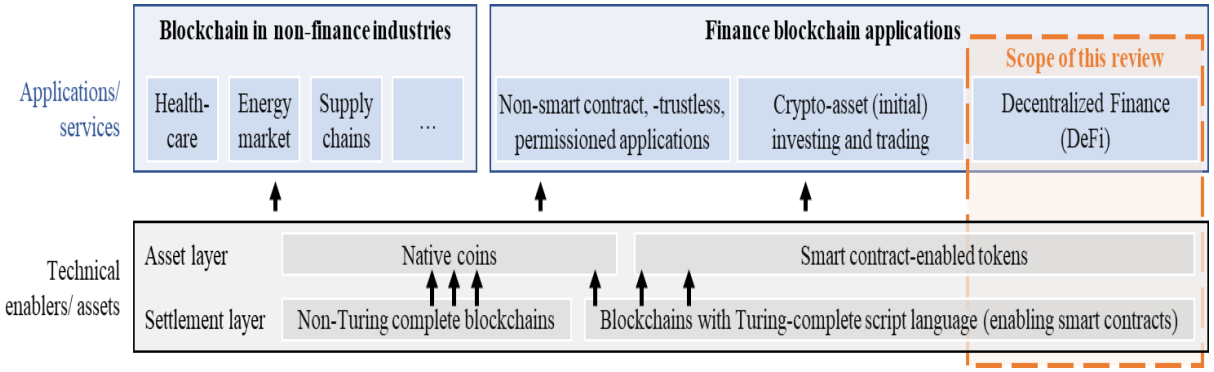

Figure 1: Schematic illustration of the scope of this literature review.

Case Studies

Case studies examine real-world integrations, such as JPMorgan's partnership with ConsenSys to tokenize assets on Ethereum and HSBC's pilot of blockchain-based gold trading (Poon & Buterin, 2017). These examples reveal that successful collaborations often focus on low-risk, high-impact areas (e.g, cross-border payments) while navigating regulatory hurdles. They also demonstrate measurable benefits, including faster settlement times (from days to minutes) and reduced operational costs, proving that hybrid models can bridge DeFi innovation with traditional infrastructure.

Qualitative Analysis

Qualitative interviews with stakeholders, DeFi developers, bank executives, and regulators uncover divergent priorities. DeFi proponents emphasize permissionless access and innovation, while bankers prioritize compliance and risk mitigation (Wood, 2014). However, common ground emerges in areas like tokenization and decentralized identity solutions. These insights highlight the need for dialogue to align incentives, such as creating regulatory sandboxes where banks and DeFi platforms co-develop compliant tools.

3. Methodology

Layered Integration Architecture

To achieve a smooth and secure interaction between decentralized finance (DeFi) systems and traditional banks, a **layered architecture** is adopted. Each layer plays a unique and essential role, and together they form an efficient, scalable, and compliant financial ecosystem.

Application Layer: This is the front-end layer that end users interact with. It includes user interfaces such as mobile banking apps, DeFi wallets (e.g., MetaMask), and financial dashboards. Users perform actions like checking balances, submitting loan requests, or making payments. In this system, the Application Layer submits requests to backend systems via the Integration Middleware. A key feature is a user-friendly design combined with secure transaction signing using cryptographic wallets.

- **Integration Middleware:** The middleware acts as a bridge between the user-facing applications and the core systems (both on-chain and off-chain). It can be centralized (e.g., hosted by a bank) or decentralized (e.g., a peer-to-peer message bus). It exposes APIs (REST, WebSocket), handles message processing (via Kafka, RabbitMQ), and enforces permissioning and compliance requirements (KYC/AML verification). For example, before allowing a user to access a DeFi loan pool, the middleware may verify

EdinBurg Peer-Reviewed Journals and Books Publishers
Journal of Information and Technology
Vol. 5||Issue 11||pp 24-34||November||2025
Email: info@edinburgjournals.org||ISSN: 3080-9576

the user's identity using off-chain data, then pass a signed credential to the DeFi protocol.

- **Protocol Layer:** This is the heart of DeFi. It includes smart contracts deployed on blockchains to perform financial functions such as lending, borrowing, trading, and tokenizing assets. Protocols like Aave, Compound, and Uniswap live in this layer. Middleware or applications can call these contracts to execute logic. For example, a user may request a tokenized loan, and the protocol layer validates the collateral and processes the transaction autonomously.
- **Oracle Network:** Oracles are critical because smart contracts cannot directly access external data. Oracle networks like Chainlink fetch off-chain data (e.g., exchange rates, identity verifications, stock prices) and feed it securely into smart contracts. In this model, when a bank verifies a user's KYC status or asset value, an oracle transmits that data to the DeFi protocol, allowing it to make informed decisions (e.g., liquidate a position or grant a loan).
- **Infrastructure Layer:** This layer consists of the blockchain networks and node infrastructure that support smart contract execution and data storage. It includes public blockchains (like Ethereum) and private permissioned ledgers (like Hyperledger Fabric or Corda) used by institutions. Nodes validate transactions, store history immutably, and enforce consensus. Reliable infrastructure ensures the DeFi system is available and secure at all times.
- **Bank Core Systems:** At the bottom of the architecture are the existing systems within banks and financial institutions. These include core banking software, KYC/AML databases, custody services, and settlement platforms. These systems are typically not blockchain-based but are integrated into the middleware to send and receive data. For example, when a DeFi platform wants to release funds, the bank settlement system checks balances and executes fiat transfers.

How They Work Together

When a user initiates a financial action (e.g., borrowing funds), the request flows through the **Application Layer**, verified and enriched by the **Middleware**, then passed to the **Protocol Layer,** where smart contracts handle logic. If needed, **Oracles** bring in external information (e.g., user identity, collateral price). The transaction is executed on the **Blockchain Infrastructure**, and relevant updates are pushed to the **Bank Core System** for record keeping or fiat settlement.

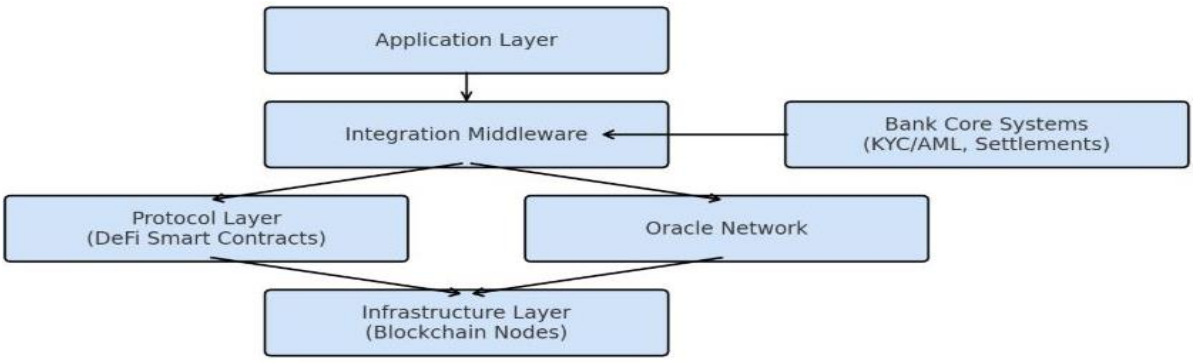

Figure 1: Hybrid DeFi and traditional finance integration architecture

EdinBurg Peer-Reviewed Journals and Books Publishers
Journal of Information and Technology
Vol. 5||Issue 11||pp 24-34||November||2025
Email: info@edinburgjournals.org||ISSN: 3080-9576

3.2 Cross-Chain Bridge with Bank Integration

The **Cross-Chain Bridge** is a powerful mechanism to enable asset movement and interaction between public DeFi blockchains (like Ethereum) and permissioned blockchains or bank systems.

- **Bank Custody/Tokenization:** Banks begin by either issuing new digital tokens that represent real-world assets (e.g., tokenized USD or bonds) or locking assets in a custodial system (e.g., a vault). For instance, a bank might take in fiat deposits and issue an equivalent amount of tokenized USD for use in DeFi.
- **L1 Bridge Contract:** The tokenized asset is sent to a smart contract on Ethereum (or another public chain). This contract **locks** the asset, ensuring that the total supply remains constant. It acts like a secure escrow. The L1 contract watches for incoming transactions and generates cryptographic proofs of deposit.
- **Proof & Messaging:** Using technologies like **zk-rollups**, optimistic rollups, or **light clients**, a proof of the locked funds is generated and passed to the destination network. This step ensures security and auditability: no asset is duplicated or spoofed across chains.
- **L2 Bridge Contract:** Upon receiving a valid proof, the bridge contract on the target chain (e.g., a permissioned network operated by banks) **mints a wrapped token** that represents the locked asset. This wrapped asset can now be used in private DeFi applications, lending markets, or enterprise settlement systems.
- **Bank Settlement System:** When the DeFi action is completed (e.g., a loan is repaid), the bridge burns the wrapped tokens, sends a message to the L1 bridge, and **releases the locked asset**. Simultaneously, the bank's internal settlement system updates fiat balances or triggers off-chain payments.

How They Collaborate

This system enables users to tokenize assets with a bank, move them across chains via **bridge contracts**, and use them in DeFi smart contracts. All while the bank maintains oversight and compliance through its custody and settlement systems.

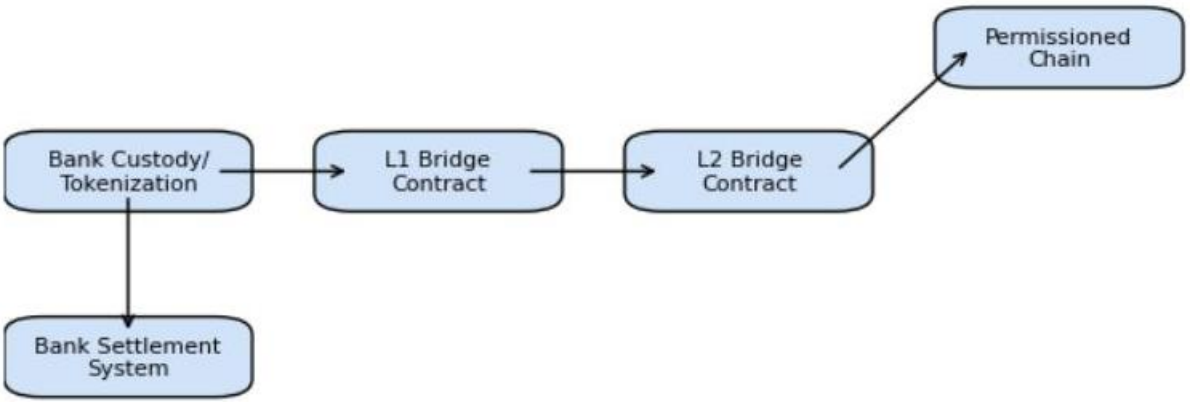

Figure 3: Cross-Chain bridge architecture with bank integration

EdinBurg Peer-Reviewed Journals and Books Publishers
Journal of Information and Technology
Vol. 5||Issue 11||pp 24-34||November||2025
Email: info@edinburgjournals.org||ISSN: 3080-9576

4. Evaluation

4.1 Programmable Transactions

DeFi transforms financial intermediation by automating processes through smart contracts, which execute agreements without human intervention. For example, platforms like Aave use smart contracts to enable instant loans, where borrowers provide crypto collateral and receive funds algorithmically, slashing costs and errors linked to manual processing (Antonopoulos, 2018). This contrasts with traditional systems, where loan approvals rely on slow, intermediary-driven workflows, highlighting DeFi's efficiency gains.

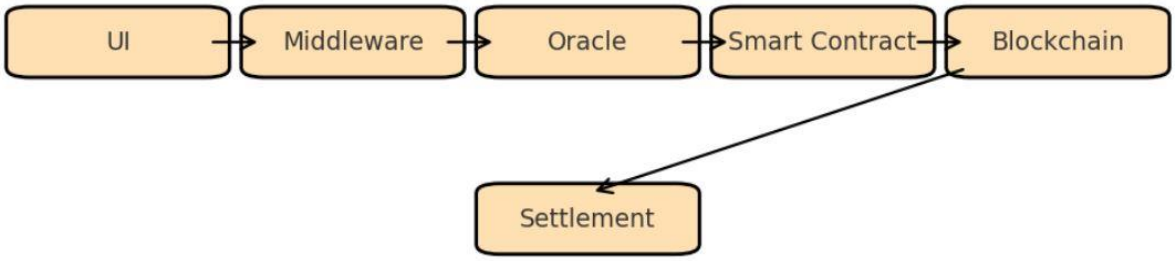

Figure 4: Loan processing

Increased Transparency

Blockchain's public ledger ensures accountability by recording every transaction immutably and visibly to all participants. In DeFi protocols like Uniswap, users can audit trade histories in real time, reducing fraud risks and fostering trust (Vogelsteller & Buterin, 2015). Traditional finance, by contrast, often operates on opaque internal ledgers, where discrepancies or errors can go unnoticed for extended periods, undermining transparency.

Financial Inclusion

DeFi expands access to financial services for unbanked populations, bypassing geographic or bureaucratic barriers. For instance, individuals in regions with limited banking infrastructure can use DeFi platforms via smartphones to save, borrow, or earn interest, addressing gaps highlighted by the World Bank's estimate of 1.7 billion unbanked adults (World Bank, 2021). Traditional systems often exclude these groups due to high fees or documentation requirements, underscoring DeFi's inclusive potential.

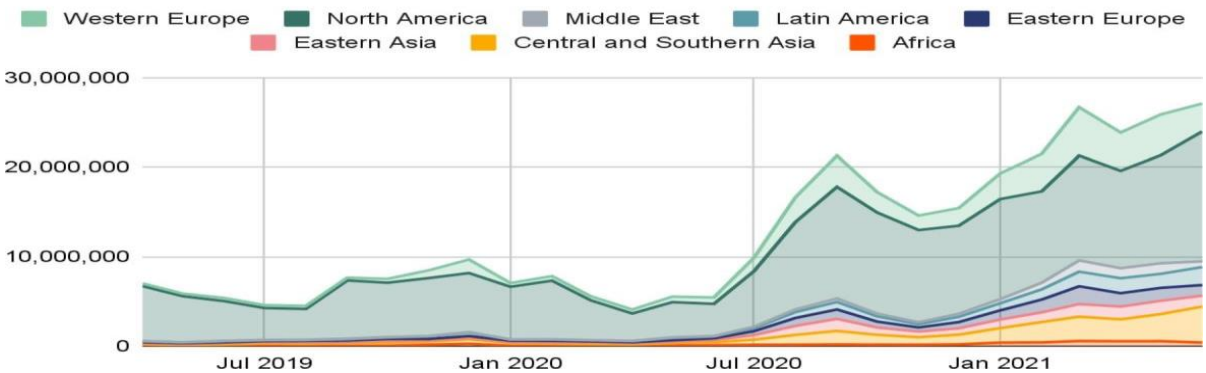

Figure 5: Total monthly web visits to DeFi platforms by country: April 2019 to June

2021 Source/Credit: Chainalysis

Automation and Efficiency

DeFi protocols revolutionize financial transactions by automating processes that traditionally require manual oversight. Automated Market Makers (AMMs), like Uniswap, replace centralized order books with algorithmic liquidity pools, enabling instant token swaps without brokers or intermediaries (Adams et al., 2020). These pools use smart contracts to adjust prices dynamically based on supply and demand, eliminating delays and human errors common in traditional trading systems. This automation streamlines operations, allowing DeFi platforms to handle transactions 24/7 with minimal friction.

By removing reliance on centralized infrastructure, DeFi protocols drastically reduce operational bottlenecks. For example, AMMs bypass lengthy settlement processes (e.g, T+2 in stock trading) by executing trades peer-to-peer in seconds, even for cross-border transactions (Adams et al., 2020). This efficiency lowers costs users pay, only network fees instead of brokerage commissions, and democratizes access to liquidity. However, challenges like impermanent loss in liquidity pools highlight the need for ongoing innovation to balance automation with risk management.

4.2 Opportunities for Collaboration

Collaboration can include: Hybrid Lending Models.

Hybrid lending models combine traditional banks' capital reserves with DeFi's decentralized protocols to optimize lending efficiency. For example, a bank could deploy funds into a DeFi liquidity pool (e.g, Compound or MakerDAO), enabling borrowers to access loans algorithmically while the bank earns interest transparently via smart contracts (Gokalp et al., 2020). This blends banks' financial stability with DeFi's speed and automation, reducing reliance on manual underwriting and expanding access to credit for underserved markets.

Decentralized Asset Management

Banks can leverage DeFi's programmable tools for automated asset allocation, replacing traditional fund managers with code-driven strategies. Platforms like Yearn Finance use algorithms to shift deposits between yield-generating protocols, maximizing returns for users (Lewis, 2014). By tokenizing assets (e.g, ETFs or real estate), banks could offer fractional ownership and real-time rebalancing, lowering fees and democratizing access to wealth management services traditionally reserved for high-net-worth clients.

Interoperable Frameworks

Interoperable frameworks bridge DeFi and traditional systems through cross-chain solutions or standardized APIs. Projects like Polkadot or Cosmos enable blockchains to communicate, allowing banks to integrate DeFi services (e.g, instant settlements) into legacy systems (InterWork Alliance, 2020). For instance, a bank could use a blockchain bridge to convert CBDCs into stablecoins for use in DeFi liquidity pools, creating seamless value transfer between centralized and decentralized ecosystems. This interoperability unlocks new revenue streams while maintaining regulatory compliance.

EdinBurg Peer-Reviewed Journals and Books Publishers
Journal of Information and Technology
Vol. 5||Issue 11||pp 24-34||November||2025
Email: info@edinburgjournals.org||ISSN: 3080-9576

4.3 Challenges

Regulatory Compliance

Aligning DeFi's decentralized nature with traditional regulatory frameworks remains a major challenge. For instance, anti-money laundering (AML) rules require identifying transaction participants, but DeFi's pseudonymous wallets complicate compliance (FATF, 2019). Solutions like "regulated DeFi" platforms, where banks act as node validators to enforce KYC checks, could bridge this gap. The EU's Markets in Crypto-Assets (MiCA) regulation attempts to standardize oversight, but adapting it to DeFi's borderless operations requires flexible, collaborative frameworks (FATF, 2019).

Technological Risks

DeFi faces technological risks such as smart contract vulnerabilities and scalability bottlenecks. High-profile exploits, like the $60M DAO hack in 2016, underscore the dangers of code flaws, necessitating rigorous audits by firms like CertiK or OpenZeppelin (Atzei et al., 2017). Scalability issues, such as Ethereum's network congestion and high fees, are being addressed through layer-2 solutions (e.g, Optimistic Rollups) and modular blockchains like Celestia. These innovations aim to balance security with performance, ensuring DeFi can handle mass adoption (Atzei et al., 2017).

Cultural Resistance

Traditional banks often resist DeFi due to cultural skepticism and fear of obsolescence. For example, legacy institutions may view decentralized governance as a threat to their centralized control, delaying partnerships. POST, 2017.. Overcoming this requires demonstrating DeFi's complementary value, such as JP Morgan's blockchain-based payment system, which improved efficiency without displacing core operations. Education and pilot projects (e.g, BNY Mellon's crypto custody services) can gradually build trust and shift institutional mindsets. Proc. POST, 2017.

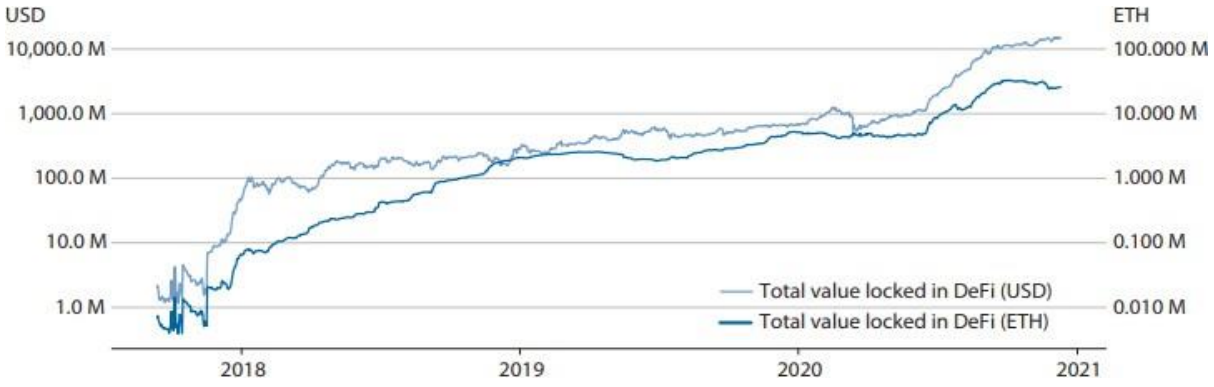

Figure 6: Total Value Locked in DeFi Contracts (USD and ETH). M, million

Source: DeFi Pulse

EdinBurg Peer-Reviewed Journals and Books Publishers
Journal of Information and Technology
Vol. 5||Issue 11||pp 24-34||November||2025
Email: info@edinburgjournals.org||ISSN: 3080-9576

5. Discussion

5.1 Strategic Roadmap for Integration Initial Phase:

Low-Risk

A phased integration approach could begin with low-risk, high-impact initiatives like "asset tokenization", where traditional assets (e.g, real estate or bonds) are digitized on blockchain for fractional ownership and liquidity (Ripple, 2018). For example, banks like HSBC have piloted tokenized gold, enabling 24/7 trading and reducing administrative costs. Similarly, "decentralized identity verification" projects, such as Microsoft's ION on Bitcoin, streamline KYC processes while maintaining user privacy, offering a secure foundation for broader adoption (Ripple, 2018). These projects minimize risk by leveraging proven technologies and aligning with existing regulations.

Scaling to Complex Integrations

Once foundational systems are tested, integration can expand to complex use cases like cross-chain liquidity pools or hybrid lending platforms. For instance, after mastering tokenization, banks might adopt DeFi protocols like Aave to offer algorithmic loans backed by tokenized collateral, merging traditional capital with decentralized efficiency (Ripple, 2018). Scaling further, interoperable frameworks (e.g, Polkadot's cross-chain messaging) could bridge CBDCs with DeFi ecosystems, enabling seamless global transactions. This gradual approach ensures stability while unlocking transformative potential (Ripple, 2018).

5.2 Balancing Decentralization and Regulation

Structure and Benefits of Hybrid Models

Hybrid models combine decentralized technologies, such as blockchain and smart contracts, with centralized institutions like traditional banks to balance innovation and stability. These systems harness DeFi's efficiency and transparency, like automated settlements and real-time auditing, while leveraging banks' expertise in regulatory compliance and risk management. For example, a hybrid stable coin might use blockchain for instant transfers but partner with banks to ensure reserves meet legal standards, blending speed with accountability (W3C, 2022).

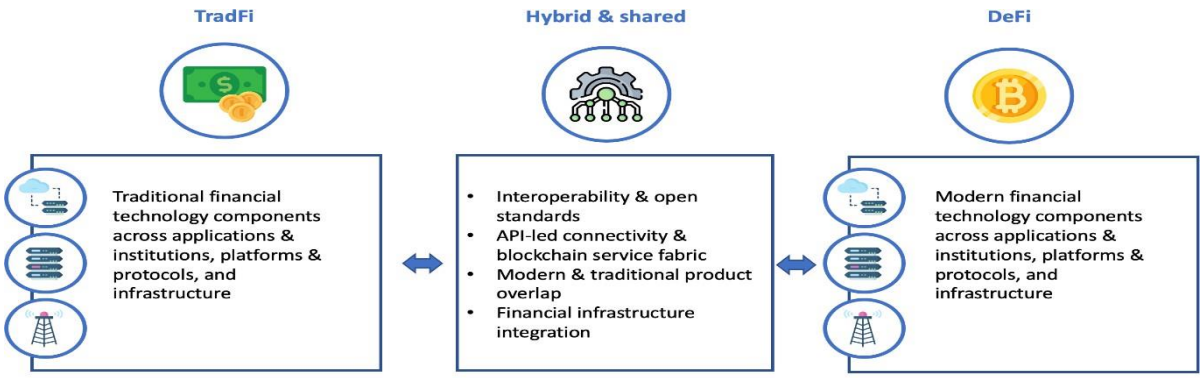

Figure 7: Total monthly web visits to DeFi platforms by country: April 2019 to June 2021 Source/Credit: thenextblock.io

Compliance and Resilience

By merging decentralized and centralized elements, these combined frameworks address regulatory and long-term systemic challenges. Centralized oversight ensures adherence to KYC rules, resolving DeFi's anonymity issues, while decentralized components or entities eliminate single points of failure, enhancing system resilience. Projects like JPMorgan's blockchain-based Repo Network demonstrate this balance, streamlining transactions on-chain while maintaining regulatory alignment through bank-led governance. Such models like the above one create adaptable ecosystems capable of thriving amid evolving regulations and market demands (W3C, 2022).

6. Conclusion

We must accept that integrating DeFi into traditional finance offers immense potential to revolutionize the financial ecosystem. Addressing challenges related to regulation, technology, and culture can and will enable a collaborative model exploiting the strengths of both systems. Further research into regulatory frameworks, technical interoperability, and stakeholder collaboration is critical.

References

(BIS). (2020). "Central Bank Digital Currencies: Foundational Principles and Core Features,".

(FATF), F. A. (2019). "Guidance for a Risk-Based Approach to Virtual Assets and VASPs,".

A. Popescu. (2020). "Decentralized Finance and Its Impact on the Financial Industry," Blockchain Res. J: vol. 4, no. 2, pp. 45–59, .

al, R. G. (2020.). "Decentralized Finance and the Future of Crypto Lending," J. Financ. Transform: vol. 51.

al:, N. A. (2017.). "A Survey of Attacks on Ethereum Smart Contracts," in Proc. POST, .

Antonopoulos, A. M. (2024). Mastering Ethereum: Building Smart Contracts and DApps. O'Reilly Media.

Buterin. (2013). V. "Ethereum White Paper," 2013. [Online]. Available: https://ethereum.org/en/whitepaper/.

E. A. Meyer, I. M. (2022). *"Decentralized Finance: A Systematic Literature Review and Research Directions,"* in Proc. ECIS,.

F. Schär. (2021). "Decentralized Finance: On Blockchain- and Smart Contract-Based Financial Markets," Fed. Reserve Bank St. Louis Rev: vol. 103, no. 3, pp. 153–174.

F. Vogelsteller and V. Buterin. (2015). "ERC-20 Token Standard," Ethereum Improvement Proposals, no. 20.

H. Adams et al. (2020.). "Uniswap v2 Core," Uniswap Docs.

InterWork Alliance. (2020). "Token Taxonomy Framework,".

J. Poon and V. Buterin. (2017). "Plasma: Scalable Autonomous Smart Contracts," White Paper.

M. Lewis, F. B. (2014). A Wall Street Revolt. W. W. Norton & Company.

M. Swan. (2015). Blockchain: Blueprint for a New Economy. O'Reilly Media.

Nakamoto, S. (n.d.). "Bitcoin: A Peer-to-Peer Electronic Cash System," 2008. [Online]. Available: https://bitcoin.org/bitcoin.pdf.

P. R. Ripple. (2018). “Banking on Blockchain: A Value Analysis for Investment Banks,” Ripple Insights.

W3C. (2022). “Decentralized Identifiers (DIDs) v1.0,” W3C Recommendation.

Wood, G. (2014). , “Ethereum: A Secure Decentralized Generalized Transaction Ledger,” Ethereum Proj. Yellow Paper, vol. 151.

World Bank. (2021). “The Global Findex Database 2021,” World Bank Group.

Y. Chen and C. Bellavitis. (2020). “Blockchain Disruption and Decentralized Finance: The Rise of Decentralized Business Models,” J. Bus. Venturing Insights, vol. 13.