The State of Decentralized Finance (DeFi) in 2024: An Academic Review

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Abstract

This article presents a comprehensive academic review of Decentralized Finance (DeFi) developments throughout 2024, examining market growth, technological innovations, protocol performance, regulatory developments, and emerging trends. Through analysis of empirical data, scholarly research, and industry reports, this study identifies key factors driving DeFi's evolution and adoption. The findings reveal significant market expansion, increased institutional participation, novel applications of blockchain technology for real-world asset tokenization, and evolving regulatory frameworks that are shaping the future of decentralized financial services.

1 Introduction

Decentralized Finance (DeFi) has emerged as a transformative force in the global financial ecosystem, challenging traditional financial models through blockchain-based protocols that operate without centralized intermediaries (Alamsyah et al., 2024). The evolution of DeFi throughout 2024 represents a critical juncture in its development trajectory, with increasing adoption, technological innovation, and regulatory attention.

This research provides a methodical analysis of DeFi's state in 2024, examining market metrics, technological advancements, protocol performance, regulatory developments, and future trajectories. By synthesizing data from multiple empirical sources, this study contributes to the academic understanding of DeFi's role in reshaping financial services.

2 Market Growth and Adoption

2.1 Market Size and Projections

The global DeFi market demonstrated substantial growth throughout 2024. According to Grand View Research (2024), the market size was estimated at USD 20.48 billion in 2024 and is projected to grow at a compound annual growth rate (CAGR) of 53.7% from 2025 to 2030. These figures represent a significant acceleration compared to previous years' growth rates.

Precedence Research (2024) provides a slightly different but equally optimistic perspective, estimating the global decentralized finance market size at USD 21.04 billion in 2024, with projections to increase to USD 32.36 billion by 2025. The research further projects that the market could reach USD 351.75 billion by 2031, reflecting a CAGR of 48.9% during the forecast period.

2.2 Total Value Locked (TVL) Analysis

Total Value Locked (TVL), a key metric for measuring DeFi ecosystem health, exhibited significant fluctuations throughout 2024. As noted by Mottaghi & Steininger (2025), "This fresh structural disturbance points to a second Ethereum DeFi sector regime change," referring to the volatility in TVL metrics throughout the year.

According to empirical data from industry sources, DeFi TVL experienced remarkable growth, rising from approximately $54 billion in January 2024 to $93 billion by the end of Q1 2024, representing a 72% increase in just one quarter (Focus on Business, 2024). Following the U.S. presidential election, TVL reached a peak of approximately $138 billion in December 2024, before retracting to around $92.6 billion by March 2025

(CoinTelegraph, 2025).

Luo et al. (2024) proposed a new framework termed "total value redeemable (TVR)" to more accurately assess the true underlying value within DeFi protocols. Their analysis of 3,570 DeFi protocols revealed significant discrepancies between traditional TVL metrics and actual redeemable value, suggesting that conventional TVL calculations may overstate market size.

3 Leading DeFi Protocols in 2024

3.1 Protocol Performance by TVL

Analysis of DeFi protocol performance reveals a concentration of capital in several leading platforms. According to DappRadar (2025) and corroborated by multiple industry sources, the top DeFi protocols by TVL include:

1. **Lido (LDO)**: Maintained its position as the leading DeFi protocol with approximately $26.06 billion in TVL
2. **Aave V3 (AAVE)**: Secured the second position with approximately $18.54 billion in TVL
3. **Sky (formerly MakerDAO)**: Ranked third with around $17.01 billion
4. **EtherFi**: Emerged as a significant player with $7.56 billion in TVL
5. **EigenLayer**: Completed the top five with substantial growth throughout the year

This concentration pattern aligns with observations from Gogol et al. (2024), who noted that the major categories of DeFi protocols cover over 90% of total value locked (TVL) in DeFi, indicating a market structure with significant advantages for established protocols.

3.2 Protocol Innovations and Updates

The year 2024 witnessed significant innovation among leading DeFi protocols:

Aave Protocol: Implemented several strategic updates including:

- Comprehensive token buyback program under the "Aavenomics" upgrade to reward users who stake AAVE tokens
- Enhanced compatibility with enterprise-grade digital asset platforms to facilitate institutional participation
- Governance refinements to strengthen community participation in decision-making processes

Uniswap Protocol: Continued its development trajectory with:

- Ongoing development of Uniswap V4 with its anticipated "hooks" feature designed to enable permissioned DeFi functionality
- Cross-chain expansion to additional Layer 2 and alternative blockchain networks
- Enhanced concentrated liquidity mechanisms to optimize capital efficiency

These innovations reflect Webb (2024)'s observation that DeFi platforms are reshaping market power dynamics through technological advancement and improved user experiences.

4 Key Technological Trends

4.1 Layer 2 Scaling Solutions

Layer 2 scaling solutions emerged as a dominant trend throughout 2024, addressing persistent challenges related to transaction costs and network congestion. Starknet (2024) reported that "Layer 2 scaling solutions boost DeFi by increasing transaction speed, reducing costs, and enhancing efficiency."

Notable developments in the Layer 2 ecosystem included:

- **Base**: Emerged as the fastest-growing Layer 2 solution, capturing approximately 28% of all new startup activity within its first year of operation (Dexola, 2024)
- **Arbitrum & Optimism**: Continued to dominate the optimistic rollup space with significant increases in TVL and user activity
- **ZK Rollups**: Gained traction with technological advancements improving transaction verification speeds

These developments align with academic perspectives on Layer 2 solutions, with TDeFi (2025) noting that "As DeFi continues to expand, Layer-2 solutions will play a pivotal role in shaping its future."

4.2 Real-World Asset (RWA) Tokenization

The integration of real-world assets into DeFi protocols represented one of the most significant trends in 2024. According to Chen et al. (2024), "The topic of real-world assets (RWA) tokenized on blockchains has recently been intensively discussed and recognized by DeFi communities." This trend manifested through:

- Tokenization of traditional assets like real estate, commodities, and securities
- Development of specialized protocols focused on bridging traditional finance and DeFi
- Creation of new financial instruments backed by real-world collateral

Baltais et al. (2024) observed that this trend creates "efficiency gains from the tokenization of different real-world asset (RWA) classes, with their subsequent integration into Decentralized Finance (DeFi) protocols." Empirical data indicates that RWA-based protocols saw their TVL increase by approximately 44%, entering the top 10 categories in terms of TVL in 2024 (TradeDog, 2024).

Xia et al. (2025) noted that "The introduction of RWA tokenization has had a significant impact on the decentralized finance (DeFi) ecosystem, providing reliable collateral and enabling more sophisticated lending mechanisms."

4.3 Perpetual Liquidity Pools and Intents-Based Architecture

Two additional technological innovations gained significant traction in 2024:

Perpetual Liquidity Pools (PLPs): These emerged as a major innovation, offering novel mechanisms for liquidity providers to manage risk and generate returns. These pools enable users to provide liquidity to perpetual futures markets, creating more efficient capital utilization in derivatives trading.

Intents-Based Architecture: This architectural approach focuses on user intentions rather than specific execution paths, allowing users to specify what they want to achieve rather than how to achieve it. This innovation has made DeFi more user-friendly and efficient, addressing a key barrier to mainstream adoption.

5 Regulatory Developments

5.1 Global Regulatory Landscape

The regulatory environment for DeFi saw significant developments in 2024. Uzougbo & Ikegwu (2024) highlighted that regulators worldwide are navigating challenges related to "DeFi's implications for consumer protection, market integrity, and financial stability."

A landmark development occurred when the burdensome IRS DeFi Crypto Broker Rule, which required self-custodial digital asset wallet providers and other developers of noncustodial software to submit reporting, was eliminated. According to U.S. House of Representatives documentation (2025), this was viewed as a major victory for the industry and a step toward more balanced regulation.

The regulatory approach is becoming more nuanced, as noted by Elliptic (2024): "These unfolding trends will make 2024 a pivotal year for the DeFi space - and one that could have a defining impact on the evolution of DeFi going forward."

5.2 Jurisdictional Approaches

Different jurisdictions demonstrated varying approaches to DeFi regulation:

United States: The regulatory landscape evolved with:

- The Treasury and IRS release of final regulations on DeFi reporting on December 27, 2024
- Congressional action in March 2025 to disallow these regulations, providing relief to DeFi platforms
- Continued SEC scrutiny of DeFi platforms, particularly those potentially offering securities

Hong Kong: According to the World Economic Forum (2024), "In 2024, the Hong Kong Monetary Authority launched a sandbox for stablecoin issuers, while the Securities and Futures Commission launched a similar initiative for licensed crypto exchanges."

European Union: Continued implementation of the Markets in Crypto-Assets (MiCA) regulation, which began to impact DeFi operations throughout 2024.

5.3 Compliance Challenges

DeFi platforms faced significant compliance challenges throughout 2024. As noted by Hackernoon (2024), "Major areas of concern include anti-money laundering (AML) compliance, securities laws, and the decentralized nature of these platforms."

These challenges align with academic perspectives, with Adisa et al. (2024) observing the tension between traditional regulatory frameworks and blockchain-based financial systems. The implementation of KYC (Know Your Customer) requirements and AML measures remains a primary concern for regulators worldwide, creating compliance challenges for truly decentralized platforms.

6 Security Considerations and Risk Management

Security remained a critical concern in the DeFi ecosystem throughout 2024. Durachman & Rahman (2024) noted that "DeFi has experienced significant growth in recent years,

both in terms of user adoption and Total Value Locked (TVL) in DeFi protocols, but this growth has been accompanied by an increase in security vulnerabilities."

The industry responded with:

- Increased focus on security audits and the growth of DeFi insurance protocols
- Implementation of multi-signature requirements, timelock mechanisms, and circuit breakers
- Industry-wide collaboration through events such as the De.Fi Security Conference

These developments reflect an increasing maturity in the DeFi ecosystem's approach to security and risk management, though challenges remain, particularly for newer or less established protocols.

7 Future Outlook and Research Directions

7.1 Projected Developments

Based on current trajectories, several developments are projected for the DeFi ecosystem:

1. **Institutional Adoption Acceleration**: Liebau (2024) surveyed 109 experts from industry, academia, and regulatory bodies, finding consensus that institutional participation in DeFi is expected to increase significantly as regulatory clarity improves and infrastructure matures.
2. **Further RWA Integration**: Riabokin & Kotukh (2024) predict that "Tokenization is gradually becoming a tool capable of transforming the financial sector," with expansion expected to include more complex asset classes and larger-scale projects.
3. **Layer 2 Ecosystem Maturity**: As Layer 2 solutions continue to evolve, greater interoperability and specialized applications built specifically for these scaling solutions are anticipated (Coinmetro, 2024).

4. **Cross-Chain DeFi**: Alt et al. (2024) observe that the future of fintech is moving toward a blend of centralized and decentralized solutions, suggesting that protocols capable of operating seamlessly across multiple blockchains will gain prominence.

7.2 Research Gaps and Opportunities

This analysis identifies several areas warranting further academic investigation:

1. **Empirical Studies on DeFi Adoption**: More granular research on adoption patterns across different user segments, including institutional versus retail participation.

2. **Economic Impact Assessment**: Comprehensive studies on the economic implications of DeFi integration with traditional finance systems.

3. **Regulatory Framework Development**: Research on balanced regulatory approaches that protect consumers while fostering innovation.

4. **Security Optimization**: Further examination of optimal security practices for DeFi protocols across different blockchain environments.

8 Conclusion

The year 2024 has been transformative for DeFi, characterized by substantial growth, technological innovations, and increasing mainstream recognition. With a market projected to reach hundreds of billions of dollars in the coming years, DeFi is positioned to continue its trajectory as a disruptive force in the financial world.

While challenges remain, particularly in the areas of regulation and security, the resilience and adaptability demonstrated by the DeFi ecosystem throughout 2024 suggest a promising future. As observed by Sharma & Agarwal (2024), the influence of DeFi on conventional financial systems continues to evolve, presenting both opportunities and challenges that warrant ongoing academic attention.

The convergence of traditional and decentralized finance appears increasingly inevitable, creating new opportunities for innovation and financial inclusion on a global scale. This transformation represents not merely a technological shift but a fundamental reimagining of financial services architecture with far-reaching implications for global economic systems.

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