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The Role of Decentralized Finance (DeFi) in Reshaping Global Financial Inclusion: Opportunities and Risks

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Abstract
This research aims to investigate the potential of Decentralized Finance (DeFi) and its impact on the world's financial systems with emphasis on its strengths and challenges. The conventional formal finance apparatuses do not reach millions of mobile money users owing to geographical, cost and organizational impediments that limit access to formal deposit accounts. DeFi has made the decentralized exchange, lending protocol, stablecoin, and decentralized insurance model possible through the open finance solution provided by blockchain and smart contracts. Celo and Compound exemplify that DeFi fosters financial expansion since it minimizes costs, funding challenges, and unfavorable reliance on intermediaries. However, this paper also considers significant concerns that affect prediction, such as regulatory concerns, uncertainty, security, and low financial literacy. With the advances in DeFi, opportunities for everyone, innovations, and more financial independence are becoming evident with time. Lastly, it is important to note that for DeFi to serve inclusive growth, it is critical to coordinate and systematically develop policy solutions to contain risks, enhance consumer awareness, and support the responsible adoption of DeFi.

Keywords: Decentralized Finance (DeFi), Blockchain, Financial inclusion, Smart contracts, Decentralized exchanges (DEXs), Stablecoins,

Introduction
Financial inclusion has become an important global development goal, and conventional financial inclusion has been seen as a foundation for poverty reduction and development. However, with the uptake of innovations in financial technology, millions still need to be locked out of the conventional financial world, especially in the developing world. This exclusion is due to various factors, including geographical area, high transaction cost, and stringent documentation, which point to basic product needs, including savings, credit, and remittances (World Bank, 2023). These methods use expensive structures with fixed transactions and channels, increasing the exclusion of the unbanked and underbanked. For example, cross-border remittance services can have charges of up to 10% of the total transaction amount, which takes a toll on people with low-income streams and migrant workers (Li and Liu, 2023). In addition, there are many cheerful needs for formal identification and credit histories that eliminate all the rural people who need help receiving necessary documents (Prabhu and Basu, 2024). This has stimulated the need for other financial models to address these issues of social injustice.
The approach of Decentralized Finance (DeFi) provides an excellent opportunity to eliminate these problems. DeFi exists on blockchains and employs smart contracts to allow decentralized finance with no need for central authorities such as banks. It shines through platforms such as

Celo and Compound, signifying how Decentralized Finance can bring about equal opportunities in the financial system. Celo's primary goal is to drive affordable cross-border transactions through mobile-anchored stablecoins, especially in the nascent markets of West Africa and Southeast Asia. Compound, in turn, allows people to lend and borrow cryptocurrencies worldwide, creating new sources of financing without credit histories (Abdulhakeem and Hu, 2021). Due to the complete decentralization of DeFi, users are not compelled to rely on specific centralized institutions but rather have an opportunity to perform various financial operations, including saving, lending and investing through an internet connection. For the unbanked populations, this implies that financial services are no longer a function of the nearest banks or a need to put up with financial structures or meet stringent documentation (Weingärtner *et al.*, 2023). It provides financing services to borrowers based on the collateral they offer from decentralized financial lending platforms and only empowers marginalized individuals. Likewise, decentralized peer-to-peer remittances done through the DeFi platform eliminate intermediaries, leading to an overall reduced cost of transactions(Uzougbo, Ikegwu and Adewusi, 2024).

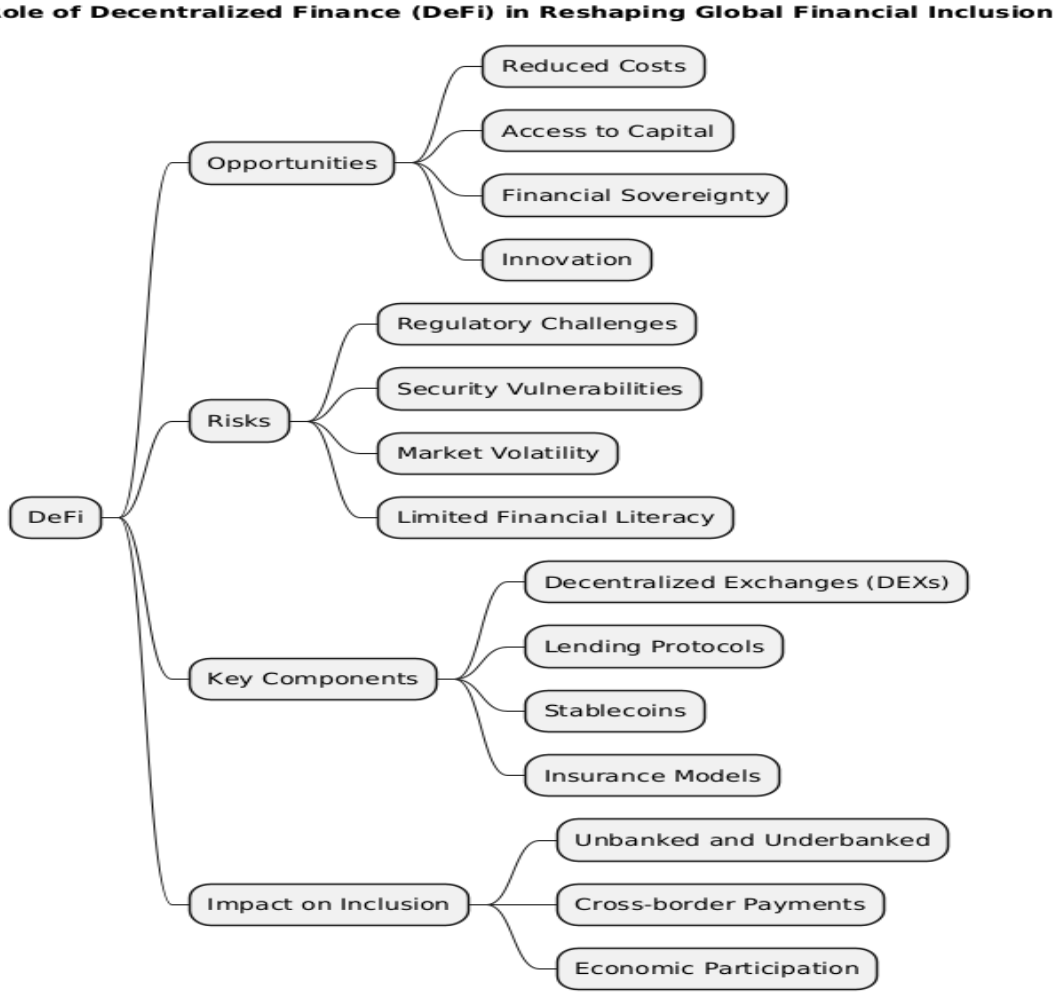

Figure 1: Role of decentralized finance in reshaping global financial inclusion

However, as it will be illustrated, DeFi brings enormous opportunities alongside specific threats and obstacles. Cryptocurrency market fluctuations influence its participants when using DeFi lending services, while security breaches in smart contacts result in money losses. Moreover, the lingering regulatory risk remains a crucial barrier to decentralized finance as governments and financial authorities try to find ways to regulate the booming sector while protecting consumers (Ali and Dembo, 2024). Mitigating these risks is essential for bringing out the best in DeFi while avoiding creating new risks (layers) of economic detriment to users.

This paper aims to understand how DeFi has shifted from its initial implementation and the future in providing more excellent capabilities for financial inclusion worldwide. This also gives a better understanding of the benefits that the unserved and the under-banked stand to gain from DeFi, such as better capital access and cheaper remittances. It also reviews the threats arising from using DeFi, such as Regulatory, security, and market fluctuation. The paper ends with regulations regarding promoting the profitable and judicious utilization of DeFi and suggestions for policy structures and consumer awareness.

Overview of decentralized Finance

DeFi can be explained as an innovative financial environment that comprises services and assets executed on decentralized platforms like Ethereum and Binance Smart Chain. Compared to centralized apps like banks, payment providers or government-implemented financial structures, DeFi applications work without relying on authorities or intermediaries. Instead, they use smart contracts – self-executing code as a basis for turning operations (Teng *et al.*, 2022). These innovative P2P financial systems allow multiple parties to engage in different financial transactions with open access and less reliance on traditional financial service providers, including but not limited to credit, debt, trading, and saving. The architecture of DeFi is unstructured to allow anybody with an internet connection to engage with these systems without prior permission from central authorities or intermediaries. Since most DeFi platforms operate in a decentralized manner without intermediaries, all trades happen according to agreed rules set out in computer code in smart contracts to minimize fraud and mistakes (Singh, 2024). In this case, the P2P financial platform is an innovative approach to the current financial systems while providing a funding structure that has reduced entry barriers, provides the borrower with more financial freedom, and increases the availability of capital and financial instruments.

Key Components of DeFi

DExs refer to Decentralized Exchanges

DEXs, for example, uni swap and sushi swap, can be used to directly transact with other users in the transactions without involving stock or any broker. These exchanges operate on automated market makers known as AMMs that transact via liquidity pools rather than a book. This decentralized model enables users to hold complete control over their assets, increasing security as compared to exchange hacks that are quite common (Harvey and Rabetti, 2024). In addition, there is no barrier, whether in terms of geographical location, as DEXs are simply decentralized, allowing participation and humanity's financial needs worldwide.

Lending Protocols

Aave and Compound are examples of decentralized lending platforms where people can deposit their crypto assets to lend and borrow from others without passing through banks, credit checks or any other documentation. Lenders earn rebates on the assets they provide to supply liquidity for the particular market, while borrowers can take loans by providing cryptographic tokens as security. Regarding its fee structure, the permission less lending model solves the challenge of financial exclusion, especially where individuals cannot access credit facilities from the regular market (Popescu, 2020). However, in DeFi, for example, loans are typically over-collateralized; thereby, to cover credit risk emanating from borrowers, they use assets valued higher than the loan amount.

Stable coins

Stable coins are cryptocurrencies backed by fiat currency (like USD) to minimize the volatile nature inherent in other crypto. S titles include decentralized autonomous organizations (DAOs), decentralized finance (DeFi), and decentralized stable coins like DAI, USDC, and tether or USDT. These stablecoins are used for remitting and making everyday purchases in volatile markets but are trustworthy markers of value. Stable coins also act as an intermediary

between the traditional financial systems and decentralized financial products since they give users a familiar currency with which to transact (Chen and Bellavitis, 2019).

Yield Farming and Liquidity Mining

Yield farming is the act of generating returns from the purchasing tokens used in liquidity pools or staking. Yield farming is a decentralized finance activity in which liquidity providers earn tokens or other rewards for depositing their funds into specific protocols; liquidity mining is a form of yield farming (Meyer, Welpe and Sandner, 2022). These mechanisms have incentivized significant capital from being directed to DeFi and increased participation based on the yields. However, they also come with certain inherent dangers: Impermanent loss—the difference in the value of a given pooled asset due to volatility.

Adoption and Growth of DeFi

More particularly, the DeFi sector has been exploding from its starting point, with over $50 billion in total value locked in different platforms by early 2023 (Zhou, 2024). This fast growth has resulted from the market, which requires supervisors to find solutions that are not banking, especially in emerging markets with low penetration of banking services. The fact that intermediaries do not influence it represented a significant selling point for DeFi for individuals in developing economies who are underbanked and, in some cases, do not have any current access to formal financial services of any sort to get loans, savings, and investments (Chen and Bellavitis, 2020). Furthermore, they say that institutional investors reached out for higher-yielding investments and new forms of assets such as DeFi.

Challenges and Opportunities

As much as DeFi provides countless opportunities, like low transaction costs and financial inclusion, there are equal issues. Intelligent contract weaknesses led to betrayals of millions of dollars, where hackers found ingenuity in security leaks to siphon liquidity from platforms. The fluctuations in cryptocurrency markets add more risk to the proposition, especially to borrowers, such as lending protocols (Bok, 2024). Furthermore, the legal issues that currently define decentralized finance inhibit its assortment, as authorities are yet to take an appropriate course of action between advancing radical innovation and safeguarding end consumers (Friesendorf and Blütener, 2023).

Nevertheless, DeFi's outstanding progress is still a big concern while developers extend new models like decentralized insurance and tokenized real-world assets to enrich its value and sustainability. The authors argue that as DeFi develops, it has the potential to redefine global financial systems by relaxing exclusionary barriers to capital on a scale hitherto unseen.

The Role of DeFi in Global Financial Inclusion

The drawbacks of financial exclusion are overcome through Decentralized Finance (DeFi) since it is based on blockchain networks that deliver various financial services. As of today, worldwide 1, 393 million of the population is unbanked because the majority cannot access banking facilities, and identity checks and high fees are too rigorous (Alamsyah and Salsabila, 2024). Unlike with intermediaries like banks, DeFi decentralizes and therefore gives everyone with internet connection permission less access to financial markets, offering a sense of financial liberation. In this section, the freedom DeFi provides will be discussed, including the improvement of banking services, reduced costs of transactions, better credit services, and financial freedom.

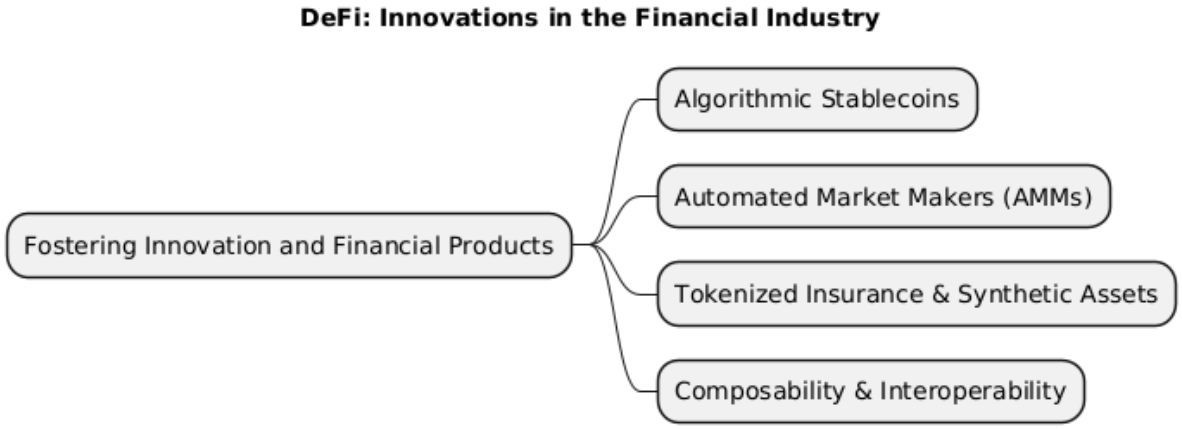

Figure 2: The Role of DeFi in Global Financial Inclusion

Access to Banking Services

Approximately half of the world's adult population, and even higher percentages in sub-Saharan Africa and Southeast Asia, are still unbanked. Some established institutions may, in the course, conduct a KYC process which, in effect, may involve asking customers to provide identification and other relevant documents, including identification cards, proof of income or proof of residence, among others. Such requirements can disadvantage people within rural or other poor areas who have limited or no resources to produce such records (Khera, Ogawa and Sahay, 2021). Additionally, since conventional banks remain unprofitable most of the time due to high operational costs, they cannot easily penetrate rural areas as they cannot afford to open branches. DeFi solves these problems through decentralized platforms that provide financial services to every individual with access to the internet. DeFi protocols are essentially accessible to users without them being required to provide identification or meet proper credit scores. This makes it possible for people with no credit status to participate in lending, borrowing and investing (Mota Makore, Osode and Lubisi, 2023). For instance, utilizing Celo, one can store and transfer stablecoins without a bank account and phone merely using their smartphone.

In contrast to the centralized financial system, where DeFi reduces the dependency on various banking structures, DeFi helps include a relatively large percentage of the population that does not have access to banking services. The population residing in rural regions can engage in financial markets without physically visiting a bank and going through rigorous identification procedures. Therefore, DeFi provides a solution for scaling banking services to as many people as possible, especially the unconceded ones, creating a base for economic sustainable development.

Lowering Transaction Costs

Conventional financial systems take a relatively long time to process transactions and, more so, the transaction costs, especially in international transfers. Cross-border payment remittance costs average 6.3 percent, describing corridors as having a higher cost of at percent (World Bank, 2023). These fees pinch the entrepreneurial spirit of migrant workers remitting money to families, especially if it's a small amount. In addition, the engagement of many players, including correspondent banks and payment processors, elevated the time and cost of transactions.

DeFi.org reduces transaction costs because it disintermediates everyone through intelligent contracts. Real-time cross-border border payments involve one party paying another directly on the blockchain for a transaction that would typically take a few minutes to complete without involving banking systems or payment processors. Stablecoins are used by other platforms, such as Stellar and Celo, to provide cheap cross-border transactions, making them vital in replacing conventional money transfer companies. Furthermore, DeFi platforms could also

facilitate micropayments that involve near-zero costs, which is helpful for small companies and people with thin profit margins (Nejad, 2022).

Reduced cost of transactions in DeFi also increases the feasibility of microfinance operations. Usually, the costs of serving micro borrowers remain high, practically offsetting the financial benefits to which microfinance serving institutions co, mostly known as micro-financial institutions (MFIs), charge their borrowers. Microfinance is thus made easier through DeFi protocols by employing automated smart contracts for loan origination and repayments. This efficiency allows fundamental Decentralized Finance to accommodate peer-to-peer lending models that will allow that individual to lend out small amounts to borrowers without the hurdle of overhead costs of typical MFIs. Thus, small businesses and entrepreneurs in developing nations have cheap access to capital to promote indigenous economic development(Sharma *et al.*, 2024).

Credit and Capital Acquisition

Credit as a financial means is one of the crucial factors in an enterprise's functioning and an economy's development. Nevertheless, the share of individuals and small businesses served by legacy credit intermediaries could be higher, especially in developing economies, due to problems with collateral and short credit histories (Ahamed and Mallick, 2019). Currently, banks are likely to require much security to lend money – a factor that negates borrowers who cannot provide securities. Additionally, established credit scoring techniques centralize credit risk assessment, leaving out the informal workers and business people by either not providing credit scores for these people or by providing them 'poor' scores when they have no established source of income or borrowing history(Sanyaolu *et al.*, 2024).

DeFi protocols, like Aave and Compound, meet and solve these issues, facilitating decentralized lending and borrowing. Through depositing cryptocurrencies as security, users can borrow financial credit without the rigidity of credit ratings and subsequent commercial paperwork. For example, a small business person in Kenya can borrow money by offering Ethereum (ETH) or stablecoins on a DeFi platform instead of getting a bank loan(Headinger, Cohen and Gong, 2024). Furthermore, DeFi establishes flash loans or no-asset-loan transactions that must be resolved in a single block of transactions. These lending models show how DeFi can increase the range of people accessing credit.

However, the need to overcollateralize continues to be a constraint, particularly for some users. This means that borrowers promise assets worth more than the loan amount, and given that not everybody has a lot of crypto to start with, it is quite a challenge. Nevertheless, the openness and decentralization of lending protocols in DeFi make it possible for citizens to use the value they hold in digital tokens to obtain credit and investment instruments.

Financial Sovereignty and Empowerment

DeFi is a system that promotes financial independence, defined as a degree of people's self-protection and self-management in their financial affairs without the intervention of manufacturers and financial intermediaries. In most conventional financial systems, the restriction of access to funds is controlled with the assistance of banks and governments. For instance, one can have one's bank account, withdrawal limits or capital and access it only during a crisis. However, DeFi changes this by providing people with self-custody wallets like MetaMask, Trust Wallet and others, giving them more control over their financial affairs (Chohan and Kerckhoven, 2023).

In DeFi, users always own their tokens because the processes involved involve settlement on blockchain networks without involving third-party service providers. This autonomy promotes financial stability, especially during political instability or high inflation. For instance, countries with dollars devalued, like Argentina or Zimbabwe, can maintain their funds in more secure USDC to prevent inflation (Chen and Bellavitis, 2020). In addition, DeFi platforms create opportunities for investors to diversify their investment portfolios and perform

investment activities using tokens concerning the global financial market and investment objects such as tokenized real property and decentralized insurance.
The focus on financial sovereignty also promotes the peer to peer relations in the economic system. They introduced integrated decentralized lending, trading and governance, where users can perform these actions without dependency on central authorities. Furthermore, DeFi is even more informative and conscious than traditional centralized finance, as the customer is actively involved in monetary activities. This empowers them to make their own decisions financially, thus leading to better financial lives, especially for the minority who have never been exposed to more enhanced financial services.

Opportunities Presented by DeFi
DeFi has enormous potential to shift international financial structures by enabling more excellent investment provision, increasing the availability and reliability of data, and increasing the pace of innovations in investing. Notably, DeFi breaks boundaries of exclusion by decentralizing the financial service provision to make it more accessible for everyone, promoting trust in the decentralized network and creating new products in the financial markets. This section explores the three primary opportunities enabled by DeFi, which include the democratization of investment instruments, improving the level of transparency and, consequently, the level of trust in the financial market, and the development of financial innovation and products.

Democratization of Access to Investment
Conventional capital markets confine access to high-value returns investments like private equity funds, hedge funds and real estate investments to retail investors or HNWIs (high-net-worth Investors) (Pantin, 2023). Other constructs, such as minimum capital requirements and regulatory barriers, further deny retail investors the ability to participate in wealth creation. However, the existing platforms and products eliminate these barriers by allowing users with small amounts of capital to participate in various operations.

- **Tokenization of Real-World Assets (RWAs):** By tokenization, DeFi platforms transform tangible property, including real estate, artwork, and commodities, into assets that can be traded on the blockchain. Real Estate investing has online platforms such as RealT, where investors can purchase as little part of the property as they desire to receive rental revenue. This makes it possible for people to invest with a small amount of capital, making investing possible for those in the lower income bracket (Allen, 2024).
- **Staking and Yield Farming**: Using staking and yield farming, DeFi is an opportunity to receive passive income in the modern world. Staking requires locking coins into secure networks or serving decentralized protocols in exchange for rewards. Yield farming helps users provide their tokens to liquidity pools and earn fees comparable to standardized financial assets (Shah *et al.*, 2023). These mechanisms ease the processes of integrating into the financial participation of crowd funding without the intervention of an institution.
- **Decentralized Autonomous Organizations (DAOs):** DAOs are a new form of organizing the work of a community to collect and invest funds in an initiative or manage an investment portfolio in a decentralized manner. , members of a DAO can make small deposits that allow them to make collective choices on where resources should be channeled, how sector and organizational controls should be managed, and where capital should be invested (Boakye, Zhao and Ahia, 2022). This model involves persons who would not have a chance to assume decision-making positions in securities markets in conventional economic systems.

DeFi is institutionalizing the future of finance through asset tokenization, staking, and DAOs. People from different walks of life can now participate in markets that were never possible

before, thus participating in financial activities for wealth creation at the grassroots level.

Improving credibility through the promotion of greater transparency

That is why transparency and trust are so important for the stability of monetary and credit relations. Nevertheless, traditional financial institutions are framed in closed environments, restricting public information disclosure on transactions and decisions made. This has led to fraud, corruption, and failure in organizations, especially in regions with poor governance systems (Turi, 2023). DeFi overcomes these hurdles by working on public ledgers that provide comprehensive data on finances and concurrently guarantee unalterable transactions.

- **Smart Contracts and Auditability:** Financial processes are also highly automated with the help of smart contracts – contracts embedded in computer code that automatically execute specific actions on a blockchain platform. These contracts conduct such transactions with the aid of the agreed conditions, thus minimizing interference and fraud. Since all transactions are made on distributed ledgers, these activities can be audited in real time, making financial activity transparent (Muralidhar and Lakkanna, 2024).
- **Decentralized Nature and Reduced Corruption**: The core concept of DeFi protocols is based on decentralization, which means that as many decisions as possible are made without the participation of centralized governors who can be corrupt. DeFi is a favorable solution in countries where legal regulation is not sufficiently developed or where government corruption is high since, in this case, people can perform transactions directly (Bhushan and Tiwari, 2024). Such a structure promotes trust because all the actors providing financial services are not associated with compromised entities.
- **Trustless Systems and User Confidence**: Based on decentralized control, DeFi does not require users to believe in a particular company, like a bank or payment service provider, since all transactions are standardized and performed programmatically. This trustless structure is highly desirable where financial institutions have led to the loss of public trust through unsavory activities. The decentralization that DeFi affords means that people can keep track of the money they hold and their transactions at any one time, thus increasing confidence in financial services (Musungwini and Furusa, 2024).

Greater transparency is a characteristic of DeFi that helps create an environment of accountability and non-scamming. Based on transparent transaction data and operating on shared ledgers, DeFi can serve as an effective means for restoring confidence in financial systems in countries that previously suffered from the consequences of corruption and unstable financial systems.

Fostering Innovation and Financial Products

DeFi is undisputedly one of the most popular areas within the financial industry as it constantly evolves due to developers trying out new products and services. DeFi implies that anyone can develop on top of existing applications, thus considerably increasing the pace of creating new financial tools to correct existing market deficiencies. All these innovations led to the added value and diversification of the means offered to the users, which were either unthinkable or unworkable in conventional banking.

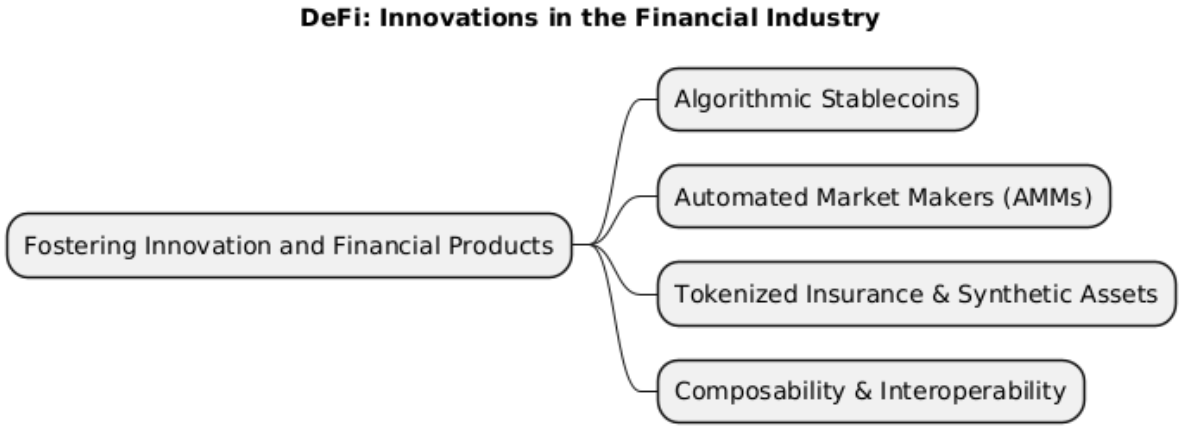

Figure 3: Innovations in the financial industry

- **Algorithmic Stablecoins**: Stable algorithmic coins are the new generation of cryptocurrencies that have a stable value and depend on changes in supply. While using real money fiat backing as their counterparts, stablecoins such as DAI operate using algorithms in the supply-demand mechanism within smart contracts. This innovation offers an opportunity to manage storage and exchange of value without involving changes offered by central and commercial banking systems (Liebau, 2024).
- **Automated Market Makers (AMMs)**: It is essential to highlight that the AMMs have drastically changed the possibilities of trading by offering the formation of liquidity pools that provide the assets exchange without using the order books. Uniswap and Balancer offer users an advanced system where token exchanges occur from pools, making liquidity constant. It has been observed that this kind of trading model does not require brokers or market makers and, therefore, improves trade conditions and the market's overall efficiency (Mohan, 2022).
- **Tokenized Insurance and Synthetic Assets**: DeFi platforms are also flexible and complex, with products including tokenized insurance and synthetic assets. Peer-to-peer insurance embodies the participation of the users in the sharing of risk and issuance of policy, making it easier to offer insurance services. However, synthetic assets are digital contrapositives of real-world assets, such as stocks or commodities, which are traded on decentralized platforms. They allow financial consumers to 'invest' in several forms of assets without having to physically own the said assets (Feng, Kim and Painsky, 2024).
- **Composability and Interoperability**: The most characteristic feature of DeFi is that it defines the usual interaction of different protocols. With different protocols, developers can develop new financial products, in turn, with highly sophisticated financial offerings such as flash loans and yield aggregation strategies. Again, this flexibility creates endless possibilities for creation as developers try out new concepts and enhance current solutions (Belchior *et al.*, 2022).

The rapid development of DeFi means the expansion of the range of offered financial services. We have easy-to-access tools that enable people to complete risk-return optimization exercises and participate in global markets. As seen with the recently developed DeFi platforms, these are bound to bring more complex products to financial innovation.

5. Risks and Challenges of DeFi

DeFi, while offering numerous opportunities for financial inclusion, is not without its risks and challenges. This section delves into the primary risks associated with DeFi, including legal issues and policy risks, information technology breaches and cyber threats, stock price

fluctuations and liquidity, and the lower level of financial and investment knowledge among average consumers.

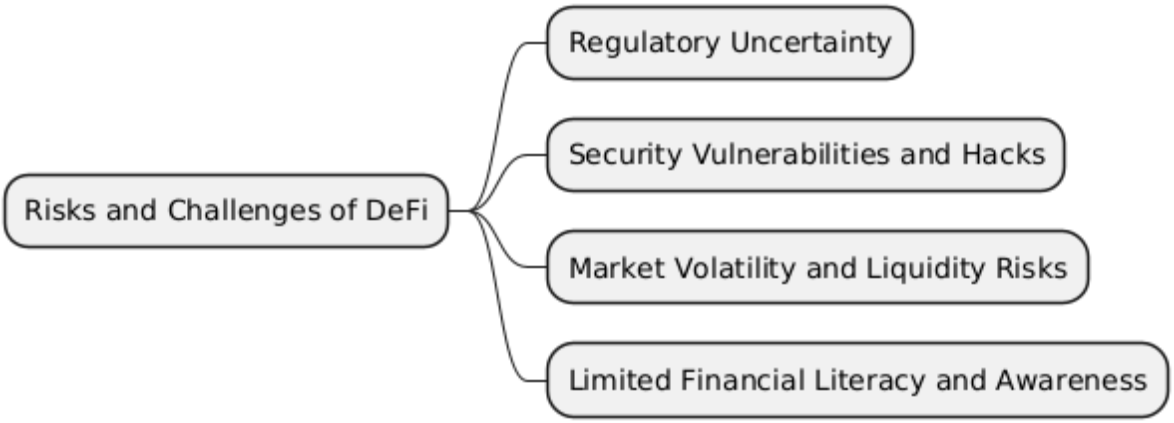

Figure 4: Risks and challenges of DeFi

Regulatory Uncertainty

Again, being decentralized and operating across borders, regulating DeFi has many limitations compared to conventional financial regulatory means. Legal regulation of decentralized finance is incomplete today; governments and financial authorities cannot decide on the legal treatment of DeFi platforms and their corresponding accountability requirements regarding consumer protection, tax, anti-money laundering and know-your-customer (KYC) policies (Zetzsche, Arner and Buckley, 2020). DeFi has eradicated control through decentralized financial control, meaning that regulators cannot enforce existing laws fully, leading to a grey area.

KYC/AML is one of the significant regulatory obstacles for business development. A significant downside of modern centralized financial institutions is that they need to identify customers; however, many DeFi platforms lack this security and are vulnerable to money mule schemes and investment in terrorism (Alamsyah and Salsabila, 2024). Since governments are raising concerns about these digital assets, DeFi platforms will likely experience enhanced regulatory barriers that may slow growth or result in uncoordinated regulations.

Furthermore, regulatory risks prevent institutional investors from fully engaging in DeFi markets as their current crores of activities expose them to several regulatory risks. This means that, with concise frameworks, the expansion of DeFi at scale can take place. That said, some areas attempt to develop proper legal frameworks for DeFi. For example, Markets in Crypto-assets (MiCA) presented by the European Union envision establishing rules of digital finance, such as DeFi services (Ahern, 2021). Unfortunately, DeFi's opportunity will remain bound by regulatory hurdles once similar frameworks are implemented.

Security Vulnerabilities and Hacks

Security constitutes one of the most cumbersome hurdles to innovation in decentralized finance. DeFi applications are utilized to manage financial apertures through intelligent contracts. All in all, smart contracts hold the benefits of optimality and fade of opalescence, but none can free smart contracts from programming errors or imperfections in design. Hackers have exploited such loopholes to perpetuate the fraud that has led to huge losses. One of the most significant DeFi breaches recorded in 2021 was a $600 million hack of the Poly Network DeFi platform (Gelsi, 2021).

The following risks are also inherent to DeFi users: phishing, rug pulls, and intelligent contract exploits. *Phishing* is a trick that makes users disclose their private keys or go to the wrong link, which results in the loss of their assets. Another threat is rug pulls, where developers pull out a project and take investors' money. Thus, according to the data provided by Akins and other authors, in 2022, investors incurred losses of about $2.8 billion because of rug pulls in DeFi.

The absence of control and supervision ultimately magnifies dangers related to security since

users do not have many legal rights when dealing with fraudsters or hackers. Most DeFi platforms still need to be equipped with insurance or any means of reimbursement for the loss and are, therefore, very risky. In response to these problems, developers turn to formal verification to verify intelligent contracts and use decentralized insurance to manage risk. Still, the security of these DeFi platforms is always an endless concern as hackers keep finding more ways to penetrate them.

Market Volatility and Liquidity Risks

Previous studies have shown that DeFi markets are usually related to cryptocurrency markets, and these are highly volatile. Liquidity price changes can have profound implications for individuals participating in lending, borrowing or yield farming processes. For example, most DeFi loans are atomic to minimize lending riskiness. However, this becomes a problem when the value of the provided collateral declines significantly, exposing borrowers to liquidation risks to clear their loans (Saengchote, 2023). This instability of prices puts off value-conscious users and causes skepticism when lending coins in DeFi. Another example of a threat is liquidity risks. Liquidity pools are DeFi's primary utility. Their low liquidity can result in slippage, which is the difference between the expected and actual rates of a particular asset. It is revealed that sometimes slippage may lead to additional costs for a trader, which would be detrimental during volatile market moments (Jiang and Li, 2024). In addition, incentives for liquidity mining that support users in adding funds to the liquidity pools are also distortions since users turn to withdraw money within a short time after the change of incentives.

It also creates system risk for individual DeFi protocols since they are all connected. This interconnectedness is a double-edged sword; while it allows for seamless transactions, it also means that a failing protocol can put the service out of order across a range of platforms. For instance, we saw the liquidation of Terra's affiliate algorithmic stablecoin UST in 2022 resulted in massive damages in several DeFi projects that invested in UST, demonstrating how some DeFi structures were unsustainable (Nejadmalayeri *et al.*, 2024). This underscores the urgency of addressing systemic risks in the DeFi market.

Limited Financial Literacy and Awareness

However, the growth of the DeFi user base continues to be a challenge, largely due to the complex nature of DeFi platforms and the low financial literacy of many potential users. Terms such as smart contracts, yield farming, and decentralized exchanges (DEXs) can be daunting for those unfamiliar with blockchain interfaces. The lack of understanding of these concepts and the associated risks often leads to poor decision-making and financial losses among DeFi users (Vilímek, 2022). Lack of knowledge about DeFi also becomes a hindrance to ubiquity. In DeFi, several developing nations could be beneficial; such citizens need to be made aware of digital platforms to engage with decentralized systems (Arslanian, 2022). Also, lack of proper information and doubts regarding concerns of cryptocurrencies make restricting them may discourage the user from checking on DeFi opportunities, resulting in its poor advancement towards the modern approach to solving the problem of financial exclusion.

These are areas that require efforts in educational interventions to be accomplished. Susceptible decentralized finance projects are developing user-friendly platforms and initiating informative campaigns. For example, Aave Uni, swap, and similar platforms have guidelines and instructions to teach people how to use decentralized finance applications and protocols without falling victim to various scams. Nonetheless, more work remains to be done on improving the levels of financial literacy or raising the signals for accessing DeFi potential and threats.

Case Studies: DeFi in Action

Decentralized finance (DeFi) has rapidly disrupted financial systems by offering practical, inexpensive and accessible solutions to global financial systems. Some DeFi projects have gained increased adoption by affecting cross-border remittances, credit, and financial solutions.

This section builds on the previous two by exploring how Celo and Stellar are transforming the cross-border payment agenda and bringing real benefits to migrant workers and communities in developing countries. The stabilization of concerns represents the second condition: Concerns (Scharfman, 2022), are everywhere and among everybody; they do not have actual influence; thus, they are not important.

DeFi for cross-border payments

Cross-border money transfers are crucial for millions of families in developing countries; however, the international money transfer operators' high fees and long transaction times still limit the overall development of financial support for these households. To this end, the average global actual cost of cross-border sending remittances is 6.3 percent of the transfer amount (World Bank, 2023). This is primarily a challenge for the poor migrant workers who use the money remitted by them to support their families. Celo and Stellar, as examples of DeFi platforms, solve these problems through the use of the blockchain system to create effective means of making fast, cheap and secure international money transfers.

Celo: Empowering Remittances through Mobile Access

Celo is a decentralized application network that aims to expand access to payment systems through mobile phones. It has an integrated stablecoin, cUSD – Celo Dollar, anchored to the U.S. dollar and facilitates cross-border payments. The mobile-first application of Celo means that recipients of the remittances do not require a bank account to receive the funds (Singhal *et al.*, 2024). This feature is important because it is prevalent where the banking index is low, like in West Africa and Latin America, where many people cannot afford to access the banking systems.

- Cost-Effective Transactions: Celo makes it easier for people to transact cross-border, something that other players in the market charge much commission for. Through decentralization, Celo guarantees that clients are offered more worth for their transactions, with charges starting from 0.01% (Foster *et al.*, 2021).
- Fast Settlement Times: Old-school methods of remittance can take several days to complete, and the situation gets worse during the weekend or any public holidays. On the other hand, Celo transactions take a few minutes to authorize, and users can perform instant transactions. The recipients also get access to the transferred amount immediately.
- Impact in Developing Regions: Celo's presence in Ghana and Kenya can help make blockchain payment systems viable for residents. For instance, migrant workers in Ghana revealed that they save more money because the digital transaction fee is cheaper, and several domestic merchants are now accepting payments in cUSD, among other formations of digital currency (Kshetri, 2023).

Stellar: A Global Network for Borderless Money Transfers

Stellar is yet another payment network on the blockchain whose principle of operation is the quick and efficient execution of cash transfers across borders. The platform can be used for exchanging and transferring both digital and traditional money around the globe, which is why it is being used for cross-border payments. Stellar provides stablecoins and other cryptocurrencies, enabling its users to trade using multiple currencies, such as USDC or XLM, which are native to the chain.

- **Lower Fees and Greater Accessibility:** Stellar's network attracts low-cost transactions, with fees beginning at 0.00001 XLM for each transaction, well below those of most remittance services. That makes Stellar more suitable for use by migrant workers who send money back home, especially those who transfer relatively small amounts of money.
- **Partnerships with Financial Institutions:** Stellar currently pairs with several banks and other financial companies to provide fiat currency for crypto conversion. Thus, a

combined strategy is established to provide users with easy and swift conversion of their purses for local and cryptocurrencies to facilitate cross-border payments.

- **Use Case in the Philippines**: In the Philippines, Stellar works with Coins, an Indigenous fiscal application. Stellar has stated success in the Philippines, wherein it has worked with Coins. Filipino workers involved in other countries, like Saudi Arabia, Hong Kong, etc., use the currency of their native country to send remittances back home quickly and cheaply (Soufaih, 2020). This has ensured that families in rural areas can access financial services and, at the same, are able to reduce expensive remitting corridors.

Necessity of DeFi in Cross-Border Payments: Major Advantages

- **Financial Inclusion for the Unbanked:** For instance, Celo and Stellar create bankless financial access since one can transact using a mobile rake or digital wallet. This eliminates the need for conventional banks and also assists a vast population with little or no access to financial institutions in getting involved with the digital economy(Li, 2022).
- **Reduced Dependence on Correspondent Banking:** Nowadays, cross-border payments use correspondent banking, which is very time-consuming and expensive. They further stated that existing DeFi platforms remove such actors through cross-chain transfers on blockchain networks(Bindseil and Pantelopoulos, 2022).
- **Stable Value Transfers:** Celo, a decentralized financial system, uses st, blouses to overcome the volatility that comes with Cryptocurrencies like Stellar. This ensures the recipients get constant value for the investment they made in the DeFi, thus serving as a reliable solution for remittance services during unstable market periods(Rabetti, 2023).

Challenges and Risks

Although DeFi has specific benefits, especially for cross-border transactions, some issues still must be addressed. Regulatory ambiguity exists in the utilization of stablecoins and blockchain-based remittances, which limits the adoption of these platforms. Furthermore, emerging issues regarding intelligent contracts and private keys also lead to threats that hurt users who do not know blockchain (Ferreira, 2024). However, as previously seen, an underlying internet network is needed in some countries, especially rural regions, to hamper the expansion of mobile-based decentralized finance platforms such as Celo. To achieve success for these initiatives, DeFi platforms, regulatory bodies, and telecommunication companies will need to work more to improve connectivity and develop literacy.

Microloans through DeFi Lending Platforms

Access to microloans has been critical in enabling **underserved communities** to access Credit, particularly in developing regions where financial institutions that would otherwise offer such credit are either nonexistent or would not extend credit because the costs of doing so are prohibitive or the default risks are too high. Microloans, typically offered by such outlets as Kiva, have enabled small businesses, farmers, and other businessmen by providing them with small credit without much paperwork. However, with the help of decentralized blockchain-based DeFi platforms, the idea of microloan is gradually implementing a scalable solution for which there is no need for intermediaries and which is more effective.

DeFi-Based Microloans:

Aave, Compound, and Goldfinch have started utilizing P2P lending through intelligent contracts for microcredit. These technologies enable the borrowers to get funds from the investors directly without going through the regular procedural formalities of the microfinance institutions (MFIs) (Gogol *et al.,* 2024). Here are some ways in which DeFi microloans improve upon traditional systems:

- **Lower Interest Rates through Reduced Overhead**: Now we know that traditional

microfinance institutions burden high-level costs on loan administration, compliance, and monitoring and pass them on to borrowers through high interest rates. Lending in DeFi removes these go-betweens through self-execute contracts, where loan origination and repayment occur without any third parties to facilitate and charge (Idawati and Syafputri, 2022). Thus, borrowers can obtain loans at a rather low cost, or at least at a low cost in terms of percentage interest rate.

- **Cross-Border Lending Opportunities**: DeFi platforms also help to provide global access to borrowers from developing countries worldwide. Through direct interaction, a farmer in Kenya can borrow stablecoins from an investor in Europe without any interference. This global liquidity increases credit options for societies that otherwise cannot access credit facilities from financial markets (Barrell and Nahhas, 2020).
- **Collateralization Flexibility**: While most DeFi loans rely on cryptocurrency as collateral, some, such as Goldfinch, utilize undercollateralized and no-collateral forms to make credit accessible to low-income borrowers (Tasin *et al.*, 2023). For instance, Goldfinch provides credit facilities to small businesses since it validates worthiness through credit reference rather than security pledges.
- **Transparency and Trust through Blockchain**: In DeFi platforms, transparency is achieved by creating an unaltered ledger of the underlying transactions recorded on the blockchain. Real-time loan tracking gives borrowers and lenders full transparency over the loans, reducing fraud and increasing responsibility among borrowers and lenders (Shaidullin and Komarov, 2022).

However, there are also some challenges to implementing a DeFi microloan. Some borrowers have not interacted with cryptocurrencies; therefore, their digital financial knowledge may be inadequate, and exchange rate fluctuations are possible. First of all, the absence of the government allows the borrower to act without protection and does not provide favorable conditions for resolving disputes with lenders. However, due to a better awareness of users and new governance mechanisms, DeFi microloans also point a way forward for financial inclusio.

Decentralized Insurance

Insurance helps to manage financial risks, while affordable insurance products are rare in developing countries. Captive insurance solutions are expensive and cumbersome since everyday insurance solution givers typically charge steep rates for insurance policies and usually offer insurance policies that demand numerous legal and formal formalities from the client. Furthermore, the procedures of claim settlement are also very tiresome and need to be more transparent, causing the public to develop mistrust in the insurance sector. Traditional insurance companies remain characterized by such barriers on DeFi platforms like Nexus Mutual and Etherisc since they provide decentralized insurance models that eradicate the above barriers through the use of peer-to-peer risk-sharing mechanisms facilitated by blockchain (Singhal *et al.*, 2024).

Decentralized insurance is a way to decentralize the imperative parts of insurance by inductively conveying the work utilizing an agreement.

- **Risk Pooling through Smart Contracts**: The users fund decentralized insurance; smart contracts manage the insurance pool. Based on these contracts, these companies established the parameters for payments and created claim processing systems that no longer rely on traditional insurance companies (Jha *et al.*, 2021). For instance, Nexus Mutual enables customers to buy protection for intelligent contract defects and to be paid out where the agreed terms formulated in the smart contract are met.
- **Governance through Community Voting:** Some insurance platforms are decentralized, operating under systems where policyholders and other interested parties are involved in decision-making. For example, Nexus Mutual's members vote on the approval of claims and risk reports. This governance model reduces conflicts of interest inherent in most insurance firms' operations (Feng, 2023).

- **Parametric Insurance Models**: Some DeFi insurance platforms also engage in parametric insurance; in this case, the insurance is activated when certain factors are achieved, such as climate conditions. For instance, Etherisc offers insurance protection to shippers in developing nations where farmers suffer loss due to climate-related covering; prompt payment can be made to the farmer when unfavorable climactic outcomes are established (Feng, Kim and Painsky, 2024). This model thus helps to do away with claim assessment through the workforce and, at the same time, increases the pace of payments.
- Lower Premiums through Reduced Overhead: Technological disruptions foster decentralization at minimal administrative overhead costs since smart contracts manage policies and claims. This has helped the platforms provide cheaper premiums, especially to low-income earners and business people (Srinivasan and Sriram, 2003).

Nonetheless, even decentralized insurance means organizational disruption. In general, decentralized insurance has drawbacks. This has made contract enforcement and consumer protection within DeFi insurance a grey area. In addition, liquidity risks arise when insurance pools are underfunded, thus constraining the platform's ability to meet the demanded claims. Nonetheless, as the DeFi environment grows, improvements in this sphere, including governance and liquidity, will provide a more stable basis for decentralized insurance models.

Policy Recommendations for Sustainable DeFi Adoption

To harness the potential of DeFi for financial inclusion while mitigating risks, policymakers should consider the following strategies:

- Develop regulatory frameworks that support innovation while ensuring consumer protection.
- Promote financial literacy programs to educate users about DeFi and cryptocurrencies.
- Encourage public-private partnerships to explore DeFi solutions for financial inclusion.
- Implement security standards for DeFi platforms to minimize vulnerabilities and protect users from fraud.

Conclusion

DeFi is important in leveraging financial inclusion for people who are locked out of standardized, permissioned and expensive conventional financial systems worldwide. Thanks to blockchain and smart contracts and the absence of intermediaries, DeFi allows users to save, borrow, lend, invest, etc., wherever they are, irrespective of whether they are financially secure. This makes it possible for users to engage in self-custody wallets and reduce transaction costs, which are very important when undertaking cross-border remittances and micro-finance activities. Moreover, new investment opportunities such as decentralized exchange, lending, staking, and tokenization of assets come with the use of DeFi platforms and thus provide chances to people with little capital to invest in large markets that institutional investors previously controlled.

However, the moving environment based on the DeFi world also has drawbacks. Regulatory concerns are still an open problem and challenging as DeFi is decentralized and without borders within what conventional financial regulations can be applied. The absence of regulatory guidance to harmonize the existing rules may discourage institutions from participating, contribute toward slow technology penetration, and put (tol) users in a vulnerable position through money laundering or fraud. On the other hand, insecurity in contract clever and phishing attacks have been evident as a cause of the significant hack-offs and great losses in DeFi. Another critical issue is the fluctuation of the market price. For example, volatile asset rates negatively affect users of lending and yield farming services, leading to collateral selling

or significant financial losses. Decision makers, creators and financial institutions must come together to work toward the sustainable development of decentralized finance. They must set rules that will allow consumer protection laws to thrive and simultaneously see the growth of new products without compromising the interest of future consumers. Regulators and DeFi stakeholders must consider new structures for regulation that reflect DeFi architecture, such as on-chain governance and self-driven reports. On the other hand, traditional financial institutions can help link centralized and decentralized finance by providing products that strengthen traditional finance while incorporating decentralized services familiar to DeFi users. Nonetheless, awareness creation and education are needed to enhance the financial literacy of users on the DeFi platform's chances and dangers. People need to gain the technical know-how to use such platforms, which is even more common amongst such populations in the developing world. Addressing the issues of how to prevent unlikely users from abusing the system and how those who will be benefiting from DeFi projects will be targeted will be possible through educational programs, friendly interfaces, and community support shields. When it comes to its security and regulation, DeFi can become the breakthrough in the field of finances, inclusion, effectiveness, and self-governance primarily due to trusted systems and materials as well as well-coordinated actions of governments and people throughout the world. It is a substitute for transferring financial decision-making power from the center, allowing for new opportunities to develop the economy and society. However, if handled appropriately, DeFi is poised to be the leading enabler of financial inclusion around the globe in the next few years, where nobody missed the ship of the new revolutionized financial world.

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