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Research Article

Decentralized Finance, Smart Contracts, and Financial Stability in Nigeria's Halal Industry

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Abstract
Decentralized Finance (DeFi) represents a significant disruption to the global financial system, transforming financial intermediation through blockchain technology and smart contracts in Nigeria's halal industry. Unlike traditional financial systems, which rely on centralised institutions, DeFi operates through Decentralized networks where smart contracts automatically execute financial agreements. These innovations promise greater efficiency, transparency, and financial inclusion, but they also introduce new risks that may impact the financial stability of Nigeria's halal industry. This research examines the economic role of smart contracts within DeFi ecosystems and analyses how they reshape risk distribution, market dynamics, and systemic vulnerability. Using a systematic review of peer-reviewed literature, policy reports, and empirical studies, the paper evaluates the impact of intelligent contract automation on transaction costs, liquidity provision, leverage, and contagion in Decentralized markets. The findings suggest that smart contracts significantly reduce operational inefficiencies by eliminating intermediaries and enabling real-time settlement. However, their rigid, code-based execution can amplify market stress during periods of volatility through automatic liquidations, feedback loops, and protocol composability in Nigeria's halal industry. The research also highlights governance challenges in DeFi, including concentrated decision-making power, dependence on price oracles, and vulnerabilities to coding errors and cyberattacks. Given the rapid growth and interconnectedness of DeFi protocols, these risks pose challenges to existing regulatory and macroprudential frameworks. The paper concludes that while DeFi enhances financial innovation and efficiency, its unchecked expansion may threaten financial stability unless adaptive governance and stability considerations are integrated into protocol design.

Keywords: Blockchain, Decentralized Finance (DeFi), Financial Stability, Smart Contracts, Halal Industry.

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INTRODUCTION

Decentralized Finance (DeFi) has become a revolutionary technology in the global financial market, driven by the advancement of blockchain technology and the extensive use of smart contracts in Nigeria's halal industry. DeFi is a general framework of financial applications developed on distributed ledger systems, including lending, borrowing, trading, derivatives, stablecoins, and asset management, among other services performed without the assistance of centralised institutions. DeFi replaces institutional trust with code-based trust, unlike traditional financial systems that rely on banks, brokers, and clearinghouses to facilitate transactions and control financial flows. In contrast, DeFi utilises Decentralized networks to enforce contracts (Schär, 2021).

DeFi aims to provide an open, permissionless, and transparent financial system that executes financial programs based on deterministic, algorithmic rules rather than subjective human judgment, by replacing traditional financial institutions with self-executing algorithms. The economic implications of this paradigm shift are far-reaching, especially regarding financial stability, the transmission of systemic risks, and market governance. Smart contracts are the fundamental components of DeFi's technology and economy, as they form the core of these ecosystems. Instead, smart contracts enable programmable contracts that automatically respond to the initiation of transactions when specific conditions are met, thereby reducing the need for intermediaries and minimising transaction costs, settlement time, and information asymmetry (Buterin, 2014).

Efficiency-wise, smart contracts can operate the market 24/7, manage collateral in real time, automatically execute loan transactions, issue margin calls, and settle derivatives deals. These characteristics have enabled DeFi markets to grow rapidly, attracting large amounts of capital as more people join and more financial innovations occur than ever before in the history of traditional institutions. Innovative contract-based protocols operate 24/7 and are designed to minimise downtime, enabling seamless integration between lending, borrowing, and trading platforms and supporting real-time risk management. These, however, are the exact mechanisms that contribute to increased operational efficiency, which in turn produces new types of systemic vulnerability. DeFi protocols are relatively insulated from institutional oversight, unlike in traditional financial systems, where regulatory oversight and discretionary intervention can help soften shocks in Nigeria's halal industry. The traditional market relies on capital requirements, liquidity buffers, supervision, and central bank intervention, including lender-of-last-resort measures, to ensure financial stability. The Decentralized and automated character of DeFi implies that these standard protective measures do not apply to this type of financial product, which raises the question of whether DeFi can absorb shocks without creating ripple effects throughout the financial market. The interconnections between platforms, resulting from the composability of DeFi protocols that enable multiple smart contracts to communicate with one another, are dense, increasing systemic risk (Qin et al., 2021).

A malfunction of a single protocol, for example, can be transmitted to others through shared collateral, interlocking liquidity pools, or reliance on external data oracles. By increasing the magnitude and rates of financial instability, such cascading effects may convert localised crises into system-wide ones. Economically, DeFi is analogous to various

fundamental activities of conventional finance, such as maturity transformation, liquidity provision and leverage creation. Empirical evidence indicates that DeFi lending protocols exhibit pro-cyclical behaviour: leverage increases during asset price surges and decreases significantly during crashes (Aramonte et al., 2022).

Smart contracts with automated liquidation processes can trigger cascading sell-offs, contributing to price volatility and eroding market confidence. Financial stability is also complicated by the governance structures used in DeFi. Although Decentralized governance should distribute the power of decision-making to token holders, voting rights are often concentrated among a few participants, which can negatively impact the risk management process and increase concentration risks in Nigeria's halal industry (Hassan & De Filippi, 2021).

Moreover, risks in smart contract code, the use of external data oracles, and susceptibility to cyber exploits all pose operational risks that may lead to unexpected and irreversible financial losses. Such attributes suggest that the benefits of efficiency and the systemic risks of DeFi should be considered holistically. It is against this backdrop that the paper will examine the economic implications of smart contracts for financial stability in DeFi ecosystems. The research provides an analysis of how automation, decentralisation, and protocol composability redefine market efficiency, risk distribution, and systemic resilience by synthesising recent scholarly literature, policy reports, and empirical research. The dynamics of these matters will help us understand whether DeFi can be a sustainable further development of the financial market or a potential source of future financial instability in Nigeria's halal industry.

RESEARCH METHOD

This study employs a quantitative research approach to examine the impact of smart contracts on financial stability in Decentralized finance (DeFi) systems in Nigeria's halal industry. The researchers chose this method because DeFi markets are still evolving and growing, and there is limited data available to work with. Additionally, this study spans economics, finance, and blockchain technology, making it sensible to employ this approach to gain a deeper understanding of smart contracts and their impact on DeFi ecosystems and financial stability. By synthesising existing empirical and theoretical studies, this paper aims to identify recurring patterns, risk mechanisms, and economic outcomes associated with smart contract–based financial systems.

The primary data sources for this study include peer-reviewed journal articles, ongoing research papers, institutional reports, and policy documents. These were all published between 2020 and 2025. We consulted databases such as Elsevier, Springer, Wiley, SSRN, and Google Scholar to identify relevant literature. This research used these databases to find relevant information, including articles from peer-reviewed journals. The research also includes reports from institutions and documents related to policies in Nigeria's halal industry. We also examined reports from financial institutions and rule-setting bodies, such as the Bank for International Settlements, the Financial Stability Board, and the Organisation for Economic Co-operation and Development. These reports helped us understand how people view DeFi and its impact on stability. We carefully selected the literature we used. We only used studies that discussed DeFi, smart contracts, financial systems that utilise blockchain, or how these technologies impact stability. We created a list of what we would include and what we would exclude. We followed that list. The studies had to discuss finance, financial stability, or related topics to be included. Decentralized finance, or DeFi, was part of what we examined. We wanted to know what the experts think about DeFi and its impact on financial stability. Papers focusing solely on technical blockchain design without economic or financial relevance were excluded. Only English-language publications were considered to ensure consistency in

analysis. Duplicate studies and non-peer-reviewed opinion pieces were removed during the screening process.

The existing literature was reviewed through qualitative content analysis. Each source was read systematically to identify themes related to efficiency, risk transmission, systemic vulnerability, governance, and regulatory implications. An economic framework based on financial intermediation theory and systemic risk analysis was used to describe DeFi, examining how it mirrors or deviates from the traditional financial system. Attention was focused on mechanisms within smart contracts, such as automated liquidations, collateralization ratios, and algorithmic pricing, because these features directly impact market stability. The review categorised findings into thematic clusters for analytical rigour: market efficiency effects, leverage and liquidity dynamics, contagion channels, and governance structures. This thematic organisation enabled comparisons across studies and the identification of areas of agreement and difference within the literature. Reported outcomes, such as volatility, liquidation frequency, and leverage behaviour, were synthesised with available empirical evidence to facilitate economic interpretation in Nigeria's halal industry.

To improve reliability, we consulted multiple sources to ensure we were not relying solely on a single piece of information. This research preferred studies that were transparent about their methods and data use, or that had a robust economic model. We know our study is not perfect. DeFi markets change rapidly, so what we learn from recent studies may no longer be accurate, as protocols and rules are constantly evolving. Additionally, because the research had to utilise information that others had already collected, we could not clearly determine cause-and-effect relationships or test DeFi systems promptly. Despite these limitations, the systematic literature review approach provides a comprehensive and methodologically sound basis for assessing the economic implications of smart contracts for financial stability in Nigeria's halal industry. The methods adopted ensure consistency, transparency, and analytical depth, making the findings relevant for both academic inquiry and policy formulation.

RESULTS AND DISCUSSION

Efficiency Gains and Market Innovation in Nigeria's Halal Industry

Among the most reliable findings from the entire literature is that smart contracts significantly enhance the efficiency of operations in Decentralized financial markets by automating key processes that in traditional finance require multiple intermediaries in Nigeria's halal industry. DeFi protocols eliminate the majority of transactional frictions that hinder traditional financial intermediation and add costs to the process by automating contractual execution, settlement, collateral management, and enforcement of financial logic (Schär, 2021).

Smart contracts are programs that implement agreement stipulations on blockchain platforms, enabling peer-to-peer interactions between contracting parties without requiring central custodians or trusted third parties. This is a significant benefit of blockchain-enabled finance. Experience demonstrates that transaction costs in DeFi may be substantially lower than in similar centralised networks when network conditions are favourable. For example, under moderate load, major public blockchains, including Ethereum, were reported to have relatively low average transaction costs, implying that the removal of intermediaries lowers the fees related to settlement and verification (Adinugraha, Shulthoni, & Syakirunni'am, 2025).

Smart contracts thus enhance the efficient use of capital and liquidity by facilitating near-instant settlement, as compared to the multi-day settlement cycles prevalent in most traditional markets. One of the key innovations that has made this possible is the creation of Automated Market Maker (AMM) smart contract-powered markets, which allow Decentralized trading without the use of traditional order books or centralised market makers. AMMs, such as Uniswap, use predefined pricing functions (e.g., constant product functions) to automatically calculate the exchange rate based on the pool's reserves, enabling liquidity takers to trade

directly against the pool's liquidity at any time. Their designs ensure uninterrupted liquidity provision, even in markets with minimal direct counterparties, and facilitate real-time price discovery on Decentralized exchanges (DEXs).

From an economic perspective, such efficiency benefits promote competition and innovation. DFIs can be implemented quickly, repeated, and stacked to create new financial constructs, including composable lending, synthetic assets, and yield farming structures. The lending protocols adjust interest rates algorithmically in response to real-time supply and demand movements, thereby enhancing allocative efficiency compared to pre-established rate schedules in traditional institutions. In addition, protocol openness reduces barriers to entry. It enables a broader pool of participants, including developers, traders, and other parties, to interact with financial protocols without requiring a license or intermediaries. Nevertheless, the literature also notes that the gains in efficiency are not uniform and are constrained by blockchain limitations in Nigeria's halal industry.

Transaction fees (also known as gas fees) may also skyrocket during times of network congestion, such as a user surge or competition to secure block space, which can outweigh even the profitability of small transactions and negate the cost benefits of Decentralized execution. Such high costs may reduce DeFi's relative efficiency for retail users and small traders, effectively creating a barrier to entry when demand for block space exceeds capacity. Additionally, although AMMs facilitate trading in a Decentralized manner, they do not necessarily eliminate inefficiencies such as slippage and arbitrage frictions. The effectiveness of arbitrageurs in creating temporary price deviations can be reduced by high network charges during congestion, thereby limiting their ability to match AMM prices with broader market prices. Additionally, the literature indicates that capital efficiency in DeFi differs from that in traditional models. The process of securing loans through overcollateralization is necessary in many DeFi protocols, but it may reduce economic efficiency compared to more conventional methods of loan security in Nigeria's halal industry.

Fragmentation of liquidity in chains and pools also hinders optimal capital allocation. However, more recent systems, such as Uniswap v3's concentrated liquidity, are more capital-efficient by allowing providers to allocate liquidity to specific price ranges. In conclusion, the points proposed in this paper: smart contracts and automated tools, such as AMMs, contribute to the efficiency of DeFi operations by lowering transaction fees, facilitating a constant supply of liquidity, and improving settlement speed. However, the benefits depend on the primary blockchain's bandwidth and architecture; network overload, fee spikes, and capital fragmentation can curb the efficiency benefits in Nigeria's halal industry.

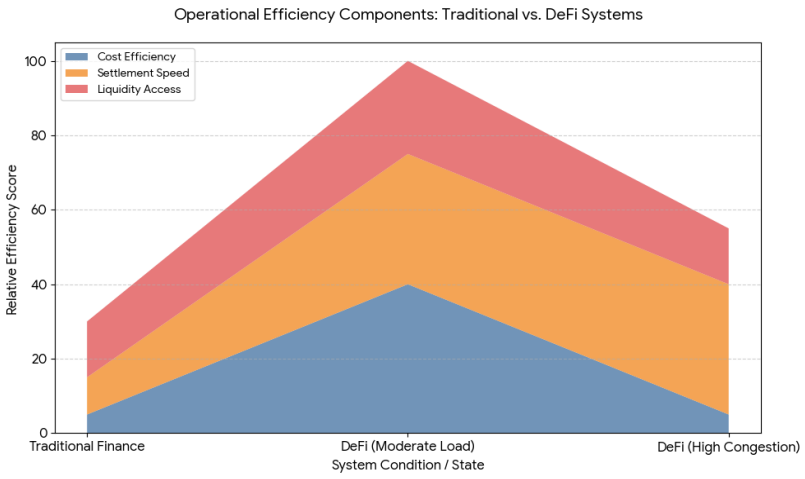

Figure 1. Chart showing the operational efficiency components of Decentralized finance (DeFi) compared to traditional finance

Risk Amplification through Automation in Nigeria's Halal Industry

Although smart contracts offer efficiency benefits, they are deterministic and inflexible, which raises new financial risks in DeFi ecosystems within Nigeria's halal industry. One common theme in the literature is that automated contract implementation eliminates discretion in financial decisions, thereby depriving decision-makers of the ability to use human judgment to mitigate shocks (Adinugraha et al., 2024). Traditional financial market lenders, clearinghouses, and regulators tend to step in during a crisis by postponing margin calls, providing liquidity, or simply halting trading to avoid a fire sale (Brunnermeier & Pedersen, 2009).

DeFi smart contracts, on the other hand, are based on the automatic execution of predetermined rules, with no discretionary modifications possible. An example is in lending procedures, where collateral liquidation is triggered when the value of the underlying collateral falls below a set threshold. Although this guarantees predictable enforcement, it also implies that any unfavourable price dynamics may cause liquidations in many protocols simultaneously, thereby increasing market pressure (Qin et al., 2021).

Empirical studies highlight the implications of this automation at the systemic level. During severe market downturns, cascading liquidation can occur within minutes, resulting in a rapid decline in asset prices. Aramonte, Huang, and Schrimpf (2022) document several instances where lending protocols based on Ethereum experienced automatic liquidations of more than 10^15 % of the total value locked (TVL), and the impact propagated to other correlated platforms. Similarly, research by Schär (2021) observes that due to the interconnectivity between DeFi protocols, realised through shared collateral and liquidity pools, shocks in one protocol can spread to the entire ecosystem. It is sometimes referred to as the composability risk, which highlights the potential for amplifying market stress systemically in Nigeria's halal industry (Fitriyansyah & Adinugraha, 2025).

The mechanical liquidation process in DeFi replicates the classical financial panic behaviour, but the lack of human intervention and circuit breakers exacerbates it. Trading halts, lender-of-last-resort interventions, or flexible collateral valuations are all mechanisms to mitigate cascading defaults in traditional markets (Gorton & Metrick, 2012). With DeFi, however, the complex rules of smart contracts create feedback loops: declining collateral values trigger liquidations, which in turn drive further price declines, generating self-reinforcing cycles of instability. For instance, in May 2021, the DeFi market crash, in which the total value locked in the most popular lending protocols dropped by approximately $2 billion in several hours, illustrates how effective automated liquidations can exacerbate volatility (Auer et al., 2023).

Other risk factors further exacerbate this weakness. External asset prices provided by price oracles can be prone to manipulation or delay, leading to unsuitable liquidation (Zhang et al., 2022). In addition, leverage in DeFi lending amplifies the effects of price changes; borrowers with high collateral ratios are prone to forced liquidations, which, in turn, increase systemic risk. Research shows that DeFi leverage ratios in the bull market may exceed 4:1, which is significantly higher than traditional banking's leverage norms. Consequently, the likelihood and effect of cascading liquidations are more pronounced and substantial (Aramonte et al., 2022).

To recap, smart contracts increase operational efficiency, but their strict, deterministic structure creates a pathway to system vulnerability. A combination of automated liquidation mechanisms, inter-protocol composability, oracle vulnerabilities, and excessive leverage creates self-perpetuating, rapid market stress events. The importance of understanding these dynamics in evaluating the stability implications of DeFi is that novel risk mitigation mechanisms, such as circuit breakers, dynamic liquidation thresholds, and Decentralized insurance, are required.

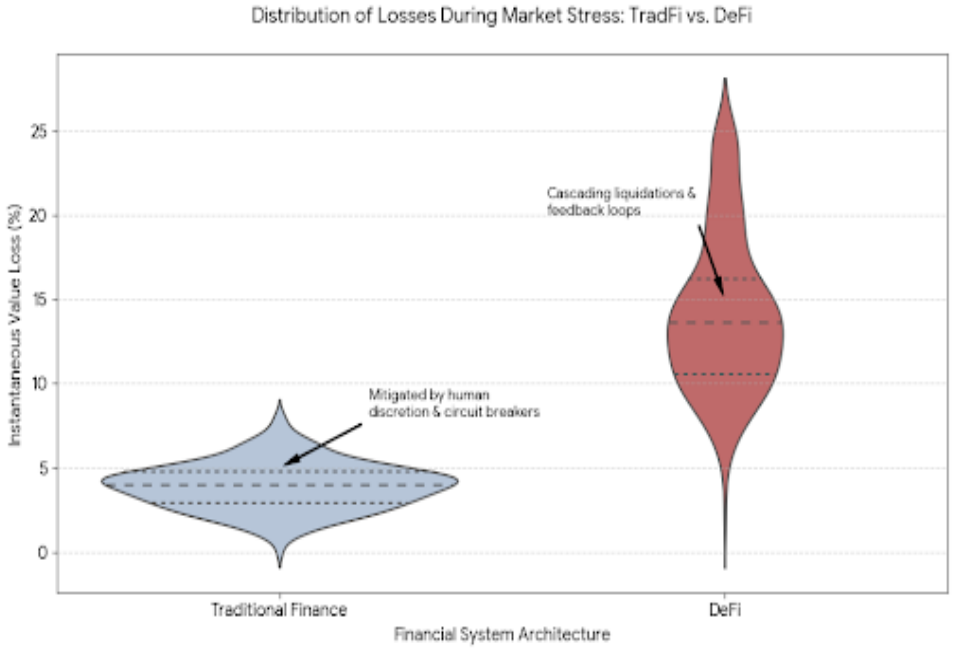

Figure 2. Plot visualising the systemic fragility described in the literature, contrasting the "discretionary" nature of Traditional Finance with the "rigid and deterministic" nature of DeFi smart contracts

Composability and Contagion Effects in Nigeria's Halal Industry

Protocol composability, the well-known criterion of DeFi innovation, is also an important systemic risk in Decentralized financial systems in Nigeria's halal industry. Composability is the quality of DeFi apps that interact with one another via standard smart contracts, liquidity pools, and collateral structures, enabling a Lego-like building. These modular financial services can be swiftly assembled to support new financial services (Schär, 2021). Such structural flexibility enables developers to create complex financial instruments based on existing protocols, thereby enhancing and increasing interoperability, scalability, and innovation (Sadali et al., 2024).

Loan services, Decentralized exchanges (DEXs), and yield farming protocols tend to interoperate with each other to maximise capital efficiency, allowing users to earn interest, borrow funds, or provide liquidity in various combinations. However, with this increased connectivity comes close coupling, and a failure in one protocol can cause ripple effects throughout the larger ecosystem. In contrast to traditional financial markets, which are separated by regulatory and operational barriers, DeFi protocols operate in a less-regulated, more open environment within Nigeria's halal industry. As a result, shocks, whether technical, economic, or governance-related, can spread quickly without any mechanisms to mitigate their spread, including deposit insurance, central bank intervention, or clearinghouse oversight (Aramonte et al., 2022). For example, when a lending protocol has a smart contract vulnerability, it can cascade across interdependent DEXs, leveraged trading platforms, and collateralised loan systems, causing systemic disruptions that are even more severe than the initial point of failure (Qin et al., 2021). The actual implications of the composability risk are highlighted by empirical evidence. A notorious case occurred in November 2021, when an exploit of a Decentralized lending protocol resulted in a loss of $ 33 million, causing the loss to spread across several interconnected systems of DeFi due to collateral pools and automatic liquidation events (Auer et al., 2023).

Equally, mass liquidations and immediate liquidity crunches across various protocols have resulted from oracle failures, in which external price feeds are inaccurate and relayed to smart contracts, triggering liquidations. In an example recorded, more than $ 8 million in losses

were incurred in a few minutes by a single mispriced stablecoin feed, illustrating how easily composable systems can become contagious (Zhang et al., 2022).

Composable networks also have governance vulnerabilities that exacerbate systemic risk. Most of these protocols are based on Decentralized autonomous organisations (DAOs) to make decisions, although voting power is usually centralised among a few token holders. Changes in one protocol can be propagated to other protocols through coordinated attacks, such as malicious proposals or vote manipulation, resulting in instability within the larger DeFi protocol (Hassan & De Filippi, 2021).

Inter-protocol dependencies are usually opaque, and it is hard for users or regulators to predict how a shock in one protocol can affect others. Economically, composability promotes the efficiency of capital and innovation and also generates highly correlated exposures. The pro-cyclical impacts of leveraged positions, collateral sharing, and automated liquidation mechanisms can be exacerbated by the properties of leveraged positions and by the ecosystem's exposure to losses from market stress in a single protocol. In contrast to the past model of financial networks, which included circuit breakers, risk management committees, or insurance policies, DeFi lacks robust systems to limit systemic contagion. This leads to the fact that composability is one of the drivers of DeFi development, but it is also a structural threat that might destabilise the financial situation as the industry grows (Schär, 2021; Aramonte et al., 2022).

Finally, the composability of protocols highlights the dual nature of DeFi: it can introduce innovation while also becoming a channel for systemic risk. The financial stability risks of highly composable DeFi ecosystems depend on these interdependencies in Nigeria's halal industry. They should be mitigated by understanding them and developing systems that provide resilience, including, but not limited to, cross-protocol insurance, dynamic collateral management and clear risk metrics.

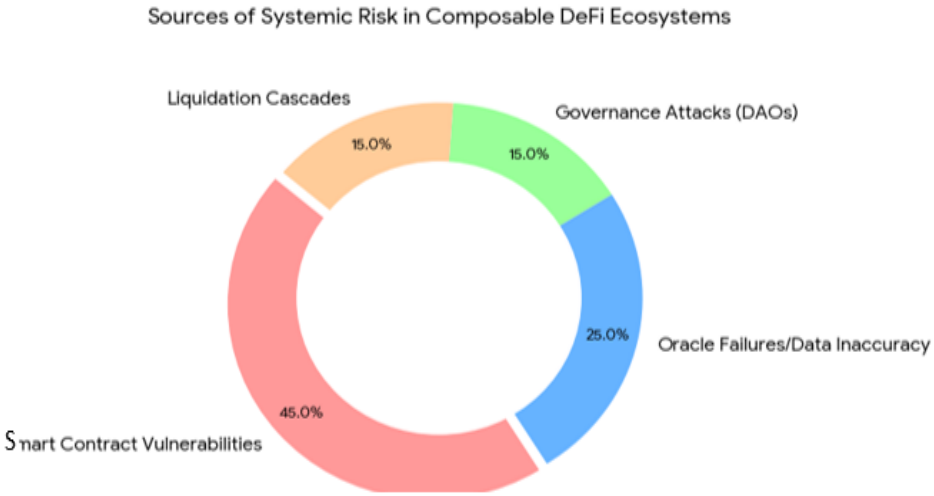

Figure 3. Chart visualising the primary sources of systemic risk within the "Money Lego" framework of DeFi composability

Leverage, Liquidity, and Pro-cyclicality in Nigeria's Halal Industry

Protocol composability, a well-known criterion of DeFi innovation, is also a significant systemic risk in Decentralized financial systems in Nigeria's halal industry (Adinugraha, Rahmawati, et al., 2025). Composability is the quality of DeFi apps that interact with one another via standard smart contracts, liquidity pools, and collateral structures, enabling a Lego-like building. These modular financial services can be swiftly assembled to support new financial services (Schär, 2021). Such structural flexibility enables developers to create complex financial instruments based on existing protocols, thereby enhancing and increasing interoperability, scalability, and innovation. Loan services, Decentralized exchanges (DEXs),

and yield farming protocols often interoperate with each other to maximise capital efficiency, enabling users to earn interest, borrow funds, or provide liquidity in various combinations in Nigeria's halal industry (Shulthoni et al., 2025). However, with this increased connectivity comes close coupling, and a failure in one protocol can cause ripple effects throughout the larger ecosystem. In contrast to traditional financial markets, which are separated by regulatory and operational barriers, DeFi protocols operate in a less-regulated and more open environment.

Thus, any shock, whether technical, economic, or governance-related, may spread quickly without mitigating measures, including deposit insurance, central bank intervention, and clearinghouse controls (Aramonte et al., 2022). For example, when a lending protocol has a smart contract vulnerability, it can cascade across interdependent DEXs, leveraged trading platforms, and collateralised loan systems, causing systemic disruptions that are even more severe than the initial point of failure (Qin et al., 2021). There is empirical evidence about the real-life implications of composability risk. The most notable incident occurred in November 2021, when a hack of a Decentralized lending protocol resulted in a $33 million loss, which was spread across a series of interconnected DeFi systems due to the commonality of collateral pools and liquidation triggers in many of them (Auer et al., 2023).

Equally, oracle failures, in which off-the-book price feeds provide incorrect information to smart contracts, have resulted in liquidations of hundreds of thousands and in the abrupt cessation of liquidity on hundreds of protocols. In a recorded example, more than $ 8 million in losses was incurred in a few minutes by a single mispriced stablecoin feed, illustrating how easily composable systems can become contagious (Zhang et al., 2022).

Composable networks also have governance vulnerabilities that exacerbate systemic risk. Most of these protocols are based on Decentralized autonomous organisations (DAOs) to make decisions, although voting power is usually centralised among a few token holders. Changes in one protocol can be propagated to other protocols through coordinated attacks, such as malicious proposals or vote manipulation, resulting in instability within the larger DeFi protocol (Hassan & De Filippi, 2021).

In addition, inter-protocol dependencies are usually opaque, making it difficult for users or regulators to predict how a shock in one protocol can affect others. Economically, composability promotes the efficiency of capital and innovation and also generates highly correlated exposures. Pro-cyclical features include leveraged positions, collateralised with others, and automated liquidation, all of which may amplify the effects of market stress on a single protocol, potentially having ripple effects across the ecosystem. In contrast to the past model of financial networks, which included circuit breakers, risk management committees, or insurance policies, DeFi lacks robust systems to limit systemic contagion. This leads to the fact that composability is one of the drivers of DeFi development, but it is also a structural threat that might destabilise the financial situation, as the industry grows (Schär, 2021; Aramonte et al., 2022).

The concept of protocol composability highlights the two-sided nature of DeFi: it is both an innovation driver and a source of systemic risk simultaneously. These interdependencies, along with resilient mechanisms to mitigate the financial stability risks of highly composable DeFi ecosystems (such as cross-protocol insurance, dynamic collateral management, and transparent risk metrics), necessitate a deeper understanding.

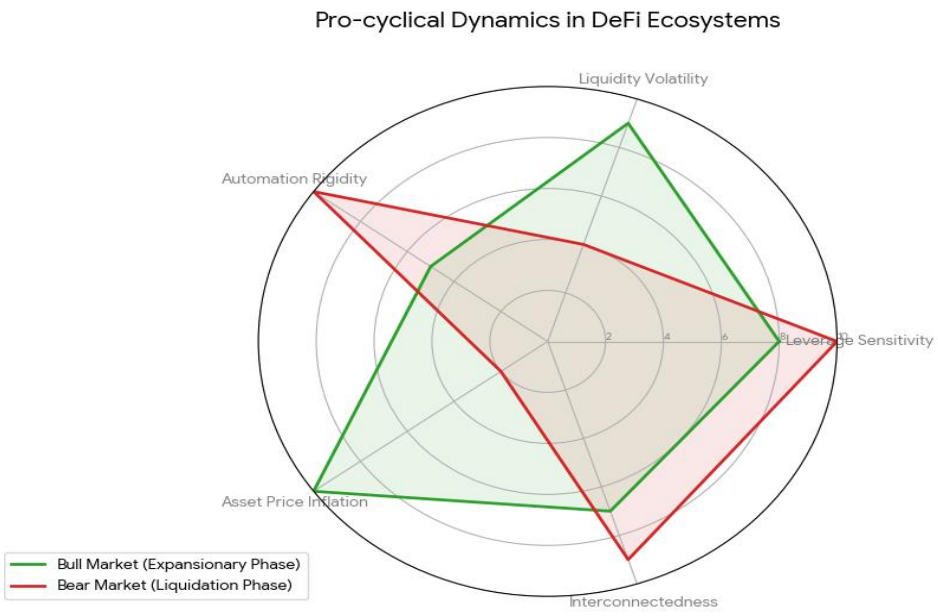

Figure 4: Chart illustrating the pro-cyclical dynamics of DeFi markets, contrasting the system's behaviour during expansionary (Bull) and contractionary (Bear) phases

Governance and Incentive Misalignment in Nigeria

Protocol composability, a well-known criterion of DeFi innovation, is also a significant systemic risk in Decentralized financial systems in Nigeria's halal industry. Composability is the quality of DeFi apps that interact with one another via standard smart contracts, liquidity pools, and collateral structures, enabling a Lego-like building. These modular financial services can be swiftly assembled to support new financial services (Schär, 2021). Such structural flexibility enables developers to create complex financial instruments based on existing protocols, thereby enhancing and increasing interoperability, scalability, and innovation (Sain & Adinugraha, 2025).

Loan services, Decentralized exchanges (DEXs), and yield farming protocols tend to interoperate with each other to maximise capital efficiency, allowing users to earn interest, borrow funds, or provide liquidity in various combinations. However, with this increased connectivity comes close coupling, and a failure in one protocol can cause ripple effects throughout the larger ecosystem. In contrast to traditional financial markets, which are separated by regulatory and operational barriers, DeFi protocols operate in a less-regulated and more open environment. As a consequence, shocks, whether technical, economic, or governance-related, may spread rapidly without any cushioning mechanisms, such as deposit insurance, central bank intervention, or clearinghouse regulation (Aramonte et al., 2022). For example, when a lending protocol has a smart contract vulnerability, it can cascade across interdependent DEXs, leveraged trading platforms, and collateralised loan systems, causing systemic disruptions that are even more severe than the initial point of failure (Qin et al., 2021). Composability risk has practical implications, as highlighted by empirical evidence. One of the most notable instances occurred in November 2021, when an exploit of a Decentralized lending protocol resulted in a loss of $ 33 million, leading to the loss of funds across multiple interconnected DeFi platforms due to shared collateral pools and automated liquidation triggers (Auer et al., 2023).

Likewise, when oracles fail, external price feeds provide incorrect data to smart contracts, resulting in mass liquidations and unexpected liquidity crunches across various protocols. In an example recorded, more than $ 8 million in losses were incurred in a few minutes by a single mispriced stablecoin feed, illustrating how easily composable systems can become contagious

(Zhang et al., 2022). Composable networks also have governance vulnerabilities that exacerbate systemic risk. Most of these protocols are based on Decentralized autonomous organisations (DAOs) to make decisions, although voting power is usually centralised among a few token holders. Changes in one protocol can be propagated to other protocols through coordinated attacks, such as malicious proposals or vote manipulation, resulting in instability within the larger DeFi protocol (Hassan & De Filippi, 2021).

Inter-protocol dependencies are usually not transparent, and it is hard to predict how a shock in one protocol can impact other protocols, whether from a user or a regulator. Economically, composability promotes the efficiency of capital and innovation and also generates highly correlated exposures in Nigeria's halal industry. These include leveraged positions, collateral sharing, and automated liquidation procedures that can lead to pro-cyclical effects, as a single protocol can cause losses to spread rapidly throughout the ecosystem. In contrast to the past model of financial networks, which included circuit breakers, risk management committees, or insurance policies, DeFi lacks robust systems to limit systemic contagion. This leads to the fact that composability is one of the drivers of DeFi development, but it is also a structural threat that might destabilise the financial situation as the industry grows (Schär, 2021; Aramonte et al., 2022). To sum it up, protocol composability exemplifies the duality of DeFi: it is both an open and potentially systemic risk. These interdependencies, along with mechanisms that make DeFi ecosystems more resilient, such as cross-protocol insurance, dynamic collateral management, and transparent risk measurement, are crucial for understanding the financial stability issues posed by highly composable DeFi ecosystems.

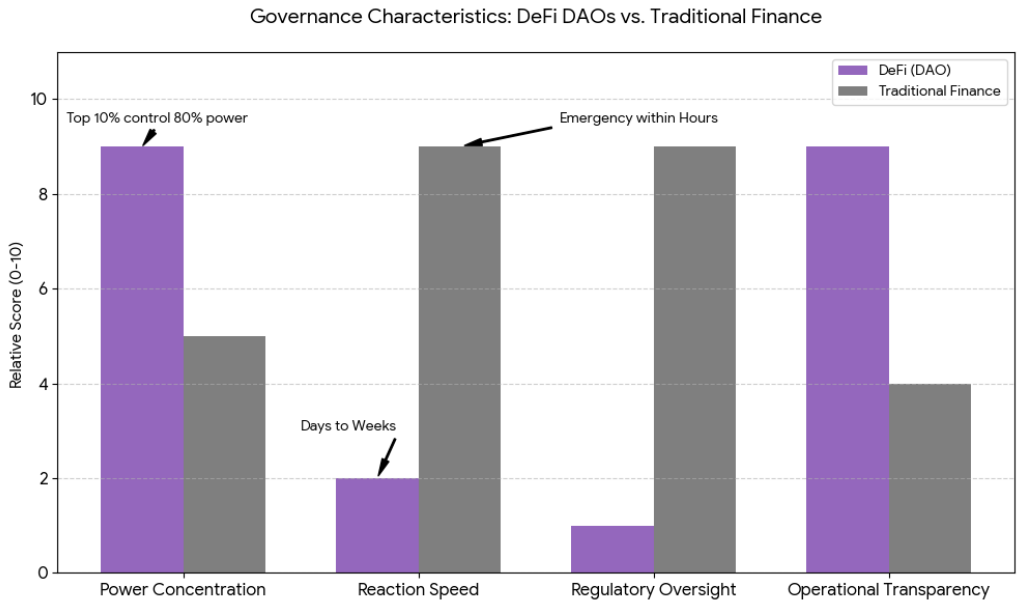

Figure 5. Chart comparing the governance dimensions of DeFi DAOs and Traditional Finance, highlighting the trade-offs between transparency and systemic agility

Regulatory and Financial Stability Implications in Nigeria

Protocol composability, a well-known criterion of DeFi innovation, is also a significant systemic risk in Decentralized financial systems in Nigeria's halal industry (Adinugraha, Shulthoni, & Al-kasyaf, 2025). Composability is the quality of DeFi apps that interact with one another via standard smart contracts, liquidity pools, and collateral structures, enabling a Lego-like building. These modular financial services can be swiftly assembled to support new financial services (Schär, 2021). Such structural flexibility enables developers to create complex financial instruments based on existing protocols, thereby enhancing and increasing interoperability, scalability, and innovation. Loan services, Decentralized exchanges (DEXs), and yield farming protocols tend to interoperate with each other to maximise capital efficiency,

allowing users to earn interest, borrow funds, or provide liquidity in various combinations. However, with this increased connectivity comes close coupling, and a failure in one protocol can cause ripple effects throughout the larger ecosystem. In contrast to traditional financial markets, which are separated by regulatory and operational barriers, DeFi protocols operate in a less-regulated and more open environment.

As a result, either technical or economic shocks, or governance shocks, can diffuse quickly, with no mechanisms in place to mitigate them, including deposit insurance, central bank rescues, and clearinghouse supervision (Aramonte et al., 2022). For example, when a lending protocol has a smart contract vulnerability, it can cascade across interdependent DEXs, leveraged trading platforms, and collateralised loan systems, causing systemic disruptions that are even more severe than the initial point of failure (Qin et al., 2021). There is empirical evidence to highlight the actual implications of composability risk. One of the most notable instances occurred in November 2021, when an exploit of a Decentralized lending protocol resulted in a loss of $ 33 million and affected several interconnected DeFi platforms due to shared collateral pools and automated liquidation triggers (Auer et al., 2023). Likewise, oracle attacks, in which externally provided price feeds have provided incorrect data to smart contracts, have resulted in mass liquidations and abrupt liquidity crunches across a variety of protocols. In a recorded example, more than $ 8 million in losses was incurred in a few minutes by a single mispriced stablecoin feed, illustrating how easily composable systems can become contagious (Zhang et al., 2022).

Composable networks also have governance vulnerabilities that exacerbate systemic risk. Most of these protocols are based on Decentralized autonomous organisations (DAOs) to make decisions, although voting power is usually centralised among a few token holders. Changes in one protocol can be propagated to other protocols through coordinated attacks, such as malicious proposals or vote manipulation, resulting in instability within the larger DeFi protocol (Hassan & De Filippi, 2021).

Inter-protocol dependencies are usually not transparent, and it is hard to predict how a shock in one protocol can impact other protocols, whether from a user or a regulator. Economically, composability promotes the efficiency of capital and innovation and also generates highly correlated exposures. Pro-cyclical effects are amplified by leveraged positions, common collateral, and automated liquidation, meaning that market distress in one protocol is directly and rapidly proportional to losses elsewhere in the ecosystem. In contrast to the past model of financial networks, which included circuit breakers, risk management committees, or insurance policies, DeFi lacks robust systems to limit systemic contagion. This leads to the conclusion that composability is one of the drivers of DeFi development but also a structural threat that might destabilise the financial situation as the industry grows (Schär, 2021; Aramonte et al., 2022).

Protocol composability illustrates how DeFi embodies a two-sided phenomenon: on the one hand, it addresses the factors that promote innovation, and on the other hand, it may serve as a channel for systemic risk in Nigeria’s halal industry. These interdependencies are crucial for understanding how DeFi-based systemic risk can impact financial stability, and that resilience to these threats can be ensured through mechanisms such as cross-protocol insurance, dynamic collateral management, and transparent risk measures.

Protocol composability, a well-known criterion of DeFi innovation, is also a significant systemic risk in Decentralized financial systems. Composability is the quality of DeFi apps that interact with one another via standard smart contracts, liquidity pools, and collateral structures, enabling a Lego-like building. These modular financial services can be swiftly assembled to support new financial services (Schär, 2021). Such structural flexibility enables developers to create complex financial instruments based on existing protocols, thereby enhancing and increasing interoperability, scalability, and innovation. Loan services, Decentralized exchanges (DEXs), and yield farming protocols often interoperate with each other to maximise capital

efficiency, enabling users to earn interest, borrow funds, or provide liquidity in various combinations.

However, with this increased connectivity comes close coupling, and a failure in one protocol can cause ripple effects throughout the larger ecosystem. In contrast to traditional financial markets, which are separated by regulatory and operational barriers, DeFi protocols operate in a less-regulated, more open environment within Nigeria's halal industry. Thus, any shock (technical, economic, or governance-related) may quickly spread without alleviating back-ups, including deposit insurance, central bank intervention, or clearinghouse regulation (Aramonte et al., 2022). For example, when a lending protocol has a smart contract vulnerability, it can cascade across interdependent DEXs, leveraged trading platforms, and collateralised loan systems, causing systemic disruptions that are even more severe than the initial point of failure (Qin et al., 2021).

The factual support of the composability risk is highlighted by its practical implications. One of the most notable incidents occurred in November 2021, resulting from the exploitation of a Decentralized lending protocol, which led to a loss of $ 33 million. This loss spread across multiple interdependent DeFi platforms through shared collateral pools and automated liquidation events (Auer et al., 2023). On the same note, external price feeds containing flawed or malfunctioning data have caused mass liquidations and liquidity crunches across several protocols. In a recorded example, more than $ 8 million in losses was incurred in a few minutes by a single mispriced stablecoin feed, illustrating how easily composable systems can become contagious (Zhang et al., 2022).

Composable networks also have governance vulnerabilities that exacerbate systemic risk. Most of these protocols are based on Decentralized autonomous organisations (DAOs) to make decisions, although voting power is usually centralised among a few token holders. Changes in one protocol can be propagated to other protocols through coordinated attacks, such as malicious proposals or vote manipulation, resulting in instability within the larger DeFi protocol (Hassan & De Filippi, 2021).

Inter-protocol dependencies are usually not transparent, and it is hard to predict how a shock in one protocol can impact other protocols, whether from a user or a regulator. Economically, composability promotes the efficiency of capital and innovation and also generates highly correlated exposures. Leverage positions, common collateral, and liquidation automation intensify pro-cyclicality, with market stress in one protocol rapidly increasing losses across the ecosystem. In contrast to the past model of financial networks, which included circuit breakers, risk management committees, or insurance policies, DeFi lacks robust systems to limit systemic contagion. This leads to the fact that composability is one of the drivers of DeFi development, but it is also a structural threat that might destabilise the financial situation, as the industry grows (Schär, 2021; Aramonte et al., 2022). Protocol composability embodies the duality of DeFi: on the one hand, it enables innovation; on the other, it introduces systemic risk. The challenge posed by highly composable DeFi ecosystems to the financial stability of financial institutions lies in understanding these interdependencies and devising resilient mechanisms, e.g., cross-protocol insurance, dynamic collateral management, and transparent risk metrics.

CONCLUSION

This research concluded that protocol composability, a defining feature of Decentralized finance (DeFi), is a major driver of innovation but also a significant source of systemic risk in Nigeria's halal industry. Composability refers to the ability of DeFi applications to interact seamlessly through standardised smart contracts, shared liquidity pools, and common collateral structures, enabling developers to build modular, "Lego-like" financial services. This flexibility enhances interoperability, scalability, and capital efficiency by enabling lending protocols,

Decentralized exchanges (DEXs), and yield farming platforms to operate in tandem. However, the high level of interconnectedness also creates tight coupling among protocols. As a result, a failure in one protocol can rapidly propagate across the ecosystem in Nigeria's halal industry. Unlike traditional financial systems, which are protected by regulatory barriers, deposit insurance, and central bank interventions, DeFi operates in an open and largely permissionless environment. Consequently, technical flaws, oracle failures, or governance shocks can spread quickly without adequate safeguards. Empirical evidence illustrates these risks. Several high-profile exploits have shown how vulnerabilities in a single lending protocol or faulty price feeds can trigger cascading liquidations and widespread losses across multiple platforms. Governance risks further amplify contagion, as decision-making power within Decentralized autonomous organisations (DAOs) is often concentrated among a small number of token holders. Composability embodies the dual nature of DeFi, fueling innovation and efficiency while simultaneously increasing systemic vulnerability in Nigeria's halal industry. Addressing these risks requires greater transparency and the development of robust mechanisms, such as cross-protocol insurance, improved collateral management, and standardised risk metrics, within Nigeria's halal industry.

Research on Decentralized finance, or DeFi, for smart contracts needs to take a broader perspective in Nigeria's halal industry. Decentralized finance and smart contracts introduce numerous uncertainties that can impact the stability of the financial system. These uncertainties pertain to economics, technology, and regulations. Decentralized finance and smart contracts can enhance efficiency. There are risks to the whole system. We do not know much about how Decentralized finance affects the economy as a whole. This is because Decentralized finance and smart contracts are evolving rapidly, and the information is scattered all over the place. This research needs to test DeFi protocols to see how they function when things don't go as planned. This means we have to try them out when prices of things are changing rapidly, when people are trying to cheat the system, during cyberattacks, and when people are borrowing a lot of money. If we do this, we can identify potential issues and develop plans to prevent them. We can make rules like circuit breakers. Change the amount of collateral people need to put up. We also need to examine how the individuals in charge of DeFi protocols make decisions. We must ensure that everyone has a say and that people consider the risks when they vote. We need to ensure that those in charge are accountable for their actions. This will help DeFi protocols be stable, for a time. DeFi protocols need to be stable. Regulatory studies could assess activity-based versus entity-based frameworks, cross-border harmonisation, and the integration of on-chain transparency with off-chain oversight to strike a balance between innovation and systemic safeguards. Interdisciplinary research that combines economics, finance, computer science, and law remains essential for understanding the implications of intelligent contract automation and Decentralized market structures. Such work will inform the sustainable development of DeFi while mitigating emerging systemic risks.

REFERENCES

Adinugraha, H. H., Fikri, M. K., & Andrean, R. (2024). Halal industry, digital economy, and creative economy: challenges and opportunities for MSMEs in Indonesia. *Journal of Islamic Economics, Management, and Business (JIEMB), 6*(2), 155–182. https://doi.org/10.21580/jiemb.2024.6.2.23588

Adinugraha, H. H., Rahmawati, F., Shulthoni, M., & Sain, Z. H. (2025). Digital Transformation Strategy for Implementing Halal Management: A Case Study of the MSME Industry in Pakistan. *Jurnal Al-Qalam, 31*(1), 146–161. https://jurnalalqalam.or.id/index.php/Alqalam/article/view/1623/815

Adinugraha, H. H., Shulthoni, M., & Al-kasyaf, M. Z. (2025). Model of halal management practices in Islamic banking: empirical evidence from Bank Syariah Indonesia. *IQTISHADUNA: Jurnal Ilmiah Ekonomi Kita, 14*(1), 25–46.

https://doi.org/https://doi.org/10.46367/iqtishaduna.v14i1.2333
Adinugraha, H. H., Shulthoni, M., & Syakirunni'am, L. (2025). Halal Supply Chain Management from Theory to Application: Case Studies in Indonesia. *Journal of Islamic Management Studies*, *8*(2), 36–48. https://publications.waim.org.my/index.php/jims/article/view/132/100
Angeris, G., & Chitra, T. (2021). Improved price oracles: Automated market makers and decentralized finance. *Proceedings of the ACM on Measurement and Analysis of Computing Systems, 5*(1), 1-35. https://doi.org/10.1145/3458736
Aramonte, S., Huang, W., & Schrimpf, A. (2021). DeFi risks and the decentralisation illusion. *BIS Quarterly Review*. https://www.bis.org/publ/qtrpdf/r_qt2112b.pdf
Aramonte, S., Huang, W., & Schrimpf, A. (2022). DeFi risks and the decentralization of finance. *BIS Quarterly Review*. https://www.bis.org/publ/qtrpdf/r_qt2212.htm
Arner, D. W., Barberis, J., & Buckley, R. P. (2022). Regulating decentralized finance: Activity-based approaches. *Journal of Financial Regulation, 8*(2), 123-152. https://doi.org/10.1093/jfr/fjac012
Auer, R., Cornelli, G., & Frost, J. (2023). Rise of the central bank digital currencies and decentralized finance. *BIS Working Papers No. 1034*. https://www.bis.org/publ/work1034.pdf
Aufiero, S., Bartolucci, S., Caccioli, F., & Vivo, P. (2025). Mapping microscopic and systemic risks in TradFi and DeFi: A literature review. *arXiv*. https://arxiv.org/abs/2508.12007
Buterin, V. (2014). A next generation smart contract and decentralized application platform. *Ethereum White Paper*. https://ethereum.org/en/whitepaper/
Dotan, M., Yaish, A., Yin, H. C., Tsytkin, E., & Zohar, A. (2023). The vulnerable nature of decentralized governance in DeFi. *arXiv*. https://arxiv.org/abs/2308.04267
Financial Stability Board. (2023). Decentralised finance: Regulatory challenges and opportunities. https://www.fsb.org/wp-content/uploads/Decentralised-Finance-2023.pdf
Fitriyansyah, I., & Adinugraha, H. H. (2025). Integration of Strategic Management and Islamic Business Ethics for Islamic Economic Development. *Annals of the University of Craiova for Journalism, Communication and Management*, *11*(1), 120–124. https://aucjc.ro/wp-content/uploads/2025/07/aucjcm-11-120-124.pdf
Gorton, G., & Metrick, A. (2012). Getting up to speed on the financial crisis: A one weekend reader's guide. *Journal of Economic Literature, 50*(1), 128-150.
Hassan, S., & De Filippi, P. (2021). Decentralized autonomous organization governance and financial stability. *Journal of Blockchain Research, 4*(1), 45-67. https://doi.org/10.2139/ssrn.3843671
Nguyen, M. H., Thanh, B. N., Pham, H., & Pham, T. T. T. (2024). The determinants of funding liquidity risk in decentralized lending. *Global Finance Journal, 101055*. https://doi.org/10.1016/j.gfj.2024.101055
OECD. (2023). Decentralized finance and financial inclusion. *OECD Digital Finance Papers, No. 16*. https://doi.org/10.1787/df-2023-16-en
Qin, K., Zhou, L., & Chen, D. (2021). On the systemic risk of decentralized finance. *Journal of Financial Stability*, *55*, 100868. https://doi.org/10.1016/j.jfs.2021.100868
Sadali, A., Fikri, M. K., & Adinugraha, H. H. (2024). Halalpreneur Opportunities and Challenges: Empirical Evidence from Indonesia. *Al-Intaj: Jurnal Ekonomi Dan Perbankan Syariah*, *10*(2), 239–258. https://doi.org/10.29300/aij.v10i2.3893
Sain, Z. H., & Adinugraha, H. H. (2025). Artificial Intelligence and Islamic Finance: Enhancing Sharia Compliance and Social Impact in Banking 4.0. *Journal of Business Management and Islamic Banking*, *4*(1), 25–46. https://doi.org/10.14421/jbmib.2025.0401-03

Schär, F. (2021). Decentralized finance: On blockchain- and smart contract-based financial markets. *Federal Reserve Bank of St. Louis Review, 103*(2), 153-174. https://doi.org/10.20955/r.103.153-174

Shulthoni, M., Khoirul Fikri, M., & Hermawan Adinugraha, H. (2025). Uncovering the Environmental and Social Impacts of Renewable Energy Use in the Halal Industry: Empirical Evidence from Indonesia. *International Journal of Science and Environment (IJSE), 5*(1), 31–40. https://doi.org/10.51601/ijse.v5i1.144

Szabo, N. (1997). The idea of smart contracts. In Nick Szabo's Papers and Concise Tutorials. Retrieved from http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_idea.html

Zhang, R., Xu, J., & Chen, Y. (2022). Oracle manipulation in decentralized finance: Causes and mitigation. *Journal of FinTech, 6*(1), 45-63. https://doi.org/10.1016/j.jfintech.2022.02.004