FAIR as an Alternative Economic Architecture: Evidence from BangNano Socio-Economic Movement in Indonesia

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Abstract:
Contemporary economic systems have generated substantial growth but populations continue to face structural challenges related to financial fragility, financial exclusion, and declining trust, particularly among disadvantaged communities. These challenges raise concerns about the long-term sustainability of debt-based and leverage-driven financial structures in achieving shared prosperity.

This paper presents the FAIR economic framework as an alternative to the mainstream economic architecture. FAIR refers to a *Full-reserve, Asset-based, Interest-free, Resiliency-first* economic framework. FAIR is grounded in four core principles: (i) full-reserve financial integrity, (ii) real asset anchoring, (iii) prohibition of interest-based extraction, and (iv) prioritization of systemic and community resilience over short-term growth maximization.

The FAIR framework is presented alongside BangNano, a digitally enabled economic system that implements FAIR in Indonesia at the community-scale. BangNano's system design incorporates asset tokenization, transparent transaction chains, and community-based crowdfunding. These design elements operationalize trust and accountability through auditable ledgers and risk-sharing through programmable financial constraints, aligning with the four main pillars of the FAIR framework.

Social and economic impacts of a FAIR-based economy are examined using descriptive data from BangNano's user activities. In particular, patterns of voluntary participation, real-asset price anchoring, and financial interactions consistent with resilience-oriented economic practices are observed. The findings suggest that FAIR offers a promising pathway for rethinking economic

architecture in pursuit of shared prosperity through inclusive, transparent, and ethically grounded economic systems.

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Key Words: FAIR economic framework, Full-reserve banking, Asset-based economy, Islamic finance, Risk-sharing finance, Financial resilience, Digital financial systems, BangNano

1. Introduction

1.1 Persistent Challenges in Debt-based Economic Systems

Modern economies rely heavily on debt-based and leverage-driven financial structures. Financial expansion is largely driven by credit creation, often exceeding underlying real asset growth. While this structure can stimulate economic activity and support short-term growth, it introduces systemic vulnerabilities at both micro and macro levels.

One of the most prominent consequences of this structure is financial fragility. Credit expansion cycles often produce boom and bust dynamics, where periods of rapid growth are followed by sharp contractions. Financial crises are frequently triggered by excessive leverage, asset bubbles, and liquidity mismatches. These dynamics have been observed across multiple contexts, including global financial crises, episodes of banking instability, and sudden contractions in credit availability.

A key source of instability lies in hidden leverage and maturity mismatches. Modern financial systems often operate under fractional reserve principles, allowing multiple financial claims to

exist on the same underlying asset while funding long-term or illiquid assets with short-term liabilities. This structure creates systemic risks during periods of financial stress, including liquidity shortages, loss of confidence, and broader financial panics.

In addition to systemic fragility, debt-based systems contribute to persistent financial exclusion. Access to affordable capital remains uneven, particularly for low-income communities. Many individuals face high-interest consumer loans, predatory lending structures, and limited access to formal financial institutions. Small businesses similarly rely on expensive credit or informal financing mechanisms, which can constrain growth and increase vulnerability.

These structural characteristics also contribute to declining trust in financial institutions. Financial opacity, complex intermediation, and past instances of misconduct have led to concerns about hidden risks, fraud, and lack of accountability. This erosion of trust affects savings behavior, limits investment participation, and weakens economic collaboration within communities.

Taken together, these challenges have led to growing debate regarding the sustainability of current financial structures. There is increasing interest in alternative models, including ethical finance, community-based systems, and asset-based approaches. A central question emerging in both academic and policy discourse is how to design economic systems that prioritize stability, transparency, inclusion, and resilience, rather than growth alone.

1.2 Relevance to Islamic Economics and Sustainable Development

Islamic economic thought provides a framework that directly addresses many of the structural concerns observed in modern financial systems. It emphasizes fairness in exchange, the prohibition of riba (interest), risk-sharing financial relationships, and the ethical stewardship of wealth. Financial interactions are expected to be linked to real economic activity and grounded in shared outcomes between participants.

The prohibition of riba plays a central role in promoting economic justice. By disallowing guaranteed returns independent of economic performance, Islamic finance seeks to prevent exploitative lending and the transfer of risk entirely onto borrowers. Instead, it encourages

partnership-based financial structures in which both risks and rewards are shared among participants.

These principles align closely with broader sustainable development goals, including financial inclusion, poverty reduction, and equitable wealth distribution. As a result, Islamic finance is increasingly discussed as a pathway toward more inclusive and ethically grounded economic systems.

Over the past several decades, Islamic finance has expanded significantly, with the development of Islamic banking institutions, sukuk markets, and a wide range of Sharia-compliant financial products. However, despite this growth, important structural challenges remain.

Many Islamic financial institutions continue to operate within the same macro financial architecture as conventional systems. In practice, this often results in continued reliance on leverage-based structures, debt-like instruments, and financial engineering techniques. Consequently, underlying systemic fragility is not fully addressed, and the principle of risk-sharing is only partially implemented.

1.3 Purpose and Contribution of the Paper

Despite the expansion of Islamic finance, key structural issues remain unresolved, including financial fragility, lack of transparency, and unequal access to capital. These limitations suggest that addressing systemic challenges requires more than product-level innovation such as non-riba based financial products. Instead, it calls for a rethinking of the underlying economic architecture.

In response, this paper introduces the FAIR economic framework, defined as a Full-reserve, Asset-based, Interest-free, and Resiliency-first system. FAIR is proposed as a coherent and integrated framework, in which each principle reinforces the others and contributes to a more stable and inclusive economic structure.

The conceptual contribution of this paper lies in several areas. First, it introduces full-reserve financial integrity as a core design principle, eliminating multiple claims on the same physical asset and reducing hidden leverage. Second, it integrates asset-based value anchoring with

constraints on financial claims, ensuring alignment between financial representation and real economic capacity. Third, it extends Islamic finance by embedding it within a resiliency-first system design that prioritizes long-term stability over growth maximization. Finally, it proposes a digitally enabled trust infrastructure, combining transparent transaction ledger, fractional ownership, and community-based participation.

In addition to its conceptual contributions, the paper provides an empirical contribution through the examination of BangNano, a community-scale implementation of FAIR principles. This case illustrates how the framework can be operationalized in practice, how participants interact within such a system, and how it can function within existing legal and institutional environments.

The paper addresses the following research questions: How can FAIR principles be translated into operational economic systems? What design mechanisms support transparency, trust, and resilience? How does a full-reserve, asset-based system behave at the community scale? And what initial patterns emerge from real-world implementation?

1.4 Structure of the Paper

The remainder of the paper is organized as follows. Section 2 reviews relevant literature on debt-based financial systems, Islamic finance frameworks, and digital trust infrastructures. Section 3 introduces the FAIR economic framework and its core principles. Section 4 presents BangNano as a community-scale implementation of the framework. Section 5 analyzes initial outcomes and observations. Section 6 discusses broader implications for economic architecture and Islamic finance, outlines future research directions, and concludes.

2. Background and Related Work

2.1 Debt-based and Leverage-driven Finance

Modern financial systems are fundamentally structured around credit creation and leverage expansion. Banking institutions increase the money supply through lending, creating financial claims that extend beyond base reserves. This mechanism plays a central role in facilitating economic activity.

Proponents of debt-based financial systems argue that such structures enable investment and consumption, support capital formation, and drive economic growth. However, these benefits are accompanied by significant structural concerns.

High levels of leverage increase systemic vulnerability, making economies more susceptible to financial instability. Credit cycles contribute to asset price inflation and economic crises, while interconnected liabilities allow financial distress to propagate across the system.

Debt obligations are typically fixed regardless of economic conditions, placing disproportionate risk on borrowers during downturns. This can lead to widespread financial stress, particularly when economic conditions deteriorate.

In addition, debt-based systems can contribute to unequal distribution of wealth. Returns tend to favor capital providers, while borrowers bear greater exposure to downside risk. Over time, this dynamic can result in wealth concentration, long-term indebtedness, and broader financial inequality.

2.2 Islamic finance principles and limitations of current implementations

Islamic finance is grounded in several core principles, including the prohibition of riba, avoidance of excessive uncertainty (gharar), emphasis on risk-sharing, and linkage of financial activity to real economic assets.

Modern Islamic financial institutions have expanded globally and introduced a range of financial instruments, including sukuk, murabaha financing, and musharakah partnerships. These developments have contributed to the growth of Sharia-compliant financial markets.

However, structural limitations remain. Many Islamic financial products replicate instruments similar to the ones conventionally used in debt-based financial systems. In practice, there is

continued reliance on debt-like contracts and fixed return structures. Furthermore, Islamic financial institutions generally operate within fractional reserve banking systems and leverage-driven financial markets.

As a result, there is growing discussion within Islamic finance literature regarding the need for more authentic risk-sharing systems and reduced reliance on debt-like instruments. This has led to increasing recognition that structural reform may be required beyond product-level innovation.

2.3 Digital Islamic Finance and Trust Infrastructures

Advances in financial technology have introduced new possibilities for designing financial systems. Innovations such as digital payments, blockchain technologies, and crowdfunding platforms have reshaped how financial transactions are conducted.

Digital infrastructure has the potential to improve transparency, auditability, and accessibility. In the context of Islamic finance, these technologies have been applied to areas such as crowdfunding, microfinance, and asset tokenization.

However, technology alone is not sufficient to establish trust. Effective financial systems require a combination of transparent mechanisms, well-defined governance structures, and aligned incentives among participants. Without these elements, digital systems may replicate existing inefficiencies or introduce new forms of risk.

2.4 Identified Gap in the Literature and Practice

Existing economic research has largely focused on growth optimization and financial efficiency. These priorities are reflected in mainstream economic frameworks that often emphasize output expansion and market-based performance indicators (Stiglitz, 2012). In comparison, relatively less attention has been given to systemic resilience and structural stability, particularly under conditions of financial stress (Haldane & May, 2011).

Full-reserve banking models have been explored in theoretical and policy contexts, including proposals such as the Chicago Plan, but remain limited in practical implementation and have not yet been widely integrated into modern financial systems (Benes & Kumhof, 2012). From an

Islamic economics perspective, full-reserve systems have been discussed as more consistent with the objectives of the Shariah (Maqasid al-Shariah), particularly in addressing concerns related to monetary expansion and the presence of riba in financial systems (Ahmad & Ismail, 2017). However, much of this discussion remains at a conceptual level.

There have been criticisms with respect to the consequential similarities between debt-like instruments Islamic financial institutions heavily rely on, such as murabaha, and the conventional interest-based loans (Shaikh, 2011). The excessive use and domination of murabaha in the Islamic finance have been referred to as the murabaha syndrome (Yousef, 2004). Although some scholars have proposed models more closely aligned with risk-sharing principles, the transition toward broader adoption of such approaches remains incomplete in practice (Iqbal & Mirakhor, 2011, pp. 370-371).

There have also been more direct criticisms to the foundational pillars of Islamic banking "being Islamic" (Zaman, 2008). Some Islamic financial institutions are involved in riba-based financial instruments behind the scenes, unbeknownst to the customers, which can turn the "profit-sharing" Islamic financial instruments dependent on the riba-based system.

Overall, there is limited development of practical frameworks that combine full-reserve constraints, real asset anchoring, and participatory financial models within a digitally enabled environment. This gap highlights the need for integrated approaches that address both the structural weaknesses of modern financial systems and the unrealized potential of Islamic economic principles.

In response, this paper introduces the FAIR framework as a full-reserve, asset-based, interest-free, and resiliency-first economic model. It extends prior conceptual discussions into a practical, digitally enabled implementation through the BangNano system, providing early evidence of how such an approach can function within existing legal and institutional contexts.

3. The FAIR Economic Framework

3.1 Definition of FAIR

FAIR is proposed as a framework to guide the design of an alternative economic system intended to address structural weaknesses observed in the current mainstream economic architecture. While modern economic systems have generated significant growth and financial innovation, they have also produced persistent challenges including financial fragility, rising leverage, declining trust in institutions, and recurring cycles of boom and bust. The FAIR framework seeks to address these challenges by establishing a set of principles that prioritize economic stability, transparency, and equitable participation.

FAIR stands for Full-reserve, Asset-based, Interest-free, Resiliency-first. Together, these four principles form an integrated framework for structuring economic relationships, financial instruments, and institutional behavior.

The framework is intended to guide the design of economic systems rather than function as a single rigid institutional model. Organizations and communities may draw inspiration from FAIR and implement its principles in different contexts. However, the framework is intended to function holistically. Implementing only selected elements of FAIR while ignoring others may undermine its intended stabilizing effects. For example, eliminating interest while maintaining fractional reserve credit expansion would not address systemic leverage risks, just as full-reserve systems without the prohibition of interest, financial structures could still create economic imbalances.

For this reason, FAIR should be understood as a coherent framework of mutually reinforcing principles rather than a menu of independent policy tools. The following subsections describe the four foundational principles that define the FAIR economic framework.

3.2 Full-Reserve Financial Integrity

The first pillar of the FAIR framework is full-reserve financial integrity. This principle requires that financial claims correspond directly to real assets and that multiple concurrent claims to the same asset are avoided.

Under full-reserve conditions, assets held on demand deposit must remain available for withdrawal at any time. In other words, the relationship between deposits and underlying assets must maintain a 1:1 correspondence. Financial institutions or custodians cannot create additional claims against these assets while they remain available for immediate withdrawal.

This principle eliminates the possibility of hidden leverage created through fractional reserve banking. Fractional reserve systems effectively create new monetary claims beyond the underlying reserves. While such mechanisms can stimulate growth by credit expansion, they also introduce systemic vulnerabilities when confidence declines and depositors seek simultaneous withdrawal of funds.

Full-reserve systems prohibit such practices for demand deposits. However, assets placed in term deposits or managed investment funds may be deployed into productive activities, provided that clear contractual arrangements ensure that no two parties hold simultaneous claims to the same asset. In these cases, participants knowingly assume investment risk and liquidity constraints.

Another related concern addressed by full-reserve principles is maturity mismatch, which occurs when short-term liabilities are funded by long-term or illiquid assets. During periods of economic stress, this mismatch can create liquidity crises even when underlying assets remain valuable. By aligning financial claims with the availability and maturity of underlying assets, the FAIR framework seeks to minimize this source of instability.

The implications of full-reserve financial integrity include improved transparency of financial risk, stronger solvency conditions, and reduced systemic fragility. Economic expansion may occur more gradually than in highly leveraged systems, but the resulting growth is expected to be more stable and less prone to speculative cycles and financial crises.

3.3 Asset-Based Value Anchoring

The second pillar of the FAIR framework is asset-based value anchoring, which requires that financial representations of value remain tied to identifiable real assets within the economy.

Within the FAIR framework, real assets are defined as goods or productive resources that possess intrinsic or economic value independent of purely financial speculation. These assets may include precious metals such as gold or silver, staple commodities that have long shelf life such as rice or salt, income-generating assets such as vehicles or equipment, and productive capital used in business enterprises.

Anchoring financial value to real assets serves several important functions. First, it creates a mechanism that ties financial activity to real economic production and consumption. This alignment reduces the likelihood of purely speculative financial expansion disconnected from the underlying economy.

Second, asset anchoring constrains the creation of financial claims that exceed the availability of real resources. When financial units correspond to identifiable assets, the expansion of financial claims must remain consistent with real economic capacity.

Third, asset anchoring supports more stable pricing of essential goods and investment assets. Because financial value is linked to tangible assets rather than abstract financial instruments, volatility driven purely by speculative capital flows would ultimately be reduced.

Within a FAIR-based system, asset-backed structures therefore play a critical role in maintaining stability and reinforcing the relationship between financial representation and real economic activity. This design principle also supports long-term savings behavior by allowing individuals to preserve purchasing power through ownership of real assets rather than reliance solely on fiat currency or speculative investments.

3.4 Interest-Free Risk-Sharing Mechanisms

The third pillar of the FAIR framework is the use of interest-free financial structures based on risk-sharing rather than risk transfer.

In conventional debt-based finance, lenders provide capital to borrowers in exchange for predetermined interest payments. This structure typically transfers the majority of economic risk to the borrower. The lender receives a guaranteed return regardless of whether the underlying

economic activity succeeds or fails, while the borrower bears the volatility of business performance.

Such arrangements can create structural imbalances. Borrowers remain obligated to repay debt even when economic conditions deteriorate, which can lead to financial distress, asset liquidation, and persistent indebtedness. At a systemic level, debt-based financing can amplify economic downturns as households and businesses struggle to service obligations during periods of reduced income.

The FAIR framework instead emphasizes financial relationships based on shared risk and shared reward. Capital providers and beneficiaries participate jointly in the economic outcomes of the underlying activity. Returns are therefore tied to the performance of real assets or enterprises rather than predetermined interest obligations.

Several financial structures consistent with Islamic finance traditions illustrate this principle. These include i. Musharakah, in which partners jointly contribute capital and share profits and losses; ii. Mudarabah, where one party provides capital and the other provides entrepreneurial effort; and iii. Murabaha, where goods are purchased and resold with an agreed margin under transparent conditions. Variations such as diminishing partnership arrangements, iv. Musharakah Mutanaqisah allows beneficiaries to gradually acquire ownership of productive assets over time.

Risk-sharing mechanisms produce several systemic implications. Because returns depend on actual economic performance, capital providers have incentives to evaluate projects carefully and support sustainable ventures. Beneficiaries likewise have incentives to maintain productive assets and operate enterprises responsibly. Financial relationships therefore become more collaborative rather than adversarial.

By avoiding compounding interest obligations and punitive penalty structures, risk-sharing systems also reduce the likelihood of debt traps and persistent indebtedness. This alignment of incentives promotes cooperation, strengthens trust between participants, and ties financial outcomes more closely to real economic activity.

3.5 Resiliency-First Design Philosophy

The final pillar of the FAIR framework is a resiliency-first design philosophy. In contrast to economic systems that prioritize maximum growth as the primary objective, the FAIR framework places long-term economic resilience at the center of system design.

Economic resilience refers to the ability of an economic system to absorb shocks, maintain trust among participants, sustain productive activity, and avoid systemic collapse during periods of stress. In this context, resilience does not imply stagnation or rejection of growth. Rather, growth is understood as desirable but subordinate to stability, trust, and long-term sustainability.

Growth-first economic models often emphasize rapid expansion of credit, financial markets, and asset values. While such expansion can generate periods of significant prosperity, it can also produce cycles of excessive leverage, speculative bubbles, and abrupt contractions. These boom-and-bust cycles can impose severe economic hardship on households and communities.

A resiliency-first approach instead prioritizes system behaviors that support stability and durability over long time horizons, where it aims to minimize boom-and-bust dynamics by constraining financial expansion through real asset availability. Full-reserve structures, asset-backed transactions, and the avoidance of interest-driven credit expansion reduce the likelihood of speculative bubbles and sudden financial contractions.

Another feature of resiliency-first systems is the prioritization of stable economic activity rather than rapid expansion. Instead of maximizing short-term growth indicators such as credit volume or financial market capitalization, the system emphasizes continuity of livelihoods, gradual asset accumulation, and steady productive activity.

Stable and predictable pricing of essential assets also contributes to resilience. In many modern financial markets, essential goods and productive assets may be subject to speculative trading that produces price volatility. Asset-backed systems that emphasize direct ownership of real goods can help stabilize access to critical resources such as staple commodities, productive tools, and investment assets.

Resiliency-first systems also encourage long-term savings and wealth preservation. In inflationary environments or highly speculative financial systems, individuals may be pushed toward riskier investments in order to preserve purchasing power. Asset-based saving

mechanisms (such as, gold and silver) and transparent asset reserves instead support stable wealth accumulation over time.

Another important objective of resiliency-oriented design is the prevention of debt-driven poverty cycles. Compounding interest obligations, penalties, and late fees can create escalating financial burdens that are difficult to escape. By emphasizing risk-sharing arrangements and flexible repayment structures, the FAIR framework seeks to reduce these structural vulnerabilities.

Resiliency-first design also supports broad participation in asset ownership. Fractional ownership mechanisms allow individuals with limited capital to participate in investment opportunities and productive asset ownership. This expands access to wealth creation and reduces barriers associated with high capital requirements.

Finally, resiliency-oriented systems aim to promote fairer geographic and demographic distribution of economic opportunity. Digital financial infrastructure and community-based investment networks allow economic participation beyond traditional financial centers, enabling broader inclusion across regions and socio-economic groups.

A particularly important outcome of these mechanisms is the preservation of wealth across generations. Instead of economic systems that encourage rapid short-term profiteering, resiliency-first design supports long-term stewardship of productive capital. Real asset ownership, endowment-style asset preservation, and long-term savings instruments allow communities to build stable capital foundations that benefit future generations.

In summary, the FAIR framework does not reject economic growth. Rather, it proposes that growth should occur within structures that prioritize resilience, transparency, and long-term stability. By subordinating short-term expansion to systemic durability, a resiliency-first economic architecture seeks to protect households, maintain trust within communities, and sustain economic cooperation across generations.

4. Community-Scale Implementation: The BangNano Case

4.1 Context and Scope

Indonesia provides a relevant setting for examining a community-scale implementation of the FAIR framework. It is a large emerging economy with a significant informal sector, uneven access to affordable finance, and a population that is increasingly engaged in public discussion around Islamic financial principles. While formal banking and digital financial services have expanded over time, many communities still face structural barriers to affordable capital, especially for household needs, micro-enterprises, and productive asset acquisition. In practice, many individuals remain dependent on high-cost consumer financing, informal borrowing, or financing arrangements that may expose them to predatory terms and long-term financial stress.

Alongside these financial constraints are broader trust challenges. Distrust toward financial institutions is not limited to borrowing arrangements, but also affects savings behavior. Many people continue to rely on conventional financial institutions because of necessity rather than confidence, despite concerns about fraud, hacking, phishing, mismanagement, or lack of transparency. Distrust also exists at the interpersonal and community level. Community-based economic activities often suffer from weak bookkeeping practices, poor transparency, and inconsistent professional standards, which reduce confidence between people and limit economic circulation. These issues are compounded by widespread fraud, including get-rich-quick schemes, Ponzi-type arrangements, and identity theft, as well as corruption concerns across various layers of public institutions. Taken together, these conditions create an environment in which both institutional and social trust are fragile, while the need for trustworthy alternatives remains high.

This context also helps explain the relevance of Islamic financial principles in Indonesia. As a Muslim-majority country, Indonesia has strong cultural and religious familiarity with concepts such as riba prohibition, fairness in trade, and ethical stewardship of wealth. Public discourse around Islamic living and Islamic finance has become increasingly visible, and demand for riba-free alternatives has grown over time. The issuance of a fatwa by the Indonesian Ulema Council (Majelis Ulama Indonesia, MUI) prohibiting riba further strengthened this normative concern. However, although Islamic banks have operated in Indonesia for decades, their adoption has remained relatively limited, at around 7% penetration (Agarwal et al., 2026) Higher financing costs for customers, limited differentiation from conventional banking, and skepticism regarding the degree of actual Sharia compliance have all constrained broader usage. This creates

an opening for community-based alternatives that are more transparent, more participatory, and more visibly aligned with Islamic economic principles.

4.2 BangNano

BangNano is an alternative economic system designed to implement the FAIR economic principles. It operates as a digital platform that enables geographically dispersed participants to engage in a shared economic environment. At its core, BangNano is a community of individuals who aim to build wealth collaboratively while strengthening trust among one another. Members interact primarily through the BangNano mobile application, which serves as the main interface for communication and financial transactions within the network.

BangNano emerged as a socio-economic movement and digital platform designed to create collaborative economic opportunities, enable ethical financial interactions, and increase transparency and trust. Rather than attempt to redesign the economy at national scale from the outset, BangNano began at the community level. This starting point was intentional. Large economic systems are difficult to redesign quickly, whereas community-scale systems provide a practical environment for experimentation, learning, and iterative improvement. Starting small also offers concrete advantages: trust formation is easier, social relationships are stronger, and feedback loops are faster. Community networks can also provide natural mechanisms of verification, accountability, and informal enforcement that are difficult to replicate in large anonymous systems. In this sense, BangNano represents a community-scale implementation environment in which the FAIR framework can be translated into operational rules and observed in practice.

BangNano's implementation has required navigation of Indonesia's legal and regulatory environment. This is important not only for compliance, but also because it demonstrates that FAIR-aligned community systems can operate within existing legal structures rather than only in hypothetical or informal settings.

In Indonesia, formal financial institutions are generally regulated by Bank Indonesia (BI) and the Financial Services Authority (OJK). Activities such as deposit-taking and lending usually require licensed institutional status. However, closed-loop cooperative systems operating only among

members fall under the jurisdiction of the Ministry of Cooperatives and SMEs (Kementerian Koperasi dan UMKM), rather than BI or OJK. This distinction is central to BangNano's institutional design.

BangNano uses an Indonesian cooperative as its primary economic entity. The cooperative structure allows members to pool savings, provide financing among members, collectively own assets, and conduct business with one another. Because these activities are restricted to cooperative members, the system operates as a closed-loop structure under cooperative law.

At the same time, BangNano uses a separate foundation, ("yayasan" in Indonesian), for social and charitable activities. This entity facilitates donations, social programs, and community support initiatives. The separation between cooperative and foundation structures helps distinguish economic activities from charitable or social activities, thereby supporting clearer governance and regulatory compliance.

This institutional separation reflects FAIR's broader design logic. Economic collaboration is conducted through the cooperative, while social and charitable functions are conducted through the foundation. As a result, BangNano demonstrates that community-scale economic systems aligned with FAIR principles can be implemented within existing Indonesian legal frameworks without requiring formal banking licenses.

This legal structure also strengthens the practical relevance of the BangNano case. It suggests that alternative economic architectures do not necessarily require immediate macro-level legal transformation in order to begin operating. Instead, implementation may begin by using existing institutional forms in ways that are legally compliant and economically innovative.

4.3 Operationalization of FAIR principles

BangNano operationalizes the FAIR framework by translating its four principles into concrete rules governing asset representation, financing structures, ownership, and participant behavior. The first principle, full-reserve financial integrity, is implemented by requiring that every digital representation of an asset corresponds to a real underlying asset. No synthetic asset creation is

permitted within the system, and no leverage or credit expansion is allowed against demand-held assets. In practical terms, this means that gold tokens must be backed by physical gold, motorcycle shares must correspond to an actual motorcycle, and rice units must correspond to real inventory. The purpose of this rule is to prevent hidden leverage, maintain solvency, and ensure that digital claims remain fully backed by verifiable assets.

The second principle, asset-based value anchoring, is implemented by linking economic activity to real assets rather than abstract financial instruments. BangNano emphasizes assets that are either essential for wealth preservation or productive for livelihood generation. These include precious metals such as gold and silver, staple goods such as rice and salt, productive assets such as motorcycles financed through Musharakah Mutanaqisah arrangements, and business capital such as equipment used in small enterprises. By tying financial representation to tangible assets, BangNano seeks to improve purchasing power preservation and reduce speculative volatility.

The third principle, interest-free finance, is implemented through partnership-based structures rather than interest-bearing loans. BangNano does not structure financing as creditor-debtor relationships with guaranteed interest obligations. Instead, it uses forms such as joint ownership (Musyarakah), diminishing partnership (Musyahakah Mutanaqisah), and profit-sharing arrangements (Mudarabah). In such structures, financial return is linked to the performance of the underlying asset or activity rather than a guaranteed interest payment. This shifts the system away from extraction through debt servicing and toward collaboration based on shared economic outcomes.

The fourth principle, resiliency-first design, is implemented by prioritizing stability and household viability over rapid expansion. This is reflected in flexible repayment arrangements, the absence of late payment penalties, and the availability of community support in cases of hardship. Rather than maximize short-term returns through rigid enforcement, the system is designed to preserve long-term participation, reduce financial stress, and sustain trust among members. In practice, this principle helps align BangNano’s operational behavior with the broader goals of resilience, continuity, and community cooperation.

4.4 Transparent Transaction Chains and Public Ledgers

A central design feature of BangNano is the use of transparent transaction chains and public ledgers to create an auditable economic environment. Every transaction within the platform is recorded in a structured digital ledger, and transaction histories are preserved in a traceable format. This allows participants to review past economic activity and verify the movement of assets and funds within the system.

The ledger follows a double-entry bookkeeping convention and records time-stamped transactions, asset references, and participant identifiers. However, BangNano distinguishes between different levels of transparency depending on the nature of the account. For personal accounts, public-facing transaction visibility is anonymized. Transactions remain visible as part of the ledger, but the identities of senders and receivers are not publicly disclosed, similar to how blockchain systems display transaction activity without directly revealing personal identities. By contrast, accounts associated with charities, corporate entities, or activities that require public transparency may choose to make account names visible in the ledger. This allows the system to balance privacy for individuals with transparency for institutions and public-interest activities.

This design supports several practical forms of verification. Members can inspect the ownership structure of assets, view crowdfunding participation pools, monitor asset transfers, and review how funds are allocated. Transparency reduces uncertainty and suspicion by making economic behavior more legible. Instead of relying solely on reputation, participants can rely on verifiable records of activity.

In this sense, transparency functions as a substitute for blind trust in centralized authority. It does not eliminate the need for governance or social trust, but it reduces the space for hidden manipulation, fraud, and opaque financial behavior. This is especially important in a context where mistrust toward institutions and community financial practices is already high. Within the logic of FAIR, transparency directly supports both accountability and resilience.

4.5 Asset Tokenization and Fractional Ownership

BangNano uses asset tokenization to represent real-world assets digitally within the platform. Tokens represent ownership shares in identifiable underlying assets rather than claims on abstract

financial products. The purpose of tokenization is not merely technological convenience, but to enable digital management of real assets while preserving full-reserve backing and traceability.

The system has applied tokenization to assets such as rice, gold, motorcycles, and small business assets. Each tokenized asset corresponds to a real asset held or recognized within the system. Fractional ownership is then used to divide these assets into smaller units, making participation possible even for individuals with limited capital. A motorcycle can be divided into many shares, gold can be represented in micro-units, and rice can be transacted in small measurable quantities. This significantly lowers the barrier to ownership and investment.

Fractional ownership plays an important social and economic role in the system. In many conventional settings, meaningful asset ownership is restricted to participants with relatively high capital. BangNano's structure allows broader participation in wealth preservation and wealth creation by reducing minimum entry thresholds. This aligns with the FAIR principle that economic participation should remain affordable and inclusive rather than restricted to wealthier actors.

To maintain consistency with full-reserve principles, tokens cannot exceed the quantity of the real assets they represent. Asset custody and verification mechanisms are therefore essential. Assets are held by designated trustees or custodians who are accountable for their safekeeping, while the types and quantities of assets are publicly disclosed through the ledger. These controls are intended to prevent the creation of unbacked digital claims and ensure that the digital system remains tied to its physical asset base.

4.6 Community-based Crowdfunding Mechanisms

BangNano's financing activities are organized around community-based crowdfunding mechanisms in which multiple participants pool capital to acquire assets collectively. Rather than relying on a single lender and a single borrower, the system enables members to collaborate as co-funders and co-owners of productive or protective assets. This structure allows collaborative wealth creation while reducing the concentration of financial power in a single institution.

The financing logic is based on risk-sharing rather than lending. Participants who contribute funds become partial owners of the funded asset. Structures such as Musharakah and

Musharakah Mutanaqisah are used to formalize this arrangement. Because investors hold ownership shares rather than loan claims, risk and return are shared among participants.

One of the clearest examples is the motorcycle funding program. In this arrangement, multiple participants contribute funds to a partnership that acquires a motorcycle. The beneficiary then uses the motorcycle and pays rent to the partnership for its use, while also gradually purchasing ownership shares over time. There is no interest charge and no late payment fee. As the beneficiary accumulates shares, the beneficiary's ownership percentage increases, and because rental income is distributed according to ownership percentages, the beneficiary indirectly receives a share of the rental flow as well. This means that as ownership increases, the beneficiary's effective rent burden declines. Over time, the asset transitions from community-funded co-ownership to fuller beneficiary ownership.

This arrangement produces several effects. Investors receive rental income according to their ownership share, beneficiaries gradually acquire a productive asset, and the structure remains more resilient than conventional debt-based financing because it allows space for tolerance and community support if hardship occurs. Instead of a rigid debt contract backed by penalties, the arrangement supports economic participation while preserving social flexibility.

4.7 Built-in Trust, Accountability, and Behavioral Incentives

Because BangNano operates in an environment where trust is a central challenge, the system includes mechanisms intended to strengthen trust, accountability, and cooperative behavior. Participation in the network is invite-only, meaning that members are introduced through existing participants. This creates a baseline social filter and reduces the anonymity that often enables fraudulent behavior. Identity verification is also required before participation, further strengthening the reliability of the network.

Beyond entry controls, BangNano embeds reputational incentives into the platform. Members can establish connections with one another similarly to a social network, and these trust networks can shape future collaboration opportunities. As members interact economically, their behavior becomes visible within the system, and patterns of reliability or misconduct can influence how others engage with them.

One formal mechanism used for this purpose is the “Commitment Score.” This functions in a way analogous to credit scoring, but is designed for a non-riba, non-loan-based environment. Rather than measure borrowing and repayment under interest-based debt, it measures the extent to which participants fulfill financial commitments and honor agreed obligations. The intention is to create a behavior-based indicator of trustworthiness within partnership-based and community-based finance.

The platform also uses technology-assisted behavioral incentives. Transparent records discourage dishonesty by increasing visibility, while digital participation features and gamification elements may reinforce engagement and a sense of belonging. Taken together, these mechanisms are intended to align individual incentives with community well-being rather than short-term personal gain.

4.8 Types of Assets and Financial Activities

BangNano’s economic activities span several types of assets, each serving different functions within the FAIR framework.

The first category consists of wealth-protection assets. These are assets intended primarily to preserve value and protect purchasing power. Examples include gold, silver, rice, salt and other staple or store-of-value commodities. Such assets are intended to help members hedge against inflation and maintain economic stability over time.

The second category consists of income-generating assets. These are assets capable of producing recurring economic returns or enabling livelihoods. Motorcycles and cars funded under Musharakah Mutanaqisah arrangements are a central example, as they can be used productively while gradually shifting ownership to the beneficiary. Other examples include small business equipment and productive tools. These assets are intended not only to preserve value but to generate income and strengthen household or micro-enterprise resilience.

The third category consists of small business partnerships. In these arrangements, members collaboratively provide capital for small enterprises under joint investment and profit-sharing structures. Examples may include small retail businesses or service-based enterprises. The

intended outcomes include entrepreneurial opportunity, broader access to capital, and more distributed ownership of productive business assets.

Together, these categories illustrate that the system is not limited to one function such as savings or lending. Rather, it combines wealth preservation, income generation, and enterprise development within a single community-based economic architecture.

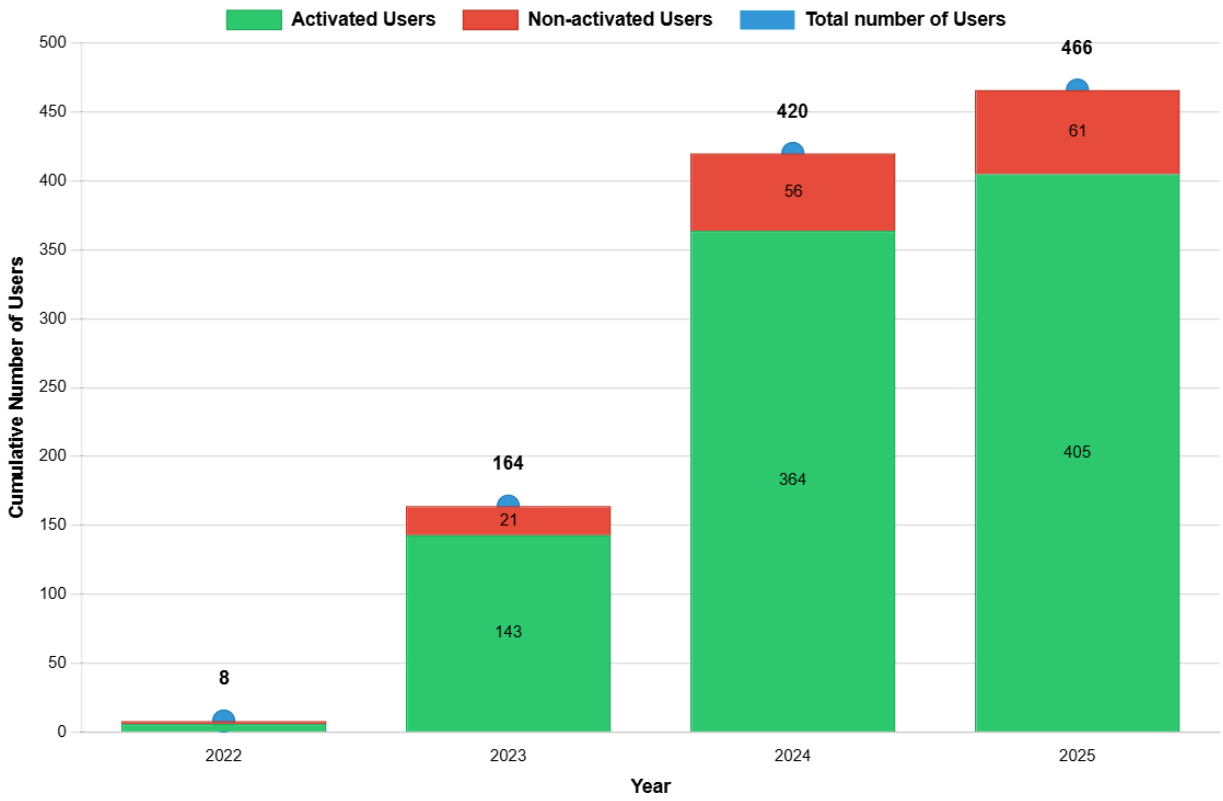
5. Initial Outcomes, Observations, and Implications for the BangNano Ecosystem

5.1 Number of Users

An initial way to understand the BangNano ecosystem is through the size and behavior of its user base. User activity provides an early indication of whether a FAIR-based system is able to attract participation, retain engagement, and build inter-user relationships. At the time of analysis, BangNano's metrics include the total number of registered users, user status and network pattern within the platform.

Figure 1 shows that the number of registered users witnesses a gradual increase from 2022 to 2025, reaching a total of 466 users. The peak increases occur in 2023 and 2024 during which the platform has field staff that are supported financially by the BangNano. Although the number of users still grow in 2025, the growth rate diminishes substantially. The drop in growth rate is thought to be strongly linked to the decrease in financial support to the field staff in 2025. This indicates that the BangNano platform still needs active field staff for the initial engagement with potential users within the community.

Figure 1. Cumulative number of users

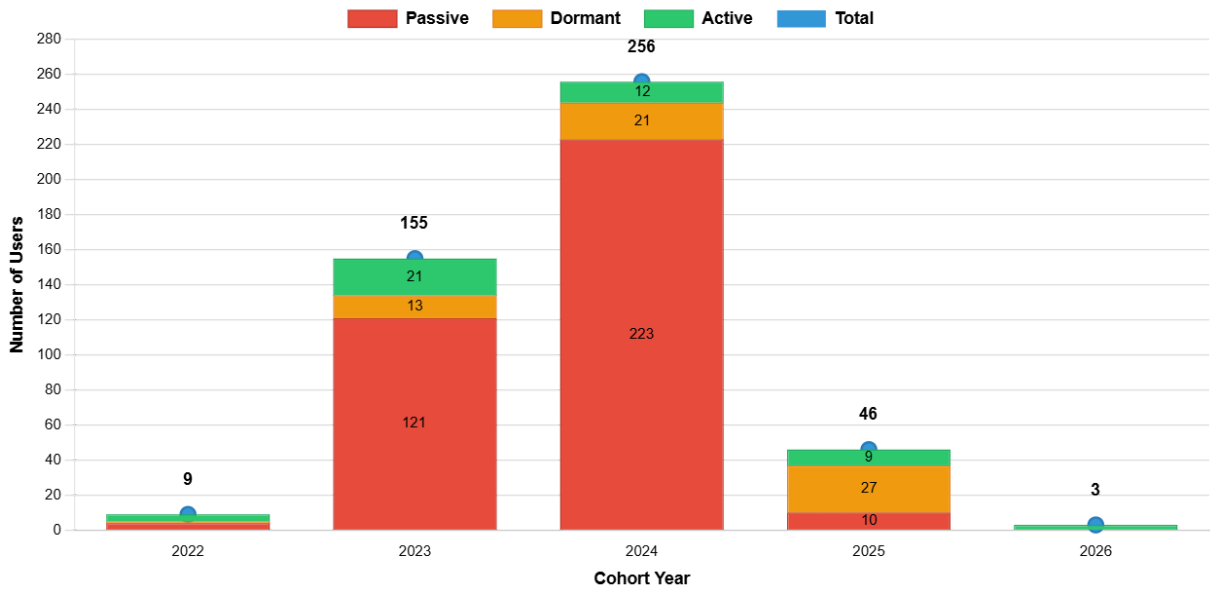


Although registration numbers show the initial attraction to the platform, what is more important is the activation rate among the registered users. The activation of an account indicates that no matter the initial motivation of the user, they find the platform useful after registration and prefer to stay within the BangNano ecosystem. The share of users who activate their accounts is consistently around 87% throughout 2022-2025. This suggests that BangNano is able to meet the initial expectations of the users in general.

Another metric related to the user domain is their activity status. Figure 2 shows passive, dormant and active number of users by year, among activated users. For analytical purposes, i. users with transaction or chat activity within the last 90 days are classified as active, ii. while users with no activity between 90 and 360 days are classified as dormant and iii. users with no activity for more than 365 days are classified as passive. The ratio of active users varies between 5%-20% throughout 2022-2025. Although the ratio of active users appears to be relatively low, the user activity should be interpreted carefully. Some users are actively engaged through chat, transactions, or investment participation, however, dormancy or being passive in communication or transactions does not necessarily imply exit from the ecosystem, since some participants

continue to maintain ownership of assets despite limited recent interaction. This distinction is important because a FAIR-based platform may function not only as a transactional environment but also as a savings and asset-holding environment. When accounted for together, active and dormant users make up around 78% of the total number of users registered and activated in 2025.

Figure 2. Number of users by status



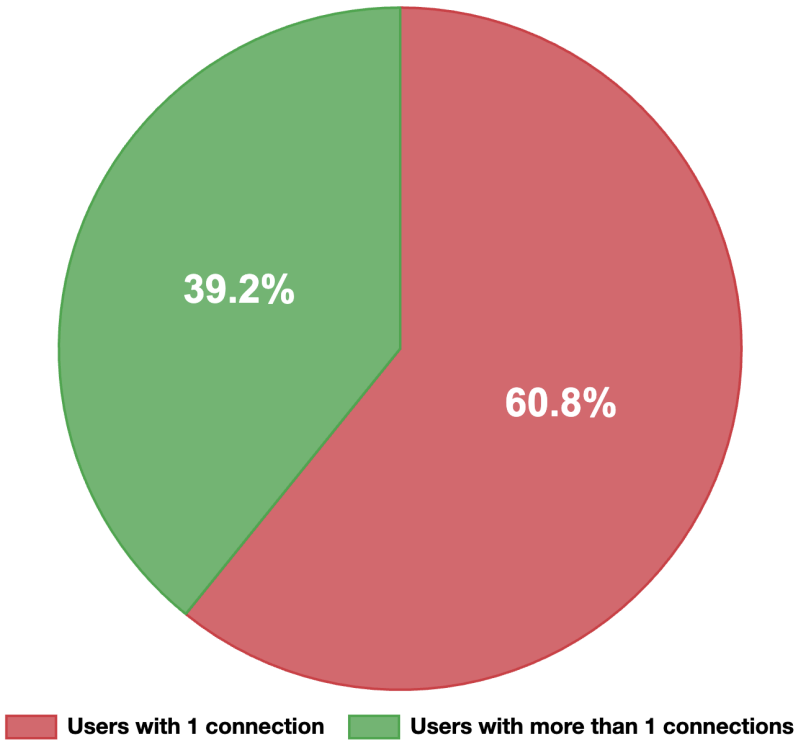
The final user-related metric examines how participants are connected within the BangNano social network. A connection between users is formed when one user sends a connection request and the other accepts it, similar to the friend request mechanism on platforms such as Facebook. However, unlike typical social networks, the motivation for building connections in BangNano is often more closely linked to economic activity rather than purely social interaction.

In particular, having a larger number of connections can signal credibility within the network. This can make it easier for users to engage in economic activities such as asset trading, fundraising, or participating in investment programs. In this sense, connections function not only as social links but also as indicators of trust and reliability.

Since BangNano operates as an invite-only network, every registered user begins with at least one connection. As users become more active within the community, they may form additional connections over time. Therefore, the proportion of users with more than one connection can

serve as an indicator of how active and interconnected the community is. Figure 3 shows approximately 40% of the users have more than one connection indicating that the users have grown their connections after joining. On the other hand, a big proportion of users as 60% have remained to have only one connection.

Figure 3. Distribution of Number of Connections Among Users



Through communication with BangNano field staff, we understood that user motivations appear to be diverse but convergent around dissatisfaction with the conventional riba-based financial system, and preference in more ethical and resilient alternatives. One major group consists of people who wish to leave riba-based financial relationships. In some cases, these participants continue to carry existing interest-based debts and seek a pathway out of them. Their circumstances may be severe, including experiences with debt collectors and aggressive collection practices. For such participants, BangNano represents not only an alternative financial platform but also an attempt to escape a cycle of compounding interest obligation and financial stress. A second group consists of users who have already left riba-based finance but still face practical challenges in managing money. These participants may not want to keep funds in

conventional interest-based banks, yet still require secure and productive ways to store value, invest, or raise funds. For them, BangNano offers an environment in which money can be directed into asset-based and partnership-based arrangements without returning to interest-based institutions. A third group includes organizations or community entities seeking to raise funds transparently. These users may be less motivated by personal finance considerations and more by the ability to conduct fundraising and collective financial activity in a transparent, auditable, and community-oriented way.

The demographic makeup of BangNano members reflect the general population features of Indonesia, where participants come from various ethnicities, but are generally muslim. Notwithstanding, there are also participants from minority non-Muslim groups. One example is a non-Muslim minority member who participated in BangNano as the beneficiary of a motor vehicle funding program and overtime successfully acquired the full ownership of his motor vehicle. This illustrates that participation in FAIR-based programs is not driven solely by religious commitment, but also by practical economic considerations such as fairness, affordability, and access to opportunity. It also reflects BangNano's willingness to support beneficiaries regardless of religion, ethnicity, or financial background.

5.2 Economic Size

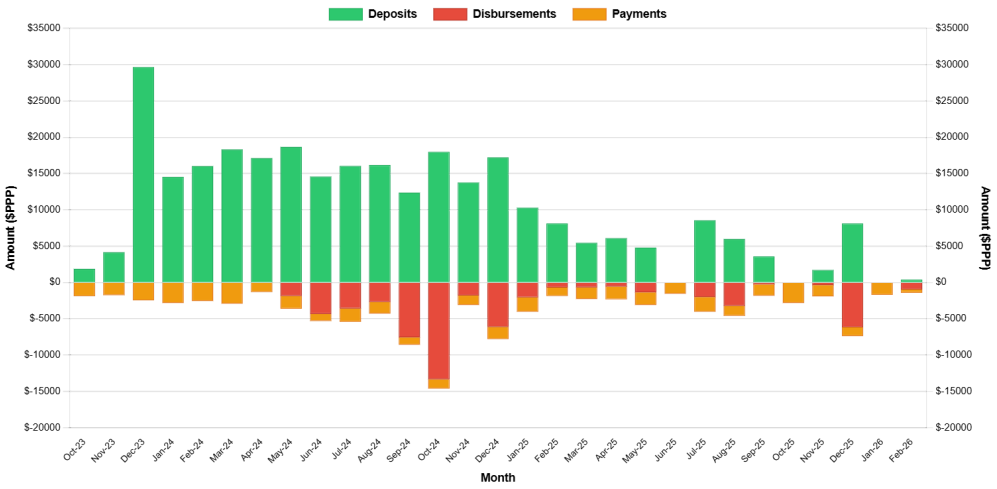
Beyond participation counts, the BangNano ecosystem can also be described in terms of its economic size and transaction activity. Between October 14, 2023 and February 15, 2026, BangNano recorded a combined transaction volume, defined as total deposits plus total withdrawals, of 1.66 billion IDR, equivalent to approximately $350,600 PPP. This indicates that the system has already supported a meaningful level of financial activity despite operating at community scale.

Deposits accounted for 1.1 billion IDR (approx. $233,200 PPP) and were made by 101 unique depositors. The average deposit size was approximately 1.38 million IDR per transaction, or about $291 PPP. These deposits represent the inflow of capital into the system, whether for savings, investment participation, asset purchases, or utility-payment usage.

Withdrawals totaled 557.4 million IDR (approx. $117,400 PPP) and took two main forms. The first category was traditional disbursements to bank accounts, totaling 305 million IDR (approx. $64,300 PPP) across 142 transactions by 38 unique users, with an average disbursement of about 2.15 million IDR or $453 PPP. The second category was payment utility withdrawals, totaling 252.3 million IDR (approx. $53,200 PPP) across 1,654 transactions by 98 unique users. These covered 252 different product types, with an average payment size of approximately 153,000 IDR, or about $32 PPP.

These patterns suggest that BangNano functions not only as an investment and funding platform but also as a practical financial utility system. Traditional disbursements reflect the need for participants to move capital out of the ecosystem into conventional financial rails when necessary, while utility payments reflect day-to-day usage and convenience. The relatively high number of utility transactions, despite their smaller average value, suggests that participants are willing to use BangNano for frequent practical purposes rather than only for large occasional transfers.

Figure 4. Deposits and Withdrawals in Time



Monthly deposits, traditional disbursements, and utility payments from October 2023 to February 2026 depicted in Figure 4 provide additional insight into system behavior. Deposit activity shows a notable negative change beginning around the end of 2024, when a third-party fin-tech partner became non-compliant and caused the BangNano system to disable the real-time

Bank withdrawals, and introduced a 24-hour withdrawal process. This created an instant liquidity inconvenience for users and appears to have reduced average monthly deposit activity. Although users retained the option to withdraw through e-wallet channels in smaller amounts, doing so required additional steps and more transactions, making the process less convenient. This suggests that even in an alternative economic system, liquidity frictions in the surrounding financial infrastructure can materially affect user behavior.

Traditional disbursement patterns also exhibit variation over time. Disbursement levels were particularly elevated between May 2024 and January 2025, with a peak in the fourth quarter of 2024. This appears to be associated with the motor vehicle program, during which assets such as motorcycles were acquired, producing significant outflows from pooled funds. In this sense, rising disbursements do not necessarily indicate instability, but may instead reflect active deployment of community capital into productive assets.

By contrast, utility-payment volumes remained comparatively stable over time. This consistency suggests that BangNano offers practical value as a payment rail, especially where transaction processing fees are substantially lower than competing options. BangNano's payment costs are more than 50 percent cheaper in some cases, which is particularly relevant for financially disadvantaged users who are sensitive to small transaction fees. In this sense, utility-payment usage connects directly to the resiliency dimension of FAIR, as lower transaction costs can improve day-to-day financial resilience among lower-income participants.

5.3 Trade

Trade is another important metric that reflects the scale at which the BangNano economy operates at an aggregate level. Beyond deposits and withdrawals, trade between users demonstrates how assets circulate within the system and how participants interact economically with one another.

Trade takes place within the "asset exchange" section of the BangNano application, where users can buy or sell assets directly. It is important to note that barter-based exchanges are restricted by the Indonesian currency protection laws. Under Law No. 7 of 2011 on Currency, transactions must be conducted in Indonesian Rupiah (IDR). As a result, all trades within the platform are

denominated in IDR. In practical terms, this means that users can only buy assets using IDR or sell assets in exchange for IDR, rather than directly exchanging one asset for another.

The asset exchange system operates through two main mechanisms: instant exchange and peer-to-peer exchange. The first mechanism, referred to as “Instant Exchange,” is facilitated through an internal component known as the “instant facilitation pool.” This pool contains a limited reserve of commonly traded assets, including IDR, and is designed to provide immediate liquidity. When sufficient assets are available in this pool, user orders can be fulfilled instantly without requiring another user to take the opposite side of the trade.

The second mechanism is “Peer-to-Peer Exchange,” which occurs directly between BangNano users. In this case, one or more users participate in fulfilling a trade order. Unlike instant exchange, this process may involve multiple participants and may require some time for the order to be fully completed.

The exchange process begins when a user creates an order to buy or sell a specific asset. The system first checks whether the instant facilitation pool can fulfill the order. If the pool has sufficient assets, whether IDR for sell orders or the requested asset for buy orders, the transaction is completed immediately as an instant exchange.

If the instant facilitation pool is unable to fully satisfy the order, it may still partially fulfill it. The remaining portion of the order is then made available to other users in the network. Notifications are sent to relevant participants, who can choose to fulfill the order either partially or in full. When other users step in to complete the transaction, this is classified as a peer-to-peer exchange.

Through this hybrid structure, the BangNano system balances immediacy and community participation. The instant facilitation pool ensures a baseline level of liquidity and convenience, while peer-to-peer exchange enables broader user involvement and supports the circulation of assets within the ecosystem.

Analysis of trade activity within the BangNano ecosystem reveals several important patterns regarding user behavior, asset preference, and economic function, which are summarized in Table 1.

In total, the BangNano asset exchange records 2,779 trade orders with an aggregate trade value of 497 million IDR, equivalent to approximately $104,685 PPP. The average trade value per order is 178,820 IDR, or about $37 PPP. These totals indicate that trade activity within BangNano represents a meaningful level of internal economic circulation at the community scale given the total BangNano user base are approximately 400 people at the time of this research.

First, trade volume is highly concentrated in a small number of asset categories. Motor vehicles (MV) account for the largest share of total trade volume at 47.1%, followed by gold (AUR) at 35.2%. Together, these two categories represent more than 80% of total trade activity, indicating that users primarily engage with assets that are either income-generating (motor vehicles) or serve as stores of value (gold). This suggests that participants are using the system both for wealth creation and wealth preservation, which are elaborated in next sub-sections.

Second, staple and consumable goods such as rice (BR1) and cooking oil (MG1) also contribute meaningfully to trade, accounting for approximately 8% of total trade volume combined. Although smaller in share compared to motor vehicles and gold, their presence indicates that BangNano is not limited to investment-type assets, but also supports everyday economic needs. This reflects the system's integration into practical, daily consumption and reinforces its role as a functioning economic environment rather than a purely financial platform.

Third, silver (AGG), while representing a smaller number of transactions, shows a relatively high average value per order. This suggests that certain users engage in higher-value trades using precious metals beyond gold, possibly for diversification or longer-term savings strategies.

Fourth, the relatively large number of motor vehicle transactions combined with a lower average value per order indicates that this asset class is both widely accessible and frequently traded. This aligns with the fact that motor vehicles are central to economic activity in Indonesia and serve as productive assets that enable income generation.

Fifth, smaller categories such as small business investments (UK), pooled motor vehicle investments (SSMV), waqf, and donations represent a minor share of total trade volume but highlight the diversity of economic activities within the system. These categories show that

BangNano supports not only trade and investment, but also social and charitable financial interactions, even if these are currently limited in scale.

Overall, the distribution of trade activity suggests that BangNano operates as a hybrid economic system where users engage in multiple functions simultaneously. These include income generation through productive assets, value preservation through precious metals and commodities, and everyday consumption through staple goods. The concentration of trade in real, tangible assets further reinforces the role of asset-based value anchoring within the FAIR framework.

Table 1. Trading assets, associated orders and values

Rank	Asset	Orders	Fulfilled (IDR)	Fulfilled (PPP$)	IDR per Order	PPP$ per Order	% of Total Trade Volume
1	MV (motor vehicle)	1,549	233,956,162	$49,285	151,037	$32	47.1%
2	AUR (gold)	788	174,937,653	$36,852	222,002	$47	35.2%
3	AGG (silver granule)	81	33,820,157	$7,125	417,533	$88	6.8%
4	BR1 (rice)	213	30,003,260	$6,320	140,860	$30	6.0%
5	MG1 (cooking oil)	82	9,801,132	$2,065	119,526	$25	2.0%
6	SSMV (MV pool)	5	9,198,466	$1,938	1,839,693	$388	1.9%

Rank	Asset	Orders	Fulfilled (IDR)	Fulfilled (PPP$)	IDR per Order	PPP$ per Order	% of Total Trade Volume
7	UK (small biz)	15	5,030,334	$1,060	335,356	$71	1.0%
8	W1 (waqf)	22	120,010	$25	5,455	$1	0.02%
9	D1 (donation)	12	60,012	$13	5,001	$1	0.01%
10	KR1 (kurma/dates)	10	15,001	$3	1,500	$0	<0.01%
11	MDB1 (mudarabah)	1	200	$0	200	$0	<0.01%
12	MD1 (honey)	1	0	$0	0	$0	0.00%
Total		2,779	496,942,387	$104,685	178,820	$37	100%

5.4 Wealth Preservation

One of the intended functions of the FAIR framework is to support wealth preservation through asset-based value anchoring. In BangNano, this can be observed most clearly through the ownership of precious metals and staple commodities, which provide alternatives to holding value solely in fiat currency.

BangNano applies an important design choice: there is no spread between the buy and sell price within the system. BangNano does not seek to generate profit from members who are trading

assets, such as gold and silver. Instead, the objective is to keep precious metals affordable, accessible, and usable as community savings instruments. This design reduces the fear of immediate loss from entering or exiting a position and encourages members to buy and sell within the community when needed. In practical terms, it lowers the friction that often discourages lower-income users from holding precious metals for savings.

This feature has important implications for purchasing power preservation. Because assets are tokenized and can be owned fractionally, users are able to participate in asset ownership even when conventional markets impose minimum entry thresholds. Someone who cannot afford to buy a full gram of gold in the open market can still accumulate gold gradually through fractional units. As an example, in respect to Gold, BangNano operates at micrograms (one-millionth), in comparison, the smallest unit of physical Gold available in the market is 1/10th of a gram. This widens access to inflation protection and long-term savings.

Fractional asset access also helps reduce missed opportunities caused by price movements. In conventional settings, a person may intend to buy gold or silver but be unable to afford the minimum tradable quantity at the moment the opportunity arises. By the time sufficient funds are accumulated, the price may have moved unfavorably. BangNano's ability to facilitate purchase and sale at very small amounts allows members to capture timely opportunities without waiting to meet conventional market thresholds. In this way, wealth anchoring in BangNano is not only about inflation protection, but also about improving accessibility to asset ownership at the moment users are financially able to participate.

One illustrative example involves a participant who accumulated fractional gold holdings over time and later forgot the total amount owned. When this participant eventually needed liquidity one year later, he realized that the value of his gold had appreciated in Indonesian rupiah terms and sold it for cash. The significance of this example lies not merely in the appreciation itself, but in the fact that fractional access made the investment possible in the first place. Without fractional ownership, the participant may not have been able to enter the gold market at all because of minimum purchase requirements.

BangNano also broadens the range of assets available for value protection. In conventional retail investing, lower-income individuals often have limited access to inflation-protecting assets

beyond whatever savings products are available through banks, and may not be able to participate meaningfully in stocks, metals, or other markets. BangNano extends the options to include not only precious metals, but also assets tied to household needs and daily life, such as rice, cooking oil, and salt. This is significant because it allows wealth preservation to occur in forms that are directly relevant to everyday consumption. In effect, participants who cannot invest in conventional markets may still store value in the very goods they expect to consume in the future.

5.5 Wealth Creation

In addition to wealth preservation, BangNano seeks to support wealth creation for both beneficiaries and investors, most prominently through its motor vehicle financing program, called MVs. This program is particularly relevant in the Indonesian context, where motorcycles are widely used for transport, work, and daily life. Motorcycles are relatively affordable compared to cars, are deeply embedded in the country's transportation culture, and serve as practical productive assets for millions of people. With more than 125 million motorcycles in Indonesia, they function in many ways as basic economic tools rather than luxury goods.

BangNano's motor vehicle program provides a mechanism for wealth creation through crowd-funded partnership structures used to acquire motorcycles and cars for community transportation needs. The program is based on Musyarakah Mutanaqisah (MMQ), a diminishing partnership arrangement in which investors and beneficiaries initially co-own the vehicle, and ownership gradually transfers to the beneficiary through payments over time. This form of partnership arrangement, i.e. MMQ is specifically preferred in line with the resiliency principle of the FAIR economic framework, so that the beneficiaries eventually graduate to become investors themselves.

Within BangNano, members may invest either in individual MV programs or in pooled MV fund called SSMV in order to diversify risk across multiple vehicles. BangNano's aim is to design pathways in order for beneficiaries to gradually become investors, once their economic situations improve. Due to BangNano allowing fractional ownership of assets, it allows for a lower barrier to entry for anyone to become investors.

For beneficiaries, the program offers several economic and practical benefits. On the monetary side, ownership or use of a motorcycle may enable income generation, for example through ride-hailing or delivery work, while also reducing reliance on buses, taxis, or informal transport. BangNano's approach is especially relevant for those in the informal sector who may be excluded from formal financing channels. The program therefore functions as both a livelihood enabler and a financing alternative. The absence of riba is also significant for many participants, both ethically and financially, and the program may function as a last viable option for some poorer households who have limited access to fair financing.

There are also non-monetary benefits. A motorcycle can improve daily mobility for taking children to school, shopping for household needs, and accessing work opportunities. These quality-of-life benefits are important, especially where public transport options are limited or unreliable.

A key distinction between BangNano and conventional riba-based vehicle financing is the treatment of late payment and hardship. BangNano intentionally does not impose late-payment penalties. The logic is that individuals who are already financially distressed should not be burdened further by monetary penalties. Instead, BangNano relies on social, reputational, and emotional incentives. One such mechanism is the "Commitment Score," which includes both positive and negative points. Participants receive positive points when they fulfill commitments on time and negative points when they are late. The two values combine to produce a final score that reflects the participant's track record of honoring obligations. This mechanism acts as a non-financial form of discipline and trust signaling.

Where hardship arises, respite may be granted rather than immediate punishment. Unlike conventional lenders, BangNano does not rely on aggressive debt enforcement or terrorizing collection practices. This matters because conventional debt distress often worsens through penalties, compounding interest, and coercive collection methods. Such conditions may push households to refinance under unfavorable terms, take on additional debt, or, in more severe cases, lead to criminal behavior or extreme psychological distress. BangNano's enforcement logic is therefore intentionally non-financial. Shame, reputation, and the risk of weakening one's standing within a reference-based community serve as the main disciplinary tools. In a system

where members are socially connected, this may be a more effective and more humane mechanism than impersonal monetary penalties.

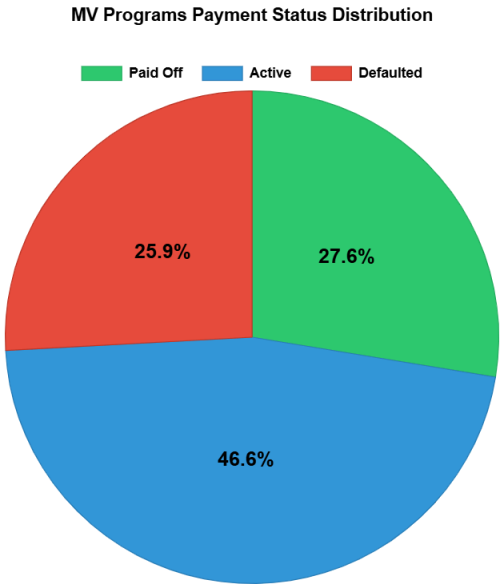
From the perspective of debt-trap avoidance, this design appears significant. By eliminating interest, late fees, and compounding penalties, BangNano reduces the mechanisms through which financial hardship becomes self-reinforcing. Beneficiaries who fall behind are not automatically pushed into a deeper spiral of debt. Instead, the system creates room for recovery and re-entry into good standing once their financial condition improves.

In some cases, this flexibility is complemented by voluntary actions from participants that further reinforce the system's resilience and social foundation. For example, there have been instances where investors chose to forgive outstanding obligations, effectively gifting the asset, such as a motorcycle, to a beneficiary in dire financial need. In another case, a beneficiary who lost their job for an extended period was granted a prolonged respite, allowing them to pause payments without penalty until they were able to recover financially. These examples illustrate how the system not only avoids debt traps structurally, but also creates space for compassion-driven outcomes that are difficult to achieve in conventional financial systems.

The scale and performance of the motor vehicle program provide additional insight. Over more than three years, BangNano operated 59 MV programs, consisting of 53 motorcycles and 6 cars. The cumulative number of MV programs depicted in Figure 5 shows the gradual expansion and composition of the programs. In terms of payment status shown in Figure 6, 16 programs (27.6%) are fully paid off, 27 programs (46.6%) are active with payments made within the last 90 days, 15 programs (25.9%) are defaulted with no payment for more than 90 days, and 1 program (1.7 percent) is too new to have payment history, as of February, 2026.

Figure 5. Number of MV programs by year

Figure 6. MV programs by payment status



In financial terms, the total value of assets funded through the program reached 378.1 million IDR (approximately $79,650 PPP). Over three years, investor returns totaled 114.1 million IDR (approximately $24,000 PPP), representing 30.18 percent ROI, or roughly 10 percent annualized. To put these numbers into perspective, an average MV funded motorcycle costs 5 million IDR ($1000 PPP).

BangNano also launched the Simpanan Sukarela MV (SSMV) pooled investment structure on January 21, 2025. SSMV is a managed fund that allows investors to hold indirect ownership across many motor vehicle programs rather than investing in a single asset. Functionally, this resembles a mutual-fund logic, though within a FAIR-aligned, community-based structure. The main advantages are liquidity, broader risk diversification, and much smaller entry size. Since 1 SSMV unit equals 1 IDR, even users with very limited capital can participate in pooled ownership of productive assets. For investors, this offers a return profile similar to individual motor vehicle programs, but with risk distributed across multiple assets.

Initial SSMV findings are encouraging. The pool covered 38 motor vehicle programs, thereby diversifying risk across many underlying assets. A total of 79.0 million SSMV tokens ($15,800 PPP) were issued by the pool, consisting of 61.0 million from deposits ($12,200 PPP) and 18.0 million from profits ($3,600 PPP). Total system-wide investor holdings stood at 167.1 million SSMV (approximately $35,200 PPP). Over 390 days, the pool generated a 12.24 percent profit yield, or roughly 11.5 percent annualized, broadly consistent with returns from individual vehicle programs. The pool also held 22.2 million IDR ($4,420 PPP) available for reinvestment in new motor vehicle programs and maintained a 5.6 million SSMV treasury reserve (equivalent to $1,120 PPP) for investor buybacks. These figures suggest that the pooled structure improves flexibility and accessibility while preserving the basic wealth-creation logic of the underlying asset model.

Taken together, the motor vehicle programs show that BangNano’s FAIR-based structures can support both wealth creation and livelihood generation at the community level. BangNano’s inclusive and community-oriented approach produces a more humane and potentially more resilient form of economic participation than conventional debt-based alternatives.

6. Discussion, Implications, and Conclusion

This paper introduced the FAIR framework, built on full-reserve financial structure, asset-based value, interest-free finance, and a focus on long-term resilience. It also showed how these principles can be implemented in practice through BangNano, a community-based system in Indonesia.

The findings provide early evidence that such an approach can support greater financial stability, transparency, and accessibility, particularly for those underserved by conventional systems. While the results are still preliminary, they demonstrate that these principles can function in real-world settings.

Rather than positioning itself against existing systems, FAIR is designed to complement them by addressing gaps in trust, access, and fairness. As the model continues to evolve, it may offer practical insights into how financial systems can better support inclusive and resilient economic activity.

The paper invites further study, testing, and collaboration across research, industry, and policy communities. This study offers early evidence that rethinking economic systems around real assets, shared risk, and transparency can lead to more stable and inclusive outcomes.

The BangNano case provides early descriptive evidence of how FAIR principles operate in practice within a real-world setting. While the system is still at an early stage, the observed patterns offer useful insights into how its core design principles translate into actual economic behavior.

Several key observations emerge. First, by ensuring that all financial claims are fully backed by real assets, the system avoids creating excess or hidden financial claims, which helps reduce the risk of instability. Second, because value is stored in real assets such as commodities and productive goods, users are better able to preserve their purchasing power over time, particularly in inflationary environments. Third, instead of relying on strict penalties, the system allows flexibility and support when participants face financial difficulties, which changes how financial stress is experienced and managed. Finally, trust within the system is built through visibility of transactions and verifiable records, rather than relying primarily on centralized institutions.

Resilience within the system can be observed in several ways. User participation remained relatively stable even when withdrawal convenience was temporarily reduced, suggesting that users value the system beyond immediate liquidity. Repayment behavior also shows signs of recovery without the need for punitive enforcement, indicating that flexible and community-based mechanisms can support financial continuity. In addition, the consistent use of

utility payments over time suggests that the system is integrated into everyday economic activity, rather than being used only for occasional or speculative purposes.

When compared to conventional debt-based financial systems, the FAIR approach differs in several structural ways. In conventional finance, risk is largely carried by the borrower, while lenders receive fixed returns regardless of the outcome of the underlying activity. Financial stress is typically addressed through penalties, enforcement mechanisms, and legal action. By contrast, in the FAIR approach, risk is shared among participants, and returns depend on the actual performance of the asset or activity. When financial difficulties arise, the system allows for flexibility and community-based support rather than relying on financial penalties.

Compared to existing Islamic finance implementations, the FAIR framework also introduces important distinctions. While many Islamic financial models aim to avoid interest, they often still operate within fractional reserve systems and may rely on structures that resemble debt in practice. The FAIR framework differs by enforcing full-reserve rules, ensuring that all financial claims are backed by real assets, and by focusing on system-level design rather than only contract-level compliance. In addition, it integrates digital transparency and asset tokenization as core components to support trust and participation.

The key distinction, therefore, is not only in the types of financial contracts used, but in how the entire economic system is structured and operated. FAIR represents a shift from modifying financial products within an existing system to rethinking the underlying structure of financial relationships and asset ownership.

The BangNano case provides several insights for the development of inclusive and digital Islamic finance. It shows that FAIR principles can be implemented in practice, with community-scale deployment serving as a controlled environment for validation and as a foundation for potential expansion to larger economic systems.

It also demonstrates the role of digital infrastructure in enabling more transparent and participatory financial systems. By making transactions visible and verifiable, digital platforms can help reduce uncertainty, improve accountability, and lower barriers to participation.

For practitioners, the findings suggest that alternative models like FAIR can expand access to financial participation. Individuals are able to own real assets even with small amounts of capital, access funding without relying on interest-based loans, and participate in community-based investment opportunities. These features are particularly relevant for underserved populations that are often excluded from conventional financial systems.

For policymakers, the case highlights that cooperative and member-based structures can provide a practical and legally compliant pathway for supporting alternative financial models within existing regulatory frameworks.

This study has several limitations that should be acknowledged. The current implementation of BangNano operates at a community scale, which means the findings may not fully reflect how the system would behave at a larger or national level. However, it serves as an important initial real-world validation of the model.

The findings suggest that FAIR may offer improved resilience and inclusivity, but further validation is required to assess its performance across different contexts and scales. In addition, the observation period is relatively short, and long-term behavior, stability, and sustainability of the system are not yet fully known.

Finally, some parts of the system still depend on external infrastructure, such as payment and withdrawal channels. These external dependencies can influence user behavior and overall system performance, and may limit the ability to fully isolate the effects of the FAIR design itself.

Future research can build on these findings in several directions. One important area is the development of quantitative models to better understand how FAIR operates compared to debt-based systems. This may include simulation-based approaches and stress-testing under different economic conditions, such as financial crises or liquidity shocks.

Further studies can also examine how the model performs in different settings, including rural or isolated communities, underserved populations, and informal sectors. Expanding the range of contexts will help assess the adaptability and robustness of the framework across diverse economic environments.

From a policy perspective, additional work is needed to understand how FAIR-based systems can integrate with existing national financial systems and operate within current regulatory frameworks. Policymakers may explore cooperative-based structures and regulatory sandboxes as ways to support experimentation while maintaining oversight.

In terms of scaling, FAIR is designed to complement existing financial systems and work alongside them. It can develop gradually through community-based initiatives, digital platforms, and collaboration with existing stakeholders. Over time, as the model is tested and refined, it may contribute to improvements in how financial systems support resilience, inclusion, and transparency.

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