

RWA 2024:

Beyond Speculation: The Rise of Real-World Asset Tokenization

November 2024



Authors' Preface



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At the end of 2023, we wrote a research report on Real World Assets (RWA). At that time, the primary market participants were still Web3 natives, with little institutional involvement. However, 2024 marked a turning point, as global tier-one institutions like BlackRock, UBS and Franklin Templeton entered the market. As industry practitioners, we have seen firsthand how competition has intensified, and how two forces, Web3 native and Web2, are starting to converge.

This convergence is also a reflection of the gradual integration of Web2 and Web3, with increasing diversity and frequency in the exchange of data, capital, and human resources. As the regulatory landscape for the crypto market continues to evolve, bringing it back to the core principles of finance, we believe that RWA will be a key direction for future development. Through faster settlement systems, more transparent markets, and collaborative databases, blockchain technology will ultimately become mainstream, enhancing the efficiency of capital markets and delivering tangible value to the real world.



Louis Wan,

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Innovations in technologies like Distributed Ledger Technology (DLT) and tokenization are poised to significantly enhance the efficiency of today's financial systems. These advancements promise not only to streamline transaction processes but also to enable new forms of financial interaction that are more transparent, inclusive, and secure. By reducing the reliance on intermediaries, speeding up settlement times, and embedding compliance measures through programmability, such technologies present the potential to reshape the foundations of the financial industry.

Today, we are witnessing an unprecedented level of public-private collaboration. It is evident that the driving force behind Real-World Asset (RWA) tokenization is no longer just Web3 industry participants, but also governments, central banks, financial institutions, and international organizations working together. Ample FinTech is fortunate to be collaborating with multiple central banks in exploring the real-world application of tokenized money. Ample FinTech will continue to explore practical solutions based on digital currency and smart contract applications, aiming to bring the inclusive value of programmable payments and finance to more people.

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About DigiFT

DigiFT is Asia's first regulatory-compliant exchange for on-chain real-world assets to be licensed by the Monetary Authority of Singapore as a Recognised Market Operator and Capital Markets Services provider. DigiFT enables asset owners, particularly financial institutions, to issue blockchain-based security tokens that investors can trade with continuous liquidity using an Automated Market Maker (AMM).

Established in Singapore in 2021, DigiFT is dedicated to meeting regulatory requirements in the markets it operates in, while delivering innovative yet responsible financial solutions that push the boundaries of financial services.

DigiFT's founding team consists of seasoned executives who have held senior positions at Citi, Standard Chartered Bank, Morgan Stanley, and the Shenzhen Stock Exchange. Their combined expertise spans both traditional and decentralized finance, demonstrating proven track records in the digital assets space.

About Ample Fintech

Ample FinTech is a Singapore-based financial technology company focused on developing enterprise Web3 payment and tokenization solutions. Ample FinTech is committed to enhancing the inclusivity and sustainability of global financial services by simplifying global corporate payment processes, improving accessibility and transaction efficiency for global payments, and unlocking potential economic value for businesses and individuals.

Since its establishment, the Ample FinTech has successfully completed two pilot projects related to CBDC, stablecoin, digital credentials, and tokenization through collaboration with three central banks. Additionally, the Ample FinTech team has received FSTI IA grant from the Monetary Authority of Singapore (MAS) in 2024 for its groundbreaking work in digital credentials and programmable payments.

Acknowledgements

Special thanks for the contribution and support from Kenneth Lim, Marko Quintero, Weiling Lee, Adimas Yosia Prasetyo and Ivy Huang. This research won't be so comprehensive without them.

Executive Summary

1. In recent months, the tokenization space has moved beyond proof-of-concept (PoC) and entered commercialization, with leading financial institutions paving the way.
2. While regulation for the global tokenization market remains unclear, major financial centres are developing more comprehensive frameworks, and some are becoming more welcoming to tokenization efforts.
3. This year, financial institutions like BlackRock, UBS, and Franklin Templeton have launched tokenization projects on public blockchains, competing with Web3-native initiatives.
4. Market opportunities, infrastructure maturity, and licensing for innovative startups are key enablers for institutional adoption of public blockchains.
5. Private sector financial institutions are leading in asset tokenization, while in currency tokenization, there is increasing coordination between private and public sectors.
6. With the increasing demand for cross-border payments, global economies have realized the inefficiencies of existing cross-border payment systems. High costs, low speed, and lack of transparency are increasingly becoming challenges that need urgent resolution. The G20 has developed a roadmap for cross-border payments to enhance the efficiency, transparency, and accessibility of payment systems. Currency tokenization has become one of the key routes to improve payment efficiency and cost.
7. The tokenization of currency not only brings cost reduction and efficiency improvements to payment systems but also achieves programmability and automation through smart contracts. This technology can provide more innovative, transparent, and faster solutions for complex financial transactions, with the global public sector undertaking related projects on a large scale.

Introduction: Moving beyond speculation

Finance is built on trust, trust for infrastructure, trust for companies, trust for people. The emergence of cryptocurrencies and blockchain technologies is to build a financial world with more efficiency and transparency, with the underlying infrastructure as a global trusted ledger. If we go back to the initial design of Bitcoin, it was targeted to build a peer-to-peer payment system. For Ethereum, it is targeted to be a smart contract platform for decentralized applications.

Bitcoin^[1]:

- Focuses on creating a decentralized digital currency for secure, low-cost peer-to-peer transactions.
- Aims to disintermediate financial intermediaries, promote financial inclusion, and establish a trustless financial system.

Ethereum^[2]:

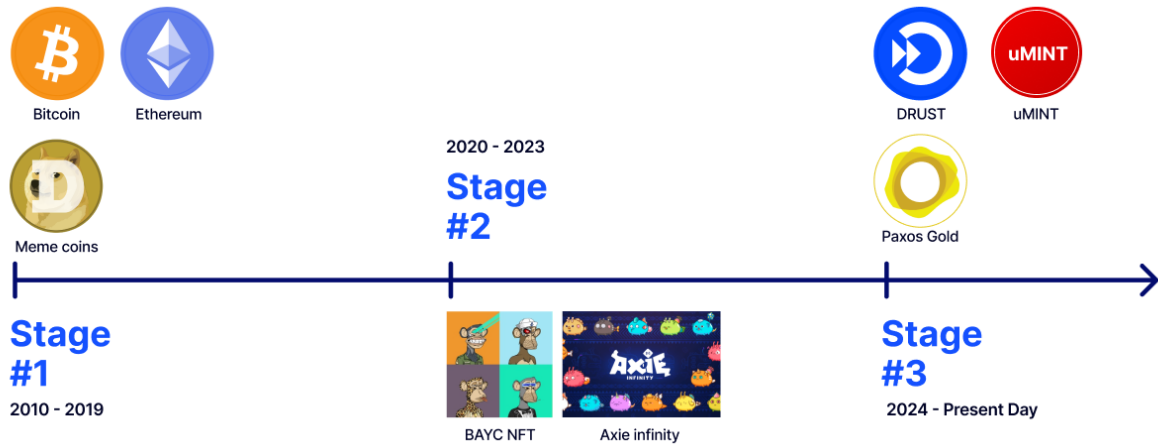
- Expands blockchain use to smart contracts and decentralized applications.
- Aims to revolutionize financial systems with programmable money, tokenization of assets, and decentralized finance (DeFi), enabling automated, transparent, and secure financial transactions and services.

Both Bitcoin and Ethereum leverage blockchain technology to improve traditional financial systems, promoting decentralization, transparency, and efficiency.

In the past few years, the native cryptocurrency market has developed rapidly, undergoing various concept cycles such as ICOs, DeFi, NFTs, and GameFi. The main innovations have centred around asset issuance and trading models, without making a large-scale impact on the real-world. As the market grows, purely relying on crypto native assets definitely cannot satisfy investors. Additionally, the advantages of the new financial technologies enable various use cases for innovators to explore, down the road. We can clearly classify digital assets powered by this technology into three stages:

- **Stage one, crypto native assets, 2010 - 2019:** Examples include DeFi tokens, meme coins, and native token of blockchains. Those assets are natively issued and traded on public blockchain, enjoying all the pros and cons of blockchain technologies.
- **Stage two, digital native assets, 2020 - 2023:** Examples include NFTs and GameFi tokens. Those assets are connected to digital services or applications.

- **Stage three, Digital twin, 2024 - now:** refer to Real world assets, assets entitlements represented by ledger entries on the blockchain, examples include gold tokens and US treasury bill tokens. In this stage, tokens are a representation and data entry on the public blockchain-powered ledger and are linked to off-chain entities or assets, to have faster settlement, real-time transparency and process automations on the ledger.



In the first two stages, web3 was more like a casino, where hot money flowed into the market, as we've seen pump and downs like meme coins. Adoption of Web3 needs to move beyond casinos, and it's important to distinguish between "cryptocurrency" and "blockchain technology", and as we are moving into stage three, we are facing challenges from unclear legal and regulatory environments, instead of tech issues, to drive and attract the real world moving into web3 era.

The traditional financial market has significant room for improvement and innovation, which can be achieved through crypto and blockchain technologies. For instance, according to estimates by the Bank for International Settlements (BIS)^[3], between 2003 and 2020, participants in the U.S. Fedwire Funds Transfer System used an average of \$630 billion of intraday liquidity daily, with a peak of approximately \$1 trillion. In the Euro system, the daily average and peak values of intraday liquidity were \$443 billion and \$800 billion, respectively. Across nine jurisdictions in the sample and over a 17-year period, participants used an average of 15% of aggregate daily payment values or 2.8% of GDP to meet their intraday liquidity needs. These large numbers underscore the critical role intraday liquidity plays in maintaining financial stability. The costs associated with providing this liquidity—approximately \$600 million annually—are incurred to meet the demands of real-time payments, manage timing mismatches, reduce settlement risks, and comply with regulatory

requirements. The reason for such arrangement is mainly the inefficiency of widely used clearing and settlement infrastructure which takes days for a simple transaction.

Blockchain-based clearing and settlement systems can make the settlement time to T+0 ^[4] or even real time to significantly reduce the demand for intraday liquidity and mitigate settlement risks.

In the year of 2024, we saw more institutional players joining the field, not only doing PoC but toward more commercialization. In terms of adoption of blockchain technologies and tokenization, there's two major realms: tokenization of currencies and tokenization of assets.

In terms of asset tokenization, several milestones happened in the year of 2024. Mainstream financial institutions have made major progress in the public blockchain area. From their perspective, they are purely focused on blockchain technology as a new and innovative ledger for ownership recording and reconciliation.

In terms of currency tokenization, we saw not only the stablecoins adoption in the crypto market, but also other meaningful use cases are being explored, examples include purpose-bounded money and programmable money.

This report focuses on mainstream financial institutions' exploration, adoption, and application of blockchain technology, particularly public blockchains and DeFi, and splits into two parts: assets tokenization and currencies tokenization. The cases mentioned are mostly in the initial stages, but we can clearly see how institutions are distinguishing between cryptocurrencies and blockchain technology, and the emerging trends and pathways for applying these technologies.

Why choose tokenization on Permissionless Blockchain

In the rapidly evolving landscape of digital technology, permissionless blockchains have emerged as a revolutionary concept, challenging traditional notions of centralized systems and paving the way for a new era of decentralized applications. At its core, a permissionless blockchain is a distributed ledger technology that allows anyone to participate in the network without needing approval from a central authority. The most well-known examples of permissionless blockchains are Bitcoin and Ethereum, which have captured the imagination of technologists, investors, and visionaries worldwide.

The key features that define permissionless blockchains are their open access and decentralized nature. These characteristics set them apart from traditional centralized systems and even permissioned blockchains, where participation is restricted to approved entities.

When we talk about permissionless blockchain, people might think about cryptocurrencies, which is one use case of permissionless blockchain, along with DeFi applications. In essence, permissionless blockchain is an open, shared database where we can use the technologies to achieve efficiency. Mainstream financial institutions already realize that cryptocurrencies can be settled within minutes in an atomic manner, and it's highly likely that such kinds of features can also be applied to other assets that can be represented in a token way. Some of the benefits we can achieve with such kind of technologies are:

- **Higher liquidity and faster settlement**
 - In traditional markets, the standard T+2 or longer settlement cycle has long been the norm, mostly due to the migration of settlement risk between different counterparties. This delay in the settlement ties up capital and increases counterparty risk.
 - To move toward shorter settlement time, a good practice is to open accounts at the same bank or custodians your counterparties. In this way, transfer of assets between you and your counterparties can be a book transfer within the bank itself which can be settled instantly. But opening a bank account is not easy, especially for a financial institution. In contrast, blockchain-based systems can settle transactions from T+0 to seconds, nearly instant.
- **Easy and Low Barrier Accessibility**
 - This open architecture is redefining accessibility in ways traditional systems have long tried to achieve. Anyone with a smartphone can access a full suite of financial services on-chain, that's the promise we're seeing unfold. Millions who've been locked out of Traditional Finance are finding new economic opportunities via financial services on public blockchain. Small businesses can access capital without jumping through endless hoops. Individuals of all backgrounds can invest and earn meaningful returns without needing a perfect credit score or a fancy suit.
- **Automated and Trustless Operations**
 - One of the most significant advantages of permissionless blockchain is their decentralized structure. Unlike traditional systems where “power” and “control” are

all held in the hands of a single entity, permissionless blockchain distributes decision-making across the entire network.

- It becomes hard for any single entity to manipulate the system or shut it down, as there's no "central" point of weakness. This creates a trustless environment, where participants don't need to rely on trust in a central authority. Instead, trust is placed in the system itself, which is governed by transparent rules and cryptographic proofs.
- Smart contracts, self-executing contracts with the terms of the agreement directly written into code, are a prime example of this trustless environment in action. These contracts automatically enforce the terms of an agreement, reducing the need for intermediaries and minimizing the potential for disputes.

- **Open Participation with Global Access**

- The open nature of permissionless blockchain enables those networks to operate 24/7, allowing transactions to occur across borders without the limitations of traditional banking hours or international transfer restrictions. This global accessibility has the potential to revolutionize remittances and cross-border payments, making them faster and more cost-effective.
- For the unbanked and underbanked populations of the world, these systems offer a way to participate in the global economy without needing access to traditional banking infrastructure. All that's required is an internet connection and a device capable of running a wallet application.

- **Transparency and Real-time Monitoring**

- Every transaction on the network is recorded on a public ledger that is visible to all participants. In comparison to traditional financial systems, where transaction records are not easily accessible, this level of transaction transparency is levels above. This public nature increases trust among users, as anyone can verify transactions and the network's overall state. Granting different counterparties access to the transaction data in real time for monitoring and automation.

Permissionless blockchain technology is promising, however, as with any new innovations, it comes with limitations and hurdles to overcome. As DeFi platforms evolve and TradFi institutions are catching up, we're witnessing a dynamic financial ecosystem full of potential and challenges. Understanding these challenges is crucial not just for risk mitigation, but for harnessing the full potential of permissionless blockchain:

- **Security and Privacy Concerns**

- There are certain risks that permissionless blockchains might be subjected to. For example, security risks like the 51% attack (in systems using proof-of-work and proof-of-stake consensus mechanisms).
- Smart contracts can also introduce security risks if not properly audited and tested.
- Transparency is a double-edged sword when it comes to privacy. All transactions on public blockchains are visible to everyone, which can be problematic for individuals and businesses that require confidentiality in their financial dealings.

- **Regulatory Uncertainty**

- The decentralized nature of permissionless blockchains require joint regulation across different jurisdictions, which presents significant challenges for regulators. Many governments are still grappling with how to classify and regulate cryptocurrencies and blockchain-based assets. We will dive into more details in the next section, where we cover more about regulations.
- Crypto regulations exist to create stability, protect investors, and prevent illegal activities like money laundering or fraud. Since the crypto market is highly volatile and largely decentralized, regulations help to reduce risks for investors and ensure that exchanges and other crypto businesses operate transparently and fairly.
- Additionally, regulations aim to integrate cryptocurrencies into existing financial systems while maintaining oversight, reducing opportunities for misuse, and encouraging more mainstream adoption by instilling trust in the system. The ever-changing nature of crypto regulation is difficult to predict, as every country and region looks at crypto differently.

- **Market Volatility**

- Cryptocurrencies, which are often the native assets of permissionless blockchains, are known for their extreme price volatility, even for Bitcoin, the largest cryptocurrencies in terms of market cap, might move 20% price within one day. Tokenized assets that co-exist with volatile cryptocurrencies in the same permissionless system might pass the risk into the mainstream financial system, which is the concern from US SEC. For example, a whale trader could use T-bill token as collateral then due to large market movement he would need to liquidate. This might cause a fire sale of the underlying assets and will impact mainstream financial markets.

- **Complex User Experience**
 - Despite the potential benefits, interacting with permissionless blockchains remains difficult for many users. The process of setting up wallets, managing private keys, and interacting with decentralized applications can be daunting for non-technical users.
 - The irreversible nature of blockchain transactions means that user errors can be costly. Sending funds to the wrong address or losing access to a wallet can result in permanent loss of assets. This high-stake environment can be stressful for users and may deter mass adoption.

- **Lack of Accountability**
 - Permissionless blockchains present significant challenges for Anti-Money Laundering (AML) and Know Your Customer (KYC) compliance, which are cornerstones of financial regulation. Unlike traditional finance (TradFi) where intermediaries act as gatekeepers, these open networks allow anyone to transact without prior approval or identity verification. This anonymity, while appealing to privacy advocates, creates an environment where illicit activities can potentially flourish unchecked. The absence of centralized oversight makes it difficult to track the flow of funds or identify the parties involved in suspicious transactions, complicating efforts to combat financial crimes.
 - The rise of DeFi on permissionless blockchains has further amplified these concerns. DeFi platforms offer financial services without the usual safeguards found in TradFi, such as identity checks or transaction monitoring. While this opens up financial access to underserved populations, it also creates opportunities for bad actors to exploit the system. Money launderers, for instance, can use complex chains of DeFi transactions to obscure the origin of funds, making it challenging for law enforcement to follow the money trail. As regulators grapple with these issues, striking a balance between innovation and security remains a key challenge in the evolving landscape of blockchain technology.

- **Difficulty in Upgrades**
 - Upgrading permissionless blockchain protocols is a complex and risky process. Unlike centralized systems where upgrades can be implemented unilaterally, changes to blockchain protocols require consensus among a diverse and distributed set of participants.
 - This difficulty in implementing upgrades can lead to technological stagnation, where known issues or limitations persist because the community cannot reach consensus

on how to address them. It also makes it challenging to respond quickly to newly discovered vulnerabilities or changing technological landscapes.

Permissionless blockchains represent a groundbreaking technology with the potential to ease our digital lives, along with revolutionizing the future world of investing. Their benefits offer great advantages over traditional centralized systems. The innovation potential they unlock, particularly in areas like decentralized finance and new economic models, is truly exciting. However, these systems also face significant challenges and risks that pose substantial hurdles to mass adoption.

Ultimately, the future of permissionless blockchains is likely to involve a process of evolution and refinement. While they may not completely replace traditional systems in the near term, they have already demonstrated their potential to complement and enhance existing financial and technological infrastructures.

As the technology matures and solutions to current challenges emerge, we can expect to see increased integration of permissionless blockchain technology into various sectors of the economy and society.

This integration will take time and require careful consideration of the trade-offs between decentralization, efficiency, security, and user experience. It is important to consider the evolution of traditional finance when comparing to decentralized finance. Internet or online banking did not happen overnight, the online brokerage and trading platforms we know today took many years to evolve and had many regulatory issues. Big-time banks or players who came on early, grew along with the evolution of TradFi and ended up being successful in the finance industry. This should be the same mindset for DeFi and its blockchain integration with the TradFi ecosystem, to achieve DeFi mass adoption.

Shifting Sands in Legal and Regulatory Trends - Regulatory Frameworks Across Jurisdictions

The global legal landscape surrounding tokenization is fragmented. Legal systems need to establish clear criteria to classify tokens that are subject to securities laws. Tokens can be used to replace traditional securities, and in such cases, the rules of securities law need to be adapted and applied. Extending securities law to tokens that are not securities can produce undesirable results and stifle economic and/or technological innovation. Some jurisdictions

have adopted a traditional approach to distinguish between security tokens and cryptocurrencies, in line with their existing securities laws.

With the rapid development of decentralized finance (DeFi) and tokenization, global regulatory bodies are continuously evolving the legal framework for digital assets and related financial activities. This trend not only reflects the growing demand from market participants but also shows the importance that governments place on maintaining financial stability and protecting investor rights. As the cryptocurrency market thrives and tokenization technology is adopted, different regulators have varying considerations and requirements for cryptocurrencies and tokenization technologies based on cryptocurrencies. We look at some of the prominent jurisdictions and their respective stance towards regulation. The jurisdictions covered are US, Hong Kong, Singapore, UAE, BVI and EU.

United States

Regulatory Bodies: The Securities and Exchange Commission (SEC), Commodity Futures Trading Commission (CFTC), and Financial Crimes Enforcement Network (FinCEN).

Crypto Regulation:

- Security Tokens: Regulated by the SEC under U.S. securities laws. If a token is classified as a security under the Howey Test, it must comply with registration requirements, exemptions (e.g., Regulation D, Regulation S), disclosure obligations and conduct standards.
- Commodity Tokens: Such as Bitcoin (BTC) and Ethereum (ETH), are classified as commodities and regulated by the CFTC.
- Payment Tokens (Cryptocurrencies): Subject to AML/CFT regulations under FinCEN if used for money transmission services.

Tokenization:

- Tokenized Securities: Treated like traditional securities and must comply with all SEC regulations regarding issuance, trading, and custody.
- Digital Asset Custodians: Must be registered and comply with SEC and CFTC regulations regarding the safekeeping of digital assets.

Hong Kong

Regulatory Bodies: The Securities and Futures Commission (SFC) and the Hong Kong Monetary Authority (HKMA).

Crypto Regulation:

- The SFC regulates cryptocurrencies that qualify as securities or futures contracts under the Securities and Futures Ordinance (SFO).
- Virtual Asset Trading Platforms: Must apply for a license under the Anti-Money Laundering and Counter-Terrorist Financing Ordinance (AMLO). Must comply with Anti-Money Laundering (AML) and Counter-Terrorist Financing (CTF) requirements.
- Regulatory Sandbox: Allows crypto platforms to operate under strict oversight to ensure they meet regulatory standards.

Tokenization:

- Security Tokens: Treated as securities under the SFO, subject to securities laws, including licensing requirements for intermediaries, prospectus requirements, and compliance with conduct regulations.
- Stablecoins: HKMA is working on a regulatory framework that would treat stablecoins as stored value facilities (SVFs) requiring licensing and prudential requirements similar to payment providers.

Singapore

Regulatory Body: The Monetary Authority of Singapore (MAS).

Crypto Regulation:

- Payment Tokens: Or called Digital Payment Token(DPT). Regulated under the Payment Services Act (PSA). Crypto exchanges and wallet providers must obtain a license and comply with AML/CFT requirements.
- Security Tokens: Regulated under the Securities and Futures Act (SFA) if they qualify as securities or capital market products. Issuers must comply with prospectus requirements and licensing if an exemption is not applicable.

Tokenization:

- Utility Tokens: Generally not regulated under the SFA unless they fall under specific categories triggering regulation. They must comply with AML/CFT and consumer protection laws.
- MAS regulates Security Token Offerings (STOs) and has established a framework to facilitate the issuance of tokenized securities under the SFA, with guidelines for regulated entities to conduct STOs.

United Arab Emirates (UAE)

Regulatory Bodies: The Dubai Financial Services Authority (DFSA), Abu Dhabi Global Market (ADGM) Financial Services Regulatory Authority (FSRA), and Securities and Commodities Authority (SCA).

Crypto Regulation:

- Security Tokens: Regulated under the financial markets regulations of ADGM and DFSA. Issuers and intermediaries must obtain licenses, comply with conduct regulations, and adhere to AML/CFT requirements.
- Virtual Asset Service Providers (VASPs): Must register and comply with specific requirements under each regulatory authority (e.g., ADGM's VA framework and DFSA's VA regulations).

Tokenization:

- Fiat-Referenced Tokens (FRTs): Regulated under ADGM's proposed framework for stablecoins and asset-backed tokens. These must be fully backed by high-quality, liquid assets.
- The UAE encourages Security Token Offerings (STOs) within financial free zones (ADGM and DIFC) with clear rules for compliance, investor protection, and issuance.

British Virgin Islands (BVI)

Regulatory Body: BVI Financial Services Commission (“BVI FSC”)

Crypto Regulation:

- Security Tokens: Regulated under the BVI Securities and Investment Business Act 2010 (SIBA). Issuers and intermediaries must obtain licenses, comply with conduct regulations, and adhere to AML/CFT requirements.
- Virtual Asset Service Providers (VASPs): Must be licensed under the VASP Act if issuer falls under the definition of a VASP. In addition, the BVI FSC has published Guidance on the Application for Registration of a Virtual Assets Service Provider (the “VASP Registration Guidance”), and the Virtual Assets Service Providers Guide to the Prevention of Money Laundering, Terrorist Financing and Proliferation Financing.

Tokenization:

- Security Tokens: Tokens that constitute securities or other financial instruments will have to consider abiding by a variety of regulations, including (but not limited to) VASP Act, Securities and Investment Business Act 2010, and Financing and Money Services Act 2009.

European Union (EU)

Regulatory Bodies: European Securities and Markets Authority (ESMA), European Banking Authority (EBA), and national regulators.

Crypto Regulation:

- The EU has established the Markets in Crypto-Assets Regulation (MiCA), which provides a comprehensive regulatory framework for crypto assets across member states.
- Asset-Referenced Tokens (ARTs) and E-Money Tokens (EMTs) must comply with requirements related to authorization, reserve management, capital adequacy, and disclosure obligations.
- Crypto-Asset Service Providers (CASPs): Must be licensed and comply with AML/CFT and market conduct standards under MiCA.

Tokenization:

- Security Tokens: Regulated under the existing Markets in Financial Instruments Directive (MiFID II) if they qualify as financial instruments, such as transferable securities.
- MiCA also addresses Utility Tokens and provides clarity on offering and trading requirements, while utility tokens may fall outside traditional securities regulation.

Summary

Each jurisdiction has its unique approach to regulating cryptocurrencies and asset tokenization. Generally:

- Hong Kong and Singapore focus on a balanced approach that encourages innovation while ensuring investor protection and market integrity.
- The US has a more fragmented regulatory landscape, with multiple agencies regulating different aspects of crypto assets.
- The UAE offers tailored regulatory frameworks within its financial free zones, fostering a regulated environment for digital assets and tokenization.
- The BVI has a clear system which relies on existing securities laws to govern security tokens in addition to having a VASP Act to govern virtual assets services.
- The EU, with MiCA, is moving towards a harmonized regulatory framework across member states, focusing on consumer protection, market integrity, and financial stability.

Asset Tokenization: Institutions Moving into Web3

Decentralized Finance (DeFi) is rapidly gaining traction for its potential to revolutionize institutional financial services through the application of blockchain technology and smart contracts. Proponents of DeFi envision a new financial paradigm characterized by fast settlement, efficiency, composability, and its open and transparent networks.

Despite its promise, the development of DeFi for regulated financial activities has progressed cautiously, largely due to the evolving macroeconomic and regulatory landscape, as well as tech development. To date, most institutional DeFi initiatives have taken place in proof-of-concept or sandbox environments. However, successful implementations are beginning to emerge, and the convergence of DeFi with digital asset and tokenization adoption is anticipated to accelerate in the next one to three years.

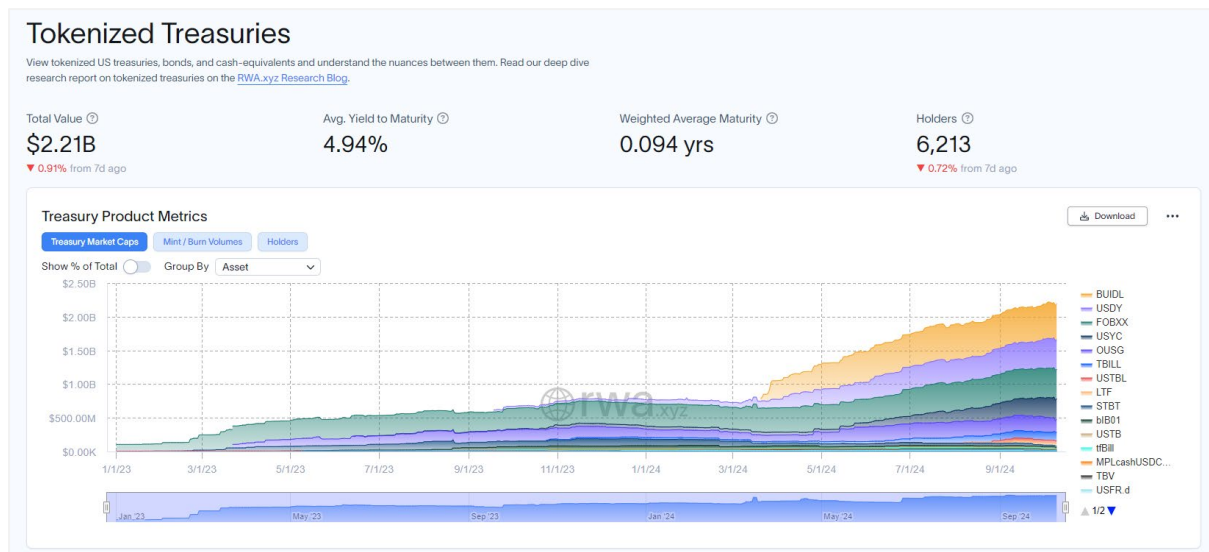
Financial institutions have been preparing for this shift for several years, recognizing the transformative potential of DeFi. As the technology and regulatory frameworks mature, the integration of DeFi into institutional finance is expected to unlock new levels of efficiency, transparency, and innovation. This part we will focus on the major composition of assets - securities, to investigate how financial institutions are exploring this area.

From Conception to Reality: Mainstream's Thinking on Blockchain and Tokenization

Tokenization, from institutions' perspective, is a form of data entry with certain benefits compared to traditional book entry form, and blockchain is a ledger for recording the ownership and facilitating transactions.

As blockchain technology and the crypto industry continue to evolve, the term "Real-World Assets" (RWA) has become increasingly common. RWAs span a wide range, from tokenization of physical assets to mainstream financial instruments, and even assets related to Environmental, Social, and Governance (ESG) criteria. The first widely adopted real-world asset class in Web3 is stablecoin which we will cover in the next part. Right behind stablecoin, the second largest is US treasuries related products, as it's widely accepted secure assets, and more standardized. During the past months we saw the growth of on-chain US treasuries

and money market fund in a fast pace, with total value grows from around 100M USD in the beginning of 2023 to 2.21B USD as of now.



Pic: Tokenized treasuries total value, as of Oct 11th. Data from RWA.xyz

The narrative of US treasuries assets started from Web3 native startups, as they are quick movers to address the market demand. As Web3 market become trillion level in terms of market cap, institutions also see the opportunities here and want to explore tokenization, doing not only PoC but real business. During the past months, there's several major breakthroughs of institutions doing tokenization on the public blockchain.

Tokenization: Mainstream Finance Milestones in 2024

Ethereum, Bitcoin, and other public blockchains have established an open financial system that allows for free trading and movement of assets. This open system has led to numerous financial innovations, but due to its anonymous and open nature, it has also posted significant challenges for Anti-Money Laundering (AML) and Countering the Financing of Terrorism (CFT) efforts. Mainstream financial institutions have invested substantial time and effort into studying and exploring solutions and are gradually beginning to find optimal solutions.

To control those issues mentioned above, financial institutions developed some best practices, to make it comfortable for regulators to allow such kind of movement to happen. Some examples include on-chain AML screening, token whitelist and blacklist control, etc.

Such kinds of practices are enabler for mainstream financial institutions to enter DeFi realm. The year 2024 appears to be a turning point, with one of the most significant milestones being the launch of the BUIDL token on Ethereum by BlackRock and Securitize^[5], followed by

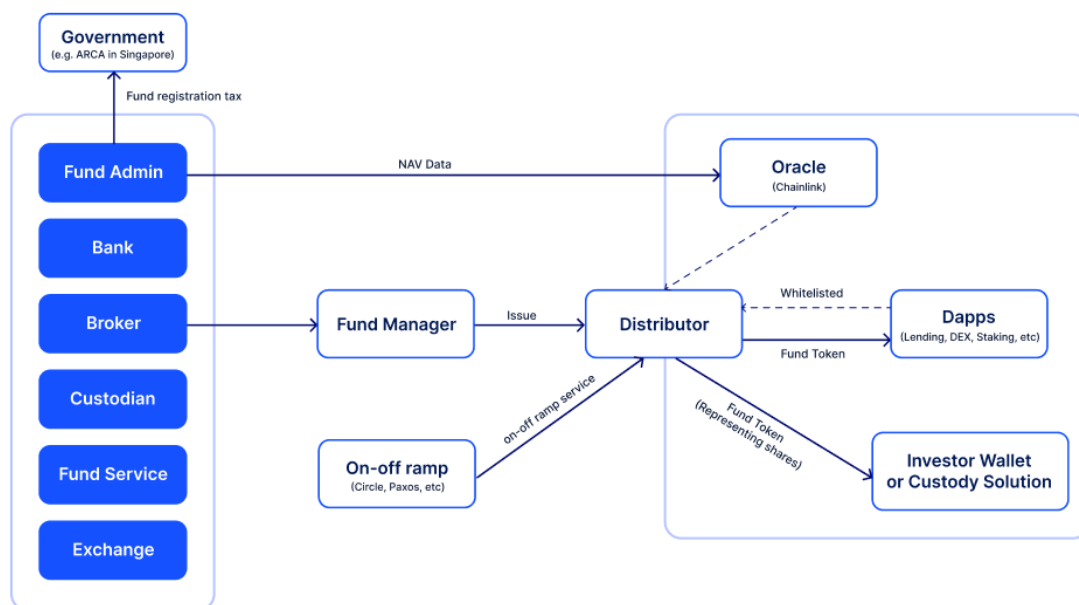
Franklin Templeton’s tokenization on multi blockchains^[6], and the issuance of the UBS US Treasury Fund in collaboration with DigiFT^[7].

The driving factors behind this progress are the efficiency of on-chain operations and market opportunities, and this is made possible by the emergence of compliant on-chain market participants. Securitize, as an SEC-approved transfer agent utilizing public blockchain as its underlying infrastructure, is able to register and record asset ownership on the blockchain. This allows Securitize, acting as BlackRock's distributor, to facilitate the tokenization and distribution of assets on the Ethereum blockchain, embedding BlackRock's BUIDL token into the DeFi and Web3 space with their connections.

Previously, Franklin Templeton also uses blockchains like Polygon and Stellar for record-keeping, but primarily relied on its traditional book entry form, using the public blockchain as a secondary ledger. However, BlackRock has made the public blockchain its primary ledger, allowing tokens to be directly transferred on-chain and the ownership transfer will be valid. Shortly after BlackRock launched BUIDL, Franklin Templeton also released its token transfer function^[8], and even support token on other blockchains such as Solana, Avalanche, Aptos, and Arbitrum, to expand its client base.

Structure of tokenization

While similar funds are already common in the web2 market, achieving tokenization still presents many challenges, as the operation of a fund involves dozens of related parties and key processes, as illustrated in the following diagram:



The process primarily consists of three major components:

- **Fund Management:** Fund manager will open accounts with institutions including banks, exchanges, brokers and custodians, to invest and manage the assets according to their strategies.
- **Fund Administration:** Involves tasks such as NAV (Net Asset Value) calculation, accounting and bookkeeping, investor services, compliance reporting, fee management, and audit support.
- **Fund Distribution:** The distribution channel serves as the bridge between investment funds and investors, providing the infrastructure for selling, marketing and delivering funds. In web3, the distribution channel will distribute into the web3 ecosystem with the fund in token format.

In the tokenization process, fund distribution is the most directly involved. However, to complete distribution, activities such as KYC linkage, AML (Anti-Money Laundering) checks, data updates, dividend payments, and distributions are all closely interconnected with the other stages.

On the graph above, we can separate it into on-chain and off-chain parts. The processes on the right side are all on-chain related, which includes:

- On-chain AML and KYC
 - Linking clients' wallet address with off-chain KYC and add the address to whitelist.
- Ownership recording
 - Token represents ownership of the fund, guaranteed by legal contracts. In this way, on-chain transfer to another address has legal effect.
- Token contract design
 - Token contract will have admin control in the fund manager, with functions such as role setting, enforced transfer, burn or mint of the token, whitelist and blacklist function.
 - Distributor will have the ability to add or remove whitelist, and mint or burn fund token.
 - End investors usually only have the right to transfer the token (into another whitelisted address or redemption contract).
- Data availability on chain

- This process usually involves an oracle to post off-chain data such as NAV of the fund shares on-chain.

As illustrated, institutional asset tokenization involves multiple parties, which require multi parties effort and it's not straightforward. Some of the institutions streamlined the process and successfully launched their fund token in the year of 2024. We consider the year of 2024 as a critical turning point.

Asset Tokenization In The Year of 2024 - Major Milestones

Blackrock Launch Tokenized Fund With Securitize

BlackRock is the first one to directly adopt fund tokenization among major financial institutions, by a partnership with Securitize.

The fund is called BUIDL(BlackRock USD Institutional Digital Liquidity), which is issued by a Blackrock BVI entity. The fund is a sub fund investing into an master fund which is managed by Blackrock Asset management. Securitize, as a SEC approved transfer agent, is the fund's tokenization platform, transfer agent and sole distributor.

The fund token, which is a representation of the fund share, is able to transfer on-chain within whitelisted addresses. With this transferability, Circle, the issuer of stablecoin USDC, adds a real time redemption smart contract for BUIDL, providing 100M USDC liquidity. Investors can transfer the BUIDL token into the smart contract and get USDC liquidity after the transaction is confirmed on Ethereum blockchain. This function showcases the fast and efficient settlement advantage of public blockchain technologies.

To invest into the fund, investors must be qualified purchasers (QP), and invest 5M USD at minimum. The fund is structured with a distribution share class, with each BUIDL fund share token always equal to 1 USD and monthly distribution of yield in the form of BUIDL token airdrop.

Franklin Templeton Launch FOBXX on Multi-blockchain

There is a widespread assumption that transfers on public blockchain have legal effects. However, in fact this is not true. In some jurisdictions, the law would need to reconcile the general regime for the transmission of intangibles with the actual operation of blockchain technology. This would be done by integrating the on-chain transfer within the generally

applicable regime. For Franklin Templeton, its fund tokenization project went through the process.

Franklin Templeton tokenized its US treasury fund on Polygon and Stella Blockchain in 2021, with its tokenization platform Benji, which includes wallet and custody solutions for retail clients. The fund is open to US retail investors.

At the beginning, Franklin Templeton's Benji token can not directly transfer on-chain. Benji only uses Blockchain such as Polygon and Stella as a secondary book keep, while they still rely on their own centralized system.

Shortly after the launch of Blackrock's BUIDL, they opened a native on-chain transfer function, and even support other blockchains such as Ethereum, Arbitrum, Aptos and Avalanche C-chain.

UBS Partnership With DigiFT To Distribute Tokenized Funds

On the 1st of November 2024, UBS Asset Management launched "UBS USD Money Market Investment Fund Token" ("uMINT"), a Money Market investment built on Ethereum distributed ledger technology (DLT). uMINT is a tokenized Variable Capital Company (VCC) fund, and the underlying fund is a Moody's AAA rated fund. UBS deploys the uMINT smart contract directly and DigiFT is an authorized on-chain distribution partner for the token.

Tokenholders can now access UBS Asset Management's institutional grade cash management solutions underpinned by high quality money market instruments based on a conservative, risk-managed framework.

UBS started to build its in-house tokenization platform, UBS Tokenize, since 2019, and launched pilot project in 2022. UBS's global DLT strategy is focused on leveraging blockchain networks for enhanced fund issuance and distribution. Being an active industry partner of The Monetary Authority of Singapore's (MAS) Project Guardian, UBS also launched a live pilot of a tokenized Variable Capital Company (VCC) fund back in October, 2023. The launch of uMINT represents a step toward commercialization.

Partnering with DigiFT enables uMINT to involve a wider range of clients in both web2 and web3, as with the capability of real time redemption powered by DigiFT's exchange smart

contract, where all the DigiFT users can add liquidity to the contract to meet the demand of real time redemption and enable seamless interaction with DeFi ecosystems.

DTCC And Chainlink Collaboration On Smart NAV Pilot

DTCC and Chainlink announced the successful completion of their Smart NAV Pilot in 2024^[9]. This initiative sought to tokenize mutual funds and automate the distribution of Net Asset Value (NAV) data using Chainlink's blockchain technology. NAV is the daily valuation of a mutual fund's assets, and traditionally, the process of disseminating NAV data has been manual, prone to errors, and slow. The Smart NAV Pilot changed this by delivering NAV data on-chain across public and private blockchains using Chainlink's CCIP .

The pilot also involved key industry participants like JPMorgan, BNY Mellon, and Franklin Templeton, who tested how blockchain-based automation could improve transparency and efficiency in financial operations.

Key achievements of this pilot are:

Interoperability: Chainlink's CCIP ensured that NAV data could be distributed seamlessly across different blockchain networks without data silos, improving both access and scalability. This cross-chain functionality is critical to the future of tokenization, as it allows traditional financial markets to interact with decentralized platforms securely.

Real-Time Data Access: By putting NAV data on-chain, financial institutions gained real-time access to pricing information, improving market efficiency. This not only allows for faster decision-making but also sets the stage for the tokenization of mutual funds, making them easier to trade and manage.

Improvement of operational Efficiency: The pilot automated many aspects of NAV data distribution, reducing manual errors and operational costs. The ability to deliver historical data on-chain also enhances transparency and record-keeping, which is vital

The Chainlink-DTCC partnership represents a forward-thinking approach to merging blockchain technology with traditional finance. By automating the transmission of key financial metrics such as NAV data, this collaboration demonstrates the potential for greater efficiency, transparency, and innovation in financial markets. With major financial players like JPMorgan, BNY Mellon, and Franklin Templeton involved, the Smart NAV Pilot is a clear signal of the growing institutional interest in blockchain-based solutions.

After Tokenization - What's The Use Cases?

Why are those mainstream financial institutions looking into tokenization? If issuing a token on public blockchain just for record and ownership keeping, no efficiency can be improved. One of the direct benefits is to enter a new market where they can increase their AUM. Institutional DeFi narratives are also one realm to explore, where there will be more use cases for the tokenized assets and can truly address some pain points of traditional financial systems.

Institutional DeFi takes time to solve not only business and technologies issues, but more on legal and compliance issues. Quick movers are DeFi players. Moving beyond tokenization, DeFi players are adding more use cases for the tokens issued by those institutions.

Real-time Settlement Capabilities

Real time settlement is a desirable scenario for the capital market, if settlement can be within one atomic transaction, then we can reduce the settlement risk to nearly zero. But in mainstream system only a minor part can achieve it. The blocker is on the clearing, settlement and reconciliation processes between different counterparties. Those processes take time as each of parties has its own ledger and won't trust each other.

But on a public open ledger, it makes possible for real time settlement. After the launch of BlackRock BUIDL, Circle builds a real time redemption contract with 100M USDC liquidity for any BUIDL holders to redeem for USDC instantly^[10]. They will manage the BUIDL token received and replenish the pool if needed.

DigiFT builds an inhouse real-time redemption contract for asset token holders to get USDC liquidity instantly, while on the backend the smart contract will trigger a normal redemption to replenish the liquidity pool.

Stable Coin Reserve Assets

Compared to crypto currencies, which are highly volatile, security tokens like treasury bill fund tokens and money market fund tokens are more suitable to be reserve assets of fiat-reference stablecoins.

Sky (prev MakerDAO) is the first decentralized stablecoin to adopt off-chain assets, now using tokenized assets for its stablecoin reserve^[11]. Recently they launched a RWA Grand Prix to

allocation 1B USDC into RWA tokens^[12], with UBS, BlackRock, Franklin Templeton and others competing for the 1B USDC allocation.

Other examples include Mountain protocol's stablecoin USDm and Ethena's stablecoin UStb^[13].

Asset Fractionalize

In the financial supply chain, distributors serve as a channel to lower the entry barrier and increase efficiency for certain assets. One of the distributor cases in Web3 is Ondo Finance which is a BlackRock's BUIDL's distribution channel, now with >200M USD in TVL.

Ondo wraps BUIDL into a fund token called OUSG, allowing US professional investors to access. Unlike BUIDL, which requires 5M USD for minimum subscription, OUSG can accept as low as 5,000 USD and achieves real time subscription and redemption for USDC, in this case, Ondo helps BUIDL distribute into a wider range of audiences.

Margin Collateral

In mainstream finance, safe and yield bearing assets like US treasury bills and corp bonds are always being used as high-liquid collateral for margin trading and derivative trading.

Take CME for example, it accepts a wide range of assets as collateral, including bonds, funds and other securities.

TICKER	NAME	CREATION/REDEMPTION UNIT AMOUNT
BIL	SPDR Bloomberg 1-3 Month T-Bill ETF	50,000
TBILL	Invesco Short Term Treasury ETF	10,000
GBIL	Goldman Sachs Access Treasury 0-1 Year ETF	10,000
SGOV	iShares 0-3 Month Treasury Bond ETF	50,000
SHV	iShares Short Treasury Bond ETF	10,000

CME Clearing will only accept shares of Short-Term UST ETFs in multiples of a given funds creation/redemption unit amount.

Pic: Screenshot from CME, they accept short term UST ETFs as collateral^[14].

Instead of using stable coin or cash as collateral, using short term US treasury fund token or money market fund token at the moment can offset funding cost for margin trading.

In 2023, Binance worked with some crypto friendly banks to provide US Treasuries as collateral for trading for its institutional clients^[15], but the whole system is still based on traditional trading venues, like Sygnum Bank.

As in Web3, institutions and crypto exchanges are more familiar with tokenized assets, with BUIDL and such kind of highly liquid secure assets emerging, they are starting to onboard tokenized assets as collateral for certain trading purposes. With instant redemption liquidity, the liquidation process also won't be a blocker.

Prime broker like FalconX^[16] and Hidden Road Partners^[17] already working on such kind of use cases, attracting institutional investors.

Asset tokenization- What's Next?

As we move into 2024 and beyond, asset tokenization is poised to transform the financial landscape by unlocking unprecedented opportunities for liquidity, efficiency, and accessibility. We can clearly see some emerging future trends.

The Web3 native tokenization ecosystem is gradually maturing. The traditional financial market is mature with participants in different roles. In 2024 we saw startups coping the business model and moving into web3. Examples are rating agency (e.g. Particula) and accounting and auditing (e.g. Elven, The Network Firm).

Besides US treasuries, as the US interest rate started to cut, Web3 investors also have appetite for high yield assets. And those assets will compete with Web3 native yield to attract investment.

Tokenization platforms and distribution channels are looking into traditionally illiquid products like trade finance products and VC funds. During the process, traditionally illiquid markets will also be democratized.

Compliance and licensing is also a major trend as we see Web3 companies are getting licenses in web3-friendly jurisdictions like UAE and EU. With licensed players in the ecosystem, mainstream institutions can also work with them to explore new market opportunities.

On-chain liquidity and real time settlement will also be realistic at large scale as institutions are becoming more comfortable with Web3 and blockchain infrastructures and moving settlement process on-chain.

Tokenization of Currencies

As the global economy continues to digitize, currency systems stand at the threshold of yet another major transformation. From dematerialization to digitization, and now to tokenization, the form and function of money are undergoing profound changes. Over the past few years, we have seen how the tokenization of Real-World Assets (RWA) has made asset management and financial services more efficient, with mainstream financial institutions like BlackRock and Franklin Templeton actively exploring applications for tokenized assets. However, beyond the tokenization of assets, the tokenization of money is also emerging as a major trend, showcasing its tremendous potential to transform payment systems and financial markets.

Various pain points in the current payment systems, such as high cross-border payment costs, slow settlement speeds, and complexities in liquidity management, are driving the financial industry to seek more efficient and intelligent solutions. The tokenization of money lies at the core of this exploration. Using blockchain and smart contract technology, money can achieve programmable, automated, and highly efficient transparent payments and settlements. Digital currencies introduce new efficiency and flexibility to existing financial systems, allowing for faster movement of funds, greater transparency, and reduced reliance on intermediaries, injecting new vitality into the global financial system.

A New Horizon: Collaborations And Innovations In Digital Money

The discussion of digital money and its application scenarios drew considerable attention in the early days of blockchain's rise. As blockchain technology rapidly evolved, the concept of digital money became a hot topic in many fintech forums and experiments. However, due to the immature understanding of blockchain technology and digital money frameworks, coupled with the lack of corresponding legal and regulatory structures, many attempts were unsuccessful, leading to a cooling off interest in this field.

Since 2017, the industry experienced multiple unsuccessful trials and adjustments in the policy and regulatory environment, gradually lowering the intensity of discussions on digital money

and blockchain's practical applications. However, the emergence of decentralized finance (DeFi) reversed this trend. DeFi's development rekindled interest in blockchain and tokenization, and as blockchain infrastructure improved, digital money discussions entered a new phase of growth.

In recent years, several emerging technologies and standards have matured, such as cross-chain technologies that enable seamless asset and data flows between blockchain networks, zero-knowledge proofs enhancing transaction privacy and security, and new token standards enriching the diversity of asset and currency tokenization. These infrastructural improvements paved the way for the practical application of digital currencies and further exploration of innovations in money and blockchain technology.

In 2020, the G20 endorsed a roadmap for enhancing cross-border payments^[18], recognizing the importance of efficient payment systems for global economic growth and financial inclusion. The roadmap's core goal is to address the challenges of cross-border payments, improving speed and transparency, increasing access to services, and reducing costs. The G20's initiative has accelerated the development of digital currencies, and support from major global economies has provided a solid policy foundation for innovation in this field.

Goals And Vision of The G20 Initiative

The G20 cross-border payments roadmap aims to fundamentally improve the efficiency, transparency, and accessibility of global payment systems, particularly in cross-border contexts. The plan outlines the following key objectives^[19]:

- **Cost**
 - By 2027, the average cost of remitting \$200 globally should be no more than 3%.
 - By 2030, the average payment cost globally should be reduced to no more than 1%.
- **Speed**
 - By 2027, 75% of cross-border wholesale payments should reach recipients within one hour of initiation, with the remainder settling within one business day; cross-border retail payments and remittances should be completed within a similar timeframe.
- **Access**
 - By 2027, at least 90% of individuals should have access to cross-border electronic remittance channels, with every end user having at least one option to send and

receive cross-border payments. Financial institutions should also provide at least one cross-border wholesale payment option per payment corridor.

- **Transparency**
 - By 2027, all Payment Service Providers (PSPs) should provide minimum information, including transaction costs, estimated time of arrival, payment tracking, and service terms.

Pain Points of Current Payment Systems

Despite the growing importance of cross-border payments, existing payment systems face numerous pain points and challenges, severely affecting payment efficiency, costs, and accessibility. According to the Committee on Payments and Market Infrastructures (CPMI) of the Bank for International Settlements, the main challenges faced by cross-border payment systems include^[20]:

1. High Cost:

Current cross-border payments involve multiple intermediaries, each adding to transaction costs. High costs make small payments economically infeasible, hindering the popularization of remittances.

2. Low Speed:

Cross-border payments typically pass through long transaction chains, with multiple participants involved in clearing and settlement, leading to a slow payment process. Batch processing and lack of real-time monitoring further extend transaction times.

3. Limited Transparency:

The involvement of multiple steps in the payment process lacks transparency, making it difficult for users to obtain detailed information on payment status and costs, increasing uncertainty and trust costs.

4. Limited Access:

Many regions have limited access to cross-border payment services, especially in developing countries, where the coverage of financial institutions and payment services is insufficient.

5. Complex Compliance Requirements:

Cross-border payments involve Anti-Money Laundering (AML) and Combating the Financing of Terrorism (CFT) compliance, with inconsistencies between regulatory frameworks in different jurisdictions, posing significant challenges for PSPs.

6. Legacy Technology Platforms:

Current payment infrastructure largely relies on legacy technology, lacking real-time processing capabilities and unified data transmission standards, resulting in inefficiencies in cross-border payments.

Trends In Distributed Ledger Technology (DLT) And Digital Currency Applications

As cross-border payment technologies continue to evolve, the application of Distributed Ledger Technology (DLT) in digital currencies is becoming an important trend. DLT provides a reliable solution that effectively addresses current payment system challenges, especially in cross-border payments. Through DLT, payment systems can achieve data sharing, transparency, and real-time operations—features that are currently lacking in payment systems.

The use of DLT has led to the realization of three main types of digital currencies: Central Bank Digital Currencies (CBDCs), tokenized bank deposits, and stablecoins^[21]:

1. Central Bank Digital Currency (CBDC):

Issued by central banks, CBDC aims to enhance financial inclusion by providing reliable digital payment tools and reducing reliance on cash. As a technology option for CBDC implementation, DLT-based CBDC architecture ensures efficient and low-cost cross-border payments while maintaining compliance and security. CBDCs are considered liabilities on central bank balance sheets, representing a direct responsibility to the public, backed by national credit, ensuring high stability and trust.

2. Tokenized Bank Deposits:

This is a digital representation of traditional bank deposits, using DLT technology to allow bank deposits to be transacted and settled in token form. Tokenized bank deposits not only improve payment efficiency but also allow real-time interbank settlement, reducing the cost of capital use. Tokenized bank deposits are liabilities on commercial bank balance sheets, similar to traditional bank deposits, with value backed by the creditworthiness of the issuing bank, subject to the bank's liquidity and regulatory framework.

3. Stablecoins:

A type of digital currency pegged to the value of a fiat currency or other asset, designed to maintain price stability. Stablecoins are commonly used in decentralized finance (DeFi) ecosystems to provide fast, low-cost payment solutions. DLT enables stablecoins to be transmitted efficiently worldwide, reducing friction and intermediary

costs in traditional payment systems. Typically issued by private companies, stablecoins represent liabilities of the issuer, supported by collateral assets, with credit depending on the quality of collateral and the issuer's reputation, often pegged to fiat currency or other assets.

Advantages of Digital Currencies

The rise of digital currencies brings many advantages, making them an important component of the financial system. Specifically, digital currencies show significant benefits in the following aspects^[22]:

Shared Ledger

Digital currencies use DLT to provide a unified infrastructure for cross-border and domestic payments. Compared to information silos in traditional systems, DLT can significantly reduce operational costs.

Reduced Transaction Time

The decentralized nature of DLT allows transactions to be completed within seconds to minutes. For example, traditional cross-border payments often require 2-5 days to process, whereas digital currencies can reduce this time to seconds to minutes.

Atomic Settlement

Digital currencies and DLT support atomic settlement, ensuring that funds and assets are delivered simultaneously, greatly reducing counterparty risk. This mechanism ensures that transactions occur only when both parties meet conditions, preventing partially failed transactions, especially in cross-border payments and high-frequency trading.

Transparency

DLT's transparency greatly enhances the visibility of transactions—all transaction records are viewable and verifiable by all participants. Blockchain platforms can reduce reconciliation times from days to seconds, mitigating counterparty risks, particularly in supply chain finance and trade finance involving multiple parties.

Elimination of Intermediaries

Digital currencies facilitate peer-to-peer transactions, reducing dependence on intermediaries. For example, traditional international remittance systems typically involve multiple banks or payment processors, while digital currencies allow direct transactions between senders and recipients, reducing fees and delays.

Financial Inclusion

According to the World Bank, 1.4 billion people globally lack access to banking services^[23], but more than 60% own a mobile phone. Digital currencies can provide low-cost, easily accessible payment solutions through mobile devices. Particularly in regions with underdeveloped financial infrastructure, digital currencies like stablecoins allow users to participate in the global economy without needing a bank account, promoting financial inclusion.

Compliance and Security

Digital currencies achieve automated compliance and secure transactions through smart contracts, reducing manual errors and minimizing fraud and security risks. For example, in financial markets, smart contracts can automatically execute KYC (Know Your Customer) and AML (Anti-Money Laundering) procedures, ensuring compliance in cross-border transactions.

Programmability

The programmability of digital currencies allows for adding conditions and logic to money, making payment systems more flexible and efficient. For instance, programmability enables financial institutions to build highly customized payment processes, enhancing efficiency and security in supply chain finance, cross-border payments, and automated investments. Smart contracts can also embed compliance checks, ensuring AML and KYC requirements are automatically fulfilled during transactions, further enhancing payment security and compliance.

A New Paradigm of "Programmable Money"

Digital currencies not only facilitate the transfer of value but also allow the issuer to embed programming logic into them. This brings multiple benefits, such as improved user experience, enhanced transparency, efficiency, and accessibility in financial services, and novel and creative applications in payment transactions, like condition-based payments, pre-authorizations, escrow payments, FX conversions in cross-border payments, and complex financial operations.

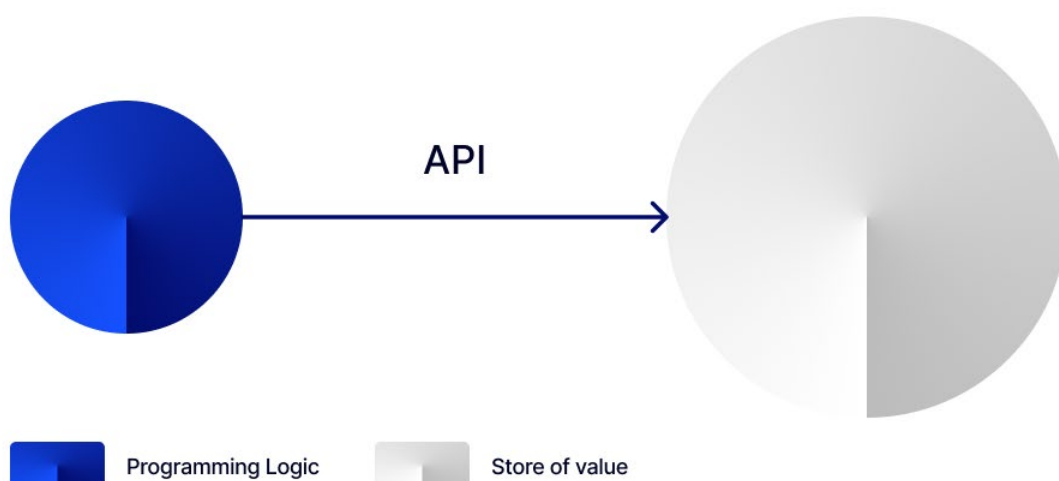
This approach is vastly different from how digital money is defined in traditional financial technology systems. In traditional systems, digital money is typically created through database entries. To achieve "programmability," an additional technology system independent of the database must be developed and connected to it, either internally for entities responsible for database maintenance or externally for customers via an Application Programming Interface (API). In this setup, applications interact with database records via traditional database APIs

with published program logic^[24]. In simple terms, value storage and program logic are independent in traditional systems, whereas in a decentralized ledger (blockchain), the value storage and programming logic of "programmable money" are unified, resulting in a new paradigm.

Despite the numerous benefits brought by digital currencies, the simple ability to attach programming logic to currency units remains controversial, primarily due to the principle of currency "Singleness." According to this principle, all forms of money, whether in a bank account, banknote, or coin, must be interchangeable at face value. In other words, a dollar in an individual's bank account must equal a dollar coin in another person's pocket. The same applies to digital money—maintaining homogeneity is essential. Therefore, if we want to apply complex usage logic to programmable money, such as using an ERC-20 stablecoin for escrow payments or restricting its usage to specific purposes, additional customization and the deployment of new contracts would be required, which could result in programmable money losing its "Singleness." Imagine whether a programmable currency that can only be used to purchase apples is homogeneous with a general-purpose ERC-20 stablecoin.

In summary, the challenge with programmable payments is that programmable money must undergo custom programming to achieve more complex rules, which not only causes the money to lose its "Singleness" but also raises policy and public trust issues, and could lead to undue control by the institution managing the execution mechanisms^[25]. To address this challenge, the Monetary Authority of Singapore (MAS) proposed a new monetary instrument called "Purpose-Bound Money" (PBM)^[26], seeking to explore extending the programmability of money without compromising the homogeneity and "Singleness" of the original asset. It also elaborated on several current forms of programmable payments.

Programmable Payment



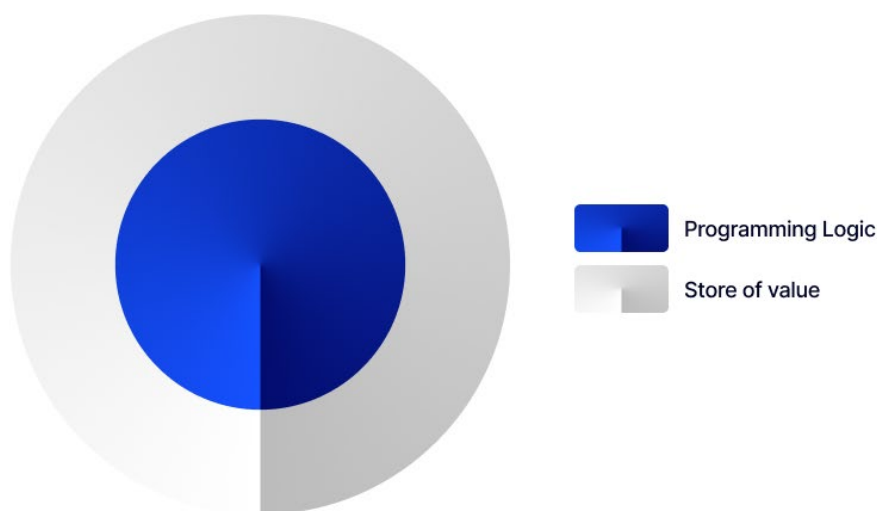
Programmable Payment: Programmable payments refer to payments that automatically execute when pre-set conditions are met. For example, users can set daily spending limits or schedule recurring payments, akin to direct debits or subscription payments. Programmable payments are typically realized using database triggers or API gateways, which sit between ledger systems and client applications. These interfaces interact with traditional ledgers and adjust account balances based on programmed logic, enabling automated fund management. Programmable payments already have wide application in banks and internet payment platforms, for instance:

Recurring Bill Payments: Bank customers can set up auto-pay features for regular expenses like utilities, rent, or loan instalments. On the designated date, if there are sufficient funds in the account, the system automatically debits the amount and completes the payment without user intervention.

Personal Finance Management: Users can set daily or weekly spending limits. For example, if a user sets a daily limit of \$50, once spending reaches \$50, further expenditures are automatically declined, helping control expenses.

Subaccount Management and Allocation: Some banks and internet payment platforms allow users to create subaccounts with different payment conditions for each. For example, users may set a subaccount for educational expenses or monthly allowances for their children, and payments are automatically made according to the pre-set conditions.

Programmable Money

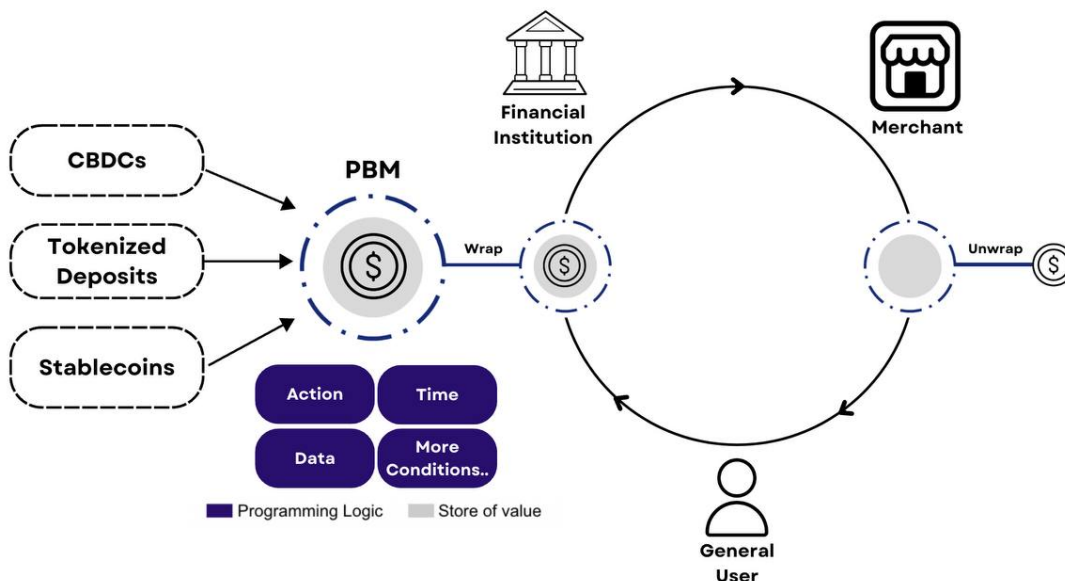


Programmable Money: Programmable money is an exchange medium where value storage and program logic are combined. These programming rules define or limit its usage, such as the Transfer, Approval, Burn, and Whitelist functions defined in the ERC-20 standard or rules limiting value storage to being sent to whitelisted wallets.

Programmable money includes stablecoins, tokenized bank deposits, and CBDCs. Unlike programmable payments, where programming logic and value storage are separate (requiring external interaction with the value storage system to execute), programmable money is self-contained, encompassing both logic and value storage. This means that when programmable money is transferred to another party, its logic and rules also follow.

Purpose-Bound Money (PBM): Purpose-Bound Money combines the features of programmable money and programmable payments, allowing for the creation of a "programmable wrapper" without the need to program the original currency itself. This wrapper imposes specific characteristics and conditions on the currency's use, such as geographic location, merchants, products, and conditions. When conditions are met, the money inside the wrapper is automatically released for the designated transaction. This mechanism maintains the homogeneity and "Singleness" of the original currency, avoiding fragmentation or divergence in its different applications while remaining flexible to accommodate various complex scenarios. For example, in government subsidies or charitable donations, PBM can ensure that funds are only used for their intended purposes, preventing misuse and wastage.

Purpose-Bound Money



Another key characteristic of PBM is its ability to achieve "Compliance by Design." By embedding KYC (Know Your Customer) and AML (Anti-Money Laundering) modules within

the programmable wrapper, PBM is inherently compliant from the design stage. This means the system can automatically verify transaction compliance as the currency circulates, ensuring funds are used lawfully and reducing the risk of financial crime.

Purpose-Bound Money finds broad applications across various scenarios, ranging from daily consumption to complex financial transactions. Here are a few typical examples^[27]:

Coupons: PBM can be used to issue and manage digital coupons. For instance, a shopping mall could issue coupons in the form of PBM, restricting their use to specific merchants, products, or time periods. When consumers purchase goods under qualifying conditions, funds within the PBM are automatically released to cover part or all the cost.

Cross-Border Payments and FX Conversion: Cross-border payments are often subject to high transaction fees, FX conversion costs, and heavy compliance requirements and manual procedures. PBM can alleviate these issues by using its "Compliance by Design" feature, which leverages smart contracts to coordinate AML and KYC compliance requirements in cross-border transactions. For example, PBM can set usage conditions to comply with funds flow rules (such as the FATF travel rule) and perform automatic KYC verifications and whitelist/sanction checks when transaction objectives are realized. In countries with capital controls, PBM can also impose spending restrictions to comply with local regulations.

Moreover, PBM can achieve compliant FX conversions by combining with decentralized exchanges (DEX). Users can make payments in one currency, which is then automatically converted into another currency via smart contracts. This FX conversion process can be completed through DeFi protocols, such as Automated Market Makers (AMM), Order Book, or Vault mechanisms, with exchange rates dynamically adjusted based on the liquidity of specific currency pairs. Although this method requires a significant on-chain presence of currency pairs and sufficient liquidity pools, with the proliferation of digital currencies and advancements in blockchain technology, this model will mature, leading to greater efficiency, reduced costs, and stronger compliance assurance for cross-border payments.

Programmable Escrow Payments: Escrow payments are widely used in global economic activities. In international trade scenarios, trade participants may use instruments like letters of credit to implement "payment upon delivery" transactions, where bank credit guarantees that sellers receive payment only after fulfilling obligations. Similarly, in e-commerce, when a buyer places an order, payment is held in escrow by a third-party platform. Once the buyer confirms receipt and satisfaction, funds are released to the seller. PBM offers an innovative

solution for this process. Payment can be pre-transferred in the form of a "programmable wrapper" and released automatically upon confirmation of receipt by the buyer. This "programmable escrow" mechanism ensures that funds cannot be withdrawn until pre-set conditions are met, while allowing immediate payment upon completion of the transaction. Because escrow funds are visible to both parties, their programmability significantly reduces the risk of fraud. Additionally, tokenized escrow funds can serve as collateral, similar to factoring, making it easier for merchants to access credit and improve financial resilience.

Charitable/Public Purpose Funds: PBM can ensure that funds are used strictly for intended purposes in managing charitable or public funds. For example, a government or charity could set relief funds to be used only at specific supermarkets or pharmacies and exclusively for essential items or medicines. PBM's characteristic prevents misuse and diversion of funds, ensuring that every donation serves its intended purpose. Moreover, the built-in compliance module ensures that fund disbursement and use are transparent and traceable, meeting regulatory requirements.

Project Cases of Digital Currency and Smart Contracts

The programmable potential of digital currency combined with smart contracts is immense, significantly enhancing the efficiency, transparency, and security of financial transactions. Smart contracts' automation ensures that fund and asset transfers are completed automatically when pre-set conditions are met, reducing human intervention and operational risk. This highly efficient, secure transaction model has demonstrated great application value and growth potential in areas such as trade finance, cross-border payments, and supply chain management. Several public and private institutions have launched explorations, with the following as typical cases:

Simplified Trade and Supply Chain Finance:

Project Dynamo: Project Dynamo, launched by the BIS Innovation Hub, Hong Kong Monetary Authority, and Linklogis, created an innovative SME financing solution on DLT using Digital Trade Tokens and smart contracts. The project aims to simplify supply chain financing by utilizing electronic Bills of Lading (eBL) and programmable payment mechanisms to facilitate faster, more transparent funding for SMEs. Additionally, every node in the supply chain can automate fund release through smart contracts, reducing default risks^[28].

Australian Tokenized Invoice CBDC Pilot: This pilot project by the Reserve Bank of Australia, the Digital Finance Cooperative Research Centre (DFCRC), and Unizon demonstrated tokenized invoices for third-party sales and payments, involving a wholesale automotive dealer (supplier), third-party financing institution, and wholesale buyer. The supplier generated a tokenized invoice representing a payment request and sold a portion to a third-party financier, optimizing the supplier's working capital. When the invoice matured, the buyer paid using stablecoins backed by pilot CBDC, which the system automatically settled between the supplier and financier^[29].

Cross-Border Payments:

Project Agorá: Project Agorá, launched by the BIS and seven central banks, aims to explore how wholesale central bank money and commercial bank deposits can be integrated into a programmable platform, improving the efficiency of monetary systems. Participating banks include the Bank of France (representing the Eurozone), Bank of Japan, Bank of Korea, Bank of Mexico, Swiss National Bank, Bank of England, and the Federal Reserve Bank of New York. The project also collaborates with more than 40 private sector entities like SWIFT, VISA, and Mastercard to modernize the monetary system^[30].

Project mBridge: Project mBridge is a cross-border payment platform developed through collaboration among several central banks, aiming to enhance cross-border payment efficiency and costs using CBDCs. The project, launched by the central banks of China, Hong Kong, Thailand, and the UAE, seeks to simplify the payment process for multilateral cross-border transactions using CBDCs^[31].

Project DESFT: Project DESFT, initiated by MAS, Bank of Ghana, Ample FinTech, StraitsX, G+D, Liquid Group, and Proxtera, aims to lower the barrier for SMEs to participate in international trade and cross-border payments. In this project, digital currency and smart contracts are used for cross-border payments between Singapore and Ghana, using Purpose-Bound Money (PBM) to achieve interoperability between Singaporean stablecoin and Ghanaian CBDC eCedi. This ensures that digital currency is only released under specific conditions, improving transparency and security, reducing credit risk in cross-border payments, and promoting financial connectivity between different economies^[32].

Project Mariana: Project Mariana, a joint initiative of BIS and the central banks of France, Singapore, and Switzerland, tested cross-border transactions and settlement of wholesale CBDC (wCBDC) using decentralized finance (DeFi) technology. The project used

standardized token technology, cross-network bridges, and automated market maker (AMM) mechanisms to seamlessly trade and settle Euro, Singapore Dollar, and Swiss Franc wCBDCs among simulated financial institutions, showcasing DeFi's potential in cross-border payments^[33].

Green Finance:

Project Genesis: Project Genesis, launched by the BIS Innovation Hub in collaboration with the Hong Kong Monetary Authority (HKMA) and the United Nations Climate Change Global Innovation Centre, explores how blockchain and smart contract technology can be used for green bond digitization. As part of the project, Project Genesis 2.0 developed two prototypes for tracking, delivering, and transferring digitalized Mitigation Outcome Interests (MOIs) tied to carbon emission contracts. MOIs are linked to green bonds as carbon emission tools, whereby bond issuers commit to future repayments using carbon credits. The project aims to enhance transparency and environmental integrity in the green bond market^[34].

Final Thoughts

The native crypto market has stagnated, showing little innovation; to cryptocurrency enthusiasts, real-world asset tokenization might seem unexciting. However, for the broader financial system, asset tokenization represents a significant evolution in financial infrastructure, with the exploration of tokenization on public blockchains being particularly crucial.

In this report, we examined the practices and innovations of various market participants from the perspectives of both asset and currency tokenization. We envision a future where all assets are represented in tokenized form on public blockchains. Currently, real-world assets on public chains (including stablecoins) amount to only \$200 billion. McKinsey's analysis suggests that the tokenized market could grow to approximately \$2 trillion by 2030. This points to vast untapped market potential and a wide range of new application scenarios that remain to be explored.

References

- [1] Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*. Retrieved from <https://bitcoin.org/bitcoin.pdf>
- [2] Buterin, V. (2013). *Ethereum: A next-generation smart contract and decentralized application platform*. Retrieved from <https://ethereum.org/en/whitepaper/>
- [3] Bátiz-Lazo, B., & D. B. (2020). *Intraday liquidity around the world*. Bank for International Settlements. Retrieved from <https://www.bis.org/publ/work1089.htm>
- [4] UBS Global. (2024). *Optimizing intraday liquidity management*. Retrieved from <https://www.ubs.com/global/en/investment-bank/in-focus/2024/optimizing-intraday-liquidity-management.html>
- [5] Securitize. (2023). *BlackRock launches its first tokenized fund, BUIDL, on the Ethereum network*. Retrieved from <https://securitize.io/learn/press/blackrock-launches-first-tokenized-fund-buidl-on-the-ethereum-network>
- [6] Coindesk. (2024). *Franklin Templeton adds Aptos blockchain to support tokenized money market fund*. Retrieved from <https://www.coindesk.com/business/2024/10/02/franklin-templeton-adds-aptos-blockchain-to-support-tokenized-money-market-fund/>
- [7] PR Newswire. (2024). *UBS Asset Management launches its first tokenised Money Market Fund, available through DigiFT*. Retrieved from: <https://www.prnewswire.com/news-releases/ubs-asset-management-launches-its-first-tokenised-money-market-fund-available-through-digift-302294618.html>
- [8] Coindesk. (2024). *Franklin Templeton's tokenized treasury fund enables peer-to-peer transfers*. Retrieved from <https://www.coindesk.com/business/2024/04/25/franklin-templeton-upgrades-380m-tokenized-treasury-fund-to-enable-peer-to-peer-transfers/>
- [9] DTCC. (2023). *Bringing capital markets onchain with DTCC and Chainlink*. Retrieved from <https://www.dtcc.com/dtcc-connection/articles/2023/september/21/bringing-capital-markets-onchain-with-dtcc-and-chainlink>
- [10] Circle. (2024). *Announcing USDC smart contract for BlackRock's BUIDL fund investors*. Retrieved from <https://www.circle.com/en/pressroom/circle-announces-usdc-smart-contract-for-transfers-by-blackrocks-buidl-fund-investors>
- [11] DigiFT. (2023). *How do DeFi protocols adopt real-world assets (RWA) - An overview of MakerDAO's RWA layouts*. Retrieved from https://www.digift.sg/insights/2023/research_DeFi_protocols_adopt_RWA.html
- [12] Sky Forum. (2023). *Announcement: Spark tokenization grand prix - Request for proposal - Spark SubDAO*. Retrieved from <https://forum.sky.money/t/announcement-spark-tokenization-grand-prix-request-for-proposal/24631>
- [13] Coindesk. (2024). *Ethena announces UStb stablecoin backed by BlackRock's BUIDL*. Retrieved from <https://www.coindesk.com/markets/2024/09/26/ethena-announces-ustb-stablecoin-backed-by-blackrocks-buidl/>
- [14] CME Group. (n.d.). *Acceptable collateral*. Retrieved from <https://www.cmegroup.com/solutions/clearing/financial-and-collateral-management/acceptable-collateral.html>

- [15] Binance. (2024). *Binance pilots banking triparty agreement to help institutional investors manage counterparty exposure*. Retrieved from <https://www.binance.com/en/blog/vip/binance-pilots-banking-triparty-agreement-to-help-institutional-investors-manage-counterparty-exposure-6193507006097722519?hl=en>
- [16] FalconX. (2024). *FalconX accepts BlackRock's tokenized fund as trading collateral, enhancing BUIDL's utility*. Retrieved from <https://www.falconx.io/newsroom/falconx-accepts-blackrocks-tokenized-fund-as-trading-collateral-enhancing-buidls-utility>
- [17] Coindesk. (2024). *Prime broker Hidden Road adds major crypto exchanges, expands use of BlackRock's BUIDL token*. Retrieved from <https://www.coindesk.com/business/2024/07/01/prime-broker-hidden-road-adds-major-crypto-exchanges-expands-use-of-blackrocks-buidl-token/>
- [18] Financial Stability Board. (2023). *G20 targets for enhancing cross-border payments*. Retrieved from <https://www.fsb.org/work-of-the-fsb/financial-innovation-and-structural-change/cross-border-payments/g20-targets-for-enhancing-cross-border-payments-2/#:~:text=75%25> of cross-border wholesale, initiation%2C by end-2027.
- [19] Deutsche Bank. (2023). *G20 roadmap: Forging a path to enhanced cross-border payments*. Retrieved from <https://corporates.db.com/publications/White-papers-guides/g20-roadmap-forging-a-path-to-enhanced-cross-border-payments>
- [20] Financial Stability Board. (2020). *Enhancing cross-border payments: Stage 3 roadmap*. Retrieved from <https://www.fsb.org/2020/10/enhancing-cross-border-payments-stage-3-roadmap/>
- [21] Hong Kong Digital Currency Association. (2024). *The future of global money movement: e-HKD*. Retrieved from <https://www.hkdca.com/wp-content/uploads/2024/07/e-hkd-future-global-money-movement-visa.pdf>
- [22] Blade Labs. (n.d.). *The evolution of cross-border payments: From bills of exchange to distributed ledgers*. Retrieved from <https://bladelabs.io/e-book-the-evolution-of-cross-border-payments-from-bills-of-exchange-to-distributed-ledgers/>
- [23] World Bank. (2022). *COVID-19 boosted the adoption of digital financial services*. Retrieved from <https://www.worldbank.org/en/news/feature/2022/07/21/covid-19-boosted-the-adoption-of-digital-financial-services#:~:text=Globally%2C> some 1.4 billion adults, go%2C much more is needed.
- [24] Finextra. (2023). *How programmable money will revolutionize the financial world*. Retrieved from <https://www.finextra.com/blogposting/25580/how-programmable-money-will-revolutionize-the-financial-world>
- [25] International Monetary Fund. (2024). *Programmability in payment and settlement*. Retrieved from <https://www.imf.org/en/Publications/WP/Issues/2024/08/15/Programmability-in-Payment-and-Settlement-553493#:~:text=IMF> Working Papers&text=Summary%3A, for understanding and evaluating programmability.
- [26] Monetary Authority of Singapore. (2023). *Purpose-bound money whitepaper*. Retrieved from <https://www.mas.gov.sg/publications/monographs-or-information-paper/2023/purpose-bound-money-whitepaper>
- [27] McKinsey. (2024). *Purpose bound money: A new paradigm in value transfer*. Retrieved from [link if available].

- [28] Bank for International Settlements. (n.d.). *Dynamo: Open finance*. Retrieved from https://www.bis.org/about/bisih/topics/open_finance/dynamo.htm
- [29] Digital Finance CRC. (2023). *Australian CBDC pilot for digital finance innovation project report*. Retrieved from <https://dfcrc.com.au/wp-content/uploads/2023/08/australian-cbdc-pilot-for-digital-finance-innovation-project-report.pdf>
- [30] Bank for International Settlements. (n.d.). *Agora: A platform for distributed ledger technology*. Retrieved from <https://www.bis.org/about/bisih/topics/fmis/agora.htm>
- [31] Bank for International Settlements. (n.d.). *MCBDC bridge*. Retrieved from https://www.bis.org/about/bisih/topics/cbdc/mcbdc_bridge.htm
- [32] Bank of Ghana. (2024). *Press release: Bank of Ghana announces successful completion of cross-border trade using digital credentials*. Retrieved from <https://www.bog.gov.gh/wp-content/uploads/2024/06/PRESS-RELEASE-BANK-OF-GHANA-ANNOUNCES-SUCCESSFUL-COMPLETION-OF-CROSS-BORDER-TRADE-USING-DIGITAL-CREDENTIALS-120624.pdf>
- [33] Bank for International Settlements. (n.d.). *Mariana: A cross-border CBDC platform*. Retrieved from <https://www.bis.org/about/bisih/topics/cbdc/mariana.htm>
- [34] Bank for International Settlements. (2023). *Issues in the design of central bank digital currencies*. Retrieved from <https://www.bis.org/publ/othp58.htm>

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