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The Future Belongs to Those Who Prepare Today - Readying for Tokenised Money

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Executive Summary

The promise of new functionalities, radically higher transaction speed, greater transparency and lower fees compared to traditional forms of money have led to the emergence of several forms of tokenised money in recent years. Numerous pilot studies have been conducted globally, and first cases have gone live. The issuers of tokenised money are equally diverse, ranging from central banks for retail and wholesale Central Bank Digital Currencies (CBDC), various FinTech players for stablecoins, to commercial banks for tokenised deposits.

A roundtable discussion at the Singapore FinTech Festival in November 2024 explored the state of play of tokenised money; its implications for regulators, financial institutions and consumers; as well as key considerations for readying for its broader adoption.

The State of Play:

1. **Digital counterparts**: Forms of tokenised money resemble traditional money:
   - Retail CBDC and cash,
   - Wholesale CBDC and central bank reserves,
   - Tokenised deposits and traditional deposits,
   - Stablecoins and e-money.
2. **Desired commonalities**: All forms of tokenised money shall share two key features:
   - **Singleness**: All forms of money hold the same value.
   - **Interoperability**: All forms of money work seamlessly across systems.
3. **Differences**: Forms of tokenised money differ vastly in terms of issuers, technical functionalities, capabilities, use cases, access and reach.
4. **Coexistence**: Due to these differences, the various forms of tokenised money serve distinct purposes and enable different use cases. As a result, it is likely that all forms will coexist in the future.
5. **Adoption**: Consumers tend to be indifferent between different forms of money. The "success" of each form of tokenised money largely depends on its use cases, adoption rates and successfully built network effects.

Recommendations:

1. **Start preparing now**: Banks need to start building separate systems to be ready for tokenised money, while the modernization of legacy technology is still ongoing.
2. **Collaboration is key**: Tokenised money requires cooperative ecosystems and agreement on common standards to be widely adopted and efficient.
3. **Adaptive regulation**: Regulatory guidelines are crucial for establishing a level playing field and ensuring trust. To be effective in a highly dynamic environment, regulators must be adaptive and allow for safe room for experimentation.

Introduction

We are amidst the largest transformation of money since the introduction of internet transfers in the 1990s. Advances in tokenisation and distributed ledger technologies (DLT) have driven rapid changes: private issuers now offer stablecoins for cross-border payments; central banks are piloting Central Bank Digital Currencies (CBDCs) for both retail and wholesale uses; commercial banks are exploring tokenised deposits that are available 24/7 and settle instantly; regulators are providing sandboxes for experimentation and issuing new regulatory guidance, such as the EU's Markets in Crypto-Assets Regulation (MiCA).

Tokenised money – especially when based on DLT instead of a central database – is built on a fundamentally different technical foundation than traditional money or even electronic money. Moreover, there's a high degree of variance between forms of tokenised money: from those on one or multiple public permissionless blockchains such as Ethereum; to those in private and permissioned blockchains operated by the issuers of the money.

This poses a challenge for financial institutions: substantial parts of today's payment infrastructure rely on systems introduced in the 1990s, using the message-based payment logic from the 1970s. Due to this, the common approach is to build a separate infrastructure layer for tokenised money, which is unlikely to change anytime soon as an extensive overhaul of legacy systems is both costly and time consuming.

Beyond the technical challenges, there is also a strong and lasting impact on business and operational models. A report by the Global Financial Markets Association (GFMA) estimates that DLT could unlock an annual cost saving of USD 20 billion in clearing and settlement costs, around one-third of total global costs for payments.[1] Much of this is driven by a reduced reliance on third parties when payments can be facilitated directly using DLT.

Scrambling to prepare for tokenised money, banks face critical questions: should they support all tokenised money forms or just some? Is one stablecoin as good as another? These questions framed the roundtable discussion of representatives of financial institutions, policymakers and payment infrastructure providers at the Singapore FinTech Festival roundtable in November 2024.

To set the scene and establish a common understanding, we can distinguish between four kinds of traditional money with different purposes:

- **Cash**: Claim against a central bank, accessible by all.
- **Central bank reserves**: Claim against a central bank, only accessible to financial institutions for interbank transfers.
- **Bank deposits**: Claim against a commercial bank, usually backed by (fractional) central bank reserves and other liquid or non-liquid (predominantly loans) assets.
- **Electronic money**: Claim against an e-money issuer, depending on jurisdiction partially or fully backed by bank deposits or high-quality liquid assets (e.g., fully backed in the EU, UK & Singapore)

As shown in Figure 1 on next page, we can assign a digital counterpart to each form of traditional money:

- **Retail CBDC (rCBDC)**: Digital cash.
- **Wholesale CBDC (wCBDC)**: Equivalent to central bank reserves.
- **Tokenised deposits or CBMT**: Digital form of traditional deposits.
- **Stablecoins**: Digital e-money^

Excluded from our comparison are cryptocurrencies. While cryptocurrencies can be used as a medium of exchange, most cryptocurrencies are mainly used as investment assets or utility tokens (e.g. for smart contracts or decentralized finance use cases). Moreover, their fluctuating value makes their use as electronic money less practical than e.g. fiat-denominated stablecoins.

Similarly, unregulated stablecoins are typically linked to cryptocurrency use cases or as an investment asset on its own (e.g., yield-bearing algorithmic variants) and therefore unlikely to be widely used as a medium of exchange.

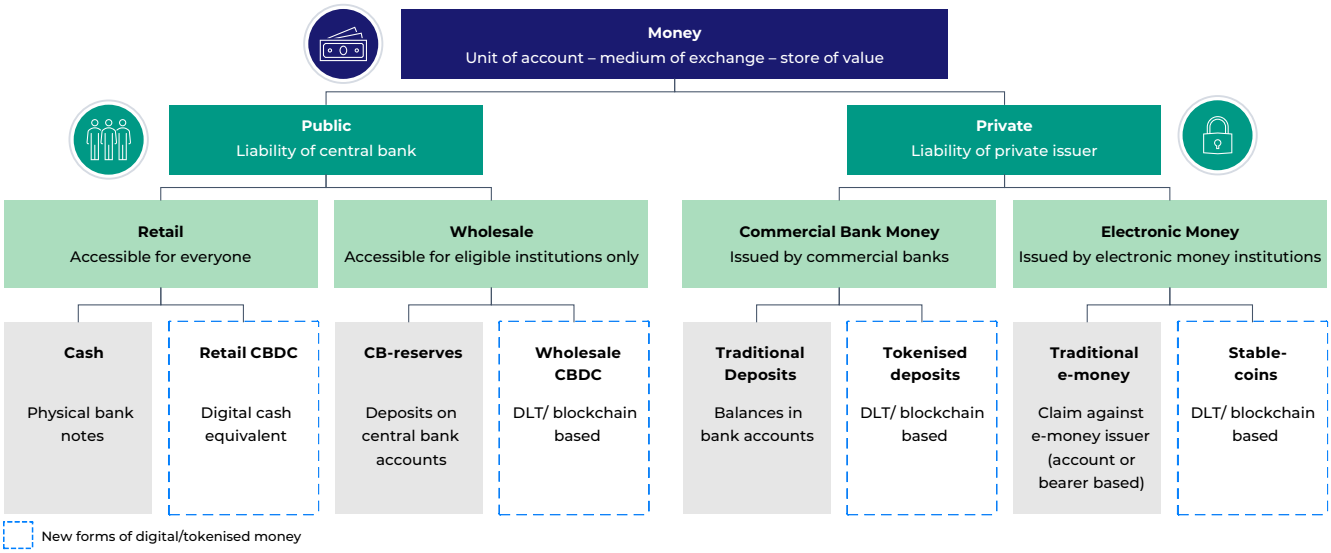
Digital assets versus tokenised money

Digital assets and tokenised money on DLT are easily mixed up: Both are typically expressed with a token definition as a smart contract; using the same basic infrastructure such as wallets and custody solutions. Tokenised money is a subset of digital assets, but for our purposes we use digital assets as assets not specifically tied to payments: Cryptocurrencies, algorithmically backed stablecoins, non-fungible tokens (NFT), funds, derivates, loans, shares, tokenised real-world assets (RWA) and so on. The key factor for these digital assets is that they are not widely usable as a means of exchange, i.e. as money.

Where digital assets and tokenised money intersect is when digital assets require a cash leg, such as when acquiring a digital asset or paying fees or interest to its issuers. Combining the digital asset transaction with a tokenised payment provides substantial benefits compared to using traditional forms of money, since the money is issued on the same infrastructure as the asset allowing for composable transactions. This allows for new, programmable use cases and can provide faster and cheaper settlement, e.g., by integrating the cash and asset leg in a Delivery versus Payment (DvP) smart contract – see also page 7.

^ (note: stablecoins are considered e-money tokens under the EU's MiCA regulation. Other jurisdictions might regulate stablecoins differently, e.g. as money market fund shares).

Figure 1: Traditional forms of money and their digital counterparts
Adapted from Deutsche Bank (2023)[2]



Source: Deutsche Bank "CBDCs in Europe: retail and wholesale projects to follow" | https://flow.db.com/cash-management/cbdcs-in-europe-retail-and-wholesale-projects-to-follow

Preparing for tokenised money

Use cases for tokenised money

Before diving into the *how*, i.e. how to prepare for tokenised money, it is important to discuss the *what:* What are the major use cases for tokenised money? And what are the benefits compared to traditional money?

The roundtable discussion covered a broad spectrum of use cases – from simple domestic payments to complex multi-party workflows across multiple countries. Many are still being explored; hence it is difficult to judge which ones will last.

Starting with rCBDC, everyday payments at a merchant point of sale or web shop and payments between private individuals are obvious use cases. Here, digital central bank money is competing with well-established traditional payment methods such as debit cards, credit cards, e-money or instant payments. Hence rCBDC will need to provide an advantage compared to them, through minimal fees, immediate settlement finality, and universal acceptance.

On a technical level, there are two models for rCBDC: The direct model, where central banks directly issue rCBDC to users, and the indirect or hybrid model where the central bank relies on commercial banks as gateway to the users.[3] The indirect model is akin to the distribution of fiat cash or bank deposits, where the central banks issues and commercial banks distribute and fulfil functions such as onboarding and Know-Your-Customer (KYC).[4]

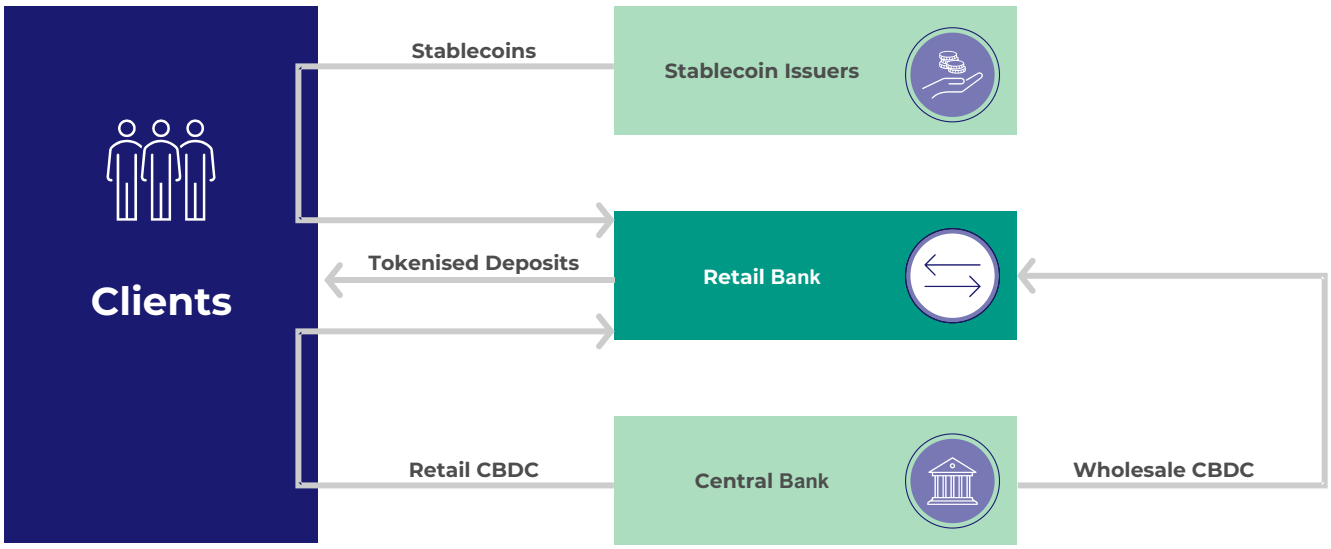
The majority of CBDC pilots and live cases use hybrid models, e.g. Project Aurum in Hong Kong, the digital Euro Project of the ECB or the eCedi in Ghana, where offline payments are conducted in rural areas with no network connectivity – akin to cash. In this model, the rCBDC is a digital representation of the central bank liability, but banks provide wallets, do AFC checks for each transaction and provide additional services to end-users.

Furthermore, even if the few live rCBDCs may run on (private) DLT networks, other central banks will not necessarily use DLT to issue and distribute their rCBDC. They might adopt technical cryptographical features or design principles like unspent transaction outputs (UTXOs) of crypto currencies, but without using a blockchain or distributed ledger to record transactions, account balances or states.

Turning to wCBDC, the participants saw it as a tokenised form of central bank reserves, which is the ultimate settlement vehicle for DLT-based capital market transactions. As with rCBDC, a significant benefit compared to private forms of money is the immediate settlement finality that can facilitate risk-free settlement.

Another use case for wCBDC are cross-border payments. Project mBridge, led by the Bank for International Settlements (BIS) and multiple central banks, has reached the Minimal Viable Product stage in 2023, piloting instant cross-border settlements.[5] Project Agorá, a partnership between the Institute of International Finance (IIF), BIS, seven central banks and over 40 financial institutions, investigates how tokenised commercial bank deposits can be seamlessly integrated with wCBDC.[6] This would allow for programmable and composable settlements across different representations of tokenised deposits and wCBDC to uphold the two-tiered banking model and correspondent banking networks, as well a payment versus payment (PvP) operations between

Figure 3: Tokenised forms of money affecting retail banks



the payer and recipient, eliminating the need for third parties such as FX clearing houses.

For broader, non-wholesale use cases for instant cross-border payments and remittances, stablecoins might be a more suitable candidate. Anyone with a compatible wallet can participate in direct transactions that settle instantly.

A particularly interesting cross-border use case for tokenised money is intra-company liquidity management. This provides corporations with the ability to instantly move cash between subsidiaries depending on liquidity needs. This would allow for constant optimisation of liquidity management, without the need for a third-party facilitator.

This is particularly appealing to large multinationals. For instance, Siemens is cooperating with J.P. Morgan to instantly move cash across the 190 countries it operates in via blockchain deposit accounts on Kinexys – a tokenised form of deposits JPM provides to its clients.[7] Offerings are also emerging that allow companies to do stablecoin-based cash management without setting up their own structures, such as through Visa's tokenised Asset Platform or the cooperation between Circle and Thunes to provide USDC and EURC based liquidity management.[8]

Stablecoin-based liquidity management could be combined with tokenised deposits, where faster settlement allows corporations to enhance their liquidity management even more, reducing the time that money is spent idle. One participant stated: "tokenised deposits are internal bank systems that run on blockchain rails." This limits their reach and imposes restrictions when it comes to cross-bank transactions. In addition, tokenised deposits can be paired with smart contracts to unlock new use cases, see next chapter.

In a recent experiment, Adhara simulated a cross-border corporate payment across UBS and Deutsche Bank. They combined the use of tokenised deposits with Bundesbank's Trigger Solution to connect market-operated DLT platforms with the Eurosystem's traditional payment system and increase the reach.[9] Similarly, HSBC and Hang Seng Bank facilitated a transfer of tokenised deposits via the HKMA's Project Ensemble Sandbox.[10]

While there are many additional use cases not covered here, we can note that the primary drivers for the emergence of tokenised money use cases are the new opportunities unlocked through composability, higher transaction speed, transparency and in some cases lower fees (not always, e.g. compared to instant payments) compared to traditional payment methods and forms of money.

Smart contracts and programmability

Turning from the *what* to the *how*, a key feature to consider is programmability, which enables fundamentally new possibilities for tokenised money as compared to traditional money.

As one roundtable participant noted: "Programmability is a key notion and adding innovation capabilities on money itself to automate what today are hugely manual processes. These are capabilities that today either don't exist or are very difficult to implement."

So, what does programmability mean? It refers to a tight integration of automatically sending and receiving money based on specified conditions that might even include activities that act as triggers in the real world or the financial system. However, the notion of programmable money is often blurry and misunderstood because attaching automation rules directly to the money token itself can pose drawbacks:

- **Compromising interoperability and singleness of money**: Programmable tokens might behave inconsistently across programmes, gaining or losing value.

- **Issuer-based restrictions**: Programming can only be done by the issuer, who might enforce policies that limit use cases and innovation.

To avoid these drawbacks, common standards such as ERC20 and open APIs are critical. Programmability unlocks the most value when not only the issuer, but also users or even third parties can configure use cases in innovative ways. By leveraging shared infrastructure elements, such as accounts, wallets, events, and payments, rules can be codified and executed 24/7.

It is important to note that smart contracts interoperate on different layers to fulfil the requirements of programmability: tokenised money, realised as smart contract, exists independently from higher-level smart contracts that might implement delivery-versus-payment use cases. As illustrated in Figure 4 below, smart contracts for tokenised money and general smart contracts operate in different layers of one system, which comprises a building block structure for facilitating complex use cases.

The business layer, at top, captures the contract signed between two companies to deliver a good versus a payment, which is translated into a smart contract in the financial service layer. This is then linked to an asset layer smart contract such as stablecoin for payment, using the underlying infrastructure such as the Ethereum Virtual Machine (EVM).

For example, the proposed ERC7683 standard for cross-chain intents on Ethereum separates token functionality from use-case logic. A cross-chain order specifies the token amount, transfer destination, and additional metadata for the target chain, while tokens separately enforce their own rules, such as whitelisting, AML, or KYC compliance.

The level of programming differs widely across the various use cases:

- **Retail end-user programming** (on wallet or account level): Configuration of when and how a predefined action occurs (refill my account, optimize unused funds).
- **Business-to-business programming**: Delivery vs Payment use cases where a smart contract automates payments streams, removing the need for third parties.
- **Financial Instruments programming** (loans, funds, tokenised assets): Definition and execution of interest and yield payouts, corporate actions and the like.

Singleness of money

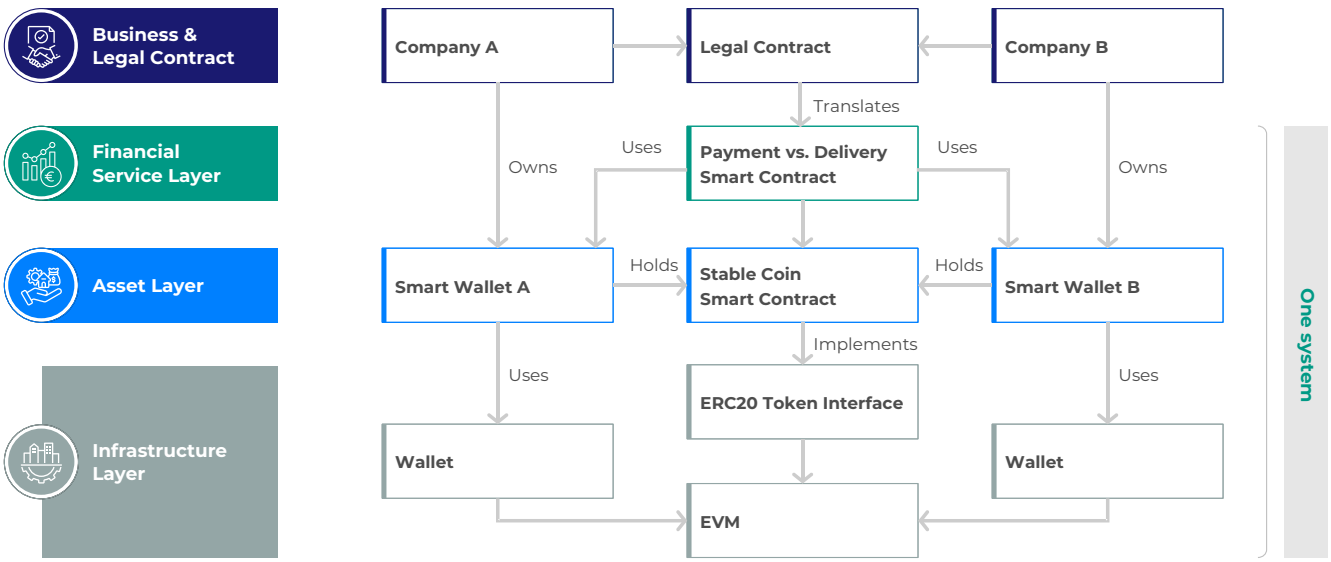
Singleness of money refers to the principle that all forms of money within a financial system should be interchangeable and hold the same value without risk of devaluation or fragmentation. It ensures that different types of money, traditional or tokenised, are universally accepted as a unit of account, medium of exchange, and store of value.

Singleness is crucial to underpinning trust and confidence in fiat money, as it provides an unambiguous unit of account that underpins all economic transactions.

Key aspects of singleness of money:

1. **Uniform value**: A dollar in cash should be worth the same as a dollar in a digital form, regardless of the issuer (central bank or commercial bank) and the form (account-based vs. token-based).
2. **Interoperability**: Different types of tokenised money should work seamlessly across payment systems without barriers.

Figure 4: Business smart contracts vs infrastructure



The regulatory view

Besides the technical possibilities and limitations, the other important consideration for the *how* is the regulatory view. The roundtable participants agreed that regulation is welcomed by all stakeholders, as it provides the common ground rules for a level playing field and ensures the trust of the users of tokenised money.

There are two sets of rules to consider: The first are well-established rules that apply to all forms of money, such as traditional and tokenised money. The second are rules specifically for tokenised forms of money or more generally for digital assets, which is a more developing field as the subjects that are being regulated are still evolving.

The discussion highlighted two key criteria for tokenised money to function effectively:

- **Singleness of money**: All forms of money should be interchangeable, maintaining the same value without risks of devaluation or fragmentation.
- **Interoperability**: All forms of money should seamlessly interact between systems, ensured through common standards and interlinking of systems.

For rCBDC and wCBDC, singleness of money is accomplished as central banks ensure interchangeability between digital and physical cash. Similarly, tokenised deposits maintain singleness as they are DLT representations of traditional deposits, i.e. are kept under the same fractional reserve requirements and ultimately settle in central bank money between different issuers (via wCBDC or a trigger into existing Real Time Gross Settlement systems).[11]

To reach singleness and interoperability for stablecoins on the other hand is more challenging. Privately issued stablecoins act as bearer instruments, i.e. they are transferrable claim on the issuer than can be moved from one person to another without being settled in central bank money.[12] Due to this, their monetary value on secondary markets can fluctuate. To avoid this, regulators should require Stablecoins to be backed by high-quality liquid assets, ensuring that holders of the Stablecoins can always redeem at par with the issuer against other forms of fiat money.

At the same time, some regulators prohibit issuers of stablecoins to pay interest to their holders to make them more comparable to cash or e-money. Stablecoins are therefore primarily suited for payments, unlike tokenised money market fund shares or tokenised deposits, which are also used as yield-earning stores of value but not as comparably effective mediums of exchange (as tokenised deposits must settle in central bank money given their account-based feature).

Interoperability, the second criterion, relies on common standards and interconnectivity that enable flawless interaction between and within traditional and tokenised money. A nice metaphor from a participant is "the highway and the cars: Can we agree on one highway, on rules of engagement, and can we agree on technical standards?"

Getting there is no easy feat, not least as the field of tokenised money is steadily evolving.

It requires regulators to provide spaces for safe experimentation to foster innovation and test best practices, such as via sandboxes and pilots; strong collaboration between all involved players; agreements on globally aligned common standards; and the willingness to be highly adaptable and pragmatic in adjusting regulations.

Interoperability of money

Interoperability means that different forms of money can seamlessly interact. As an example, a recipient of a cross-border stablecoin payment onto a blockchain wallet, would be able to transform it into a normal bank deposit of equivalent value, which can again be transformed into rCBDC with the same value. All systems operating different forms of money, shall technically interact to share and migrate the value, and in line with proposed common standards, in future also automatically handle the payment meta information (payer/recipient identification, reference texts, ...).

This requires standardisation with aligned and consistent rules, protocols and data formats across systems and networks. In the traditional financial sector, all players adopt ISO 20022 XML / JSON formats for structured data. Stablecoins could also adopt this standard which would increase interoperability chances to traditional forms of money. With that foundation, the financial ecosystem can grow, reducing barriers for developers and users and enable new use cases efficiently.

In the context of cross-border payments, interoperability additionally means that two different kinds of currencies can be used. Here, rules are required that define currency conversion rates, otherwise the systems of currency A cannot properly interact with the systems of currency B. This is a developing area, for further information see also the BIS report "*Options for access to and interoperability of CBDCs for cross-border payments*".[13]

Migration and technical challenges

Many large banks still rely on legacy IT systems from the last century, making transformation challenging. This is evident in the slow adoption of updates like ISO 20022 XML to replace message type messages. Transitioning to tokenised money represents a far more significant shift, as foundational elements such as T+1 or overnight processing are replaced with instant, just-in-time payments.

The rapid enhancements of instant payments systems in recent years, particularly in South-East Asia, show that incremental change and innovation is possible within the existing payment infrastructure. However, for cross-border payments, remittances or treasury payments, tokenised money might bring additional challenges.

Aside from newer financial institutions such as neobanks and fintech that may not yet have substantial amounts of technical debt, established financial institutions will need to cope with the technical implications of this change, e.g. by setting up parallel infrastructures to facilitate tokenised money while modernising their legacy technology.

The expected coexistence of multiple forms of tokenised money poses an additional challenge for technical adoption, as the possibility for synergies is reduced by differences in their technical requirements. One way of handling this challenge is through cooperation. A similar area where this has already happened are cryptocurrencies, where established banks partner with FinTech companies to offer their customers the opportunity to seamlessly buy crypto-currencies from their trading accounts without needing to make its bank-internal infrastructure ready for it. It is therefore likely that “plug-and-play” solutions will emerge for tokenised money, where a third-party solution is integrated into the bank's infrastructure.

In addition to technical considerations, the emergence of tokenised money also entails changes to the operational processes of banks. A key challenge is that most tokenised payments will be settled instantly, which requires banks to also instantly perform risk controls such as for anti-money laundering, sanctions screening and fraud-detection. Similar concerns have existed for instant payments – hence banks and regulators alike will be able to draw on experiences and existing solutions. One solution to this problem is the automation of risk controls to reduce manual workloads, and many banks are already integrating AI into risk processes to increase automation even more.

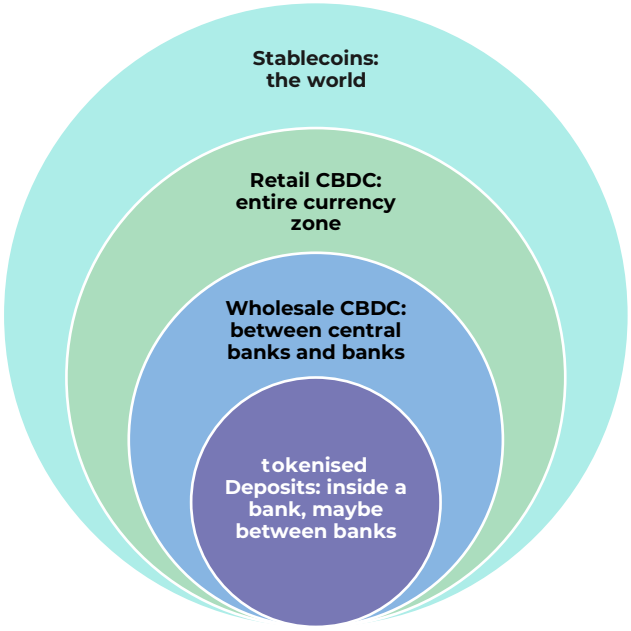
To summarize, the migration of existing payment and banking systems to support tokenised money is a long-term effort for banks and their customers. Traditional money systems and emerging tokenised money systems are expected to coexist for an extended period, and banks will look to rapidly prepare for handling tokenised money while also pursuing their long-term technical modernization efforts.

Conclusion

We foresee that the four major forms of tokenised money will coexist, as they fulfil different use cases with a different reach (see Figure 5). Accordingly, large global financial institutions will need to prepare for a future in which they need to support most, if not all, forms.

Transaction speed, transparency of cash positions, lower fees and ubiquitous availability are main drivers for adoption. Beyond these potential advantages compared to traditional money, tokenised money will also enable completely new use cases, such as real-time liquidity and cash management for corporations that can be programmed and automated via smart contracts and interact seamlessly with other smart contracts orchestrating business processes, cash pooling or capital market transactions.

Figure 5: Scope of tokenised money forms



For this reason, banks should not only consider the technical impact for supporting a new IT system infrastructure. A change to tokenised money will also change business models, operating models and enable new revenue streams.

The regulatory landscape is evolving towards legal clarity. Its guardrails enable a levelled playing field for all market participants for payment technologies, stablecoins and/or CBDCs. But each jurisdiction has its own pace. It is advisable

to stay in close contact with the regulators to shape the landscape and to be informed as early as possible.

A strong win-win connection is the combination of digital assets and tokenised money as their obvious cash leg, enabling pure on-chain transactions and reaping full benefits from delivery vs. payment in an atomic fashion. This reduces counter party risks, combines settlement and payment in a combined activity, and allows for T+0 processing.

The payment landscape is moving fast and will change fundamentally. Financial institutions cannot avoid adopting some form of tokenised money in the future. It is important to start preparing now.

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