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The triple revolution
in securities post-trade

How the new digital asset ecosystems are
impacting roles and post-trade landscape
for new growth opportunities and risks

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SPECIAL

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Foreword

Deutsche Bank's May 2019 white paper, *Transitioning into the future of securities post-trade*,[1] highlighted the persistent structural margin compression that reflects the asset management industry's declining fee levels, and the increasing regulatory costs for asset protection and market stability.

It identified distributed ledger technology (DLT) as a driver that can facilitate our industry's evolution into a digital future, with the potential for new tokenised or digitalised assets to introduce new revenue sources and reduce unnecessary legacy costs. In this future, industry post-trade workflows would transition into a more modern, concurrent system with greater levels of automation and built-in intelligence. The 2019 paper also identified the types of digitised assets and high-level custody considerations, a range of settlement methods using distributed Hash-Time Locked Contracts (HTLCs), and the need to reinterpret laws and regulations to reflect the new context and encourage adoption. It concluded that the effects of technology tend to be underestimated in the long run.

Three years on, digital assets have expanded and established three large ecosystems, with further specialised sub-ecosystems like decentralised finance (DeFi) and stablecoins in the cryptocurrency one. Metaverse looks to be a new forming ecosystem that can yet create more demands for new custodial capabilities (although as an emerging linked ecosystem, in its early evolutionary stage it is outside the scope of this paper). The prospects of new revenue sources and a new operating environment, first highlighted in 2019, are now clearer – as are the demands on market participants, which include new activities, managing new risks and acquiring the necessary expertise to support value creation in the new environment.

These new digital assets are also attracting new participants to the market, expanding the roles of intermediaries, and prompting existing market structures to transform – gradually re-ordering the competitive dynamics. Workflows modelled on or after DLT are now proving that they can save costs, and markets are gradually rolling them out to replace legacy operating models, processes and infrastructure. Echoing the Bank of France's Governor,[2] we are calling these three changing elements – digital assets, intermediary roles and market structure – the three revolutions in the securities post-trade industry. Together, they represent a major transformation and the core elements of the digital asset supercycle journey that the industry has embarked on. This will be an exciting space to watch, especially bearing in mind a further point noted back in 2019 – that the effects of technology and regulations, although they might appear over-hyped in the short term, tend to be underestimated in the long run.

This 2022 paper focuses on how the digital asset ecosystem has since grown, its convergence with traditional finance and the growth possibilities as viewed from the lens of a digital asset custodian.

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Introduction: The digital asset universe

Having waxed and waned in public opinion – periodically moving from "the next big thing" to "overhyped" and then back again – the concept of digital assets, popularised by the rise of Bitcoin and other cryptocurrencies, is now entering into the financial mainstream. Institutional investors are making their way into the space, creating a demand for service providers to support these investments. Growing in response to this demand are the green shoots of new and vibrant sectors – Crypto or digital assets hedge funds, asset managers, intermediaries and service providers have all emerged and continue to mature.

What does this mean for securities services and those in the post-trade industry? To understand the impact, one first needs to understand the world of digital assets – one that consists of distinctive yet interconnected parts, forming a continuous ecosystem that can nevertheless be sub-divided into three broad categories:

— Cryptocurrencies;

— Tokenised financial assets; and

— Central Bank Digital Currencies.

This trio provides the foundations for new participants and market structures to build on, amid established investor interests and regulatory supervision for bringing these assets nearer everyday use.[3]

"We cannot overlook that the digital assets ecosystem was created from the random, separate and countless convergences of technologies, user adoption, regulations and market structure. Today, this ecosystem is a new future for our industry to build on. In many ways, each step that the industry, our clients and regulators are taking will shape the digital assets industry. To prepare for these changes, we need to be thoughtful, responsible and bold in forging the path ahead"

Paul Maley,
Global Head of Securities Services, Deutsche Bank

Figure 1: The digital assets universe and its ecosystems

Digital assets supercycle
Maturing technology regulatory clarity increasing adoption

2009

Future

*Size of diagram
not indicative of
size of market

Highlights of digital assets ecosystem's contributions to digital finance

Crypto	Crypto – DeFi	Tokens	CBDC
Open source of value – using the internet to transfer value (payments)	Uncollateralised Flash Loans	Fractionalisation	Dual Offline
New distribution capabilities – Airdrops	Yield Farming	Programmable Assets	Managed Anonymity
Digital confidentiality – anonymous coins and wallets	Self-Hosted Wallets	Direct Issuer-Investor distribution model	Hybrid Token-Account Balance
Intelligent infrastructure – Distributed Autonomous Organisations (DAOs) and Smart Contracts	Decentralised Trading Book / Liquidity Pools	Intermediary-lite model	Programmable Payment
Direct risks capital formation model – Initial Coin Offerings (ICOs)	Automated Market Maker	Interoperability	Programmable Money
Digital True Copy –Non-Fungible Tokens (NFTs) and Distibuted Ledger Technology (DLT) in Trade Finance	Synthetic Assets Platform		Interoperability
Interoperability – Cross Chains and Wrapped Cryptos	Composability – "Lego" building blocks		Massive throughput scale
Deferred Settlement – Layer 2 transfers			

Source: Deutsche Bank

1.1 Cryptocurrency

Cryptocurrency is the first category of the digital assets ecosystem and the starting point for the ongoing triple revolution in the securities post-trade industry.

Bitcoin, the progenitor of cryptocurrencies, started as a disruptive payment method and a medium of value. With its fast confirmation (settling in around 10 minutes), ability to be traded from peer to peer, and low transfer fees (based on a spread and what was, at its inception, the cost of a few kilobytes of data), Bitcoin was first used by entrepreneurs as an alternative to standard cross-border remittances, which often settled on a timeline of T+3 to T+5 from the value date and came with relatively high fees that ate into low-value transfers.

It is now regarded by many as a hedge against the traditional financial system, a tool of portable wealth, and/or an infrastructure for transferring value off the traditional banking network. For others, the cryptocurrency represents a new global sentiment-based asset, given its global accessibility, while for a third group, it is little more than an instrument for scams and other crimes. Regardless of the narratives, Bitcoin's multi-year price growth and velocity as a globally traded asset have sparked global investors' interest, resulting in the creation of new segments of crypto-savvy asset managers and traders who require digital asset custodians to service them.

More recently, stablecoins have stepped in to adopt the role of a medium of value and payment, while Bitcoin and other public cryptocurrencies have become more asset-like, taking on new characters.

1.1.1 Decentralised finance

The cryptocurrency space is also home to the relatively young and powerful decentralised finance (DeFi) segment. While it can be (and has been) defined many different ways, for the purposes of this paper we can consider DeFi as the use of emerging technology such as decentralised ledgers to facilitate peer-to-peer or peer-to-contract transactions and financing, as opposed to centralised transactions and financing using traditional infrastructures.

DeFi adds additional paradigms to DLT – including composability (the ability for different interoperable elements to be assembled in various ways, as with pieces of Lego), smart contract managed liquidity pools, and automated market makers – that can herald new product developments when they start intersecting with traditional funds and financial markets; for example in the way that Bitcoin has.

The foundations for the DeFi space were first laid by the cryptocurrency Ethereum, specifically its vision to be a "world computer" and its additional programmability layer, which uses scripting language to create smart contracts – where actions are triggered automatically once the necessary conditions set out within them are met. From the early days of its launch as a Decentralised Autonomous Organisation (DAO), through to the quiet birth of the new DeFi segment around 2017-18, and its high-profiled Initial Coin Offering (ICO) period, each served to demonstrate the promise of performing existing banking activities in different ways to realise new outcomes.

Today, from Ethereum and other decentralised blockchain platforms like Algorand[4], Solana[5] and Polkadot[6], DeFi services that include borrowing, lending, derivatives and liquidity pools have been launched. These services are exemplified by individual success stories such as Yearn Finance; Aave, Balancer, Curve, Compound, Maker, Synthetix, Metamask and Uniswap, among many others. Institutional or permissioned DeFi with Know-Your-Customer (KYC)[7] has also recently been introduced, albeit starting from behind walled gardens.

The innovative characteristics and decentralising features that distinguish DeFi from DLT and cryptocurrencies include:

— **Automated Market Makers (AMMs).** In the absence of entities playing the role of market maker in the Cryptoasset secondary market, decentralised exchanges such as Uniswap have emerged to offer an exchange that allows traders to swap assets against liquidity pools that are maintained by smart contracts. Operating without a central order book, these liquidity pools work by pairing volatile assets to a more reliable one, such as a stablecoin, using a constant function product model to determine the pricing. See Figure 2.

Figure 2: Mathematical formula for automatic pricing of digital assets

The formula:

$$(x) \times (y) = k$$

Where x and y are tokens A and B in a liquidity pool that are swapped for each other, and k is a constant between them that automatically adjusts A and B relative price based on demand and supply.

Source: Deutsche Bank

Through AMMs arbitrageurs are incentivised to participate, which causes the price of the assets in the liquidity pool to adjust until it reaches equilibrium with the rest of the market. Meanwhile, the initial liquidity providers that deposited assets into pools are rewarded with their share of trading fees paid by traders and arbitrageurs. Uniswap uses a governance token called UNI to coordinate open community governance of the structure and continues to improve via Uniswap "V2" and V3"[8], which offer superior capital efficiency and accuracy.

This is an aspect of DeFi that is only starting to be experimented with in the traditional financial space, but it will be interesting to see the development of its potential as a means of attracting and seeding liquidity for new products, and to better understand its risks and limitations[9].

— **Self-hosted wallets.** These allow investors to manage their Cryptoassets' private keys themselves, using a secure and convenient app-hosted wallet, or web-hosted wallet such as Metamask. Using these wallets creates an option for the investor to move away from centralised digital assets custodians.

On the other hand, there is also scope here for a possible product extension, where digital asset custodians offer a traditional centralised service alongside a decentralised custody one to help investors streamline the number of digital asset custodians they work with. In this case, the provider's decentralised services could hold those cryptocurrencies or tokens that its centralised services would not safekeep.

— "Autonomous" banking applications. In addition to AMMs and self-hosted wallets, the DeFi space also offers neo-financial services such as borrowing and lending. Calculated interest income from smart contracts can be compounded on a near-real-time basis, while loans without collateral can be taken to be repaid within a single transaction. Examples of lending and borrowing applications include Maker, Compound and Aave, while others such as Synthetix offer cryptocurrency derivatives.

These applications can operate as self-contained services, or be linked (or "composed") by other DeFi applications such as Yearn Finance, to provide investors with a fuller range of investment strategies in one place.

1.2 Tokenised financial assets

Tokenised financial assets represent the second segment of the digital assets ecosystem that grew with the abstraction of key characteristics from cryptocurrency's underlying distributed ledger technology (DLT) to apply in the traditional financial sector. A key new characteristic here is the programmability, automation and distribution environment that can pave the way for "intermediary-lite" integrated primary market to post-trade activities.

Initially an attempt to create digital versions of securities, the movement has since led to pilots of digital tokenised financial instruments, including:

— bonds that encapsulate DLT's programmability for new efficiency gains;

— digitally fractionalising traditional financial assets that facilitate financial inclusion; and

— new operating models that enable issuers of tokenised financial securities to directly offer to investors without many of the traditional intermediary layers.

Indeed, the tokenised financial assets space is all about implementing modern market process flows with new concurrent, autonomous automation and open architecture paradigms.

For example, American post-trade clearing provider DTCC's Project ION[10] and Project Whitney[11] both use DLT in financial market infrastructures to optimise and accelerate the public securities settlement cycle, and to introduce greater levels of automation and efficiency in the private markets. Meanwhile the Paxos Securities Settlement Platform pilot has, since its February 2020 launch, offered transaction counterparties fast and efficient ways to settle listed US equities and tokenised cash directly with each other on blockchain. It thereby also demonstrates the viability of a bolt-on post-trade digital capability option for traditional central securities depositories.

Elsewhere, the Hong Kong Exchange's DLT-inspired Project Synapse introduced in November 2020 leverages on concurrent communication to reduce duplicated reconciliation between parties in the same transaction flows,[12] Project Helvetia by the Bank for International Settlements (BIS) Innovation Hub, the Swiss National Bank and SIX, investigated the settlement of tokenised assets in central bank digital currencies,[13] while the Stock Exchange of Thailand will reportedly launch a Digital Asset Exchange in the third quarter of 2022.[14] Singapore Exchange (SGX) has also launched its Marketnode joint initiative with sovereign wealth vehicle Temasek in January 2022 that seeks to transform financial market infrastructure and where DLT technologies would play key roles.[15]

In the tokenised financial asset ecosystem, financial market infrastructures are arguably one of the main forces of innovation, working alongside issuers and the financial industry, which will naturally also have their own innovation programmes.[16]

1.3 Central bank digital currencies

Central banks are leading the development of national digital currencies and central bank digital currencies (CBDCs) make up the digital asset universe's third ecosystem.

These currencies are designed to introduce digital payment methods, programmable payments, central bank trust, and a future channel for monetary policies. At the same time, CBDCs should also catalyse the further development of digital assets, which require an equally sophisticated cash leg to settle complex instruments.[17] For instance, if a digital asset is programmable, it will require the cash leg to be programmable too, i.e. programmable payments.

Currently, the majority of use cases are focused on retail uses, although there are other use cases in corporate supply chain payments, as well as in capital markets settlements. The Bank of International Settlements (BIS) leads several interesting use cases, including Project m-Bridge and Project Dunbar, which respectively assess a super-correspondent banking model and the use of a common settlement platform to provide interoperability for CBDCs created on different technologies.[18]

Lending additional momentum to digital asset innovation, there have already been several ground-breaking experiments in capital market uses of CBDCs,[19,20] and in the case of Project Helvetia, a financial market infrastructure was allowed to handle the digital cash leg together with the digital securities. In the age of accelerated traditional securities settlement cycles from T+2 to T+1, DTCC's Project Lithium[21] would be assessing how a CBDC might operate in post-trade. If and when such CBDC-capital market uses were to be implemented in the wider market, it can re-order the roles and market structure of the entire post-trade industry.

In the foreseeable future, CBDCs are likely to develop fresh methods of massive throughput scale to meet transaction volumes and digital resilience, leading to hybrid combinations of centralised-decentralised operating models. This could facilitate "dual offline"[22] CBDC transactions that are executable independent of internet connection and without connecting to bank accounts. These and other design considerations – such as managed privacy and anonymity, hybrid token-based and account balance-based methods to account for digital currency balances, digital proofs of identities and know-your-customer/anti-money laundering – will drive innovative angles to add to the overall digital asset universe, influencing the future of CBDCs and laying the foundations for their use in cross-border investments.

CBDC will have additional considerations that will be introduced in the near term, including monetary supply considerations if they are to be used in capital markets, programmable money versus programmable payments, cross-border CBDC, foreign exchange and collateral management. It remains to be seen whether there will be such a thing as an offshore tokenised CBDC with a separate "rates curve", and how it would be separately treated on a corporate's balance sheets.

1.4 The advent of the digital custodian

With asset and investor protection among its key established tenets, custodians in name and in different "shapes" stand at the nexus of this growing digital asset universe and the world of securities post-trade and fund services, complete with new tasks, products and market structures to be assimilated. The next two chapters outline the changes to the infrastructure and roles of the custodian, as prompted by the growth of the cryptocurrency and tokenised asset spaces.

Figure 3: The triple revolution – simplified causal relationships from digital assets type to infrastructure and role evolutions
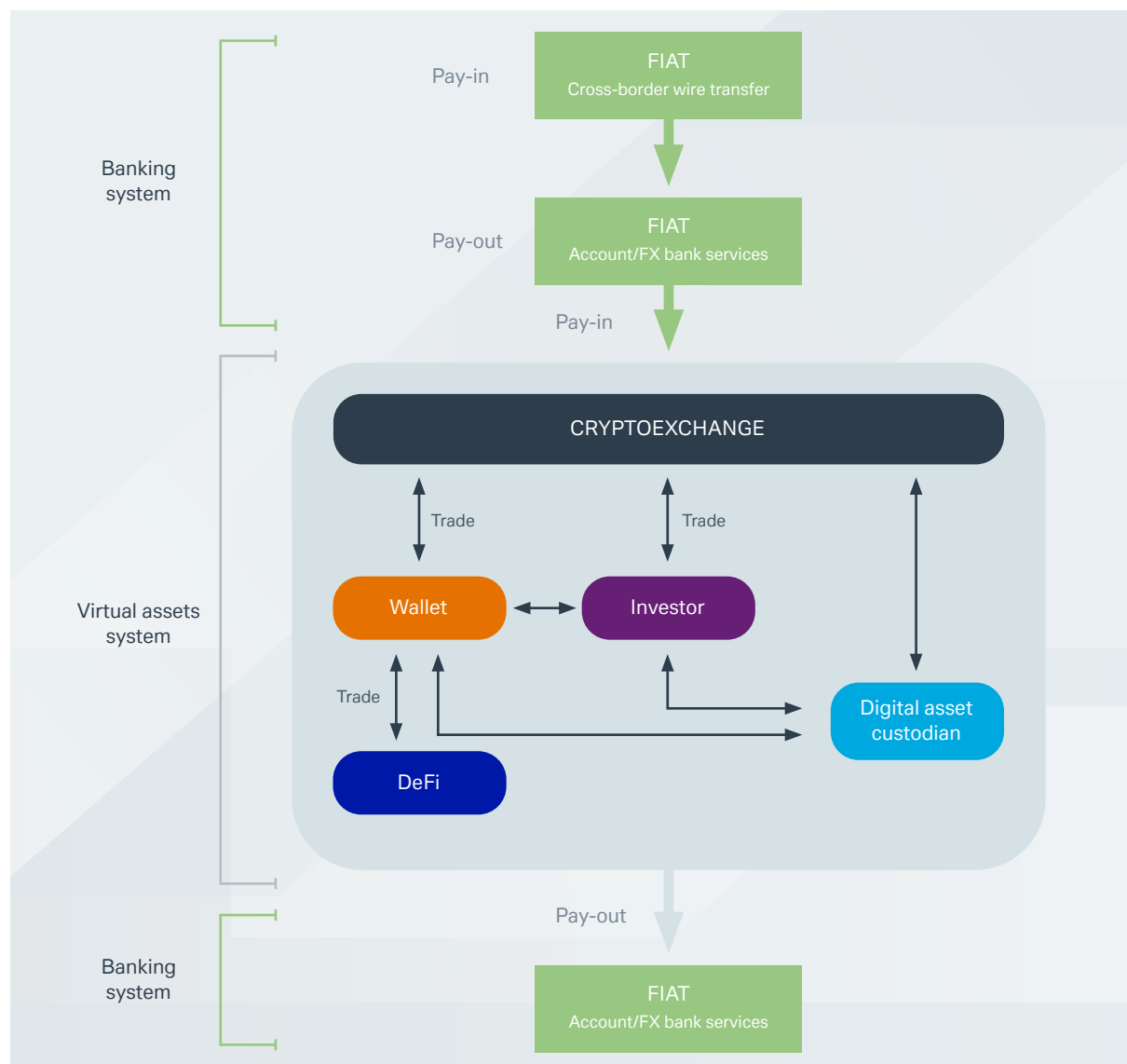

Source: Deutsche Bank
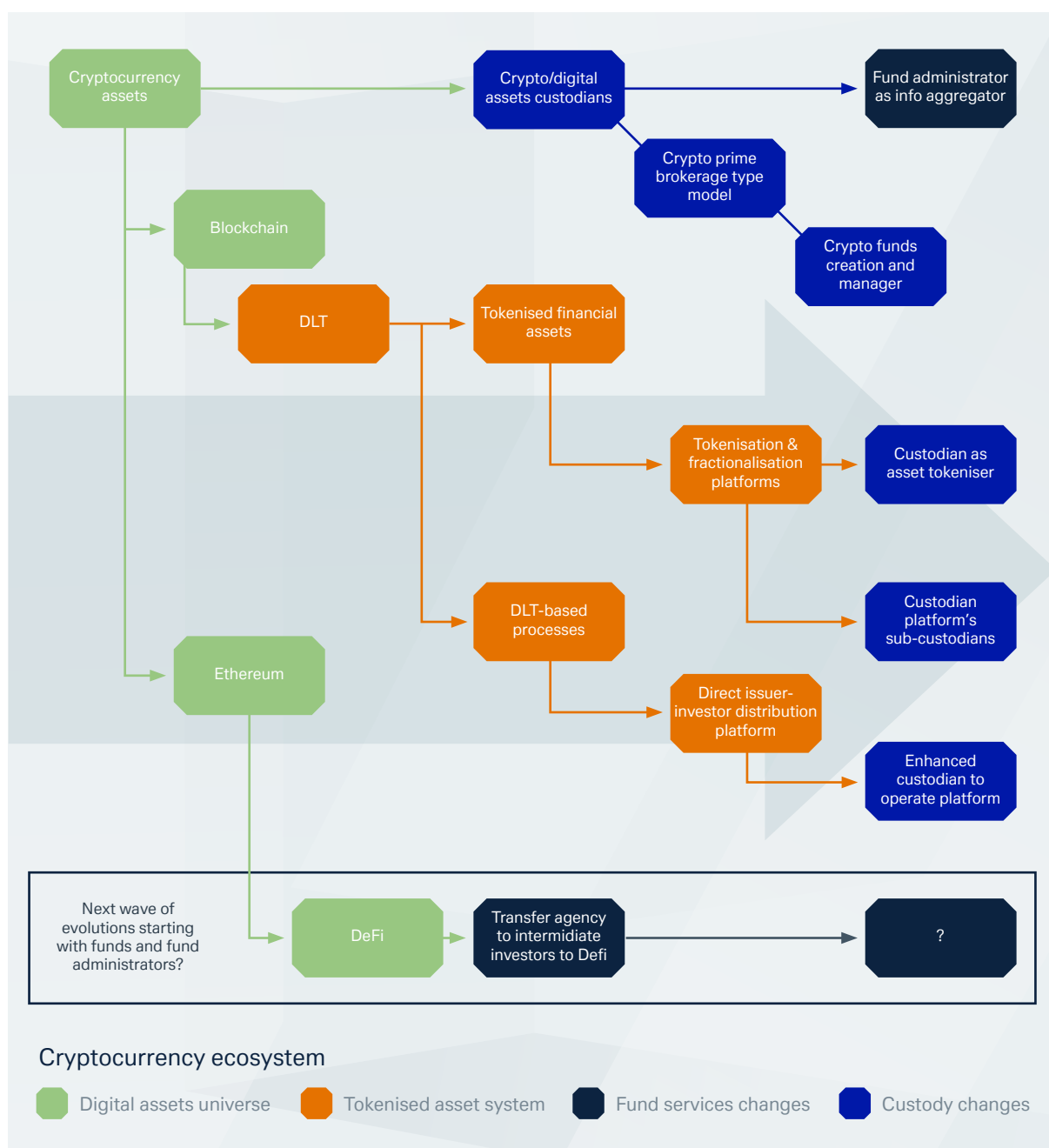
2

The digital assets custodian: Cryptoassets

2.1 Cryptoassets and the custodian

The global trade in cryptocurrencies has given rise to a new breed of crypto-savvy asset managers and hedge funds, ready to meet the needs of asset owners and investors interested in allocating into this exciting asset class. Therein lies the first demand for a crypto-savvy digital asset custodian – to safekeep the assets. While the role remains unchanged, the way such assets are safeguarded differs from traditional custody.

Figure 4: Cryptocurrency value chain and where the crypto/digital asset custodian fits

Source: Deutsche Bank

2.2 Some differences from traditional custody

2.2.1 Safekeeping private keys

In the public blockchain space, there are broadly three types of Cryptoassets that investors can allocate to:

— Protocol tokens: These are assets that are native to the public blockchain, like Bitcoin, Litecoin, Ethereum's ETH or Solana's SOL.

— Application tokens: These are tokens that are used in applications built on protocols, for example, in-game tokens.

— Governance tokens: These represent the investor's rights to vote and govern in a community-based governance model. Examples include UNI, COMP and MKR.

At the root of the custodian's safekeeping function is their control over an asset to prevent its unauthorised use or loss[23]. For cryptocurrencies both regulatory and general industry opinion is, thus far, that control of the private cryptographic keys would be evidence of such control to satisfy the custodian's discharge of its safekeeping function, since these keys allow the transfer and other operations of their associated digital assets. Similarly, losing the private key would be tantamount to losing the associated assets. Hence, as a first significant difference, the topic of cybersecurity-cryptography shifts from being a "hygiene" factor in traditional custody into a central digital custody asset protection topic.

A core consideration in the safekeeping of private keys is the application of cybersecurity methods to mitigate the risks of a "single point of failure" – i.e. the risks that a single complete key stored in a single location is more vulnerable to harm – which creates the need to ensure there is a "defence in depth" of controls and governance to protect the private keys from risks such as theft, hacks, unauthorised uses and insider threats.

Safekeeping discussions would also naturally extend to how the private keys are kept. For example, a main approach to safekeeping can involve "military grade" Federal Information Processing Standard (FIPS)-certified[24] hardware security modules (HSM) as secured storage of the keys.

A common question is whether they are stored in "hot", "warm" or "cold" wallets, with the temperature analogy referencing the level of direct network connectivity between the wallets (storage) and external sites as a rough indicator of the level of cybersecurity risks.

While generally accepted that "hot" wallets are risker than "cold" wallets, several trade-offs mean the analogy is not quite so simple. For example, a "cold" wallet is typically held in a computer that is not connected to much of the network (an "air-gapped" computer), which can mean that deposits and withdrawals of the Cryptoassets involve more manual processes than using a "hot" wallet that would be more integrated with systems and machines. A level of network risk is thereby replaced with human risk in a "cold" wallet. Having a physically air-gapped "cold" wallet can also potentially disrupt a service provider's plans for a pure Cloud application hosted model, although insurance cover and premiums on the Cryptoassets can be a significant influencing factor to override manual risk concerns.

Custodial safekeeping can also cover the private keys of the smart contracts that have issued the coins or tokens.

> "Custodian safekeeping of the private keys to Cryptoassets is a vital part of today's custodian services. Clients demand institutional grade security to ensure their assets are appropriately secured and available when they need them"

Sabih Behzad,
Head of Digital Assets and Currencies Transformation, Deutsche Bank

Storage choices could then be paired with multi-signature (Multisig) and/or multi-party computation (MPC), which are techniques to use the private key in ways to reduce the risks of a "single point of failure" by "breaking up" the single private key into multiple pieces that will need to be reassembled for its effective use. Hence, the security of the key management processes is another related new value-creation area for the crypto digital asset custodian to manage. These processes come broadly within three areas:

1) The digital key ceremony – when private keys and their back-ups are generated and communicated;

2) Key management – when the private keys are stored for use; and

3) Transaction signing activities – when the private keys are utilised to operate the assets.

2.2.2 Blockchain *force majeure*

Force majeure is a legal risk management term that releases parties from performance obligations due to hindrance of an unforeseeable nature or unavoidable disasters. Depending on the jurisdiction, *force majeure* is either:

— a contractual provision that will specify the "uncontrollable" events and conditions that are agreed between parties, or

— a term that is defined in statute and interpreted in judicial decisions.

Can similar legal recognitions of unforeseeable or unavoidable events in the digital Cryptoasset space be developed too, to help parties manage obligations and risks?

For example, public blockchain-based digital assets such as Bitcoin and Ethereum are beyond any single organisation's cybersecurity scope. A digital asset custodian would be highly efficient and effective in securing these public assets internally within its organisational and related supply chains. However, the asset's integrity and availability can also be affected by the associated blockchain and telecommunication infrastructure that lies outside of the custodian's organisational lines.

These infrastructures are like public smart contracts or the permissionless blockchain rails that can be subjected to cyber-attacks, forks, airdrops and even electricity shortages. Among the potential vulnerabilities: the transparency of open-source codes could aid zero-day exploits; there might be a 51% attack on the blockchain; telecommunication networks latency and traffic can affect activities on public blockchains; while a Cryptoasset's governance can be impacted should core developers suddenly leave its community.

Each of these events lies outside a digital asset custodian's control and it should not be expected to bear the risk of assets loss from permissionless networks. However, these events can directly impact the assets that a digital asset custodian holds on investors' behalf. If an institutional digital asset custodian cannot be involved because the risk occurs beyond its boundaries, but the digital assets that it is operating are then eventually "lost" due to such "outside" risks, investors will need to be aware and be educated of such possibilities, and the industry would need new interpretations of what could be *force majeure-equivalent* events in the Cryptoasset space to facilitate dispute resolutions as part of a healthy ecosystem's growth.

2.2.3   Other custodian services and crypto fund administration

In this new value chain of services, other new digital custodial services can include:

— fiat-crypto-fiat intermediation;

— execution as part of a cryptocurrency asset's atomic settlement and custody – like a prime brokerage model;

— smart contract creation and management;

— stablecoin governance; and

— acting as a trusted gateway to staking, lending and borrowing activities.

Batched transfers for on-chain settlement between a third-party custodian and its investor or cryptocurrency exchanges could be used to manage high transaction fees costs and risks. In this case, batched transfers could exhibit intraday elements of market risks from the exposure to valuation movements that would need the traditional custodians' margin and collaterals management expertise to better manage. Alternatives can include transaction settlements off the main blockchain via what are known as "Layer 2" networks – secondary frameworks/protocols built on top of an existing blockchain system.

Figure 5: Summary of FATF Travel Rule

Modelled after correspondent banking transfer details, the Financial Action Task Force (FATF)'s Travel Rule[25] is a global transparency drive for recipient, sender and payment details, which underpins many licensing regimes' requirements of the cryptocurrency space.

Globally, the FATF defines virtual assets and who should be viewed as 'Virtual Asset Service Providers' (VASPs). The FATF Travel Rule specifies certain transfer information concerning the underlying originators and beneficiaries that should also be transferred between VASPs once the transfer value crosses a certain threshold. In-scope participants include centralised exchanges, OTC desks, hosted wallets and crypto-custodians.

Although work had started much earlier, FATF first released the "crypto Travel Rule" – that includes VASPs – in a 2019 extension to its "Recommendation 16" that was accompanied by an interpretive note to Recommendation 15 on how the requirements should apply. With subsequent refinements[26], among other requirements, VASP intermediaries are tasked with record keeping and sanction screening, and the Travel Rule data transfers must be immediate and secure.

Since 2019, FATF has published an annual review on jurisdictions' implementation of and compliance with the Travel Rule[27], with the second 12-month review issued in July 2021[28]. Current challenges include an uneven rollout of Travel Rule requirements by jurisdictions that can hamper industry compliance, the need for interoperability between different Travel Rule solutions, and cross-border data privacy requirements. As a major update to its focus, in 2021[29], FATF released new guidance to address stablecoins, non-fungible tokens (NFTs), DeFi and decentralised applications.

https://www.fatf-gafi.org/publications/fatfrecommendations/documents/guidance-rba-virtual-assets.html

Source: www.fatf-gafi.org

Source: Deutsche Bank

In conducting its activities, the custodian should also become familiar with regulatory compliance such as the Financial Action Task Force's (FATF) "Travel Rule" for effective KYC/AML. Cross-border data privacy regulatory requirements is a further consideration since the Travel Rule will require it to transfer data across borders and store those that it receives, while a custodian will also require a review of policies on how it should cooperate with legal enforcement and judicial agencies on crypto-facilitated crime investigations that can predicate on speed of response.

Continuous development of blockchain analytics by firms such as Elliptic, TRM Labs and Chainalysis, and research into massive temporal network graphs like Raphtory-Pometry, to successfully track illicit activities and mitigate AML risks extend the capabilities by these custodians and other cryptoasset participants to facilitate a safer and sounder market space.

As an adjacent value chain activity, Cryptoasset fund administration is a service that provides fair market price to value and account for the invested protocol, application and/or governance coins. Such market prices could be a snapshot of Cryptoasset prices from specific crypto trading venues, taken at a particular time of the day for investment valuation purposes; or the market price could be sourced from recognised benchmarks[30], data sources[31] or rotating liquid trading venues in a 'follow-the-sun' approach (i.e. without regard to geographic location or time zone) to ensure the fair-value used reflects prevailing market conditions.

A crypto fund administrator would also recognise and track the equivalent of corporate actions in the crypto space, account and evidence the accuracy of new fund expenses, and cashflow differentiation to facilitate capital gains and/or income tax reporting. Two examples of current services that are adaptable for crypto fund administration with the right data set are "look through" portfolio transparency of master-feeder funds to enable more precise exposure management, and applications of multiple accounting standards to satisfy both local and international accounting requirements.

Finally, since bank-operated digital assets custodians are unlikely to hold the complete range of coins and tokens, and fintech-based custodians can be used too, a crypto fund administrator can be an aggregator of valuation, data and post-trade compliance services linked to a client's multiple sub-custodians.

Although the fund valuation and accounting approaches in this space should not be new, determining how they are to be applied will require new skill sets. In the same way that hedge fund administration developed, third party Cryptoasset fund administrators can grow as regulators such as those in the US, Hong Kong, Luxembourg,[32] Germany[33] and Thailand[34] start permitting fund managers to create and manage Cryptoasset funds, although Cryptoasset fund legislation is still forming, and such funds are likely to be for non-retail investors.

2.3 DeFi and the custodian

Currently, visible DeFi intersections with traditional finance are scarce although AMM was mentioned in a Project Dunbar project report, and there has been a leading proposal to collateralise stablecoin borrowing with native digital financial bonds issued on blockchain[35]. While this experiment was proposed as a cross-currency repurchase transaction, it sets out the possibility that the borrowed stablecoins could be used in DeFi trading activities to enhance yields. In current DeFi models, there is no immediate visible need for a third-party digital asset custodian – as in this case, the pledged collaterals are "safekept" in smart contracts while there are various options to keep or convert the stablecoin into its underlying fiat currency.

In May 2022, another industry proposal is to enable permissioned liquidity pools with native digital financial bonds issued on blockchain[36].

One of DeFi's main disruptive and innovative potentials could be in asset management, and its realisation could be aided by an informed asset managers' focus to be as digitally enabled as possible. There are interoperable permissioned/permissionless blockchains such as Hyperledger Besu on which digital assets and funds can be based to offer a variety of new investment opportunities – ranging from tokenised financial assets to crypto funds or permissioned DeFi offerings.

In this intersection, a digital transfer agency can be a starting point to firstly help investors access such digital asset funds. In such a case, a custodian can be a gateway that combines transfer agency with fiat-crypto exchange ramps and custodial interoperability with funds including permissioned DeFi structures. For example:

— The transfer agency here would link investors with funds and handle the associated subscription-redemption cashflow – including real-time information – to aid the asset manager's deployment of liquidity. Handing investor KYC transparency, the digital transfer agent[37] enables investors to effectively assess different crypto funds.

— Underlying governance tokens from DeFi activities can be safekept with the digital asset custody capabilities, which could also safekeep any tokenised fund's tokens.
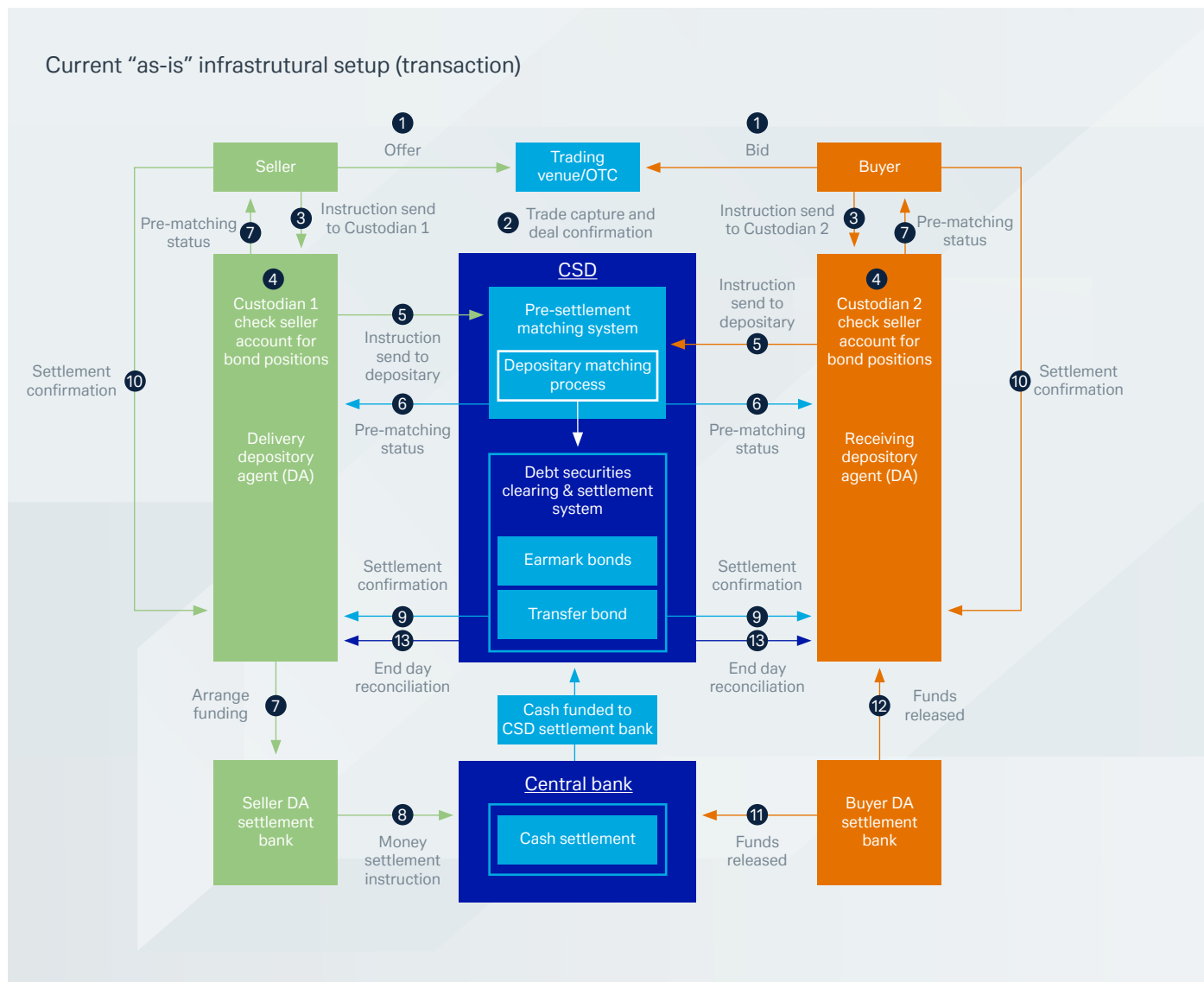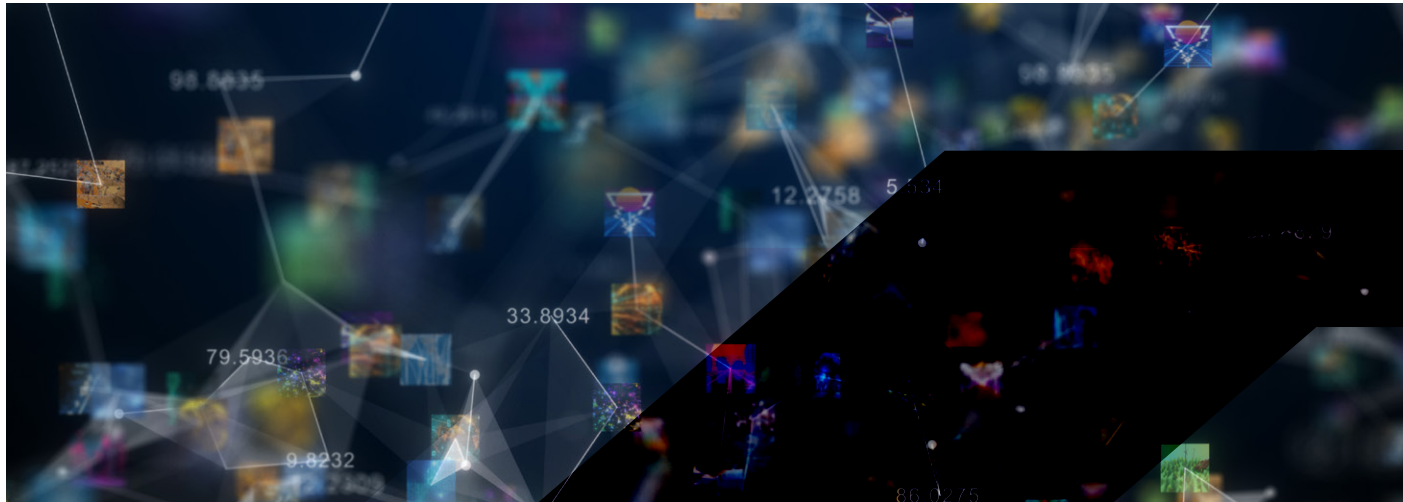
3

Tokenised assets and the custodian

3.1 Tokenised assets: infrastructure

Tokenised financial assets have introduced DLT to enable the digitalisation of assets and workflows, with smart contract automation, programmability and concurrent flows among the new competitive characteristics that this form of assets brings. Additionally, the benefits of tokenised assets lie not in the digitalisation of the asset *per se*, but from the success of digitalisation and simplification of process flows[38] to shrink market structure footprints and create more versatile, compact and cost-effective operating models. The focus for achieving success in tokenised financial assets should firstly prioritise having the right infrastructure. Figure 6 summarises a simulation of how the over the counter (OTC) bond market would look if deploying DLT.
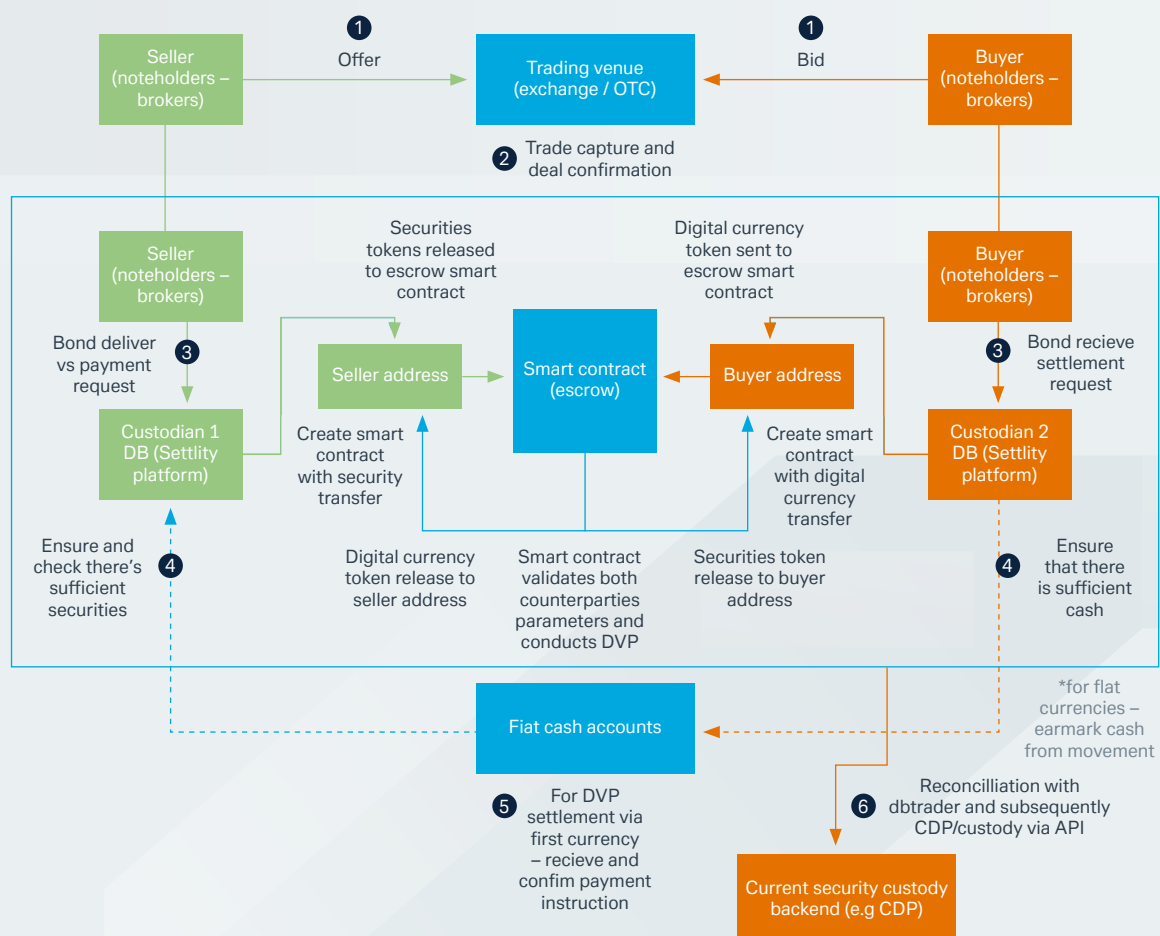
Figure 6: Before and after DLT – a simulation of how the OTC bond market structure could be redesigned

Source: Deutsche Bank

## A more compact market infrastructure based on DLT operating model and assumptions

Seller (noteholders – brokers) — 1 Offer → Trading venue (exchange / OTC) ← 1 Bid — Buyer (noteholders – brokers)

2 Trade capture and deal confirmation

Seller (noteholders – brokers)

Securities tokens released to escrow smart contract

Digital currency token sent to escrow smart contract

Buyer (noteholders – brokers)

Bond deliver vs payment request 3

Seller address → Smart contract (escrow) ← Buyer address

3 Bond recieve settlement request

Custodian 1 DB (Settlity platform)

Create smart contract with security transfer

Create smart contract with digital currency transfer

Custodian 2 DB (Settlity platform)

Ensure and check there's sufficient securities 4

Digital currency token release to seller address

Smart contract validates both counterparties parameters and conducts DVP

Securities token release to buyer address

4 Ensure that there is sufficient cash

Fiat cash accounts

*for flat currencies – earmark cash from movement

5 For DVP settlement via first currency – recieve and confim payment instruction

6 Reconcilliation with dbtrader and subsequently CDP/custody via API

Current security custody backend (e.g CDP)

A 2021 experiment and analysis by Deutsche Bank, with a fintech collaborator, of an OTC bond market structure in Singapore found potential technological improvements of up to 50% in settlement processing efficiencies, and up to 60% in asset servicing through:

— Deconstructing the existing market processes, and then reconstructing them using DLT, smart contracts and APIs. A unifying DLT platform can thereby be deployed across both the primary and secondary markets to provide immutability of data as a single source of truth for intermediaries and participants. This will significantly reduce manual work and duplicated reconciliation across the same transaction flow handled by different parties, while smart contracts would automate actions like allocations, calculations, and distribution based on rules to increase scalability and capacity.

— Application programming interfaces (APIs) enabled real-time pulled information to allow DLT-source data communication with existing IT systems, while processes could be replaced with smart contracts to calculate, check, process and distribute income streams. APIs would channel information flows between DLT and non-DLT systems and be used for integration with external entities like the central securities depositories.

Figure 7 highlights the areas from primary to secondary market post-trade and asset servicing where significant (50-70%) improvement of workflow steps could be achieved.

Figure 7: Theoretical processes saved based on DLT workflows
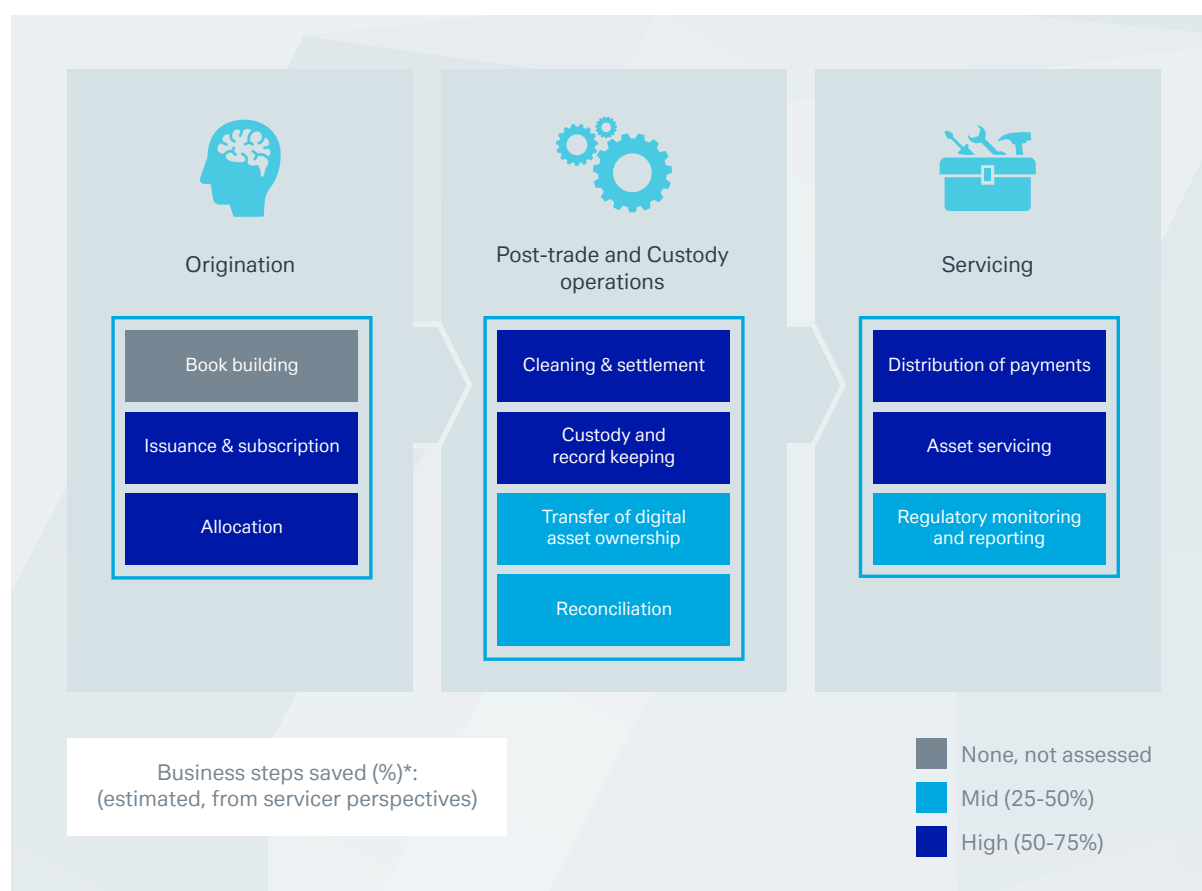
Source: Deutsche Bank, performed as part of Project Benja, a Monetary Authority of Singapore's Financial Sector Technology and Innovation Proof of Concept (MAS FSTI POC) in 2021

These new efficiencies, where functions previously performed by different participants are consolidated onto a unifying platform and/or automated, can lead to more cost effective "peer-to-peer" or issuer-to-investor connectivity.

Leading issuers in the market have already used such models to launch live transactions. For example, in 2020 for the highly successful Thailand Ministry of Finance's "1-baht" DLT retail savings bond[39], the issuer directly distributed the bonds nationwide to subscribers holding participating banks' mobile wallet to subscribe and pay for the minimum of 100 Baht (THB) (around €2.70/US$2.90) per lot. The DLT platform provided an immutable real-time source of truth that materially reduced repetitive validation and shrank a 15-days process to just two.

A similar DLT-based treasury bond has also been live since 2020 in the Philippines[40], where additional digital retail and corporate bond initiatives are anticipated, while the European Investment Bank (EIB) issued theirs in 2021[41].

Each demonstrated the practical possibilities of using an innovative direct "B2C" or issuer-investor distribution operating model that utilises peer-to-peer characteristic to significantly improve investor engagements for issuers. In the future, programmability could add precision to enable cost-effective specific investor segment engagements.

3.1.1 Digital assets on different technology stacks

Despite many improvements, one still needed is to manage the varied technology infrastructure used in different-permissioned environment. As the tokenised digital assets would be created by these different technologies and can only exist within specific technology environment, this characteristic challenges intermediaries and investors to have effective access to the opportunities that such tokenised financial assets can represent.

For example, investors and intermediaries will be exposed to different technology risks represented by each environment, or investors need to address different sets of KYC/AML for each platform they seek to participate in. A related challenge includes deciding how the private keys of these digital assets might be held by a third-party digital asset custodian too, and what this could mean for asset protection duties and obligations.

Figure 8: What if an investor invests in digital assets based on different technology stacks?
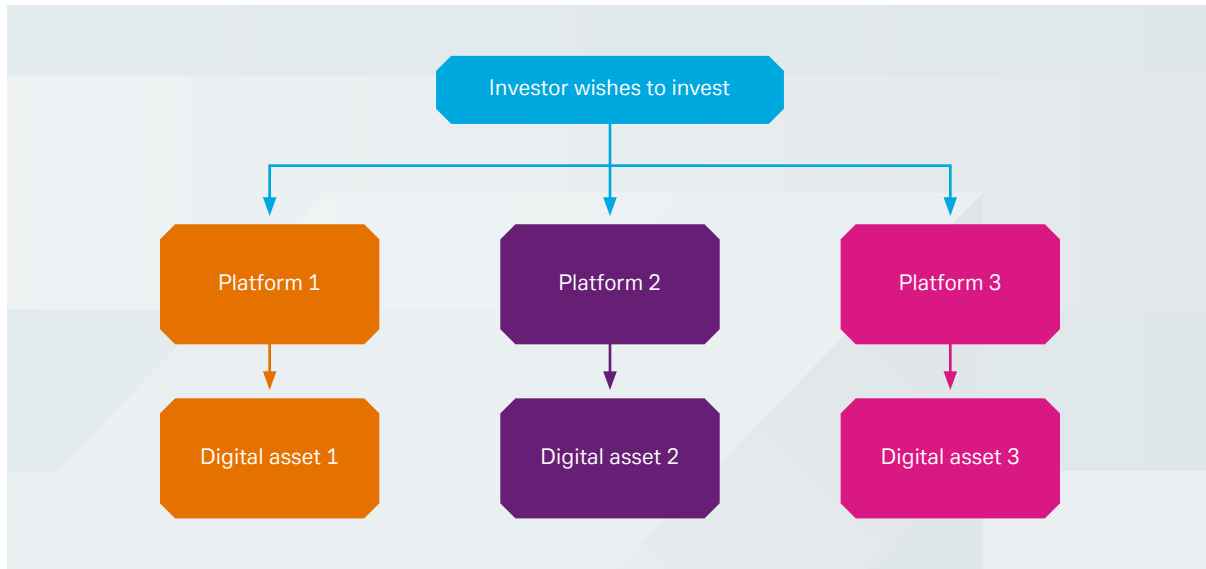
Source: Deutsche Bank, performed as part of Project Benja, a MAS FSTI POC in 2021

For the custodian to take custody of and asset service the tokenised financial assets, there are three optional models open (see Figure 8), each with a focus on interoperability, as follows:

1) **The sub-custody model.** This sees the investor's custodian appoint a tokenised asset platform as its sub-custodian if the private keys cannot leave the platform and the investor is active on that platform. In this option, the platform will use APIs to update the traditional custodian's IT systems with status and the traditional custodian will not need to change their IT systems. However, the traditional custodian will still require the necessary expertise to perform due diligence and resolve tokenised asset-related issues.

   In this case, the tokenised financial assets need not exist as a token – i.e. with its own private cryptographic key – and can be in an account entry similar to today's electronic financial assets.

2) **Account operator model.** The custodian takes on an account operator role via a node to access the platform to safeguard and operate the private keys to the digital assets. This can work only if the platform has nodes, and these nodes would not only act as a gateway to the platform but also assist the custodian in investor account structure management.

   Also important in this model is the platform node's information integration capabilities to the custodian's legacy systems for the custodian to consolidate information for the investing client.

3) **Crypto-inspired model.** To take direct custody of the different tokenised asset, the investor's custodian may exchange the platform's tokenised asset for a "wrapped" version that it can directly hold. Acting as a digital depository receipt, the wrapped token will represent the unit of the underlying tokenised assets.

   The platform will either require a custodian or have custody capabilities that can immobilise the tokenised financial assets on the platform, and on the back of these immobilised assets, issue another token that can work with the custodian's blockchain capabilities.

These models emphasise the importance of "interoperability" – which the modern custodian will need to offer – to bridge investments and safekeeping with assets in different environments which are built on different technology stacks and with traditional systems. The interoperability feature is also important to facilitate a network effect by lowering the entry barriers to investors and their appointed intermediaries.

3.2 Tokenised assets: the new roles

The ability to interoperate accessibility into the choice of permissioned platform opens new roles to a digital asset custodian:

— **A centralised traditional custodian** appointed by the issuing platform to hold the underlying traditional securities that back the digitally tokenised issuances. The traditional custodian can also act in a cash account bank role, whereby its additional activity would include reconciliation and management of the linked lifecycle activities between the traditional securities with the tokenised ones, like those performed by a depository receipt bank.

If this traditional custodian also offers digital assets custody, other related activities can include structuring the digital account structures for intermediaries and any third-party distributor platforms that are involved.

— **An asset tokeniser.** In a depository receipt model where there is already an underlying traditional asset that is being tokenised, a digital asset custodian can also play the role of an asset tokeniser. From an asset protection perspective, this would be ideal as the custodian can immediately contribute asset servicing rules and investor-related filters to the smart contract that the tokenised financial asset would be issued from. From a safekeeping perspective, the custodian can also hold the private keys to the smart contracts that are involved in the issuance of the digital assets.

For example, programming filters can include eligibility whitelists based on investor characteristics or differentiated sets of filters to reward different investor segments. This opens possibilities for equity issuers – such as those in fast-moving consumer goods (FMCG) – to directly reward their base of longer-term domestic retail investors with incentives like digital tokenised discount vouchers as a strategy against sudden foreign capital reversals or short-term speculators. Financial inclusion-based filters can potentially better deliver income to those with higher welfare needs like retirees. Digital income and incentives such as vouchers can be easily and efficiently "airdropped" into recipients' digital wallets.

— **As the DLT platform operator** on which issuers and investors would participate.

Evidently tokenised financial assets can lead to a list of services that resembles traditional requirements but delivered in different digital means. There are also differences between servicing Cryptoassets and tokenised financial assets for the digital asset custodian, with interoperability as a new requirement in this ecosystem.

4

Forces shaping the digital asset supercycle

The opportunities and potentials of the Digital Assets are shaped as much by regulatory maturity and ecosystem adoption as by technology – together these channel mainstream adoption of the different types of digital asset. We will briefly explore the key successes and challenges in the respective cryptocurrency and tokenised financial assets ecosystems.

4.1 Cryptoassets, DeFi and regulations

In the cryptoasset ecosystem, regulations will continue as a major force in shaping the evolving opportunities. In the tokenised financial asset ecosystem, it will be the pace and level of industry adoption of DLT and/or DLT-inspired infrastructure that establishes tokenised assets' success. While the CBDC journey is still at an early stage, a future challenge in this space could be from spillovers of national security issues – for example concerns about counterfeit CBDCs, telecommunications integrity, and CBDC-related hardware and software manufacturers.

Today, crypto-related know-your-customer/anti-money laundering (KYC/AML) regulations are well established globally following the FATF's multi-year efforts (see Figure 5 on page 16), reports and guidance on the "Travel Rule".

Starting from payment transparency requirements, regulations increasingly cover promoters, accreditation of investors, asset management and financial industry stability. They range from restrictions of retail-level advertisements to investigations into social media influencers; cross-border marketing and sales; permitting a level of fund's exposure; and proposed credit institution's balance sheet treatments. Globally, there is also a wave of regulatory concerns over stablecoins[42] and DeFI[43,44] which over time should refine to more granular levels to address real risks for harmony with growth. For example, decentralisation in DeFi can mean decentralised trading order books – including via "semi-anonymous" liquidity pools or self-hosted custody wallets. How regulation addresses KYC/AML for example would require different approaches depending on the DeFi structure. With actual skin-in-the-game, the DeFi community's diligence and vigilance is a complementary source of governance alongside any new regulatory approaches.

However, the most complex – and potentially the least understood – emergent regulation is the Basel Committee on Banking Supervision (BCBS) consultative document on the prudential treatment of the cryptoasset exposure, which was published in June 2021[45]. Just as Basel III and IV reshaped investment banking activities, the BCBS proposals on balance sheet treatment of cryptoasset exposures can assert one of the most powerful effects on participants including non-financial institutions that can either benefit or be impacted by spillover effects.

Briefly, the BCBS consultation divides the digital assets ecosystems into three groups:

1) Group 1(a) that contains tokenised financial assets;

2) Group 1(b) cryptoasset with stabilisation mechanisms or essentially stablecoins; and

3) Group 2 that essentially contains all the cryptocurrencies.

Figure 9: BCBS overview of prudential treatment of cryptoasset exposures

Prudential requirements	Group 1 cryptoassets (fulfilling classification conditions)		Group 2 cryptoassets (not fulfilling classification conditions)	Out of scope
	Group 1a: Tokenised traditional assets	Group 1b: Cryptoassets with stabilisation mechanisms (ie stablecoins)	Cryptoassets that do not qualify as Group 1 (eg bitcoin)	Central bank digital currencies
Credit and market risk requirements	Capital requirements at least equivalent to those of traditional assets (with further consideration for capital add-ons)	New guidance on application of current rules to capture the risks relating to stabilisation mechanisms (with further consideration for capital add-ons)	New conservative prudential treatment based on a 1250% risk weight applied to the maximum of long and short positions	N/A
Other minimum requirements (leverage ratio, large exposures, liquidity ratios)	Application of the existing Basel Framework requirements with additional guidance where applicable			N/A
Supervisory review	Additional guidance to ensure that risks not captured under minimum (Pillar 1) requirements are assessed, managed and appropriately mitigated (including through capital add-ons)			N/A
Disclosure	New requirements for banks to disclose information regarding cryptoasset exposures on a regular basis			N/A

Source: BCBS Prudential treatment of cryptoasset exposures, 2021

As a key foundation, the consultation paper sets out four classification criteria for a public cryptoasset to meet – and which a bank will be responsible for assessing, monitoring and compliance if it was dealing in such a cryptoasset – in order for that particular cryptoasset to be classified within Group 1. Where a cryptoasset does not meet the four criteria, it then falls into Group 2 where a 1250% risk balance sheet weight would attach to it.

Briefly, the four classification criteria are:

1) Is the cryptoasset a tokenised traditional asset or has it a stabilisation mechanism that is effective *at all times*? If there was a stabilisation mechanism, the responsibility to monitor the daily difference between the underlying linked assets lies with the cryptoasset. The threshold of difference is 10 basis points, which cannot be breached more than three times in a one-year period.

2) All rights, obligations and interests are clearly defined and legally enforceable in jurisdictions where the asset is issued and redeemed. There must be settlement finality contained in the related legal frameworks.

> "There is a flurry of digital asset's activity happening across APAC, propelled by a combination of market regulatory reforms, dynamism of new opportunities for participants including in custody, borrowing and trading, and interests by institutional investors in digital assets. The digital asset market is deepening, and further accentuated by a widening application of blockchain and DLT – most notably in exciting areas such as CBDCs and NFTs"

Anand Rengarajan,
Global Head of Sales and Head of Asia-Pacific, Securities Services
at Deutsche Bank

3) There must be robust risk governance and controls applied to the cryptoassets, including the management of credit, market and liquidity risks, operations risks, outsourcing, cyber and fraud risks and risks of loss of data; in addition to other risks.

4) Entities that are involved in the redemption, transfers or settlement finality of the cryptoasset are regulated and supervised. They include custodians of any underlying assets supporting the stabilisation mechanism.

The BCBS also noted their proposal is a minimum standard, and jurisdictions can apply additional or more conservative measures. The consultation has taken a broad-brush approach to cryptoassets and triggered industry concerns[46] for a balance between prudential approaches and benefits from the Cryptoasset space that are yet to be enjoyed across the economic sectors.

Along similar lines that can raise balance sheet capital requirements, a US Securities and Exchange Commission (SEC) Staff Accounting Bulletin number 121[47] has interpreted that a digital asset custodian should recognise such an asset as an on-balance sheet liability. The European Financial Reporting Advisory Group[48] has also issued recommendations that include cryptoassets custody services and whether fiat-currency pegged stablecoins should be deemed to be cash equivalents.

Over time, the combined effects of these regulations could, ironically, affect liquidity to impact fair-valuation and investor accessibility. They could inhibit hoped-for new growth and/or participation by financial institutions. For example:

— A country's licensing requirements assert jurisdictional boundaries on investor and cryptoexchange domicile that determines who is allowed to participate in secondary market activities. This can fragment the liquidity of what has been essentially a globally available asset class with global demand to impact local bid-offer spreads for investors.

— Financial institutions can find it costly on the balance sheet due to capital charges, resulting in only a small pool of players and intermediaries for this new asset class.

— Risks, asset and investor protection and costs considerations eventually lead to slow growth in the pool of regulated participants that impacts liquidity and velocity of trades. Over time, assuming the non-financial institutional Cryptoassets space continues to grow, these factors could eventually favour those markets with large available liquidity to sustainably continue with the opportunities from the digital assets supercycle.

Within the cryptoasset marketplace and, by inclusion, the DeFi ecosystem, regulation exerts the largest and most powerful shaping force that will continue to decide their future and how roles such as the digital asset custodian evolve.

4.2 Tokenised financial assets and ecosystem

Successes and challenges in this specific ecosystem are both determined by market infrastructure.

The benefits of tokenised financial assets, such as digital green bonds that contain environmental, social and governance (ESG) data payloads, lie in the platform infrastructure that must accompany them and which determines the success of tokenised financial assets.

The focus on infrastructure as a criterion for success is evident from current enterprising "end-to-end" fintech platforms offering a high efficiency market vehicle that can issue-trade-settle-safekeep tokenised/digital assets on their platform. As a one-stop access from primary issuance to secondary market activities for investors, they represent a starting point for the growth of tokenised financial assets.

While a multiplicity of such fintech platforms would offer choice for investors, they could also present adoption challenges as investors would then need to contend with each platform's specific membership criteria and multiple counterparty risk profile. Tokenised products on these platforms can suffer from fragmented liquidity, and the combination of these factors could eventually lead to consolidation. However, should such a consolidation occur before any of these fintech platforms achieve dominance, tokenised digital assets could become either a niche segment or part of a larger organisation's service offering.

Financial market infrastructures (FMIs), like central securities depository and exchanges that are at the centre of all capital market activities, represent another starting point for tokenised assets adoption. Due to their strategic position, any change introduced by them will percolate through the various intermediary layers in the ecosystem. They are significant engines that can propel the industry towards a future of post-trade infrastructure with a modern paradigm of concurrent workflows, higher level of autonomous automation and more cost-effective operations.

Hence, initiatives at both FMI-level and at industry level – like the EU pilot regime for financial market infrastructure based on DLT – are important. Incumbent custodians and other participants should be undeterred by the technology-content of new value creation roles from identifying and defining their future new place.

Meanwhile, a more gradual adoption of tokenised financial asset-ready infrastructure can be made by leading individual organisations; one that incorporates DLT and DLT-inspired characteristics into their own internal workflows for new competitiveness. The first wave benefits could include significantly reduced reconciliation effort; more consolidated data sources of reliability; much tighter "market cut-off time" for client's settlement instructions; better exceptions responsiveness and others. While these results will be less immediately obvious, such leaders' competitive successes can inspire peers for DLT solutions to spread.

6

Summary of key points

Our September 2019 white paper *'Transitioning into the future of securities post-trade: DLT and digital asset's path to smart custody'* highlighted the possibilities of digital assets and the DLT infrastructure. The subsequent "triple revolution" brought about by the digital assets supercycle has shown that new paradigms, operating model efficiencies and business opportunities are achievable to advantage the financial industry generally although the accompanying disintermediation effects and costs mean that not all incumbents will necessarily benefit.

The digital asset supercycle is made up of a number of ecosystems including cryptoassets and DeFi, tokenised assets and CBDCs. Their collective outcomes that are defining these growth possibilities include:

— Greater post-trade effectiveness and efficiencies from the new infrastructure paradigms of DLT's characteristics of concurrency, autonomously executed automation and interoperability.

— New value creation points and roles. For example, the digital assets custodian role can be multi-faceted and extends beyond safekeeping some popular Cryptoassets or just to ensure settlement. In the Cryptoasset space, an institutional prime brokerage model with custody, execution, staking, borrowing and lending can become a competitive approach.

To service asset managers, a digital asset custodian could combine activities from distribution, transfer agency services and fund administration to offer a one-stop intermediation point for qualified investors into digital assets funds.

In the primary issuance space, a digital asset custodian can introduce settlement and asset servicing rules for a more autonomous automated platform to allow cost-effective 'B2C' issuance and distribution models. It can also play central roles in interoperability, tokenisation of traditional financial assets and/or as a platform operator to ensure investor and asset protection.

— New capability emphasis. For example, interoperability capability with the different type of digital assets and funds will be an important service to bridge demand with digital assets opportunities.

"Financial products and services are DNAs of our industry epoch. Some products become dinosaurs while others are like liquid crystal that changes shape while retaining its core. Digital assets custody is one such crystal that is now reinterpreting asset safekeeping in the age of Web3.0 to serve investors and capital markets"

Mike Clarke,
Head of Product Management Securities Services, Deutsche Bank
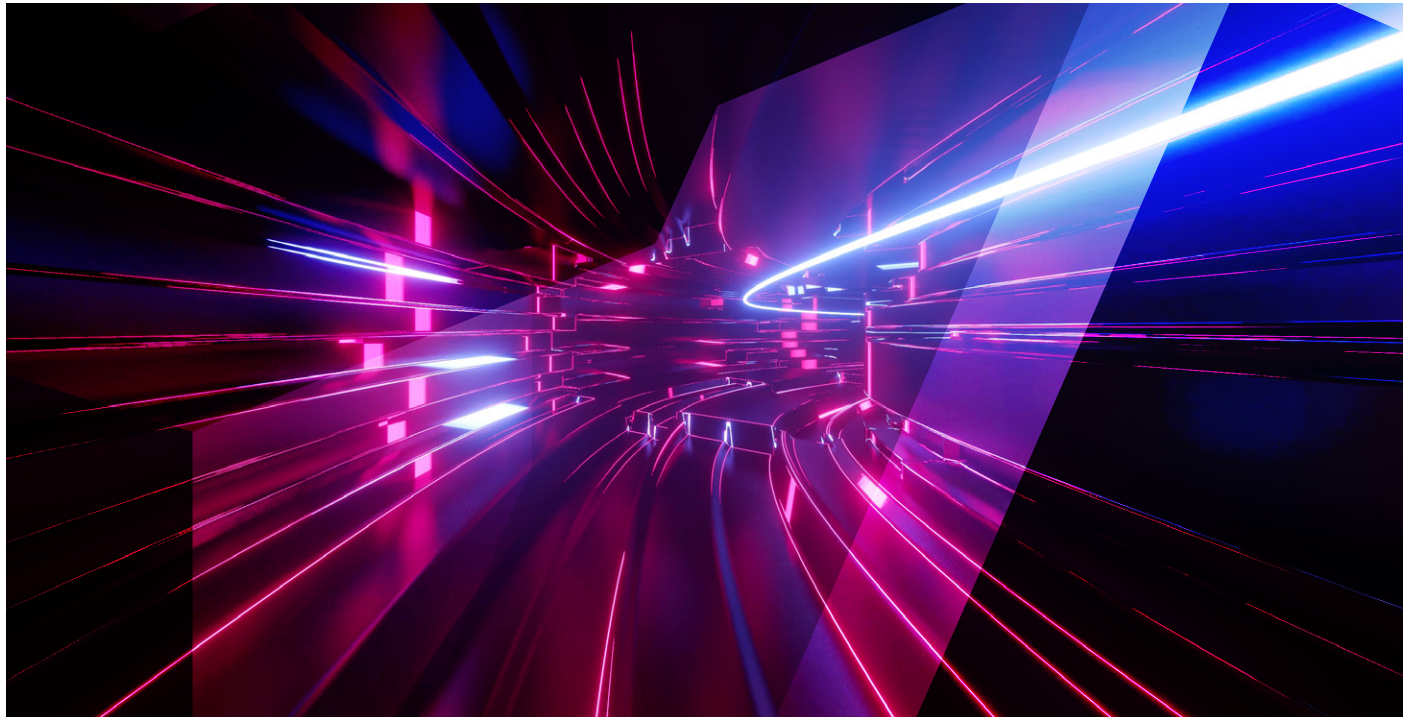
Even as the digital assets universe grows and converges more with traditional finance, there is a dynamic multi-boundary line between concerns of risks, responsible innovation and informed regulation.

— The first wave of regulation has diligently (and successfully) clarified who and how to regulate digital assets; for example, is it a commodity, a payment method, an asset, a fund, a string of programming code, a property, etc? and provides for KYC/AML while allowing organic innovations.

— From these starting points, ongoing regulatory intentions are now broader, complex and more deeply encompass areas like investor protection, market risks and financial institution's prudential requirements. These will release further benefits.

Given all these developments, to improve the chances that current potential is fully realised, digital assets communities, financial institutions, regulators and policy makers should continuously engage in thoughtful experiments in the intersection of financial services, regulations and digital assets for forward looking understanding of the key trade-offs, risks and opportunities.

It is clear that the future of post-trade is being redefined by advanced technologies, represented by the digital asset supercycle and the triple revolution, to move into modern digital paradigms necessary for new growth sources. We are in a transition period now between traditional and new ways of doing things, and complex and inter-related factors are involved – ranging from technology, economic and monetary policies to regulations, financial inclusion and the banking/finance and real economy sectors.

Each stakeholder group needs new perspectives so that progress avoids the mistake of being guided by rear-view mirrors. As the supercycle continues, participants will need deep multi-disciplinary views to ensure bold and informed decisions on the new values, risks, costs, roles and responsibilities they take on, if they are to prosper as this brave new future unfolds.

Glossary

Application Tokens
Cryptoassets that are typically issued and used in decentralised applications.

Automated Market Makers (AMMs)
Decentralised exchanges that allow traders to swap assets against liquidity pools that are maintained by smart contracts

Blockchain
A specific type of distributed and decentralised database network in which the transactions are simultaneously accessed, stored in "blocks of transactions" and secured using cryptographic techniques. Blockchain only allows "append-only" data structure and transactions in previous blocks cannot be edited or deleted

Central bank digital currencies (CBDCs)
Central bank digital currencies (CBDCs) are an electronic form of money that consumers and businesses hold with their country's central bank

Cryptoasset
A term that generally refers to cryptographically secured digital representations of value or contractual rights that are powered by forms of distributed ledger technology (DLT) and can be stored, transferred or traded electronically

Cryptocurrency
Cryptocurrency is a type of Cryptoasset, which typically does not provide rights, but is used as a mean of exchange – for example, to enable the buying or selling of a good provided by someone other than the issuer of the cryptocurrency, or for investment purposes or for the storage of value. Examples include Bitcoin and Ethereum

Decentralised finance (DeFi)
DeFi refers to peer-to-peer or peer-to-contract transactions and financing using smart contracts and cryptoassets

Distributed ledger technology (DLT)
Distributed ledger technology is a term that generally refers to a database network for recording and synchronising transactions between parties in different places at the same time. Every node in a DLT network has a copy of the same record. Blockchain is a subset of DLT

Governance tokens
Are issued by smart contracts to represent the investor's rights to vote and govern in a community-based governance model

KYC (Know your customer)
A standard in the financial industry that ensures financial institutions know that their customers are who they say they are and that they are suitable counterparties for the transaction in question

Metaverse
A three-dimensional representation of activities and space on the internet that facilitates digital interactions, often through augmented and/or persistent virtual reality

Private keys
Used as a pair of keys with each pair consisting of a Public and Private Key. The Private Key is an extremely large number that is used in cryptography, similar to a password , which should not be known by anyone except the rightful holder

Protocol tokens
These are Cryptoassets that are defined and governed by the underlying blockchain protocol

Self-hosted wallets
Allows investors to manage their crypto assets' private keys themselves, using a secure and convenient app-hosted wallet, or web-hosted wallet

Smart contract
Generally refers to a cryptographically secured computer program or a transaction protocol that automatically executes once pre-defined conditions are met

Stablecoins
A cryptocurrency that has been designed to have a relatively stable price, typically by pegging the value to underlying assets

Tokenised financial assets
Digital representations of financial assets

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