

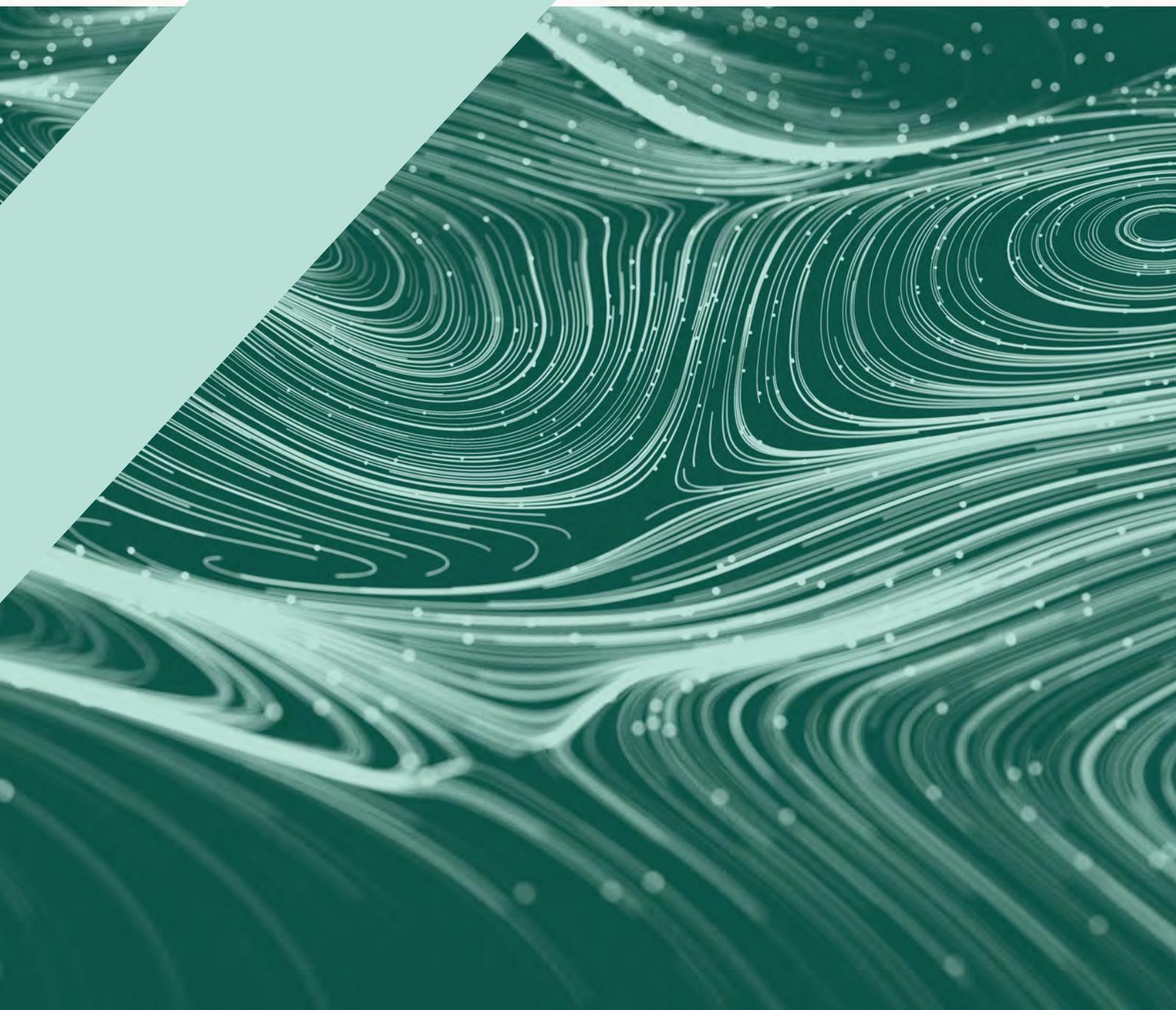


**DTCC**

February 2024

# **BRINGING TRADITIONAL ASSETS TO DIGITAL NETWORKS**

**A SUMMARY OF DTCC'S PARTICIPATION IN CITI'S PROOF  
OF CONCEPT ON TOKENIZATION OF PRIVATE ASSETS**



# TOKENIZATION OF PRIVATE ASSETS

## DRIVING BLOCKCHAIN INTEROPERABILITY, LIQUIDITY, AND EFFICIENCY IN SECURITIES LENDING AND COLLATERAL MANAGEMENT

The financial industry is undergoing rapid transformation, spurred by the shift towards digitalization, with market participants increasingly looking for ways to raise liquidity, reduce cost and risk, and automate inefficient processes. At DTCC, we believe digital asset technology offers exciting potential to capture these benefits and could ultimately help push us toward a more streamlined and resilient financial ecosystem – where blockchain networks and traditional rails seamlessly integrate. We are committed to supporting the industry shift from blockchain experiments to production-ready capabilities.

Successful adoption of distributed ledger technologies (DLT) hinges on two key hurdles: the portability of assets and the need for consistency of processes across both public and private ledgers. Solving for these challenges will not only boost liquidity for digital assets, but it could also further unlock the automation of end-to-end processes including distribution, lending, pricing, and collateral management.

With these challenges in mind, DTCC Digital Assets (formerly Securrency) was pleased to partner with Citi, Wellington Management and WisdomTree in an innovative Proof of Concept (POC) to replicate and improve the on-chain and off-chain processes of an asset lifecycle with the use of Web 3 technologies.

Our shared thesis: tokenization, smart contracts, blockchain interoperability and compliant asset portability across different ledgers offer an innovative solution to increase liquidity to digital financial assets as it reduces the operational barriers investors face to enter or exit their positions at any given time.

In this POC, DTCC Digital Assets participated in "Use Case 3" focused on lending and collateral management. Conducted on the Avalanche Spruce institutional test subnet, a Wellington issued private fund tokenized by Citi was used as collateral and a WisdomTree Money Market fund token was used as a borrowed asset. DTCC Digital Asset's Composer, a platform that enables the creation and composability of smart contracts, was used to automate the core workflow of the lending transaction including loan processing, collateral pledging, and liquidation.

We proved that assets issued using various tokenization platforms can be ported across networks and ecosystems, with their compliance rules remaining intact and with ability to move across wallets and investors atomically.



“ We are pleased to have participated in this innovative POC to enhance the economic value of digital funds beyond issuance, showcasing the portability of compliance rule sets across ecosystems and back-office processes. Our technology and efforts demonstrated blockchain interoperability of assets across smart contracts and blockchain standards, and potential efficiencies with lending and collateral management processes. By addressing current industry challenges in the institutional space, we have begun to open the door for widespread adoption of digital assets. ”

**NADINE CHAKAR**

**Managing Director,  
Global Head of DTCC  
Digital Assets**

## WE BELIEVE THIS CREATES SEVERAL OPPORTUNITIES TO IMPROVE EFFICIENCY AND REDUCE RISK IN SECURITIES LENDING AND COLLATERAL MANAGEMENT PROCESSES, INCLUDING:

- 1** Tokenized assets combined with smart contracts can expand the usability of the asset in different types of transactions, e.g., Private Equity funds can be pledged to borrow Money Market Funds, as we did in the POC.
- 2** Loan liquidation rules built into the smart contract can facilitate atomic settlement, eliminating the need to manually transfer collateral between parties, reducing counterparty risk.
- 3** The smart contract can establish a single source of truth with respect to eligibility and availability of collateral throughout the lifecycle of a securities loan, enforcing the terms for provisioning collateral.

Tokenization and smart contract technology offers a reliable and scalable way to re-shape and strengthen financial markets infrastructure.

This lending and collateral management use case is just one example of how DTCC is empowering the industry with blockchain interoperable and compliant tools to further advance the adoption of digital assets and drive liquidity. Moving forward, there is a need for further experimentation and exploration to define new roles and ecosystem dynamics to propel broader adoption and access. This is just the beginning. We encourage you to read the report to learn more.

### ABOUT DTCC

DTCC is the premier post-trade market infrastructure for the global financial services industry. From 20 locations around the world, DTCC, through its subsidiaries, automates, centralizes, and standardizes financial transaction processing, mitigating risk, increasing transparency, enhancing performance and driving efficiency for broker/dealers, custodian banks and asset managers. Visit [www.dtcc.com](http://www.dtcc.com) for more.

### ABOUT DTCC DIGITAL ASSETS

DTCC Digital Assets provides institutional-grade infrastructure and products to facilitate end-to-end lifecycle processing for digital assets. Its innovative digital infrastructure enables market participants to unlock the power of institutional DeFi by accessing secure, efficient, and compliant capital markets. DTCC Digital Assets' blockchain agnostic solutions allow for near-real-time payments and blockchain interoperability and are designed to increase global liquidity. In addition, its technology will ultimately underpin the development of DTCC's enterprise digital asset infrastructure.



## Background

Across financial services, there is a growing recognition that the use of distributed ledger technology (“DLT”) presents a significant opportunity to re-architect capital markets. Against an increasingly complex and competitive environment with persistent margin pressures, backed by a history of technological innovation spurring developments like ETFs or direct indexing, financial institutions are now exploring opportunities provided by DLT.

The potential benefits range from solving infrastructural issues in traditional operating models to the possibility of new investment product and servicing capabilities enabled by DLT features, such as programmability and composability. This could represent a step-change in how private assets are held and transacted.

The vision is an end-state of digitally native investment products that are created, traded, and administered entirely on DLT infrastructure. Digitally native products have the potential to enable better distribution, unlock new product capabilities, and deliver operational efficiencies. The transactions are also fully traceable and auditable with the potential to exist on a shared infrastructure resulting in reduced reconciliation overhead.

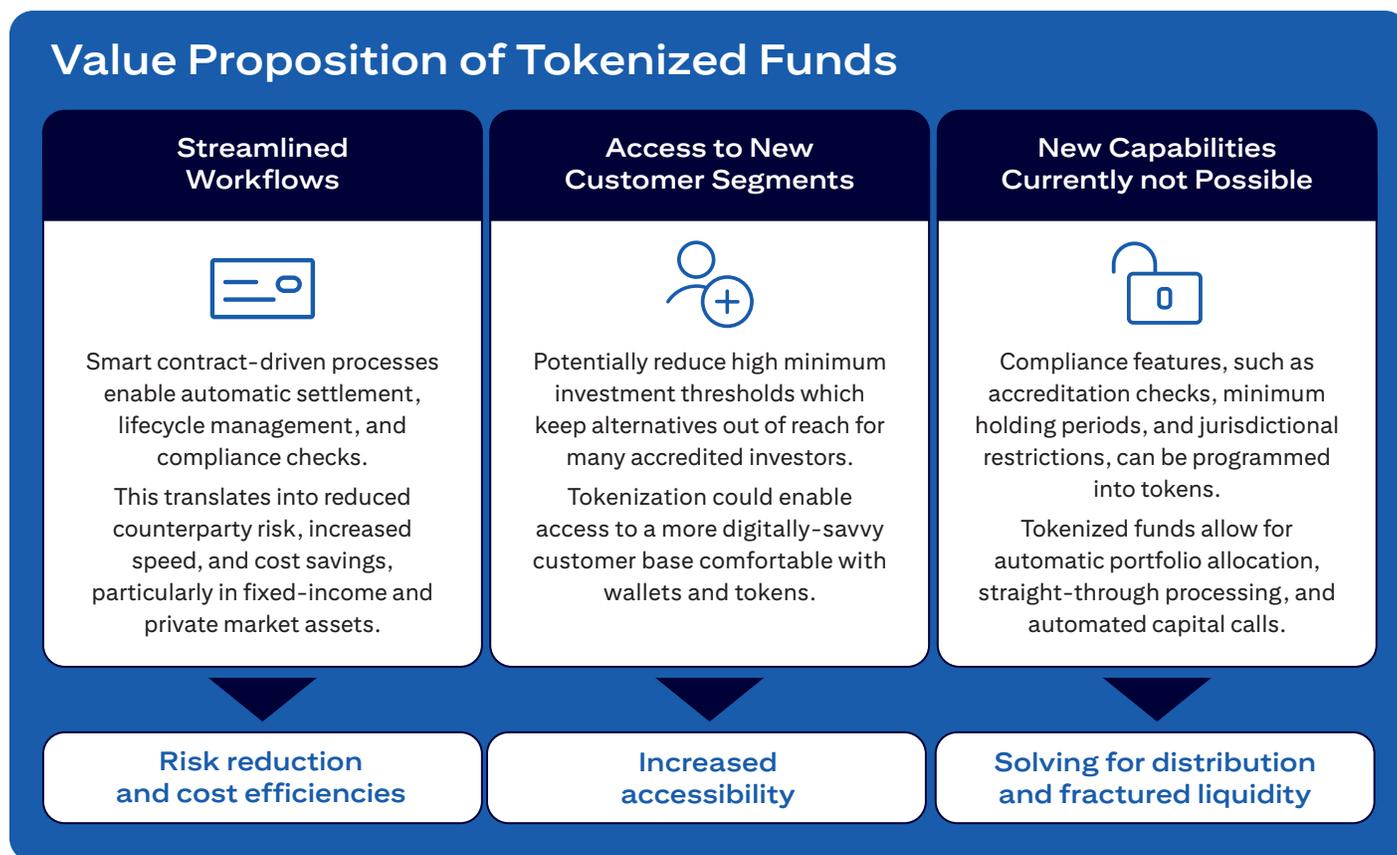
In such an end-state, regardless of whether asset allocation and personalization are driven by emerging technologies like artificial intelligence (AI) or by an advisor, DLT can be the complementary execution layer that a range of assets - including efficient public market assets like ETFs and equities - live and transact on. Leveraging the power of smart contracts with ownership recorded on DLT, these assets can be automatically allocated, fractionalized, and rebalanced by intelligent applications supported with instant implementation. The future of wealth management for the average self-directed investor would likely see AI-assisted personalized model portfolio allocation with DLT-based implementation.

However, the transition from traditional to digital infrastructure is complex. Tokenizing existing assets, issuing new assets on DLT networks, and changing the underlying administration technology bring operational challenges and associated costs. In addition, even if every new asset were now to be issued digitally, there would still be a long tail of analog assets likely left out of the new infrastructure as they currently live on the traditional infrastructure.

Hence, market participants must evaluate how to enable an efficient and flexible on-ramp for traditional assets to digital networks. Such an on-ramp mechanism, operating at scale and facilitating interoperability between different components, coupled with an effective overall compliance and control environment, could accelerate the digital transition for investors, issuers, and other market participants.

*The potential benefits range from solving infrastructural issues in traditional operating models to the possibility of new investment product and servicing capabilities enabled by DLT features, such as programmability and composability.*

Chart 1: Spectrum of Benefits to Improve Pain Points in Traditional Operating Models



## Citi Proof of Concept on a Permissioned Institutional Test Subnet

In partnership with key investment and wealth management clients, we conducted a proof-of-concept (“PoC”) to better understand key technological, operational, and legal considerations that are required to kickstart the transition from analog to digital. The PoC consisted of the issuance and transfer of a dummy “test token” with no value and which did not represent any legal rights, permitting us and our clients to focus on technological and operational issues.

Our evaluation focused on private funds due to the potential delta of efficiency and accessibility which digitization and tokenization can provide for these assets versus the current fragmented and unstructured operating ecosystem. Private markets, although an over \$10 trillion asset class<sup>1</sup>, are characterized by an infrastructure that is complex and manual, with this lack of standardization and transparency leading to inefficient distribution and operations.

### Overview

Citi, along with Wellington Management and WisdomTree, tested use cases that demonstrated how traditional assets could be tokenized and brought onto digital networks.

In the PoC, we simulated workflows using a Wellington Management-issued private equity fund as the underlying asset. ABN AMRO acted as the investor into the underlying fund, and WisdomTree simulated the role of the wealth platform on the DLT network. Citi played the role of the issuer’s agent. We used the Avalanche Evergreen Subnet called “Spruce” for its multi-level permissioning, EVM compatibility, institutional focus, and customizability.

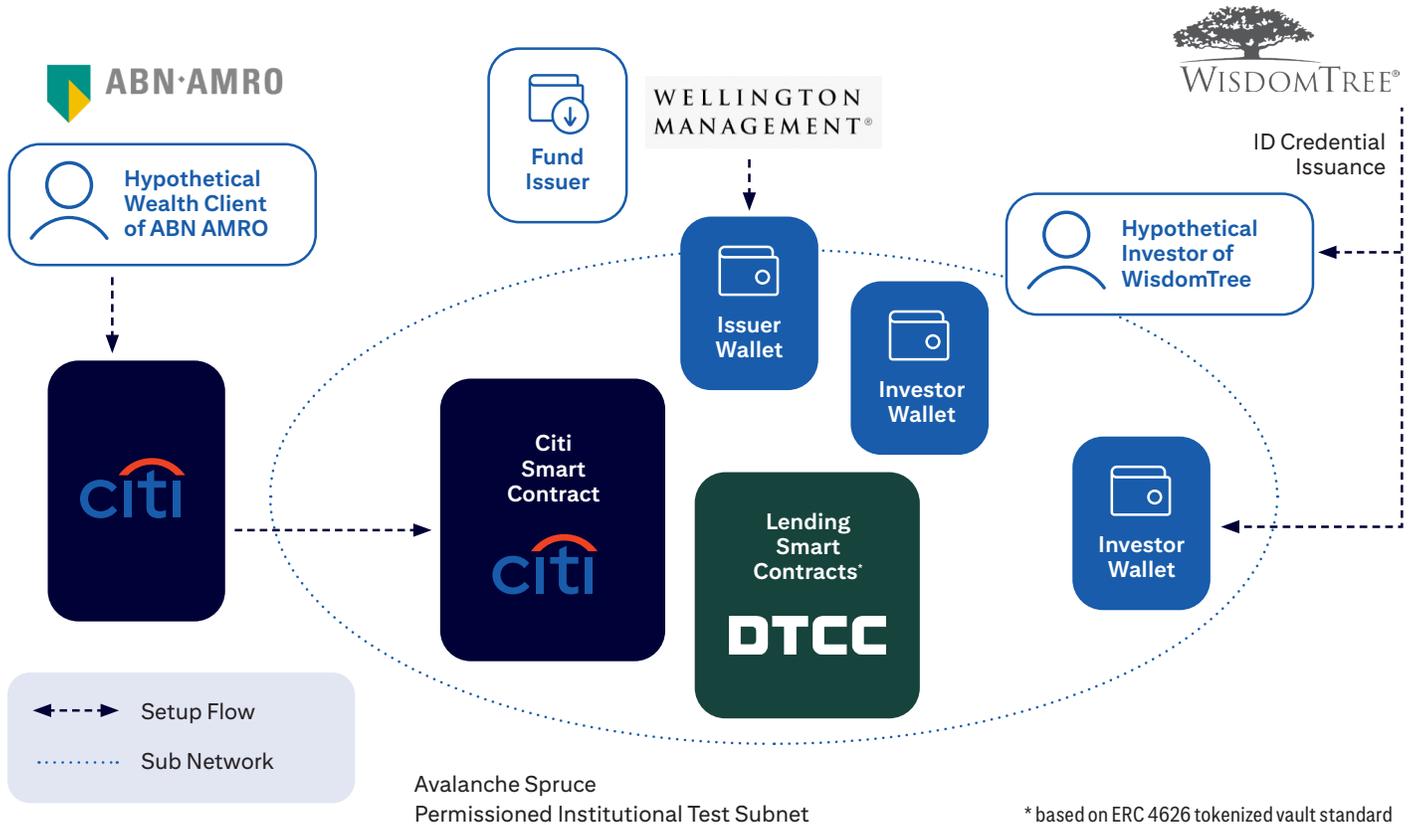
Once on the Spruce test network, these tokenized assets could be programmed to automate operations, settle faster, and enable new and composable use cases. In the PoC, the tokens were always under the control of Citi, leveraging smart contracts enforcing “compliance-by-design”, even as we relied on KYC credentials issued by WisdomTree, simulating their role as the wealth platform. Recording ownership on DLT also enables use cases that were previously infeasible, such as using a private asset fund token as collateral to borrow more liquid asset tokens, tested jointly with DTCC Digital Assets (formerly Securrency).

<sup>1</sup> Citi Business Advisory Services’ analysis based on data from Broadridge Global Market Intelligence (GMI)

Table 2: Participant Roles

Entity	Role
Citi	Issuer of enhanced ERC-20 compliant tokens from a Citi-deployed smart contract
ABN AMRO	Wealth management entity instructing Citi to transfer a traditional fund holding under Citi custody to a wallet on a digital network
Wellington Management	Asset manager simulating the role of the issuer
WisdomTree	Asset manager and wealth platform issuing identity credentials, undertaking KYC verification, onboarding end-investors, and testing receipt of test tokens and a use case related to lending and borrowing
Ava Labs	Infrastructure provider for private permissioned blockchain test network
DTCC Digital Assets	Digital assets technology infrastructure provider that developed and deployed lending and collateral management smart contracts
Tokeny	Tokenization technology provider that supported the test of ERC-3643 and ONCHAINID framework

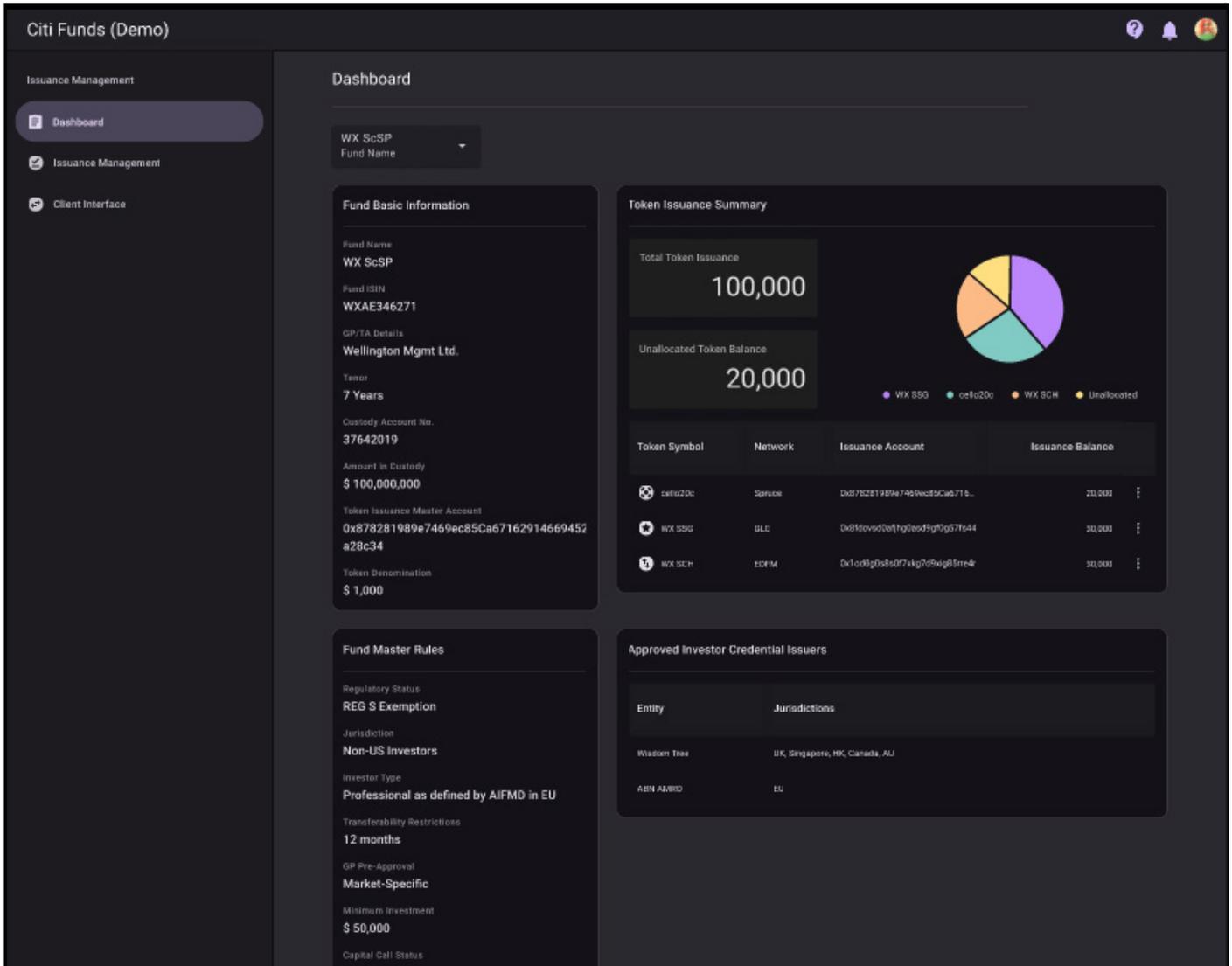
Chart 3: Setup of Participants on the Permissioned Institutional Test Subnet



## Use Cases Tested

1. Tokenize a simulated traditional private fund and bring it onto a DLT network with underlying fund distribution rules encoded into the smart contract and embedded in the token.
2. Test multiple scenarios of transfers with the Citi smart contract relying on identity credentials issued by WisdomTree. We tested multiple implementation models, ranging from simple ID NFTs to the ERC3643-ONCHAINID framework.
3. Jointly with DTCC Digital Assets, the PoC evaluated using the private fund token as collateral in an automated lending contract for borrowing more liquid money market fund (MMF) tokens from a pre-funded lending pool. The loan was subject to a haircut and collateralization ratio set based on the pool parameters.

**Chart 4: PoC Simulated Citi User Interface for Tokenized Funds Showing Issuance and Management of Fund Tokens on Multiple Networks**



## Key Takeaways

- While industry views point to digitally native issuance – administration – transfer workflow as the targeted end state, tokenization of existing assets can offer meaningful improvements over the status quo and is likely a necessary step for achieving scale. Tokenization unlocks the value in traditional markets to new use cases and digital distribution channels while enabling greater automation, more standardized data rails, and even improved overall operating models, such as those facilitated by digital identity and smart contracts. These are significant advantages over traditional models.
- Encoding asset distribution rules into smart contracts can help enable always-on compliance, including through a fully traceable audit trail. This could provide some level of assurance that the transfer of the asset is consistent with legal and regulatory requirements. For instance, using the ONCHAINID framework, we tested automating conditions around minimum holding-period, investor-jurisdiction verification, investor qualification checks, etc. In combination with fractionalization, more transparency, and liquidity for secondary trading, this capability could open-up hitherto inaccessible asset classes like private assets to a wider base of investors.
- Beyond an initial distribution use case and digital tokens providing an easier format to handle and transact, our expectation is that tokenization will soon start driving tangible utility through the new use cases it enables. The programmability provided by digital tokens enables models that are traditionally infeasible, for instance, automating rules-based asset allocation. Making it easier for private assets to trade and settle faster might also make them more accessible in automated model portfolios.
- In working with law firms Allen & Overy LLP and Davis Polk & Wardwell LLP, we have identified a number of potential considerations that need to be assessed to establish a legally sound tokenization framework, which include but are not limited to the following issues 1) legal entity and permissibility, 2) legal and regulatory status of the tokens, 3) contractual rights, 4) AML/CFT, and 5) capital and tax. This analysis should include the optimal go-to-market jurisdiction, especially in light of continued regulatory fragmentation across leading financial centers.
- Identity standards have matured and smart contract technology has the potential to leverage such standards to bring major gains for a variety of asset classes, with private markets demonstrating the most significant uplift. The adoption and implementation of these identity standards on the investor side may be crucial to these networks gaining critical mass. It is important for the industry to come together to build an infrastructure around identity, as a public utility of sorts, for tokenization to gain more widespread adoption.
- The data required for digital networks to support these assets in a tokenized format is not to be ignored. Creating the rails for two-way investor and issuer data flow in a secure and compliant manner may be key for many promising use cases, especially when data lives in multiple traditional systems. Once brought on-chain, this data can be wrapped along with the token and leveraged for novel use cases.
- Digital networks are transparent by design. However, financial transactions usually contain confidential or proprietary information. Even though transactions on digital networks only capture wallet addresses and associated public keys, potential repeated use of keys could enable observers to identify transaction patterns, and thereby compromise the identity of the real-world entity or individual. There is however meaningful progress in the development of new technologies to introduce transaction-level privacy through verification without knowledge (zero knowledge proofs), fully homomorphic encryption, etc.
- Token standards are important to set a consistent framework for issuers, investors, KYC/AML providers, wallets, exchanges, regulators, and developers to work together without friction. Whilst the core EVM-based ERC-20 standard is powerful and most-used for issuances, it might not directly fit-for-purpose for representing securities, which come with associated conditions to ensure investor protection and a fair and orderly market. Multiple frameworks and standards potentially more fit for financial assets and securities are being developed. However, it is important to ensure a basic level of compatibility with ERC-20 and EVM frameworks given their widespread adoption.
- Asset-servicing rails, including the ability to support complex private equity features like capital calls, are going to be as critical as enabling the initial issuance. In the initial period of tokenization, it is very likely that different forms of the asset would have different settlement timelines (potentially instant on DLT vs weeks and months on traditional rails), and these differences would need to be bridged.
- Leveraging smart contracts for use cases like lending and collateral management will help unlock the power of composability whereby assets tokenized by one institution can be used as collateral by other institutions. In the PoC, DTCC Digital Assets' Composer technology was used to automate core lending workflows including loan processing, collateral management, and liquidation. This was a promising use of self-executing processes that could potentially help unlock operational efficiency and scalability.

## Conclusion and Next Steps

This PoC demonstrates some of the benefits of tokenization in private markets. Through traditional partnerships (issuer, distributor, servicer) and leveraging DLT (moving value over the internet, digital identity, fractionalization, smart contract-based compliance checks), we propose a framework aimed at putting private assets into the hands of investors in newer digital-formats with upgraded capabilities, not possible under the traditional market structure.

There are often complex legal and regulatory restrictions related to private assets. DLT-based systems can be used to aid banks and other financial institutions in satisfying these legal and regulatory requirements. This would enable greater automation and the potential for an enhanced compliance and control environment for issuers, distributors, and investors.

Much work remains to be done. Our PoC highlighted a few priority areas including the evaluation of 1) end-to-end data rails, 2) end-to-end servicing workflow, 3) nuanced digital identity solutions, 4) incorporating a tokenized cash leg to facilitate atomic settlement, and 5) comprehensive legal and regulatory considerations to validate a suitable model to bridge analog and digital networks.

Overall though, our evaluation showed that providing a flexible on-ramp for traditional assets to digital networks for distribution and enabling a compliant and efficient environment for management and servicing of these assets has the potential to transform the way private market assets are held and transacted today.

Citi clients can request the detailed report or discuss private market tokenization with us at [nisha.surendran@citi.com](mailto:nisha.surendran@citi.com) or [joana.niculcea@citi.com](mailto:joana.niculcea@citi.com).

## Contributors:

1. Citi
2. Wellington Management
3. WisdomTree
4. DTCC Digital Assets
5. Ava Labs
6. Tokeny



#### Disclaimer

“Digital Assets” is a broad term and can cover different products including, without limitation, tokenized securities and assets, tokenized deposits, stablecoins, cryptocurrencies, e-money tokens, utility tokens, Non-Fungible Tokens, and other digital representations of value or contractual rights that may or may not be based on distributed ledger technology systems (e.g., digital yuan or e-money). Certain types of digital assets may not be issued or backed by a central bank or other authority or issuing entity, may not be backed by fiat currency or other assets, and may be subject to different regulatory treatment or may be unregulated in one or more jurisdictions.

The laws and regulations surrounding Digital Assets, the technology supporting them, and related documentation, including contractual documentation, are evolving. Citi assumes no obligation to update You or the Document to reflect any ongoing developments in these areas.

Citi does not assume any undertaking to:

- supplement such information as further information becomes available or in light of changing circumstances, laws or regulations or to correct any inaccuracies which may become apparent,
- to update You of such developments or of their impact on Your financial position when trading in such Products.

Any Citi initiative discussed or mentioned in the Document may be subject to regulatory and/or internal approval and Citi may make further changes or withdraw such initiative or related information without prior notice and without having any liability for losses incurred due to Your reliance on such information or initiative.

From time to time and as a result of the evolving landscape characterising digital assets, Citi may be required to change the terms under which You enter into Transactions or Citi’s internal categorisation of a type of digital asset or Product, including in order to comply with legal requirements or to reflect changes in the underlying technology or in the cost of running its business and Citi has no liability for any losses incurred due to such changes.

You will need to ensure that You obtain legal, financial, tax advice from independent and professional advisors which is always up to date and specific to Your circumstances.

© 2024 Citigroup Inc. Citi, Citi and Arc Design and other marks used herein are service marks of Citigroup Inc. or its affiliates, used and registered throughout the world.

# DTCC

DTCC DIGITAL ASSETS



For more information on our products and services, visit [DTCC.com](https://www.dtcc.com)

