JUNE 2026

ISDA
FUTURE LEADERS
IN DERIVATIVES

Digital Assets and Derivatives: Where Next?

CONTENTS

EXECUTIVE SUMMARY

Digital assets are moving into a phase of institutional integration into derivatives markets. Trading venues, custodial infrastructures and tokenization platforms now exist across both traditional financial markets and public blockchain networks. While this diversity has accelerated innovation and liquidity formation, it has also exposed structural constraints in settlement infrastructure and finality, capital treatment, collateral eligibility and operational resilience that limit scalable institutional participation.

This paper, which was developed by the ISDA Future Leaders in Derivatives 2025/2026 cohort, examines digital assets in derivatives markets and associated distributed ledger technologies (DLT) through the lens of settlement design, prudential capital treatment and collateral management. Its central finding is that the institutional viability of digital assets depends on how exposures are structured, margined, settled and recognized within existing prudential frameworks.

The institutional significance of digital assets lies in how distributed settlement infrastructure alters the mechanics of derivatives markets. By changing the frequency of financial transaction settlement, collateral mobility and the length of time and degree to which mark-to-market (MTM) exposures remain unsettled between counterparties, digital settlement infrastructure changes how derivatives exposures interact with existing prudential capital and liquidity frameworks. The resulting economic effect is that post-trade infrastructure determines the extent of balance sheet efficiency.

This paper demonstrates that faster settlement frequency and portfolio compression can reduce counterparty exposure, and the associated valuation adjustment that is factored into the price of an over-the-counter (OTC) derivatives contract to account for risks and costs beyond the pure market value (ie, x-value adjustment, or XVA) by approximately 40–45%, even when underlying market risk remains unchanged. These gains arise primarily from shorter exposure persistence and lower gross exposure metrics, rather than changes in volatility[1].

Digital assets have the potential to scale within existing regulatory regimes, but that opportunity requires appropriate settlement arrangements to preserve legal finality and collateral structures to support predictable liquidation mechanisms under stress. Digital asset exposures must also qualify for regulatory capital treatment that is commensurate with the risks of the underlying asset under prudential frameworks. The development of industry-wide standards, including ISDA documentation and the Common Domain Model (CDM), provides a credible foundation for interoperability across traditional and distributed market infrastructures. Extending these standards will allow digital assets to evolve without fragmenting legal certainty, risk management frameworks or supervisory alignment.

[1] These reductions are driven by two independent effects: (i) shorter exposure persistence reducing replacement cost; and (ii) lower effective gross notional reducing potential future exposure

1. THE VALUE OF DIGITAL ASSETS AND IMPROVEMENTS ON TRADFI

Digital asset settlement infrastructure is transitioning from experimental deployment by market disrupters to full-scale production and integration within traditional financial (TradFi) market institutions. While the associated legal, regulatory and risk management frameworks have yet to reach maturity, preventing digital asset markets from reaching a stable and determinative state, market participants can take actions now with respect to post-trade infrastructure of transactions that will favorably alter the capital and liquidity requirements of digital asset exposures. Specifically, because capital requirements depend on both the magnitude and persistence of exposure, improvements in digital settlement architecture can materially affect a transaction's balance-sheet efficiency, even when the underlying market risk of the reference assets remains unchanged.

Digital settlement rails which leverage decentralized finance (DeFi) innovations such as real-time settlement capabilities, DLT and tokenization together introduce the possibility of continuous margining, programmable collateral transfers and faster settlement finality. These compress exposure persistence and alter the balance sheet economics of derivatives portfolios.

This paper examines how settlement infrastructure, collateral frameworks and prudential capital treatment interact to determine the institutional viability of digital assets in derivatives markets. The analysis focuses on how digital settlement rails, tokenized collateral and new forms of digital money may influence exposure persistence, liquidity management and balance sheet efficiency within existing derivatives market structures.

Institutional use of digital assets in derivatives markets depends on how all of these factors interact with existing prudential regimes. Where digital asset exposures benefit from enforceable settlement methods, recognized collateral structures and risk-sensitive capital treatment, derivatives transactions referencing digital assets can be intermediated using the same risk management frameworks that support traditional derivatives markets.

This paper adopts the taxonomy and definitions from the Commodity Futures Trading Commission's (CFTC) Global Markets Advisory Committee's 2024 recommendations as the baseline language for its analysis[2]. While tat taxonomy is broad and jurisdictionally agnostic, this paper focuses on a narrower subset of digital assets with the greatest near- to medium-term potential to catalyze innovation, liquidity and risk-transfer efficiency in derivatives markets.

[2] This taxonomy is shown in Annex 7.1 and is based on the Commodity Futures Trading Commission's Global Markets Advisory Committee's adoption of an approach for the classification and understanding of digital assets, March 7, 2024, www.cftc.gov/PressRoom/PressReleases/8873-24

2. REGULATORY FRAMEWORKS FOR DIGITAL ASSETS

Regulatory restrictions have, until recently, limited how digital assets can be used in regulated financial markets. Stringent supervisory and registration requirements for dealers, brokers, exchanges, issuers and other financial market intermediaries have created obstacles for institutional entities. Further, because derivatives markets operate across jurisdictions and rely on the soundness of legal concepts such as settlement finality, collateral enforceability and netting, regulatory treatment plays a decisive role in determining the integration of digital assets into institutional market infrastructure.

Recent regulatory initiatives have largely endeavored to accommodate digital assets within existing supervisory frameworks, and, where possible, to adopt a technology-neutral approach to digital assets regulation in order to future-proof regulation for further innovations.

In the EU, building on the Markets in Crypto-Assets Regulation (MiCA) which introduced a licensing and supervisory regime for crypto-asset firms in 2023[3], more recent policy initiatives focus on integrating DLT within existing financial market infrastructure frameworks. For example, the European Central Bank (ECB) has confirmed that the Eurosystem will accept eligible marketable assets issued through DLT-based services as collateral for credit operations beginning in March 2026, subject to existing eligibility criteria and settlement connectivity requirements[4]. In parallel, the European Commission (EC) has proposed amendments to the Central Securities Depositories Regulation to accommodate DLT-based settlement systems and clarify the legal moment of settlement finality[5].

US financial regulators, including the prudential bank regulators, the CFTC and the Securities and Exchange Commission (SEC), have all issued significant rulemakings, interpretive guidance and regulatory relief over the past year in an attempt to integrate digital assets into a transparent federal regulatory framework for the first time.

- The Guiding and Establishing National Innovation for US Stablecoins (Genius) Act , the first enacted federal law to govern digital assets, establishes a regulatory framework for stablecoins and their issuers[6]. Technical rulemakings by the prudential regulators are in process to implement regulations under the GENIUS Act by the July 2026 deadline.

- The Office of the Comptroller of the Currency, the primary US prudential regulator for national banks, has also issued guidance confirming that national banks may hold crypto assets as principal to pay associated network fees and may also engage in riskless principal crypto-asset transactions[7].

[3] Markets in Crypto-Assets Regulation, Regulation EU 2023/1114

[4] 2017/390 supplementing Regulation (EU) No 909/2014; ECB paves way for acceptance of DLT-based assets as eligible Eurosystem collateral, European Central Bank (ECB), January 27, 2026, www.ecb.europa.eu/press/pr/date/2026/html/ecb.pr260127_1~a946167ce1.en.html

[5] The EBA consults on amendments to technical standards on prudential requirements for central securities depositories, European Banking Authority, December 3, 2025, www.eba.europa.eu/publications-and-media/press-releases/eba-consults-amendments-technical-standards-prudential-requirements-central-securities-depositories

[6] Guiding and Establishing National Innovation for U.S. Stablecoins Act of 2025, Pub. L. No. 119-18, 139 Stat. ___ (2025)

[7] Interpretive Letter No. 1186, Authority of National Banks to Hold Crypto-Assets as Principal and Pay Crypto-Asset Network Fees as Incidental to a Permissible Banking Activity, Office of the Comptroller of the Currency (OCC), November 18, 2025, www.occ.gov/topics/charters-and-licensing/interpretations-and-actions/2025/int1186.pdf; Interpretive Letter No. 1188, Authority of National Banks to Engage in Riskless Principal Crypto-Asset Transactions, OCC, December 9, 2025, www.occ.treas.gov/topics/charters-and-licensing/interpretations-and-actions/2025/int1188.pdf

- One pending legislative initiative with significant support, the Digital Markets Clarity Act, would classify most digitally native tokens as digital commodities and assign jurisdiction of cash and spot market transactions in such assets to the CFTC. It also distinguishes digital commodities from digital securities by defining parameters for decentralization that transform a digital asset from a digital security (in that it is the subject of an investment contract) to a digital commodity (once the blockchain network it is part of becomes 'mature')[8].

- Consistent with the market landscape contemplated by the Clarity Act, recent interpretive guidance issued jointly by the SEC and CFTC sets forth the application of the federal securities laws to certain digital assets and transactions, confirming that most digital assets (including stablecoins) are not securities but may be sold in such a way that the securities laws apply to them[9].

In addition, both the SEC and CFTC have issued guidance and a number of no-action letters and other relief with respect to tokenized assets (including tokenized securities and stablecoins) to allow market participants such as clearing houses[10], custodians[11], brokers and exchanges[12] to intermediate in digital asset transactions.

Other major financial centers have adopted similar approaches. For example, the Monetary Authority of Singapore has implemented a classification-based framework in which digital assets are regulated according to their economic function rather than their technological form. Meanwhile, Brazil has moved toward integrating crypto-asset activities within the core perimeter of financial regulation through coordinated oversight by the central bank and securities regulator.

Despite this progress, regulatory fragmentation remains a challenge. Because digital asset markets operate across borders and infrastructures, inconsistencies in legal recognition, settlement rules and prudential treatment can create operational friction and an unlevel playing field.

These developments suggest that the evolution of digital assets in the context of derivatives markets will depend less on the development of entirely new regulatory and risk management regimes and instead focus on the consistent application of existing financial market principles, particularly those governing settlement finality, collateral enforceability and prudential capital treatment. To that end, while existing legal concepts provide an idea of how regulation will develop, there is work to do to harmonize approaches.

[8] H.R. 3633, Digital Asset Market Clarity Act of 2025, 119th Cong. (2025)

[9] Application of the Federal Securities Laws to Certain Types of Crypto Assets and Certain Transactions Involving Crypto Assets, Release Nos. 33-11412, 34-105020, US Securities and Exchange Commission (SEC), March 17, 2026, www.sec.gov/files/rules/interp/2026/33-11412.pdf; Statement on Tokenized Securities, SEC Division of Corporation Finance, Division of Investment Management, Division of Trading and Markets, January 28, 2026, www.sec.gov/newsroom/speeches-statements/corp-fin-statement-tokenized-securities-012826-statement-tokenized-securities

[10] No-Action Letter Request to The Depository Trust Company's Development of the DTCC Tokenization Services, SEC Division of Trading and Markets, December 11, 2025, www.sec.gov/files/tm/no-action/dtc-nal-121125.pdf

[11] Request for No-Action Relief Under Section 206(4) of the Investment Advisers Act of 1940 and Rule 206(4)-2 thereunder and Sections 17(f) and 26(a) of the Investment Company Act of 1940 with Respect to State Trust Companies that Provide Crypto Asset Custody Services, SEC, September 30, 2025, www.sec.gov/rules-regulations/no-action-interpretive-exemptive-letters/division-investment-management-staff-no-action-interpretive-letters/simpsonthacherbartlett093025

[12] Tokenized Collateral Guidance, US Commodity Futures Trading Commission (CFTC) Staff Letter No. 25-39, December 8, 2025, www.cftc.gov/csl/25-39/download; Staff No-Action Position Regarding Digital Assets Accepted as Margin Collateral, CFTC Staff Letter No. 25-40, December 8, 2025, www.cftc.gov/csl/25-40/download.

3. MARKET STRUCTURE IMPLICATIONS FOR DERIVATIVES MARKETS

Digital asset infrastructure alters the mechanics of derivatives markets by changing when and how exposures between counterparties are terminated. Digital settlement infrastructure can materially affect exposure persistence, liquidity requirements and balance sheet consumption, without necessarily affecting the underlying economic risk of transactions.

Traditional derivatives markets rely on batch-based settlement cycles, time zone-dependent payment systems and fragmented collateral arrangements. These structures create exposure persistence between margin calls, require liquidity buffers to manage settlement timing differences and constrain collateral mobility across venues and counterparties. On the other hand, batch-based processes allow exposures to be offset through netting, reducing gross funding requirements.

Digital settlement infrastructure introduces the possibility of more continuous margining, faster collateral transfers and programmable post-trade workflows. These changes allow exposures to be extinguished more quickly and collateral to be mobilized more efficiently, shifting exposure management from reliance on netting towards a greater dependence on timely liquidity. This does not necessarily imply an increase in liquidity risk. Where portfolio composition limits netting gains, the incremental liquidity demand under near real-time settlement may be modest. Risk lies in the timeliness of access rather than the volume of liquidity required.

At the same time, digital rails challenge longstanding assumptions about when settlement is legally final, which assets are prudentially eligible and how margin models classify digital exposures. Hybrid settlement routes, diverse tokenized collateral types and DLT-based infrastructure risks widen gaps between technical settlement and legal discharge.

The value of digital assets in institutional markets is dependent on legal enforceability, standardization and alignment with existing prudential frameworks. Efficiency gains and new use cases cannot be realized at scale where settlement finality is uncertain, asset behavior is inconsistent or lifecycle events are not recognized across legal and operational systems. As a result, the most durable use cases for digital assets are those that integrate seamlessly with established documentation, risk management frameworks and supervisory expectations.

3.1 Settlement Architecture and Exposure Management

The shift from batch settlement to continuous, event-driven models changes not only how exposures are extinguished but also the liquidity and operational logic that surrounds them. As settlement frequency increases, the buffers and controls that once operated at end of day must move to intraday. This requires real-time exposure monitoring, automated collateral transfers and pre-defined fallback procedures. Institutions with stable funding profiles may absorb these requirements more efficiently. Balance sheets optimized for netting and compression may face higher funding costs during the transition.

Liquidity management therefore becomes more important than counterparty netting, requiring intraday liquidity buffers, real-time collateral optimization engines and automated funding mechanisms to ensure margin and settlement obligations can be met continuously. Practical responses include implementing real-time exposure monitoring, intraday margining capabilities and programmable collateral transfers that allow exposures to be terminated continuously rather than accumulated until end-of-day netting. Portfolio compression, automated collateral substitution and coordinated settlement windows across venues can further reduce gross exposure build-up while maintaining operational scalability.

The move toward continuous, DLT-based settlement will not occur uniformly or simultaneously across markets. During the transition period, institutions will operate across hybrid environments in which some exposures settle on distributed ledgers while others remain on traditional infrastructure, often within the same portfolio. This coexistence introduces sequencing risk: settlement finality may be reached at different times on different rails, creating temporary mismatches between legal discharge and operational records. Legacy systems may not yet recognize on-chain events, requiring manual reconciliation that offsets some of the efficiency gains digital infrastructure is meant to deliver. Managing this period requires coordinated industry action on documentation, data standards and fallback procedures, so that the migration path itself does not generate the fragmentation it is designed to replace.

Settlement must still satisfy the same core requirements as traditional derivatives markets: enforceable title transfer, legal settlement finality, reliable custody arrangements and operational resilience under stress. Existing documentation frameworks were designed for intermediated environments with centralized registries, custodians and traditional payment systems. Cross-border divergence in the legal characterization of digital assets further complicates consistency and enforceability.

Settlement Finality in Law

'Settlement finality' generally refers to whether an asset transfer can be considered final, such that it cannot be reversed (outside of certain limited scenarios). Within digital asset markets, there is often a commercial expectation that an on-chain transfer of digital assets equates to the final discharge of the transferor's obligation to transfer the relevant assets to the transferee. However, the application of certain insolvency regimes can lead to the reversal of certain types of transactions, despite a transfer being complete from an 'on-chain' perspective.

Finality in digital asset settlement operates across three distinct layers:

1. **Operational finality** reflects the point at which a ledger records a transaction as irreversible, but this alone does not discharge obligations;

2. **Legal finality** traditionally arises when a financial market infrastructure (FMI) rulebook, common law or statutory framework recognizes the settlement as binding; and

3. **Contractual finality** is defined in a contract, which determines when payment or delivery obligations are deemed satisfied and discharged.

To facilitate institutional adoption, operational finality, legal finality and contractual finality must align so that an on-chain transfer of digital assets is not only technically irreversible, but also legally recognized and contractually effective. DLT transfer rails can, in theory, provide clearer and more robust settlement finality than many traditional post-trade structures, because 'finality' can be pre-defined and engineered into the transaction processing and governance stack.

Ledgers can address both operational and legal/contractual finality through network and smart contract design, system rulebooks and contractual allocation of roll-back risk. The extent to which these measures can be implemented depends on the network's permissioning model, which determines how participants are identified, governed and contractually bound.

There are two types of operational finality in blockchain networks: deterministic finality and probabilistic finality. With deterministic finality, largely achieved through permissioned blockchain networks, once a block is agreed upon by the requisite validators and added to a blockchain, the transactions that it records are immediately and irreversibly settled. With probabilistic finality,

which public/permissionless blockchain networks typically rely on, settlement confidence increases as additional blocks confirm a transaction. While the likelihood of reversal declines rapidly as confirmations accumulate, the probability never reaches absolute certainty. On the other hand, private/permissioned blockchain networks will typically define the moment of operational and legal settlement finality through consensus protocols, governance frameworks and rulebooks, to which parties must agree to as a condition of use. In these environments, operational finality can be aligned more directly with contractual and legal definitions of settlement.

Existing financial market frameworks provide mechanisms through which market participants can achieve legally recognized settlement finality. However, many of these frameworks were designed for traditional intermediated infrastructures and do not yet explicitly address settlement conducted on distributed ledgers. Where operational, contractual and statutory finality remain misaligned, technical settlement on a distributed ledger may not translate into legally recognized discharge of obligations within derivatives contracts.

Closing this gap requires action from both industry and regulators, and recent regulatory developments are beginning to address it. For example, the EC's market integration initiatives propose revisions to its central securities depository (CSD) rules to accommodate DLT-based settlement systems and clarify the legal moment of settlement finality for transactions recorded on distributed ledgers. On the industry side, documentation will need to evolve alongside settlement infrastructure. A digital asset delivery annex, supported by a DLT settlement protocol, could define delivery mechanics, settlement triggers and fallbacks for network events. Updating industry netting and collateral opinions to cover digital asset instruments would provide greater legal certainty. Addressing these issues will require definition and analysis of the specific legal structure used by the digital asset.

Without such legal recognition, improvements in settlement speed or programmability enabled by DLT are less likely to translate into reliable risk reduction within derivatives markets. Beyond insolvency, the interaction of DLT-based settlement with recovery and resolution frameworks, including the operation of stays, position porting and authority intervention, remains comparatively untested and should be treated as a structural dependency for scaling institutional adoption.

Operational Processes and Post-trade Infrastructure

The shift to continuous, event-driven settlement, where transactions trigger automated margin, collateral and reporting actions, rather than waiting for batch processing and programmable collateral, necessitates a redesign of current workflows. The goal is to protect legal certainty and systemic resilience under round-the-clock operation in hybrid architectures without stacking new layers onto an already fragmented landscape, and to build common foundations for a multi-asset, cross-ledger, T+0-enabled post-trade system. Operational resilience, liquidity buffers and automated controls now perform functions previously handled through netting cycles and end-of-day cut-offs, creating new challenges in intraday liquidity management, exception handling and fallback design, particularly where margin and settlement depend on the same infrastructure.

The possible expansion of digital assets introduces a broader set of settlement architectures and deliverable assets than those traditionally available in derivatives markets. While most existing products remain cash-settled, digital infrastructure allows settlement to occur across a combination of distributed ledgers and traditional infrastructures:

1. **Single ledger settlement**. Both legs of the transaction settle on the same ledger, allowing atomic execution where delivery and payment occur simultaneously within a single technical environment. This model provides the clearest operational finality but remains limited to environments where both assets exist on the same infrastructure.

2. **Hybrid settlement**. One leg of the transaction settles on a distributed ledger while the other settles through traditional financial market infrastructure such as real-time gross settlement systems, custodians or CSDs. Hybrid settlement models allow digital assets to interoperate with existing market infrastructure but introduce timing and coordination challenges that must be managed contractually and operationally.

3. **Cross-ledger settlement**. Both legs settle on distributed ledgers, but on different networks. Settlement therefore requires bridging or orchestration layers capable of coordinating transfers across networks while preserving delivery vs payment (DvP) or payment vs payment (PvP) semantics. Some initiatives are exploring the use of tokenized commercial bank deposit instruments and related coordination layers to support continuous settlement of the cash leg and preserve PvP/DvP semantics across connected infrastructures.

Digital assets also expand the range of assets that may function as settlement items or deliverables. While the characteristics and collateral treatment of different digital asset types are examined in detail in this paper, several implications for settlement design are relevant here. Digital markets blur the traditional distinction between cash-settled and physically-settled derivatives. Tokenized financial instruments, native digital assets and tokenized real-world assets can in principle be delivered directly on distributed ledgers. At the same time, a growing range of digital cash instruments – including tokenized deposits, stablecoins and future forms of wholesale digital money – can be used for the settlement payment leg. Digital settlement assets may take several forms, each with distinct legal, operational and prudential characteristics. These differences affect redemption mechanics, settlement finality, liquidity under stress and the treatment of exposures within regulatory frameworks.

Continuous settlement environments require ex-ante operational controls and predefined fallback procedures. Institutions can mitigate settlement disruption risks by implementing asset validation rules, transaction eligibility checks, automated exception handling and operational circuit breakers within settlement workflows. In addition, contingency procedures should address infrastructure disruptions such as network congestion, price feed failures or protocol events, with contractual documentation and operational playbooks defining how settlement, margin and valuation processes continue under degraded conditions.

In fully on-chain DeFi derivatives (such as perpetual digital asset futures), trading, margining and settlement are entirely integrated. Positions are continuously marked to market, margin is pre-funded and locked in smart contracts, and profits and losses are realized or liquidated in real time. While future institutional markets may not fully replicate this model, it illustrates a possible scenario for settlement frequency and immediacy in derivatives markets. Where margin movements and settlement transfers occur on the same rails, traditional organizational separation is replaced by technical governance. As a result, automated controls, pre-funded buffers and escalation logic become central to risk management.

3.2 Infrastructure Effects on Exposure and Capital

This section examines the quantitative implications of settlement frequency and portfolio compression. The case study evaluates a representative institutional derivatives portfolio consisting of Bitcoin (BTC) and Ethereum (ETH) non-deliverable forwards and options exposure with a combined notional of $160 million. The analysis holds volatility, margin period of risk (MPOR) and portfolio composition constant, while varying only the collateral infrastructure and exposure persistence characteristics of the settlement environment.

Digital infrastructure may enable more frequent or automated compression cycles. Therefore, the compression factor represents stylized portfolio compression achieved through smart contract-enabled multilateral netting and tear-up of offsetting positions. Settlement acceleration and portfolio compression affect different components of counterparty exposure. Faster settlement primarily reduces replacement cost by shortening exposure persistence, while portfolio compression reduces potential future exposure by lowering effective gross notional.

The case study isolates the effect of exposure persistence by holding netting assumptions constant. The purpose is to show the pure infrastructure effect, not a full equilibrium model. In practice, reduced netting would partially offset these benefits through higher gross liquidity requirements.

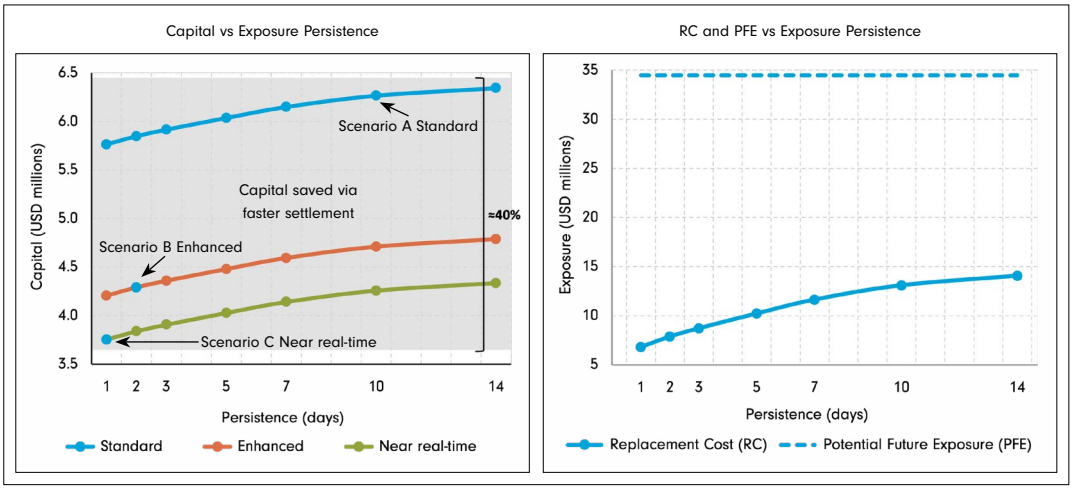
Three settlement environments are compared below.

1. **Standard infrastructure**. A conventional bilateral credit support annex (CSA) with daily variation margin (VM) and traditional payment rails. Settlement frictions and operational processes produce an effective exposure persistence window of approximately 10 days, which reflects the aggregate of several components that stack under a standard bilateral CSA with non-cleared collateral: dispute resolution rights, with ISDA standard being one to three days; minimum transfer amounts that defer margin calls until thresholds are breached; operational and custodial confirmation timing; and the gap between margin calculation and legally recognized settlement finality[13].

2. **Enhanced infrastructure**. Improved operational processes and automated collateral workflows reduce exposure persistence to approximately two days, while portfolio compression reduces gross notional exposure.

3. **Near real-time infrastructure**. Programmatic collateral transfers and near-continuous margin recalculation reduce effective exposure persistence to roughly one day, approximating a digital settlement environment with minimal hold-out between margin calculation and settlement finality.

Figure 1 – Infrastructure, Exposure Persistence and Capital Efficiency



Source: Yahoo Finance

[13] The resulting 10-day window is broadly consistent with the standardized approach for counterparty credit risk 10-business day margin period of risk floor applicable to bilateral non-cleared derivatives

The analysis shows that settlement infrastructure materially affects counterparty credit exposure and regulatory capital outcomes under the Basel Committee on Banking Supervision's (BCBS) SCO60 crypto-asset exposures framework. Under the assumptions of this illustrative analysis, moving from a conventional collateral environment to near real-time settlement may reduce the capital proxy associated with the portfolio from approximately $6.3 million to $3.7 million, a directional reduction of around 40% while holding market risk constant.

The reduction arises both from changes in replacement cost and, via portfolio compression, potential future exposure. Replacement cost declines as exposure persistence shortens, and potential future exposure is reduced through compression of gross notional[14].

These results highlight an important feature of risk-sensitive regulatory frameworks. Capital requirements are determined not only by the volatility of the underlying assets, but also by how long MTM exposures remain outstanding before settlement. Improvements in settlement speed and collateral mobility may therefore translate directly into lower exposure at default and reduced capital consumption, even when the underlying market risk of the portfolio remains unchanged. Post-trade infrastructure design can become a determinant of balance-sheet efficiency. Digital settlement infrastructure may therefore contribute not only to operational efficiency but also to improved prudential outcomes for digital assets.

3.3 Collateral and Capital Efficiency

Digital assets and DLT can improve the speed, portability and productivity of collateral across derivatives markets, allowing firms to minimize costs by posting the optimal asset and managing capital and liquidity more efficiently.

Three mechanisms drive these benefits:

1. **Programmatic collateral mobility increases the speed and predictability of collateral movements**. Digital assets and DLT enable collateral to be instructed and settled by code with deterministic finality, 24/7 availability and machine-readable controls for encumbrance, substitution and release. This reduces the need to pre-fund buffers and lowers liquidity trapped in settlement and time zone gaps. Near-instant settlement narrows the distance between required VM and posted collateral. The ability to fractionalize tokenized assets will allow more precise posting and reduces over-collateralization. A unified tokenized collateral pool could support multiple central counterparties (CCPs) and bilateral CSAs through controlled re-use, improving allocation and reducing the need to pre-position assets in multiple venues.

2. **Reduced operational settlement friction lowers exposure windows and capital drag**. Traditional collateral processes rely on fragmented messaging, batch cut-offs and multiple intermediaries, which force excess buffers and increase settlement risk. Digital assets may reduce these frictions through atomic settlement, where delivery and payment occur as a single event, and through synchronized records that give market participants a consistent and auditable view of ownership and control. Automated lifecycle events reduce manual intervention, timing differences and operational breaks. Faster settlement may reduce risk-weighted assets inflation and allows firms to mobilize collateral more precisely and reduce over-collateralization.

3. **On-chain optimization selects and routes the right asset to the right venue at the right time**. Firms today post collateral across bilateral CSAs, CCPs, prime brokers and repo markets

[14] Settlement timing refers to the operational exchange of collateral, while exposure persistence reflects the period over which residual mark-to-market exposure remains economically relevant across the system

under different eligibility rules, haircuts and timing constraints. Without synchronized views or instant substitution, they over-post and maintain buffers to avoid penalties. On-chain optimization can enable cheapest-to-deliver selection using live data, intraday substitution and automated execution of CSA terms and eligibility rules. Encoding these rules directly into workflows may narrow the gap between theoretical optimization and actual delivery, subject to eligibility, concentration limits and disciplined management of volatility and wrong-way risk.

Industry-wide capital efficiency depends on legal certainty around title, control and settlement finality. Industry guidance already maps the main tokenization structures and the legal opinions required, and pilots have demonstrated that encumbrance and seizure can be evidenced on-chain. Harmonized rules on title transfer and control remain essential for systemic adoption.

Interoperability is the next enabler. On-chain collateral flows are most powerful when they can settle against money that is final and continuously available. Wholesale digital payment systems and central bank experiments indicate that synchronized cash and collateral settlement can shorten exposure windows and lower operational buffers.

Valuation, eligibility, haircuts and disclosure must advance together to ensure that tokenized assets are recognized consistently across CSAs and CCPs. Usable capacity can be viewed as the product of four drivers: value establishes the starting point; eligibility determines whether the asset counts at all; haircuts determine how much of that value is recognized; and risk treatment determines the capital cost of holding and deploying the asset. When these four elements progress in tandem, tokenized collateral can shift from a technical possibility to reliable balance-sheet capacity.

Tokenized money market funds (MMFs) illustrate these dynamics. They extend the collateral stack by allowing posted assets to retain yield, which improves funding efficiency and reduces opportunity cost. The benefit depends on authoritative and time-aligned net asset values (NAV) that support intraday settlement. Predictable treatment across venues requires consistent pricing sources, standardized haircut bands and explicit concentration limits. Those features allow optimization engines to treat tokenized MMFs and other tokenized instruments with the same confidence as their traditional equivalents. In parallel, coherent capital valuation adjustment (KVA – the capital cost of committing balance sheet to a transaction over its lifetime) treatment of digital assets is required to reflect the enforceability of rights in collateral, close-out certainty and liquidation behavior under stress, as KVA captures the capital impact of these factors through their effect on exposure profiles and loss realizability. Without clarity on KVA, firms can face capital friction even when operational processes are well designed.

3.4 Market Access and Intermediation

The shift towards continuously transferable, tokenized collateral has the potential to mitigate longstanding structural barriers in derivatives markets and may, over time, broaden participation across regions and institution types.

In this future state, the following benefits are anticipated.

- **Mitigation of time zone and cut-off constraints**. Round-the-clock collateral mobility would reduce reliance on fixed banking windows, allowing margin obligations to be met outside traditional settlement hours. Counterparties in different time zones could, in principle, rely less on large liquidity buffers or operationally driven liquidations during periods of volatility. Instant or near-instant settlement may enable responses to VM calls outside primary settlement windows without full dependency on regional payment rails.

- **Broader geographic distribution of eligible collateral**. Tokenized MMFs and Treasury-backed liquidity funds, if transferred on regulated tokenization frameworks, could eventually support more seamless cross-border use. This might reduce the need for non-US dealers, regional banks and offshore liquidity providers to establish local custody in the US or maintain dedicated US dollar operating accounts. Assets that historically remained geographically tied would, in principle, be able to support cleared and bilateral trading across markets and time zones.

- **Programmable collateral could lower operational thresholds**. Automated reservation, locking and release of collateral could reduce the operational burden that has historically limited smaller participants. Hedge funds, investment advisers and high-frequency market makers can benefit from streamlined back-office processes to meet margin obligations. Automated posting and atomic settlement can reduce failed margin calls and lower operational barriers to participation.

- **Off-exchange collateral models could reduce concentration and funding friction**. Tokenized collateral could support tri-party or distributed custody models where exchanges recognize assets held with regulated custodians. Market makers operating across multiple venues may be able to centralize custody while maintaining trading and margin credit relationships with multiple venues without needing to hold assets locally at each one. Such arrangements may reduce working capital requirements and could encourage broader institutional liquidity over time.

As digital asset collateral becomes technically feasible and incrementally operationalized, the binding constraint shifts to the documentation framework governing whether dealers, clearing members and buy-side firms are permitted to use it at scale. Without uniform documentation, even high-quality tokenized instruments face slow approvals, bilateral negotiations over eligibility terms, inconsistent haircut treatment and uneven pricing across venues. Standardized frameworks covering eligible collateral schedules, CSA definitions and lifecycle events would likely allow a broader set of firms to participate more quickly and on more consistent terms.

3.5 Infrastructure Standardization

As digital asset markets mature, convergence around common token standards and robust pricing frameworks will be essential to ensure that assets can be valued, transferred and managed consistently across platforms and jurisdictions. This section highlights two areas where infrastructure standardization is particularly important: convergence on token standards and central pricing feeds.

Convergence on Token Standards

Convergence on token standards, lifecycle logic and data representation is a precondition for a globally integrated digital assets ecosystem. Current token architectures differ on how the operational transfer of assets and legal rights is performed. This diversity complicates operational control, data reconciliation and prudential risk evaluations.

While the advantage of DLT is its ability to disseminate information, operate and settle continuously and, on permissioned networks with deterministic finality, the same processes using institutional TradFi infrastructure occur in batch-based T+1 or T+2 settlement cycles. When natively digital and TradFi platforms are combined, a latency mismatch introduces structural settlement and operational risks.

For example, legal title, accounting treatment and risk positions may depend on off-chain books and records, while operational control resides in on-chain keys and smart contracts. This can create dual 'sources of truth' and result in inconsistent accounting, legal and control outcomes.

A coordinated standards agenda is therefore required, linking:

- Token standards and metadata;
- Contractual definitions and lifecycle events (such as those in the ISDA Digital Asset Derivatives Definitions);
- Common data models, such as the CDM; and,
- Regulatory frameworks on settlement finality, netting and collateral recognition.

Intermediary layers such as custody connectors, chain abstraction platforms that orchestrate execution across multiple ledgers, compliance and policy enforcement engines and wallet governance systems have emerged to mitigate fragmentation in digital asset markets.

Central Pricing Feeds

Accurate and robust pricing is a critical dependency for both spot and derivatives products referencing digital assets, though the nature of that challenge varies by asset type. For native digital assets, price discovery is fragmented across centralized and decentralized venues and requires active aggregation. For tokenized traditional securities, reference pricing is largely inherited from established benchmarks. The operational challenge is ensuring that on-chain feeds are authoritative, time-aligned and available on an intraday basis. For digital instruments without active secondary markets, including certain digital bonds, the pricing challenge more closely resembles that of illiquid traditional instruments, where mark uncertainty and valuation disputes can extend effective exposure periods. High price volatility, fragmented liquidity, diverse trading venues and the coexistence of centralized and decentralized execution models create the following challenges for constructing a dependable central pricing feed:

- Pricing data is sourced from numerous exchanges, OTC request-for-quote platforms, automated market makers and decentralized exchanges (DEX). Representing the value of a digital asset at a given point in time requires expertise in venue selection, outlier filtering, volume weighting and latency management.
- Fragmentation across data formats and access models, proprietary application programming interfaces and transparency levels increases integration cost and complicates best execution and fair value determinations.
- Structural advantages for early movers and highly connected firms give them an outsized contribution to pricing initiatives. Digital asset trading venues should contribute to a consolidated, fair and broadly accessible pricing framework.
- New digital exchanges, DEX aggregators and oracle providers lack access to consolidated data frameworks. Regulators should examine how to prevent exclusionary practices.
- Data ingestion platforms must be protocol-flexible and interoperable with traditional risk, valuation and post-trade systems, enabling access to critical historical pricing for CCP and bank risk model calibration.

Standardized settlement semantics and asset representations will also be essential. Frameworks such as the CDM can allow deliverable assets and settlement events to be represented consistently across both on-chain and traditional environments, reducing operational fragmentation and enabling hybrid settlement architectures to scale across institutional markets.

Finally, protocol-agnostic technical standards, smart contract templates with embedded settlement logic and integration models built on the CDM would allow DLT-based settlement to interoperate with existing risk, trading and clearing systems.

3.6 Standards, Governance and Interoperability

The CDM is a canonical, machine-readable representation of products, events and processes in financial markets, aligned with industry-standard trading documentation and designed to support interoperability across institutions, systems and regulatory frameworks.

Benefits of the CDM include:

- The product model captures instrument economics;
- The event model defines lifecycle state transitions;
- The process model records execution, calculates and records settlement and processes events;
- The legal agreement model provides standard data for clause outcomes across documents, such as many versions of a credit support document, a CSA or collateral transfer agreement, including eligible collateral terms.

Implemented in a domain-specific language that can be compiled into executable code, the CDM provides a shared operational and legal reference layer for post-trade automation and regulatory consistency. The CDM has already demonstrated its potential by providing a machine-readable, unambiguous golden source of information for TradFi markets, transforming complex derivatives and regulatory reporting and collateral agreement information into executable code. Standardizing representation of transactions, their economic terms, state transitions and different asset types (such as cash, commodities or instruments), reduces fragmentation and increases interoperability. The derivatives market can leverage the CDM as the unified operational standard to bridge legacy infrastructure with on-chain finance, avoiding a fragmented landscape.

Future improvements to the CDM should focus on the representation of digital assets and integrating smart contracts and automation layers that are interoperable with DLT.

Extending the CDM for Digital Asset Representation

While the current CDM includes a 'DigitalAsset' type as a placeholder, the model must evolve to cover the specific technical and legal requirements of on-chain transactions. To achieve this, the CDM should be extended to represent both native digital assets and tokenized versions of traditional instruments, ensuring they inherit the same rigorous standards as existing asset classes.

The CDM enhancement should focus on three strategic aims:

- **For Native Digital Assets:** The model must categorize the specific economic roles of crypto assets while documenting their unique governance structures and minting protocols.
- **For Tokenized Assets:** The CDM should seamlessly link the digital token to its underlying off-chain record. This includes identifying the legal issuer and codifying embedded rights, such as dividends, directly within the machine-readable framework.

- **Common Technical Metadata:** For all digital assets, the CDM must capture the on-chain reality. This includes blockchain protocol metadata, smart contract addresses, backing or peg mechanisms (for stablecoins) and custody arrangements.

By integrating these attributes, the CDM enables a tokenized asset or a native crypto asset to be represented with the same operational rigor as a traditional asset, bridging the gap between legacy infrastructure and DeFi markets.

Tokenized Settlement and Finality

The current CDM already provides a robust foundation for representing, in a unified language, asset movement and delivery, through its elements 'Transfer' and 'SettlementTerms'. The CDM is particularly relevant for digital asset derivatives because it provides a shared operational representation of transactions across different infrastructures. By describing lifecycle events in a technology-neutral format, the model allows market participants to integrate distributed ledger settlement mechanisms while preserving consistency with existing derivatives documentation, risk management processes and regulatory reporting frameworks.

Building on this strength, the CDM can evolve into the definitive operational standard by extending these structures to support native on-chain settlement representation. This can be achieved by introducing an 'On-ChainSettlementTerms' structure and extending the current 'Transfer' logic. These extensions could be ledger and network identifiers, on-chain timestamps and explicit indicators of transaction finality, as well as atomic DvP and PvP semantics and cross-chain routing information. The On-ChainSettlementTerms structure should define on-chain settlement parameters, specify finality conditions (such as confirmation thresholds or notarized checkpoints, or record redemption rights for stablecoins and deposit tokens), and potentially define fallback paths to off-chain settlement where digital rails are unavailable. Extending the CDM in this way would allow settlement events executed on distributed ledger infrastructures to be represented within the same canonical operational framework used for traditional market infrastructure. This would support consistent lifecycle processing across platforms and help align technical settlement outcomes with the contractual definitions embedded in derivatives documentation.

Collateral at the Portfolio Level

When it comes to collateral management, the CDM already provides a strong framework for representing collateral agreements and margining processes, including the digitization of CSA terms into machine-readable logic. The model includes structures for collateral portfolios and margin call events, providing a standardized representation of how collateral requirements are calculated and communicated between counterparties.

Elements of legal agreements can be linked to operational processes through data structures such as 'CollateralPortfolio' and functions including 'PostedCreditSupportItemAmount', enabling aggregation of collateral balances and risk adjusted valuations across multiple asset types. The model also includes structures for representing margin call events, providing a standardized way to capture how collateral requirements are calculated and communicated between counterparties.

Building on these capabilities, the CDM could further support portfolio-level orchestration of collateral lifecycle processes. In practice, collateral is typically managed across bilateral portfolios spanning multiple trades, where margin calls, substitutions and collateral movements occur as part of a continuous workflow.

Extensions to the CDM could therefore enhance the representation of these portfolio level processes by building on existing collateral and margin call structures. For example, a portfolio-level event structure such as 'CollateralPortfolioStep' could represent the sequence of operational actions affecting a collateral portfolio, including margin calls, substitutions and settlement events, while providing a clear audit trail between proposed, executed and accepted states.

Such enhancements would build on the existing collateral and margin call capabilities already present in the CDM and may support more consistent orchestration of collateral workflows across institutions while remaining aligned with established derivatives documentation and operational practices.

Executable Lifecycle Logic

The automation of margin calls and collateral balance processes illustrates how CDM lifecycle logic can support greater transparency in operational workflows. Rather than representing collateral processes as a single function, the CDM allows these processes to be expressed through a sequence of standardized lifecycle events, including valuation, exposure integration and margin call determination based on contractual terms such as thresholds and minimum transfer amounts.

In implementations that leverage distributed ledger infrastructures, these lifecycle representations may be executed through programmable logic that reflects the contractual terms captured in the CDM. In this context, smart contract functions can act as operational triggers for events such as margin call generation, collateral updates or settlement instructions, while the CDM continues to provide the canonical representation of the contractual and operational state.

This approach allows distributed ledger implementations to execute operational processes while maintaining a consistent contractual representation across institutions through the CDM.

3.7 Industry Path Forward

The previous sections demonstrate that digital settlement infrastructure can materially alter the mechanics of derivatives markets by changing how quickly exposures between counterparties are terminated and how efficiently collateral can be mobilized across trading relationships.

Digital settlement infrastructure introduces the possibility of continuous margining, programmable collateral flows and faster settlement cycles, which can shorten the period during which MTM exposures are outstanding and reduce liquidity buffers required to manage settlement timing differences. As prudential capital frameworks are sensitive to exposure persistence, improvements in the settlement architecture can translate directly into lower exposure at default and reduced balance-sheet consumption.

Realizing these benefits at institutional scale, however, requires that technical execution, legal enforceability and prudential recognition evolve together.

Intermediary layers and orchestration technologies can help reduce integration friction between distributed ledgers and existing financial market infrastructure. Yet these solutions cannot substitute for the standardization of token behavior, lifecycle definitions and settlement semantics across platforms. Without common standards, digital settlement environments risk reproducing the fragmentation that already exists across traditional post-trade systems. Settlement architecture therefore becomes a central determinant of institutional viability. Operational settlement on distributed ledgers must align with contractual and legal definitions of settlement finality so that on-chain transfers discharge obligations within derivatives contracts.

Industry standards provide a pathway for achieving this alignment. Frameworks such as the CDM may allow transactions, collateral movements and lifecycle events to be represented consistently across both traditional and distributed infrastructures. By extending these standards to digital asset environments, the industry can integrate new forms of settlement and collateral into existing derivatives markets without creating parallel or fragmented market structures.

Where settlement architecture, collateral frameworks and prudential recognition evolve together, digital asset infrastructure can potentially reduce exposure persistence, improve collateral efficiency and expand market participation, while preserving stability and resilience in the derivatives ecosystem.

4. COLLATERAL MATTERS

Collateral frameworks determine whether digital asset derivatives can operate safely under stress. An asset's technological form is secondary to its ability to satisfy the core requirements of institutional collateral: predictable liquidity, enforceable legal rights and reliable settlement finality within the MPOR.

The eligibility of digital assets to be used as collateral is ultimately a stressed liquidation question: can the asset be liquidated with predictable timing and legal certainty within MPOR? Some digital assets trade 24/5 or 24/7 and can appear liquid in benign conditions, but institutional eligibility is determined by performance under stress; specifically, whether liquidation can be completed at scale, with enforceable rights and reliable settlement finality in recognized forms of money. Tokenization can reduce operational friction in moving, substituting and reconciling collateral, but it does not by itself create stressed-time liquidity, legal certainty or dependable cash conversion.

To support institutional-scale derivatives activity, treatment of tokenized collateral (eligibility criteria, haircut methodologies, control and perfection requirements, liquidation mechanics) must be harmonized, and frameworks must account for risks specific to on-chain environments, including chain disruption and dependency on oracles which connect on-chain actions to external data. Digital assets entering institutional collateral frameworks must achieve prudential, legal and operational equivalence with their TradFi counterparts and satisfy the same core requirements. They must be highly liquid, convertible, operationally reliable and hold their value in times of market stress. These requirements pose challenges for digital assets where conflicts arise between existing market structures and DLT.

- Liquidity and cyclicality. Collateral must retain mobilization capacity in both normal and stressed markets. Digital assets show higher procyclicality, weekend liquidity gaps and exchange-driven volatility, requiring more dynamic haircuts and expanded stress horizons.

- Convertibility. Traditional assets convert through predictable settlement rails. Digital assets depend on exchange uptime, node reliability and chain congestion, which may cause timing mismatches with regulated settlement windows.

- Operability. Collateral must be pledgeable and movable, with these actions carrying legal enforceability. Digital assets introduce key-management risk, multi-party computation approval time, gas-based execution delays and block-finality considerations.

As a result, current adoption is concentrated around permissioned and centrally governed infrastructure and asset types that mirrors today's market plumbing.

This section examines the use of digital asset collateral in arrangements for bilateral initial margin (IM) and VM, CCPs, and title transfer/security interest agreements, the mechanics of liquidation and settlement, valuation and margining. Among these frameworks, the paper assesses key categories of digital assets according to their potential as collateral.

4.1 Adoption Across Collateral Arrangements

The adoption of digital assets as collateral will not occur uniformly across all collateral frameworks. This section addresses the distinct advantages and constraints of key frameworks to anticipate where tokenized collateral may gain industry-wide traction first: under title transfer arrangements (instead of security interest), in bilateral arrangements for VM (in contrast to IM), and in arms-length, pilot projects for CCPs (rather than widespread adoption).

Title Transfer vs. Security Interest

Using digital asset collateral in common legal collateral arrangements such as title transfer[15] and security interest[16] is complicated by its recognition as a form of 'property', legal processes protecting security interests, and its enforceability in the event of insolvency.

- **Property status**. Under title transfer arrangements, the collateral provider transfers full ownership of an asset to the receiving party, and under a security interest, the provider grants the receiving party a legally enforceable interest in an asset against other parties. The asset must be legally recognized as capable of being owned, giving the receiving party the ability to enforce its property rights against its counterparty or third parties.

  Without consensus that a given digital asset is 'property' and how existing property law applies, an on-chain transfer of title may be ineffective, a security interest may be void, and the receiving party's 'rights' to the asset may lack the expected value (or not exist). Under English law, recent reform has increased certainty in this respect. The Property (Digital Assets etc.) Act 2025 provides that digital assets are capable of being the object of personal property rights[17]. Similarly, a growing number of US states have enacted UCC Article 12, which treats certain digital assets (defined as 'controllable electronic records') as personal property that is enforceable against third parties[18].

- **Perfection**. Perfection is a legal process whereby a party takes steps to validate and protect its security interest against third parties. Even if digital assets are property, most security interest laws were written for accounts and certificates (and not DLT), and traditional perfection mechanics such as taking possession or filing a public notice have not been updated in many jurisdictions to account for on-chain assets. In US UCC Article 12, a security interest over a digital asset can be perfected either by filing a financing statement or by obtaining 'control' (generally, exclusive ability to transfer the asset); where a security interest perfected by control has priority over a conflicting interest perfected by filing. Some jurisdictions may lack a clear concept of 'control' or 'perfection' in relation to digital assets; some courts might find a security interest perfected when a token is held in a segregated wallet under the pledgor's key, but others may demand filing of a public notice. As a result, it may be unclear how a security interest over digital assets can be perfected at law, and therefore whether a security interest validly perfected in one jurisdiction will legally bind third parties in another jurisdiction. This is discussed in further detail below.

- **Liquidation and enforcement**. Even when the transfer of property rights is legally sound, legal opinion frameworks do not yet address the enforceability of DLT-based collateral arrangements (eg, for on-chain title transfers), meaning firms lack legal certainty that their close-out netting rights and the validity and enforceability of their collateral arrangements will be upheld in the event of a counterparty's insolvency. Liquidating digital assets collateral likely presents novel issues. Traditional sale or auction procedures assume physical or book-entry assets; where a pledge structure is used rather than title transfer, enforcement may require instructing a custodial wallet transfer, triggering smart contract close-out logic, or activating protocol-level

[15] Title transfer arrangements involve the full transfer of relevant assets to the receiver of collateral

[16] Security interest arrangements are a form of security arrangement where the collateral taker receives a security interest in the assets, but the collateral provider retains an ownership interest in the collateral

[17] Despite not falling under traditional categories of 'things in possession' (tangible) or 'things in action' (rights enforceable through legal action); Property (Digital Assets etc) Act 2025, December 2, 2025; www.legislation.gov.uk/ukpga/2025/29.

[18] 2022 Amendments to Uniform Commercial Code, Article 12, UCC, www.uniformlaws.org/committees/community-home?communitykey=1457c422-ddb7-40b0-8c76-39a1991651ac

encumbrance[19] mechanisms, often under time pressure and extreme price volatility. Many blockchains are global and operate around the clock, complicating court intervention. These complexities mean write-down or liquidation procedures are untested in most insolvencies.

Many major common law jurisdictions now treat certain digital assets as property[20], making title transfer models more attractive as a result of direct ownership rights. Practical considerations remain regarding the legal characterization and transfer of proprietary rights in distributed ledger environments, including the mechanisms through which title to digital assets is transferred, how security interests are created, perfected and prioritized, and how these rights interact with established close-out netting and insolvency frameworks. Clarifying these elements within existing legal structures is important to ensure that digital asset collateral arrangements benefit from the same legal certainty and enforceability that underpin traditional derivatives markets. The UCC's technology-neutral approach to updating existing frameworks could therefore be replicated in other jurisdictions to reduce cross-border uncertainty and fragmentation in collateral outcomes. In parallel, industry legal opinions should be refreshed to explicitly address on-chain transfer mechanics, custody/wallet structures, the meaning and standards for 'control' or 'possession', and the creation, perfection and priority of security interests in digital assets.

Conflicts of Law in Private International Law

Even where DLT-based systems are capable of giving rise to property rights in certain jurisdictions, uncertainty exists with respect to what governing law applies and what court or adjudicatory body has the authority to decide a particular legal claim, in relation to disputes arising between parties in respect of digital assets. The decentralized, borderless and anonymous nature of some DLT-based systems and digital assets presents novel challenges to well-established principles of private international law that apply to traditional forms of property[21].

This area of law has gained significant attention in recent years[22]. However, uncertainty and fragmentation in approaches by authorities persists, making proceedings and outcomes of disputes less predictable. In DLT-based financial market infrastructure, interim solutions to this uncertainty are focused on agreeing bilateral contracts or using private, permissioned ledgers and platforms that explicitly designate governing law and jurisdiction, and placing digital asset collateral with regulated custodians in jurisdictions with clearer conflict-of-law frameworks.

These solutions may not solve future challenges, such as the exchange of digital assets on public, permissionless, blockchains (eg, 'mature blockchains' under the Clarity Act), or forum shopping and regulatory arbitrage by participants seeking to exploit this uncertainty.

[19] Protocol-level encumbrance mechanisms are only possible on permissioned networks. For example, a swap dealer seeking to liquidate a counterparty's posted Bitcoin (BTC) collateral could not enforce an on-chain transfer of the counterparty's BTC if it has only been contractually pledged to the swap dealer, without a smart contract to act on the swap dealer's behalf, or an arrangement with a custodial wallet provider to transfer the BTC in such circumstances

[20] Eg, England and Wales (Property (Digital Assets etc.) Act 2025), New Zealand (Ruscoe v Cryptopia), Singapore (ByBit v Ho Kai Xin), Hong Kong (Re Gatecoin), etc

[21] Ie, where the location of assets and/or parties can be ascertained. Typically, for tangible property, private international law relies on the asset's location to determine the applicable law and jurisdiction, and for intangible assets, such as securities, jurisdiction can follow the location of the relevant register, or in respect of debts, the debtor's place of residence; in each case, barring any dedicated financial regimes, such as the Hague Convention on the law applicable to certain rights in respect of securities held with an intermediary

[22] Eg, the Law Commission of England & Wales consultation series on digital assets and electronic trade documents in private international law (lawcom.gov.uk/project/digital-assets-and-electronic-trade-documents-in-private-international-law/), publications from the Financial Markets Law Committee on 'Digital Assets – Governing Law and Jurisdiction' (fmlc.org/publications/paper-digital-assets-governing-law-and-jurisdiction/), ISDA's series on the 'Private International Law Aspects of Derivatives Contracts Involving DLT' (www.isda.org/2020/10/21/private-international-law-aspects-of-derivatives-contracts-involving-dlt/), etc

It is crucial that an international conflict-of-law framework for DLT-based financial transactions and systems is developed and agreed upon by the authorities to exert jurisdiction over these disputes. This framework should prioritize party autonomy by recognizing mutually agreed elections and/or the accession of parties to overriding platform rules. Parties should seek to ensure that their elections in a contract are mirrored on the platform used for transactions, in arrangements in respect of the off-chain asset (eg, custody, record-keeping), and in downstream or secondary market activities. Dedicated financial regimes that designate governing law and jurisdiction should be extended to their equivalent forms in DLT-based environments[23]. Most importantly, jurisdictions should adopt harmonized approaches to these frameworks, enabling mutual recognition across borders and allowing parties to predict and, where possible, select the governing law and jurisdiction applicable to their disputes.

Bilateral CSAs for VM and IM

Although VM and IM share broadly the same eligible collateral types under the non-cleared margin rules, their operational and legal requirements differ significantly. This can be largely explained by the function of each: while VM is intended to be used for daily settlement of profit and loss, the purpose of IM is to serve as security for future exposures. As a result, IM must be segregated with an independent custodian, be bankruptcy-remote and meet stricter standards for control and perfection. These safeguards are more complex to implement for tokenized assets, where on-chain custody, enforceability and segregation models remain under development. Accordingly, the practical use of digital assets for non-cleared IM is likely to remain slower to scale than their use in non-cleared VM.

Regulatory capital recognition for VM follows the BCBS's standardized approach for counterparty credit risk conditions. Under the leverage ratio framework, non-cash VM is generally not recognized for mitigation of a party's exposure, resulting in a reduced capital charge, whereas cash VM may be used as a credit risk mitigant if strict conditions are met. Only BCBS Group 1(a) assets on the CRE22 eligible financial collateral list (eg, tokenized government bonds) may be recognized in VM collateral frameworks for credit risk mitigation purposes. These strict capital requirements reflect the volatility of certain categories of digital assets, which can lead to valuation mismatches between the value of the derivatives and the collateral posted, thereby triggering disputes and extending the MPOR.

VM requirements under the non-cleared margin rules are principles-based, requiring daily collateral exchange but without imposing a rigid eligibility list[24]. This flexibility allows counterparties to agree to exchange tokenized traditional assets such as government bonds or MMF shares, provided legal enforceability and operational standards are met.

Several factors position bilateral VM as the most practical starting point for tokenized collateral adoption:

- **Contractual pathway (ISDA):** ISDA's Tokenized Collateral Model Provisions (2023)[25] insert standardized language into the ISDA 2016 VM CSA to expressly accommodate DLT-recorded cash and securities, allowing parties to treat on-chain collateral movements as equivalent to

[23] Eg, EU Settlement Finality Directive and Financial Collateral Directive, which provides that the rights of an ultimate investor in relation to intermediated securities will be governed by the law of the place of their immediate intermediary; referred to as 'place of the relevant intermediary account' or 'PRIMA'

[24] Non-cleared margin rules indicate that national supervisors should develop their own list of eligible collateral; eg, as implemented in the US, where two US-based covered swap entities face each other, they are limited to cash only for variation margin

[25] Tokenized Collateral Model Provisions for Inclusion in ISDA 2016 Credit Support Annexes for Variation Margin (VM), www.isda.org/book/tokenized-collateral-model-provisions-for-vm-csa/

traditional title transfer/credit support mechanics and enabling permissioned-ledger pilots to operate in controlled, bilateral environments without creating systemic exposure or requiring market-wide rulebook changes.

- **Operational lift (VM vs. IM):** VM does not require independent segregation (unlike non-cleared IM), so on-chain posting, recall and substitution can be piloted with less operational overhead.

- **Regulatory flexibility:** Because VM eligibility is principles-based and bilaterally negotiated, parties can agree to use tokenized forms of already eligible assets without waiting for new supervisory approvals, speeding permissioned ledger pilots.

VM collateral is commonly transferred under a title transfer model, granting the receiver ownership and the right to re-use the asset. In the tokenized context, this structure allows early adoption to occur safely within controlled, permissioned environments. Parties can test tokenized risk-weighted assets (RWAs) without needing fully developed secondary market liquidity or system-wide infrastructure.

Central Counterparties

In contrast to the use of tokenized assets in non-cleared CSA arrangements, in cleared markets tokenized collateral discussions relate primarily to IM rather than VM. At major CCPs, VM is overwhelmingly cash settled – the CCP must make VM payments to parties with positive MTM in a form that is universally liquid and not subject to bilateral haircut negotiation. Non-cash VM requires the CCP to impose haircuts acceptable to all receiving parties under stress conditions, which poses a structural constraint that makes cash the only viable medium at scale. IM eligibility determines what non-cash assets can be held and liquidated to support default management. Accordingly, the pace of CCP adoption of tokenized assets as eligible collateral is a function of prudential frameworks and systemic resilience concerns, despite increasing institutional interest in tokenization. The use of tokenized assets in cleared markets ultimately depends on enforceability across jurisdictions, resilient liquidity and liquidation within the MPOR and the extent to which new asset forms can interoperate seamlessly with existing FMI. Cautious approaches to eligibility, conservative risk treatment and deferred adoption are appropriate where these conditions are not consistently met.

In this context, the gradual integration of tokenized assets into clearing frameworks can be seen as a function of CCPs' ability to rely on this form of collateral operationally, and also the extent to which regulatory frameworks governing what collateral CCPs can accept allow this. If CCPs accept tokenized RWAs, it will signal regulatory confidence and accelerate industry-wide adoption. However, CCP adoption faces systemic risk constraints, regulatory barriers and operational complexity. CCPs require robust default management playbooks and interoperability with CSDs, and changes to CCP rulebooks require regulatory approval and member consensus.

In December 2025, the CFTC specified (among other conditions) that tokenized collateral must be "liquid, with established haircuts and hold [its] value in times of financial stress", emphasizing that a derivatives clearing organization "must limit the assets it accepts as initial margin to those that have minimal credit, market, and liquidity risks[26]". In other words, it should be a high-quality liquid asset. Collateral posted to CCPs is more reliant on secondary market liquidity than in bilateral VM arrangements. In a default scenario, CCPs must liquidate collateral rapidly within

[26] Acting Chairman Pham Announces Launch of Digital Assets Pilot Program for Tokenized Collateral in Derivatives Markets, CFTC, December 8, 2025, www.cftc.gov/PressRoom/PressReleases/9146-25; Tokenized Collateral Guidance, CFTC, December 8, 2025, www.cftc.gov/csl/25-39/download

the MPOR. Without deep and reliable liquidity for tokenized assets, systemic risk would increase. This requirement makes CCP adoption contingent on proven market depth and interoperability with existing settlement systems.

CCP acceptance of tokenized RWAs as collateral will depend on the success of pilot projects and the ability to scale these. Current initiatives have primarily focused on the mobilization of IM collateral. One CCP has explored operationalizing DLT to support collateral mobilization, while the underlying assets continue to move through traditional custody and CSD infrastructure. In this structure, the distributed ledger functions as an operational layer that enables real-time collateral mobilization while preserving the legal and custody arrangements of existing market infrastructure.

VM will remain the key constraint on achieving 'always on' clearing and settlement. Tokenization of non cash collateral can improve the mobility of IM, but it does not address the core limitation that VM calls must be met in cash through payment rails that still operate with time zone and operating hour constraints. As a result, the full benefits of tokenization in cleared markets, particularly intraday liquidity efficiency, extended trading hours and reduced reliance on liquidity buffers, are unlikely to be realized until CCPs can accept and settle VM in digital forms of money that preserve cash like finality. These include tokenized commercial bank deposits, wholesale central bank digital currencies (CBDCs) or appropriately regulated payment stablecoins.

4.2 The Cash-leg Conundrum

Tokenized collateral can improve the speed and certainty with which non-cash assets are mobilized, substituted and returned. In both cleared and bilateral markets, however, a binding constraint is frequently the cash leg: margin flows and liquidation proceeds must convert into usable settlement funds with legal finality and predictable completion under stress. Where settlement depends on banking cut-off times, cross-border correspondent processes or redemption mechanisms with discretion or operational frictions, improvements in collateral mobility can simply move the bottleneck from the collateral leg to the settlement leg.

Across cleared and bilateral markets, the timing assumptions embedded in margin models and default playbooks require that liquidation and settlement complete within defined time horizons. In cleared markets in particular, VM is cash-settled, which makes the cash leg central to both routine margin operations and stressed default outcomes.

VM is a cashflow process. The requirement is not simply the absence of cut-offs in today's rails, but the ability to deliver cash-equivalent value with legal finality and operational resilience at the frequency required by margining. Existing payment systems provide final, irrevocable settlement, even though their operating hours create timing frictions and until digital forms of money can preserve bank money finality while extending availability beyond traditional windows, the full benefits of tokenization for cleared markets will remain capped. For IM, the central question is whether collateral can be liquidated and proceeds converted into usable settlement funds within the default management timeline and the MPOR assumptions used in IM calibration. Default management ultimately depends on the cash leg completing reliably after liquidation. If this cannot be assured, IM eligibility and adoption remain constrained regardless of improvements in collateral mobility.

A reliable cash leg is necessary but not sufficient. Tokenization does not automatically create liquidation capacity, as many tokenized instruments still lack deep, diversified secondary markets and tested execution channels at scale. Where liquidity is fragmented across platforms or constrained by limited market-making capacity, liquidation will often depend on narrow venue

access or primary market redemption. In such conditions, the cash leg becomes more fragile because the conversion of collateral into cash depends on market conditions and operational processes that may not hold under stress, reinforcing conservative eligibility outcomes in cleared contexts. As a result, liquidity solutions are critical to the adoption of tokenized collateral.

4.3 Liquidation Pathways and Default Management

The primary purpose of collateral is to be liquidated upon the default of a counterparty. Close-out must complete within the MPOR used in IM models and default playbooks. Many clearing houses design their default management processes to hedge or transfer risk within a relatively short time horizon following a member default. This objective is typically achievable only where collateral can be converted into cash in a predictable manner and at sufficient scale within the relevant time window.

Three preconditions underpin MPOR-compatible liquidation:

- Clear and enforceable title to the collateral;
- Settlement finality that stands up legally; and
- Confidence that collateral can be liquidated with costs that can be absorbed within the applicable haircut assumptions.

These considerations help to explain why many CCPs conduct regular default management testing exercises and apply conservative haircuts even to high-quality assets where stress-time liquidity may be uncertain. Similar considerations also apply in bilateral derivatives markets. Under the non-cleared margin framework, IM must be enforceable and segregated, and its eligibility ultimately depends on whether it can be liquidated in the time available for close-out.

Limits of Digital Asset Liquidation Infrastructure

Digital asset markets provide three primary routes to transforming collateral into cash. Each works within its niche ecosystem, but none yet offers the time-certain and legally robust monetization needed for CCPs or non-cleared margin regimes at default.

- **On-chain (DeFi) liquidations**. Oracle-driven auctions are transparent and fast in small clips. Under shock conditions, depth collapses, price impact rises and maximal extractable value (MEV) costs increase. This behavior is not deterministic within MPOR constraints.
- **Centralized exchange (CEX) liquidations**. CEXs unwind exposures quickly when markets are calm. Under stress, opacity in risk logic and fragile order books become binding constraints. As demonstrated by the crypto flash crash on October 10, 2025, in the 24 hours spanning the flash crash, crypto-asset markets saw approximately $19 billion in forced liquidations and approximately 1.6 million accounts closed, as order-book depth evaporated and cascaded through major venues. Intraday data show BTC's top-of-book depth shrinking by more than 90%, amplifying price impact as market makers stepped back. Binance said core systems stayed operational and that it later compensated users by approximately $283 million for losses tied to collateral de-pegs[27], while post-mortems debated whether venue collateral and pricing mechanics worsened deleveraging. The claims remain disputed, but the risk signal is not disputed – CEX stacks do not provide MPOR-grade liquidation suitable for CCP auctions or bilateral IM enforcement.

[27] Binance compensates 283 million USD after Depeg incident, Binance, October 12, 2025, www.binance.com/en/square/post/30940401044538

- OTC market makers and stablecoin redemption. Dealer balance sheets may become less readily available during periods of systemic stress. In addition, issuer redemption processes and operational cut-off times can introduce timing frictions that may limit the reliability of immediate cash conversion in a default scenario. These channels work for platform crypto-asset trading but do not meet the guaranteed, time-certain, legally robust execution required for CCPs or bilateral IM enforcement. Traditional mechanisms (such as CCP auctions, repo to cash, MMF primary issuance, CSD order books) remain solid foundations. For digital asset liquidation infrastructure to mature, evolution requires:

    - Custody structures that recognize tokenized assets as enforceable property;
    - Cross-ledger DvP/PvP settlement with clear legal finality; and
    - Interoperability across FMIs, custodians and execution venues.

4.4 Valuation and Margining

Valuation is a core component of collateral management for derivatives and its importance is heightened for digital assets. It encompasses both the valuation of the underlying exposure and assets posted as collateral. When digital assets are used as collateral, robust valuation frameworks and reliable market data are essential. Standardization efforts around digital asset valuation (including pricing frameworks, data standards and collateral methodologies) are progressing rapidly, but remain incomplete and not fully harmonized across markets and products. Market participants rely on established valuation methodologies (primarily MTM, mark-to-model and hybrid approaches) to determine the value of digital assets used as derivatives collateral.

Calibration of margin models is a process of continual adjustment as volatility, liquidity and infrastructure constraints reshape risk. This is particularly true for IM, which is designed to cover potential future exposure over the MPOR in the event of a counterparty default. Since margin is typically calculated frequently (often daily) by both sides, achieving consistent results is critical for efficient financial markets.

The need for consistency has led to the adoption of common methodologies such as the ISDA Standard Initial Margin Model (ISDA SIMM)[28] or standardized schedule/grid-based approaches for non-cleared derivatives, while CCPs rely on proprietary margin models, which are not always fully transparent in their calibration. The treatment of digital assets within these frameworks is still evolving and remains far from harmonized.

Given the highly heterogeneous nature of these products, there is a growing need for greater granularity in IM calculations, yet current rules and model taxonomies have only partially accommodated this diversity. The ISDA SIMM organizes exposures into several risk classes (including interest rates, credit, equity, FX and commodities). The assignment of digitally native crypto assets and other digital assets to ISDA SIMM risk classes is not applied consistently across institutions, reflecting the absence of official guidance on this mapping rather than ambiguity in the underlying regulatory capital classification of these assets. This leads to divergences in IM calculations between market participants, which can lead to disputes, over-or under-collateralization, and, in cases of persistent disagreement, damage to trading relationships.

This challenge is compounded by the fact that a substantial portion of digital asset derivatives transactions still occurs on venues outside the scope of the non-cleared margin rules, where exchange-style and proprietary IM models dominate. Differences in model choice, asset classification and stress calibration can lead to significant divergence in IM requirements across

[28] ISDA Standard Initial Margin Model, www.isda.org/isda-solutions-infohub/isda-simm/

venues and counterparties, increasing the risk of disputes and procyclical margin behavior during periods of market stress. Risk weights are generally calibrated from historical data. For many digital asset instruments, data histories are short and regulatory and industry standards on correlation and netting between traditional instruments and their tokenized forms are still emerging, making capital and margin calibration uncertain.

At the same time, risk weights and margin models need to reflect risks that are specific to digital markets such as chain congestion, finality delays, liquidity droughts and peg breaks. Against this backdrop, both CCP IM approaches (standard portfolio analysis of risk, value-at-risk, exponentially weighted moving average-based and expected shortfall models) and bilateral ISDA SIMM or grid frameworks face the challenge of incorporating stress scenarios that capture extreme market and infrastructure events, necessitating the integration of calibration features such as longer look-back periods, intraday volatility windows, event risk overlays for protocol upgrades or forks, as well as explicit concentration limits, correlation caps and wrong-way risk controls with issuers and custodians.

Faster, more automated margining can shorten exposure windows and reduce counterparty risk, but risks accelerating procyclical feedback loops, where rising margin calls during stress force simultaneous liquidations that amplify price moves, unless paired with explicit anti-procyclicality controls such as volatility floors and extended lookback periods.

In a paper published in February 2026, the Federal Reserve advocates for the creation of a new risk class to capture the specific characteristics of cryptocurrencies[29]. Building on this, there is indeed a need for greater granularity and clarity in standardized IM rules for digital assets to better reflect their diverse nature. Even where regulatory convergence on a dedicated crypto-asset risk class is achieved, the infrastructure build required across margin engines, sensitivity frameworks and bilateral documentation means near-term adoption will be uneven, and not all firms will be in a position to commit to implementation within a short timeframe.

4.5 Eligible Collateral by Asset Type

Institutional adoption is unlikely to converge on a single dominant collateral asset. Eligibility and uptake will instead likely be shaped by how each asset type performs against established institutional thresholds, prudential treatment, liquidity under stress, enforceable rights and interoperability with existing FMI.

Tokenized versions of assets that are already well established within collateral frameworks such as tokenized government bonds and tokenized MMFs offer the most credible near-term route to scalable digital collateral in derivatives. Stablecoins are also a potential candidate, as fully reserve-backed stablecoins behave closer to cash-equivalent collateral; reducing haircut volatility, strengthening redemption assurances and allowing intraday and continuous collateral flows, thereby bypassing the T+1 constraints of fiat rails. However, the eligibility of stablecoins remains conditional on participants demonstrating sufficient reserve quality and redemption mechanics, and meeting BCBS SCO60 Group 1b requirements. As a result of the BCBS standards and their price volatility, unbacked platform crypto assets are seen as unattractive options as collateral.

This section evaluates key types of digital assets, according to their potential usage as collateral, against the same standards that govern traditional collateral.

[29] Initial Margin for Crypto Currencies Risks in Uncleared Markets, Federal Reserve Board, February 11, 2026, https://www.federalreserve.gov/econres/feds/files/2026009pap.pdf

Table 1: Adoption of Collateral Asset Types

Asset Type	Bilateral Credit Support Annexes (CSAs)			Central Counterparties (CCPs)		
	Fit	Challenge	Likelihood	Fit	Challenge	Likelihood
Tokenized Government Bond	Very strong; High-quality liquid assets economics preserved, improves mobility and delivery-versus-payment	CSA and custody updates for distributed ledger technology title/control; opinions for perfection and cross border enforceability; ledger interoperability and cut off alignment	High	Strong; sovereign debt is the benchmark asset for central counterparty collateral	Margin period of risk (MPOR) grade liquidation depth; central securities depository/ financial market infrastructure connectivity; rulebook amendments naming token wrappers/ networks.	Medium
Tokenized Money Market Fund (MMF)	Very strong; Group 1a when legally/ economically equivalent; near instant mobility	Net-asset value (NAV) record authority; fund governance on chain	High	Medium; needs rulebook updates (token standards/ networks) + NAV/fund governance safeguards	Eligibility definitions; default liquidation	Medium
Tokenized Gold (Commodity)	Moderate (niche). Improves mobility where gold already in CSA	Volatility; large/ procyclical haircuts; issuer/custody processes; venue concentration for redemption	Medium	Very low; commodity volatility misaligned with CCP initial margin	MPOR auctionability to cash; concentration caps and stress liquidity vs high-quality liquid assets standard	Low
Tokenized Bank Deposit	Very strong; On balance sheet bank liabilities; ideal for real time variation margin	Interoperability; liquidity fragmentation	High	Low; CCPs avoid single issuer bank exposure at margin	Cash leg finality in MPOR (often requires redemption to real-time gross settlement)	Low
Wholesale CBDC	Excellent long-term; ideal for settlement rails	Availability; policy design; integration	Low	Attractive for rails; not posted collateral yet	CCP integration; legal finality	Low
Stablecoin	Operationally strong but prudentially weak (capital relief limited): useful for immediacy in niche bilateral flows	Redemption certainty (reserves, governance), network constraints (whitelists/ jurisdictions), non interest economics vs MMFs/deposits	Medium	Very low; redemption/ issuer risk and current supervisory stance make CCP use unlikely	Need guaranteed par redemption and bank money finality in MPOR – not yet demonstrated	Low
Unbacked Platform Crypto Asset	Low; volatility and Basel Committee Group-2 capital burden	Extreme volatility and weekend gaps; maximal extractable value/forks/ oracles; fragmented liquidity and fair value disputes	Low	Very low; volatility, no backstop, stress depth collapse; Group 2b capital	Default risk	Very low

This analysis distinguishes between operational suitability and prudential recognition, as assets that are technically capable of supporting collateral transfers may not qualify as eligible financial collateral under current regulatory frameworks.

Tokenized Financial Assets and Real World Assets

Tokenization can be applied to financial instruments such as government bonds or MMF shares, as well as to non-financial real-world assets such as commodities. By representing these assets on distributed ledger infrastructure while maintaining the underlying legal claims, tokenization can reduce operational frictions in transfer and settlement while leveraging asset types that already benefit from established regulatory frameworks. This approach may help reduce legal uncertainty and support alignment with existing prudential treatment, although it also introduces operational considerations including technology integration, custody arrangements and implementation costs.

- Capital Treatment. Tokenized traditional assets that meet BCBS Group-1a criteria are treated like their non-tokenized TradFi equivalent, with supervisors reserving the option of an infrastructure add-on where DLT operational risks warrant it. The BCBS standard is explicitly cautious on the interaction between permissionless rails and Group-1 eligibility, so near-term CCP acceptance will cluster around permissioned, CSD-connected networks with clear legal finality and segregation rules. In practice, that means bilateral and tri-party channels will likely adopt tokenized RWAs first (as eligibility schedules and haircuts can be tailored) focusing on bonds and MMFs, while CCP rulebooks may, in due course, be updated to name-specific token wrappers and networks. Tokenized RWA commodities such as gold are unlikely to be recognized or adopted as capital-efficient collateral, mirroring its TradFi equivalent. However, the operational savings, ease of movement and fractionalization offered by tokenization may open up future opportunities for RWAs that were traditionally unsuitable as collateral.

- Technology and Custody. Each token typically sits on a specific blockchain or permissioned ledger. When an institution pledges or receives a tokenized asset as collateral, it must trust the security of cryptographic key custody. While institutional custodians now offer more robust key management (ie, hardware wallets, multi-signature, etc), any loss or breach of keys can lead to theft of the asset. Unlike with banks or depositories, where legal regimes specify custodian obligations, custodian liability for digital assets remains unsettled across the spectrum: more developed for tokenized securities where existing securities custody frameworks offer partial coverage, but considerably less certain for native digital assets where contractual terms rather than statutory obligations define custodian duties. It remains unclear, for instance, whether a digital asset custodian owes fiduciary duties equivalent to a bank holding securities, or how insurance covers token loss. These uncertainties make some firms wary of accepting tokenized RWAs without stringent due diligence on the custodian.

- Integration Costs. Firms have invested heavily in legacy trading, clearing and collateral management systems built on traditional asset conventions. To use tokenized collateral, they must update legal agreements to recognize tokens, connect to DLT-based platforms, train staff on new workflows and adjust risk and accounting systems to handle 24/7 settlement. These costs can deter adoption for many firms. As a result, many institutions may limit on-chain collateral use to pilots or opt for hybrid models where a custodian holds the underlying asset and issues or administers the corresponding token. On-chain transfers and pledge instructions are mirrored as book-entry movements on the custodian's ledger. This model, which underpins most institutional tokenized collateral pilots to date, preserves familiar custody relationships and legal title mechanics while adding DLT-based instruction and settlement efficiency.

Tokenized Government Bonds

Where sovereign bonds already dominate collateral schedules, tokenization changes the delivery method and not the asset mix. Evidence from the Bank for International Settlements (BIS) shows that tokenized government bonds can have tighter bid-ask spreads than conventional bonds

without higher issuance costs[30]. This indicates that market structures can support their use as collateral as token supply grows. Because these instruments carry the same duration and liquidity as the underlying US Treasuries, gilts or Bunds, the main limitation to their usage is the volume of tokens in circulation and the connectivity of the ecosystem, rather than asset quality.

The key challenges are legal (eg, control perfection, bankruptcy remoteness and collateral eligibility in regulatory frameworks), operational (eg, interoperability across CSDs/agents), and governance (ensuring a single source of truth between off-chain registries and the token), but none of these are novel for market infrastructures. The commercial logic for tokenized government bonds as collateral is strong: fewer failures, faster recalls and substitutions and intraday margin without sacrificing the economics of high-quality liquid assets.

Tokenized Money Market Funds

Tokenized MMF shares, issued as tokens on a blockchain, are gaining limited but promising traction across institutional markets because they enable real-time collateral mobility while preserving the depth and operational familiarity of the existing MMF ecosystem, although prudential recognition remains subject to the treatment of the underlying fund shares within applicable collateral eligibility frameworks.

Typical tokenization models place the transfer agent's record on (or mirrors it to) a permissioned distributed ledger, while maintaining the transfer agent's record as the authoritative source of truth. This structure allows intraday settlement, wallet-level access control and direct connectivity with primary dealer and collateral management infrastructure. While tokenized MMFs are conceptually compatible with bilateral and triparty arrangements for already-eligible funds, their practical use remains limited to controlled pilots and industry working groups. Widespread deployment requires further development of authoritative record governance, operational resilience and integration into collateral management and triparty infrastructures.

TradFi workflows typically involve collateral providers redeeming MMF units to cash (subject to cut-offs and settlement timing), posting that cash as collateral through payments/custody rails, whereupon the cash is re-subscribed into the MMF. This conversion adds multiple handoffs (transfer agent instructions, cash movements, reconciliations, re-investment) where timing breaks and manual errors can occur, increasing operational risk for both pledgor and collateral receiver.

It also creates liquidity risk for the MMF itself, because margin-driven redemptions can spike during volatility, forcing the fund to support outflows and amplifying stress dynamics. A tokenized MMF structure can potentially mitigate this by allowing an eligible MMF to be delivered or returned directly as collateral within a shared record of transfer across transfer agent/custodian/pledge parties, reducing both the operational fragility of the cash conversion cycle and the liquidity pressure created by repeated redemptions and reinvestment.

The remaining challenges are largely operational: institutions must formalize governance over the authoritative record when mirrored ledger models are used, embed reliable reconciliation processes and align NAV cut-offs with intraday margin and settlement cycles. Token logic must incorporate transfer restrictions, eligibility rules and wallet whitelisting to meet fund governance and compliance requirements. Firms also need to industrialize operational processes supporting tokenized collateral workflows.

[30] Tokenization of government bonds: assessment and roadmap, Bank for International Settlements, July 10, 2025, www.bis.org/publ/bisbull107.pdf

Tokenized Gold

Tokenized gold is a digital twin token representing an interest in (or entitlement to/claim on) gold (typically held by a custodian), where the representation itself satisfies the definition of such interest, entitlement or claim on gold under local law.

Under the non-cleared margin rules, physical gold is already an eligible collateral type for IM in many jurisdictions, and its treatment follows the standardized commodity haircut schedule. As a result, tokenized gold could in principle be used for non-cleared IM where the token wrapper provides enforceable rights, clear control/perfection, and segregation consistent with digital asset custody models. In practice, however, adoption remains limited because most institutions require additional certainty around token-level enforceability, custody governance and cross-border recognition before treating tokenized forms as operationally equivalent to traditional gold holdings.

For CCP IM, the economic constraints remain more binding. Gold's volatility leads to materially higher and more procyclical haircuts, and its usefulness in default management auctions is limited by the absence of deep, ready-to-use financing and hedging markets at scale. Tokenization does not change these structural characteristics.

Under bilateral margin frameworks such as the non-cleared margin rules, the considerations differ somewhat because IM is segregated and not typically liquidated through a centralized default auction process. In those contexts, eligibility may depend more on legal enforceability, segregation arrangements and valuation transparency. Even so, volatility and liquidity characteristics remain relevant for determining appropriate haircuts and operational treatment.

Operational considerations include issuer processes, venue concentration and the management of commodity value-at-risk. Tokenization reduces operational friction but does not address the economic constraints that limit gold's usefulness as margin collateral. Its role is therefore centered on making existing gold-based workflows more efficient, rather than reshaping collateral hierarchies across derivatives markets.

Tokenized Deposits and Deposit Tokens

Tokenized deposits represent an existing record of a traditional ownership claim for a bank deposit on the token-issuing bank or depository institution, for a fixed amount of commercial bank money. Deposit tokens are transferable, digitally native tokens issued by a licensed depository institution which evidence a deposit claim against the token-issuing bank or depository institution, for a fixed amount of commercial bank money or fiat cash. These instruments replicate several core functions traditionally associated with cash – including transferability, immediacy and continuous availability – and bring commercial bank money onto distributed ledgers while remaining within the regulated banking perimeter.

Unlike stablecoins or reserve-backed digital currencies, tokenized deposits remain on-balance-sheet liabilities of regulated banks, fully backed by traditional deposits held at the issuing institution. Capacity is ultimately determined by the issuing bank's balance sheet, which means the focus shifts from market liquidity to interoperability and treatment within existing post-trade infrastructures. For holders, they represent standard credit exposure to the issuing bank. CCPs are unlikely to accept concentrated exposure to a single commercial bank issuer at margin call and may instead require redemption into central bank money for settlement.

From a legal perspective, tokenization does not transform the deposit into a new asset class. Rather, it represents a technological extension of regulated commercial bank money. Regulators

have explicitly recognized this approach in several jurisdictions. In the EU, tokenized deposits would be expected to be classified as bank deposits (thereby excluded from the scope of MiCA and falling instead under the existing Capital Requirements Directive and Regulation framework). The Bank of England has commented that tokenized deposits would fall within the existing banking regulatory framework and would therefore constitute traditional bank liabilities represented on distributed ledger infrastructure[31], and US authorities have largely adopted a technology-neutral stance, distinguishing tokenized deposits from payment stablecoins.

Interoperability represents a core structural challenge for tokenized bank deposits, which are inherently issuer-specific claims and, in the absence of shared clearing and settlement frameworks, tend to remain confined to closed, bank-specific ecosystems. This limits network effects and mirrors the liquidity fragmentation observed in correspondent banking. Scalable deployment therefore depends on mechanisms such as regulated liability networks that enable exchange at par, conversion or netting across banks under common technical and legal standards, supported by reciprocal acceptance rules and shared governance models. At the same time, the design of tokenized bank deposits is subject to regulatory and private law constraints aimed at preserving the singleness of money. The principle of functional equivalence requires tokenized deposits to remain fungible with non-tokenized currency and to trade at par value regardless of their technical form. To maintain this equivalence, tokenized bank deposits can be structured as non-bearer instruments that ultimately settle interbank obligations using central bank money or wholesale CBDCs.

Residual risks relate to permissioning, key management and operational control when tokens circulate on public or hybrid chains. Additional concerns include single-issuer concentration and the need for robust incident management and contingency frameworks. Addressing these operational and governance issues, alongside credible interoperability solutions, will determine whether tokenized deposits evolve from efficient bilateral instruments into scalable settlement assets that can support market-wide payment, collateral and margin processes.

Central Bank Digital Currencies

CBDCs are digital tokens that represent a claim on a central bank for a fixed amount of central bank money denominated in a single currency and are a liability of a central bank, with no credit or liquidity risk. Retail CBDCs are specifically designed for use in transactions and holdings by individuals and smaller firms, whereas wholesale CBDCs are specifically designed for use in transactions and holdings by regulated financial institutions.

Globally, many jurisdictions are exploring CBDCs, but concrete deployments remain limited[32]. The ECB is in the next phase of the digital euro project, aiming for a pilot by mid-2027 and possible issuance by 2029[33]. The digital euro is expected to be intermediated by banks, maintain user privacy and have holding limits – design choices that will directly affect its use as collateral[34]. In contrast, the US has effectively halted any CBDC for retail use. A January 2025 executive order expressly prohibits federal agencies from developing or promoting a CBDC[35].

[31] Not just token gestures - speech by Sarah Breeden, Bank of England, October 15, 2025, www.bankofengland.co.uk/speech/2025/october/sarah-breeden-panellist-at-fintech-foundation-2025-dc-fiintech-week

[32] For example, Sand Dollar in the Bahamas, JAM-DEX in Jamaica, e-Naira in Nigeria; Atlantic Council CBDC Tracker (accessed February 2, 2026), www.atlanticcouncil.org/cbdctracker/

[33] Digital euro, ECB, October 2025, www.ecb.europa.eu/euro/digital_euro/html/index.en.html

[34] Frequently asked questions on the digital euro, ECB, October 30, 2025, www.ecb.europa.eu/euro/digital_euro/faqs/html/ecb.faq_digital_euro.en.html

[35] Strengthening American Leadership In Digital Financial Technology, The White House, January 23, 2025, www.whitehouse.gov/presidential-actions/2025/01/strengthening-american-leadership-in-digital-financial-technology/

Certain CBDC design configurations allow a digital instrument to closely approximate the functional characteristics of cash, particularly where it constitutes a direct liability of the central bank, is convertible at par and supports widespread settlement use. Functional proximity to cash depends on design choices, including access, remuneration, holding limits and technological architecture. This diversity reflects policy flexibility, allowing central banks to balance cash-like features with financial stability and monetary policy considerations. When CBDCs launch, their features (eg, holding caps, identity controls, offline functionality) will determine whether they can flow smoothly into derivatives collateral pools, or if new rules will be needed.

Stablecoins

Stablecoins have become some of the deepest liquidity pools in digital asset markets. Fiat-referenced stablecoins are designed to replicate certain operational attributes of cash, including a stable unit of account, near-instant settlement and continuous transferability within distributed ledger infrastructures. Regulatory frameworks governing stablecoins are continuing to evolve across major jurisdictions, with several authorities developing supervisory approaches and legislative and rulemaking initiatives.

From an operational perspective, stablecoins have been widely used as settlement and collateral assets in digital asset markets and tokenized financial infrastructures, particularly where traditional cash settlement mechanisms are not natively available.

Stablecoins represent claims on private issuers and are therefore exposed to issuer credit risk, operational risk and reserve management risk. Their stability depends on the quality, liquidity and accessibility of their reserve assets and confidence in the issuer's ability to honor redemptions at par under stress. Historical de-pegging events, when pegged stablecoins traded below their target par value on exchanges, demonstrate that even fully collateralized stablecoins may experience price dislocations during periods of market stress, regardless of the issuer's ultimate redemption capacity.

Stablecoins vary widely in design and regulatory status, so their collateral treatment diverges by type and jurisdiction. The key requirement is an enforceable redemption claim against the issuer at par value. The EU MiCA framework and the US Genius Act both require one-to-one reserve backing made up of specified high-quality liquid assets and provide that stablecoin holders have a direct claim against the reserve backing assets in the event of an issuer's insolvency. However, requirements for reserve composition and redemption mechanics differ across other jurisdictions and stablecoins cannot, therefore, be treated as a homogeneous asset class for collateral eligibility purposes.

Fully backed, single-currency stablecoins issued under regulated frameworks may operationally resemble cash-equivalent instruments within certain digital market infrastructures. However, under current Basel Committee prudential standards, such instruments are not generally recognized as eligible financial collateral for credit risk mitigation purposes. Their role as collateral in institutional derivatives markets therefore remains limited, even where reserve quality and redemption mechanisms are robust.

Even where stablecoins demonstrate strong operational liquidity, prudential recognition remains constrained. Under the Basel Committee's crypto-asset framework, fiat-referenced stablecoins may qualify as Group-1b exposures where strict stabilization and redemption criteria are met. However, Group-1b assets are not currently included in the Basel eligible financial collateral framework used for credit risk mitigation. As a result, stablecoins are unlikely to be widely accepted as collateral within regulated derivatives markets under existing prudential standards, although they may continue to play a role as settlement assets within digital trading venues.

Even then, practical adoption may be further constrained by economics, particularly where stablecoins pay no interest and are subject to restrictions on how and where they can circulate. Future adjustment to the treatment of fiat-referenced stablecoins that meet Group-1b classification and stabilization conditions under BCBS SCO60 (ie, that are not recognized as eligible financial collateral for credit risk mitigation) is likely to depend on sustained evidence of stablecoins' resilience during stress and continued improvements in issuer governance and reserve transparency. Most regulated stablecoins do not pass through yield, creating a meaningful opportunity cost relative to tokenized MMFs or deposits that offer interest and enjoy more favorable capital treatment. Indeed, retail-orientated frameworks in major jurisdictions[36] specifically bar yield-bearing tokens as qualifying 'stablecoins'[37], viewing yield generation as undermining their function as a payment instrument (instead of an investment), incentivizing deposit flight and complicating reserve asset management and consumer protections.

Bilaterally, regulated stablecoins may still gain traction where on-chain immediacy matters. For CCPs, acceptance as margin remains remote under current BCBS rules, with tokenized cash, government securities and MMFs retaining priority.

Native Platform Crypto Assets

Under BCBS SCO60, digitally native tokens that are unbacked platform crypto assets sit squarely in Group 2b, unless it is demonstrated that they meet the hedging recognition criteria for Group-2a treatment (eg, for major cryptocurrencies like BTC or ETH). As a result of Group-2 treatment, there is a clear distinction between their viability inside digital asset markets and their limited role in mainstream rates and FX IM.

BTC and ETH are among the most liquid platform crypto assets and have seen growing institutional interest. Challenges to their use as collateral include price volatility, divergent treatment of forks and airdrops, potential exposure to MEV and the risk of chain reorganizations on specific networks. Procyclical haircuts can amplify stress during periods of market dislocation. BTC and ETH have long been pledged within native digital asset derivatives markets, where steep and highly dynamic haircuts are standard.

Even with regulatory allowances[38], these assets are highly volatile. The CFTC requires substantial haircuts (at least 20%) on BTC/ETH collateral to account for this volatility[39]. Even if a futures commission merchant holds platform crypto assets as collateral, it must comply with segregation, reporting and risk rules that treat the assets conservatively. Importantly, platform crypto-asset markets have no proven crisis backstop: unlike Treasuries, there is no central bank buyer of last resort. When prices crash, exchanges and liquidity providers often withdraw, deepening losses. For these reasons, most parties to bilateral CSAs will limit BTC/ETH collateral to pilot programs, impose large additional margin buffers or avoid them entirely outside narrow contexts.

[36] Eg, Markets in Crypto-Assets Regulation (MiCA), Hong Kong Monetary Authority, Bank of England consultation, US Genius Act. Although unlike previous frameworks, the Genius Act does not explicitly prohibit service providers (eg, exchanges) from paying 'rewards' to holders – ie, the issuer cannot provide interest to holders, but platforms or exchanges may still try to recreate yield through other structures.

[37] Under MiCA, issuers and crypto-asset service providers "shall not grant interest" for either asset-referenced tokens or e-money tokens

[38] Eg, the CFTC pilot program permitting platform crypto assets, including BTC and ETH, to be accepted by futures commission merchants as collateral – Acting Chairman Pham Announces Launch of Digital Assets Pilot Program for Tokenized Collateral in Derivatives Markets, CFTC, December 8, 2025, www.cftc.gov/PressRoom/PressReleases/9146-25

[39] CFTC Staff Reissues Letter 25-40 Updating Payment Stablecoin Definition, February 6, 2026, www.cftc.gov/PressRoom/PressReleases/9180-26

4.6 Institutional Adoption of Digital Asset Collateral

The collateral landscape for digital assets will be stratified rather than convergent. Adoption will be shaped by legal enforceability, prudential treatment, liquidity under stress and interoperability with existing FMI. Tokenized representations of assets that already satisfy institutional collateral requirements in their traditional form, particularly government securities and MMF shares, are structurally best positioned for early and broader adoption, as tokenization primarily alters settlement mechanics (offering efficiency gains) rather than economic substance or risk characteristics. Other asset types, including tokenized deposits, stablecoins and selected RWAs, may eventually play complementary roles where their design, governance and liquidity characteristics align with specific settlement or margining use cases, but their scalability remains constrained by issuer dependence, interoperability limitations and conservative risk treatment. Native platform crypto assets that are subject to Group-2 treatment are expected to remain peripheral to institutional collateral frameworks.

This section demonstrates that digital assets can support enhanced capital efficiency in derivatives markets only where they meet established legal and prudential thresholds for collateral eligibility. Improvements in speed, portability and programmability translate into balance sheet benefits when they reduce exposure persistence, settlement friction and the need for excess liquidity buffers. These benefits are not automatic and depend on alignment with technical capabilities with enforceable rights, reliable valuation and predictable liquidation outcomes.

Programmatic collateral mobility, reduced settlement friction and on-chain optimization mechanisms illustrate how tokenization can narrow the gap between theoretical capital efficiency and realized delivery. Faster and more predictable collateral movements reduce the distance between required margin and posted assets, while atomic settlement and automated lifecycle events have the potential to limit reconciliation breaks and operational delays that inflate risk-weighted assets. Optimization across venues further reduces over-posting by enabling precise allocation and substitution, subject to strict management of eligibility, concentration limits and wrong-way risk.

At the same time, enhanced capital efficiency is constrained by foundational dependencies. Recognition of tokenized collateral still relies on the core legal conditions set out in this paper across both bilateral and cleared markets. Interoperability between collateral and cash rails, particularly the availability of continuously transferable settlement assets, is necessary to compress exposure windows in practice rather than in theory. Valuation, eligibility, haircuts and risk treatment must advance in a coordinated manner, as usable balance sheet capacity reflects the interaction of all four elements rather than the quality of any single input.

In summary, digital assets can potentially enhance capital efficiency by reducing settlement latency, improving collateral utilization and enabling more precise optimization across markets. Realizing these gains depends on structural alignment across legal, operational and prudential frameworks, rather than a property of technology alone. Their scalability depends on the convergence of standards, documentation and supervisory recognition across the post-trade lifecycle.

5. RECOMMENDATIONS

This paper demonstrates that the institutional use of digital assets in derivatives markets depends less on the characteristics of the assets themselves than on the infrastructure through which those assets are traded, margined and settled. Settlement design, collateral frameworks and prudential treatment ultimately determine whether digital asset exposures can be intermediated efficiently within existing derivatives markets.

As digital asset markets mature, the principal constraints on institutional participation extend beyond technological capability and market liquidity, though both remain material challenges in practice. Legal certainty, balance sheet efficiency and supervisory recognition have emerged as equally binding structural constraints. Where exposures remain non-qualifying – because settlement finality is uncertain, collateral frameworks are inconsistent or lifecycle definitions are fragmented – capital costs and liquidity requirements will continue to limit market intermediation.

The central question for policymakers and market participants is therefore not whether digital asset derivatives markets will scale, but to define the structural conditions under which they can do so sustainably and at institutional depth.

The analysis in this paper highlights four priorities for achieving that outcome.

5.1 Align Digital Asset Markets with Existing Prudential Frameworks

Institutional adoption will depend on whether digital asset exposures qualify for risk-sensitive treatment under existing prudential regimes.

Where settlement arrangements preserve legal finality, collateral frameworks support enforceable rights and exposures benefit from recognized netting and margining structures, digital asset derivatives can be accommodated within existing Basel capital frameworks rather than treated as exceptional instruments.

The priority for market participants and policymakers should therefore be to structure digital asset activities in ways that satisfy the conditions required for prudential recognition.

5.2 Modernize Settlement Infrastructure to Reduce Exposure Persistence

Settlement frequency is a fundamental determinant of counterparty exposure.

Faster settlement cycles, more continuous margining and improved collateral mobility shorten the period during which MTM exposures remain outstanding between counterparties. The quantitative analysis in this paper shows that these structural improvements can reduce exposure at default and associated capital measures by approximately 40-45%, even when underlying market risk remains unchanged.

Achieving these benefits requires both operational and legal alignment. Operational settlement finality on distributed ledgers must be complemented by contractual and legal recognition so that on-chain transfers extinguish obligations in a manner consistent with close-out netting and insolvency frameworks.

Modernization of the cash leg of derivatives settlement will also be essential. Regulated forms of digital money – including tokenized bank deposits and wholesale CBDCs – may allow continuous settlement while preserving the legal certainty required for institutional markets.

5.3 Introduce Digital Collateral Through a Risk-based Adoption Path

Institutional collateral frameworks must continue to prioritize liquidity, enforceability and reliable liquidation under stress.

Tokenized representations of assets that already meet these requirements, such as government securities and MMFs, represent the most credible pathway for early adoption, as tokenization primarily alters settlement mechanics rather than the underlying risk profile of the asset.

Other digital assets may play complementary roles in specific market contexts, but their broader adoption will depend on the development of deeper liquidity, robust governance structures and clear legal treatment.

Margin and haircut frameworks must also incorporate risks specific to digital market infrastructure, including chain disruptions, oracle dependencies, governance failures and liquidity fragmentation, to ensure consistent risk management across institutions.

Market development should therefore proceed through a sequenced adoption path, beginning with bilateral and pilot use cases before expanding to broader market structures, once operational, legal and prudential frameworks are fully established.

5.4 Build Common Standards for Interoperable Market Infrastructure

Digital assets cannot scale efficiently without common operational and legal standards.

Shared documentation frameworks, standardized lifecycle definitions and common data models – such as the CDM – provide the foundation for interoperability between distributed ledger systems and existing trading, clearing and risk infrastructure.

Standardization must extend beyond data formats to encompass the full lifecycle of derivatives transactions. Legal documentation, operational workflows and on-chain execution logic must produce consistent economic outcomes for events such as margin calls, settlements, substitutions and defaults.

Without such alignment, fragmentation across infrastructures will increase operational risk and reduce the efficiency gains that can be delivered by digital technologies.

5.5 Conclusion

A separate financial system is not required to integrate digital assets into derivatives markets. When settlement infrastructure, collateral frameworks and prudential recognition evolve together, digital assets can be integrated into derivatives markets using the same legal and risk management principles that govern traditional finance.

The opportunity ahead is therefore not to reinvent derivatives markets, but to improve their infrastructure and, as a result, their efficiency. Where regulatory frameworks, settlement design and collateral treatment converge, digital asset infrastructure can reduce exposure persistence, improve collateral efficiency and expand market participation, while preserving the stability and resilience of the global derivatives ecosystem. The challenge is one of integration rather than innovation – ensuring that digital infrastructure develops in a way that strengthens, rather than fragments, the foundations of global financial markets.

6. APPENDIX

6.1 Digital Assets Taxonomy and Definitions

Term	Name
Digital Asset	A controllable electronic record, where one or more party can exclusively exercise control through transfer of this record and where the controllable electronic record itself is uniquely identifiable. Examples: Bitcoin, tokenized deposits, non-fungible token (NFT)
Digital Native Token	A digital asset that exists only on its native ledger, with no separate off-chain record. Examples: Bitcoin, Ether
Digital Twin Token	A digital asset that mirrors an off-chain asset recorded in another system of record. Examples: tokenized government bonds, tokenized equities, tokenized fund units
Digital Money	A digital asset that meets at least one of the following conditions: reliable store of value, medium of exchange or unit of account. Examples: CBDCs, regulated stablecoins, reserve-backed digital currency
Central Bank Digital Currency	Digital tokens representing a claim on a central bank for a fixed amount of central bank money denominated in a single currency. **Retail CBDC:** designed for use in transactions and holdings by individuals and/or small and medium-sized enterprises. Example: e-CNY (retail pilot) **Wholesale CBDC:** designed for wholesale use in transactions and holdings by regulated financial institutions, including settlement of securities transactions. Example: Project Jura
Tokenized Deposit	Digital tokens that represent an existing record of a traditional ownership claim for a bank deposit on the token-issuing bank or depository institution, for a fixed amount of commercial bank money denominated in a single currency. Example: bank-issued programmable deposits
Deposit Token	Transferable digital tokens issued by a licensed depository institution which evidence a deposit claim against the token-issuing bank or depository institution, for a fixed amount of commercial bank money or fiat cash denominated in a single currency. Example: on-chain commercial bank money pilots
Stablecoin	Privately-issued, money-like, digital token that aims to maintain a stable value relative to a peg specified by a reference asset(s) and designed to minimize value fluctuations relative to these reference assets(s). Examples: USD Coin (USDC), EUR CoinVertible (EURCV)
Tokenized Financial Asset	A digital twin token that represents an underlying security or financial instruments issued on a different platform (eg, a traditional CSD or registrar), where such representation itself satisfies the definition of a security/financial instrument under local law. Examples: tokenized government bonds, tokenized security, tokenized derivative, tokenized interest rate swap
Security Token	A digital native token that satisfies the applicable regulatory definition of a security or financial instrument under local law. Examples: native equity or debt security tokens
Tokenized Real-World Asset	A digital twin token representing an interest in, entitlement to, or claim on a physical good or other non-financial asset under local law. Example: tokenized gold, tokenized real estate
Crypto Asset	A non-redeemable digital native token, with no rights conferred against the issuer (if one exists), that may be exchangeable for specified value, is hard coded into any underlying platform and must serve one or both of the following functions: (a) cryptographic economic incentive to maintain and secure network or application infrastructure including preservation of processing throughput (eg, through payment of 'gas fees' or staking); or (b) universal medium of exchange of the underlying network infrastructure. Examples: Bitcoin, Ether
Platform Cryptoasset	A crypto asset hard-coded into an underlying platform providing cryptographic incentives to maintain and secure the network or act as the network's universal medium of exchange. Examples: Bitcoin, Ether
Network Token	Digital native token providing application or protocol utility (eg, governance, staking, rewards). Examples: protocol governance tokens, staking reward tokens, incentive tokens

6.2 List of Contributors

Firm	Name
AXA Investment Managers	Corentin Leblond
Banco Santander	Paula Milla Laborde
Bank of America	Natasha Hirani
BNP Paribas	Wael Haffar
BNY	Chris Balzano
Cargill Inc	Diego Tremonti
Citi	Michael Swain
Clifford Chance	Jesse Overall
D2 Legal Technology	Claire Gerrand
DBS Bank Ltd	Jurena Chan
Eurex	Nicolae Raulet
HSBC	Yasmina Benbakhti
ICE	Nazareen Gilbertson
Jones Day	Alexandre Cheriet
JPMorganChase	Milo LeDoux
Landesbank Baden-Württemberg (LBBW)	Friederike Sofie Burckhardt
Linklaters LLP	Sam Quicke
LSEG	Samuel Fajemilua
MetLife Insurance Investments	Charu Kejriwal
Mizuho	Hiroyuki Toda
Morgan, Lewis & Bockius LLP	Nikita Cotton
NatWest Markets Plc	Aimee Churchett
OSTTRA	Teodor Opasiak
Pinheiro Neto Advogados	Fabio Moretti de Gois
Royal Bank of Canada	Gordon Evens
Societe Generale	Prarthana Shetty
Standard Chartered	Ksenia Shnyra
Statkraft	Ljubica Djabirova Pokrass
TD Securities	Kam Selladurai
TradeHeader	Laura Garcia

ABOUT THE IFLD

The ISDA Future Leaders in Derivatives (IFLD) program aims to make a positive impact on the future of the derivatives industry by identifying a diverse group of emerging leaders across the industry. The program has four core objectives: to create an active forum for networking and discussion of industry topics and future industry trends; to increase the demographic, cultural and professional diversity of senior leaders within the financial services sector; to support emerging leaders in developing soft skills and technical expertise; and to develop and produce content on issues of strategic importance to ISDA and its members. For more information on the IFLD program, please contact IFLD@isda.org.

ABOUT ISDA

Since 1985, ISDA has worked to make the global derivatives markets safer and more efficient. Today, ISDA has more than 1,000 member institutions from 79 countries. These members comprise a broad range of derivatives market participants, including corporations, investment managers, government and supranational entities, insurance companies, energy and commodities firms, and international and regional banks. In addition to market participants, members also include key components of the derivatives market infrastructure, such as exchanges, intermediaries, clearing houses and repositories, as well as law firms, accounting firms and other service providers. Information about ISDA and its activities is available on the Association's website: www.isda.org. Follow us on LinkedIn and YouTube.