GFTN
Innovating Finance. For Everyone.

TOKENIZED MARKETS

PRACTICAL IMPLEMENTATION PATHWAYS FOR AUTHORITIES CONSIDERING TOKENIZATION

'A token is worth what can be done with it, which depends on who will buy it, lend against it or accept it as collateral, with what money, and under what rules.'

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EXECUTIVE SUMMARY

Tokenization is moving beyond pilots, but slowly. Close to half of tokenized real-world asset value, excluding stablecoins, sits in government debt, mostly US Treasury funds. Even these see little secondary trading after issue. Few pilots have become production systems with broad participation. In many markets, existing infrastructure already settles efficiently, so firms need a clear economic case to switch.

This report brings together three pieces of GFTN work for authorities considering tokenization. Section 1 explains why tokenization matters and why tokenized markets are not yet scaling. Section 2 presents the Tokenization Pathways Toolkit: a method an authority can use to assess one tokenization scheme at a time. Section 3 records eight frictions reported by private-sector firms, maps each onto GFTN's view of the tokenized ecosystem, and shows where each would surface in an authority's own assessment.

Four findings run through the report.

Representing an asset is not the same as trading like it. A token shares the asset's price and liquidity only when two conditions hold. First, it must give holders substantially the same exposure, risks and legal rights. Second, dealers must be able to create and redeem tokens against the asset efficiently. When both hold, dealers trade away any price gap and can draw on the asset's liquidity to meet large orders, much as with an ETF. When they do not, the token trades in a separate market with its own price and liquidity. That market is usually less liquid, and the token's price can drift from the asset's. An authority should therefore ask which market the token will trade in, not just what asset it represents.

Most of the gains depend on money and law, not code. Atomic settlement, round-the-clock collateral and programmable payments all need a settlement asset on the same ledger or on one linked to it. Where settlement takes place in a separate system, the asset and payment legs must be coordinated off the ledger, and much of the risk and cost that tokenization promises to remove returns. Such schemes can still digitise the asset record, but they cannot deliver the full gains. They also need law that treats the ledger as the legal record of ownership, because a ledger transfer passes only the rights that the token legally carries. If the law does not recognise the ledger as definitive, the payment can be final while the buyer's claim to the asset is not: the buyer's money is gone, but ownership may remain open to challenge.

The binding constraint is which authority can act. The report identifies eight frictions that slow the move from pilot to production. All eight raise questions of governance and compliance, and in seven the main barrier is coordination between authorities. Where mandates overlap, each authority can wait for the others to act. Where there are gaps between mandates, no authority is responsible for acting. And even where mandates are clear, coordination often fails because authorities lack shared information, not because they lack the power.

Authorities can still act, one scheme at a time. The report's toolkit takes an authority from a firm's proposal to one of five recommendations: support the scheme, allow it within limits, monitor it, return it for changes, or decline it. It checks the instrument's legal features against what the ledger records and does, covers up to nine assessment areas, and indicates the material impact of getting it wrong. Each condition attached to a decision has a named owner, the evidence required and a review date, so the decisions can be revisited as evidence accumulates. Used consistently across authorities in a jurisdiction, the toolkit gives firms a clear path, as they know in advance what they need to show. It also eases the coordination failure that leaves schemes undecided, with each authority waiting for another to decide first. Because most outcomes are conditional and subject to review, deciding first carries less risk. Nor does any authority need others to use the toolkit before it does: each authority that uses it adds value, as firms operating across borders face the same questions in each market and can see where differences in law require different answers.

The problem statements in Section 3 are perspectives from parties with a stake in the outcome. They are frictions for a country to weigh against its own starting conditions, not conclusions to adopt as given.

This report represents the first attempt to offer a practical guide that supports authorities in assessing the role and decisions they must take in a growing tokenised market. It is not intended to solve all the questions, or replace the significant efforts being undertaken by public and private sector in this space. Rather, we see this as a comprehensive baseline building on the work already delivered, continuing the discussion on the most pressing challenges and understanding how these dynamics change over time to allows us to iterate and update the pathways toolkit. It will also be complemented with an online learning tool and lab environment. We intend to take in feedback, views and perspectives form both public and private sector participants and will continue to contribute to meaningful action. The private sector use cases are particularly important in offering live examples of where the friction lies.

Turning insights into action is a key ambition of GFTN. We hope this body of work and its next stages will be a clear demonstration of that ambition.

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SECTION 1
CONTEXT AND INTRODUCTION

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In 2025 GFTN published its first Global Digital Assets Report, at the GFTN Insights Forum.[1] It drew on more than 40 executive interviews and a survey across 12 jurisdictions in Asia, Europe, the Middle East and the Americas, and covers eight areas, including digital money and stablecoins, asset tokenization, crypto exchanges, staking and decentralised finance.

KEY FINDINGS FROM THE REPORT

- **Regulatory maturity.** At least 9 of the 12 jurisdictions studied have digital-asset frameworks in place or in draft.
- **Growth opportunity.** Of survey respondents, 56 per cent named more efficient capital markets through tokenization as a key growth opportunity, and 46 per cent named programmable money.
- **Scale already in motion.** The report counts more than 300 million active users of decentralised finance, and over US$263 trillion in stablecoin transactions since 2019.[2] These are raw on-chain measures, which count wallet addresses rather than people and include automated and internal transfers, so they overstate underlying activity. This activity is also largely separate from the institutional tokenization of financial assets, but it shows the volumes that shared ledgers already carry.
- **Real-world impact.** The report finds that tokenization could widen access to finance: cheaper cross-border payments and market access for small firms, cheaper remittances for migrant workers, and smaller minimum investments in assets such as infrastructure and real estate. But smaller units widen access only where minimum size was what held investors back. For a single building, a small slice carries the same concentrated, hard-to-value risk as the whole, and investors seeking small-ticket property exposure can already get it through diversified and liquid listed real estate funds. Without demand, fractional tokens trade in thin markets, if at all.

The market data bear this out. Close to half of tokenized real-world asset value, excluding stablecoins, sits in government debt, mainly US Treasury products, while assets such as real estate remain at an early stage.[3] Even tokenized government debt and money-market funds trade little after issue[17376], and pilots have rarely moved into lasting production use with broad participation. Here the obstacle to demand is different. In many markets, existing infrastructure already settles efficiently, so participants need a clear economic case to switch. Authorities cannot create demand by order, but they can lower the barriers to entry, for example by clarifying legal treatment and deciding on schemes in a timely fashion, and can support early activity through sandboxes, pilot programmes or recognizing on-ledger settlement assets.

Technical terms used in this paper are defined in the Glossary at the end of the document.

WHAT TOKENIZATION CHANGES

The way ownership of securities is recorded has changed before. Until the second half of the twentieth century, many securities were paper certificates, and selling one meant delivering the paper. Central securities depositories then immobilized the paper and later dematerialized it, recording ownership as entries in accounts. Settlement periods fell from a week or more to a few days, and in several large markets now to one day (T+1). Tokenization is the latest change to the record.

Here a tokenized asset means a claim on an identifiable party recorded on a shared ledger, and not everything on a blockchain meets that test. Most crypto-assets are unbacked or are stablecoins. By value, the market is dominated by bitcoin, ether and stablecoins; by number, by millions of short-lived memecoins. Unbacked crypto-assets such as bitcoin and memecoins are no one's liability, so they are not tokenized assets in this sense. Bitcoin becomes one when it is wrapped for use on another blockchain, as is common in decentralized finance: the wrapped token is a claim on the custodian holding the bitcoin. A stablecoin is a tokenized asset for the same reason, because it is a claim on its issuer. This paper is mainly about tokenized real-world assets, such as bonds, fund units and shares, which form a much smaller market, but its analysis applies equally to other tokenized instruments. Some are digital twins, mirroring a claim recorded in an off-ledger register, such as a company's share register, which remains the legal record of title. A transfer on the ledger then takes legal effect only when that register is updated. Others are issued natively on a ledger that the law recognizes as the legal record of title, so the ledger entry itself creates and transfers ownership, as Switzerland's ledger-based securities and Germany's electronic securities law allow.

Tokenization changes how records are updated and what can be done with them. Instead of a depository and each intermediary keeping separate records that must be reconciled, participants update one shared record under common rules, and restrictions on who may hold or transfer an asset can be written into the smart contract that records it. Where asset and cash sit on the same ledger, or on linked ledgers, they can settle atomically: both move in one step, or neither does. Conventional delivery versus payment already ensures that one side cannot pay without the other delivering. What atomicity adds is the ability to settle several legs at once, to make settlement conditional on terms in a smart contract, and to settle when payment systems are closed, as long as the cash on the ledger can move then; final settlement in central bank money still waits for those systems to open. These gains have limits. Because every trade must be funded in advance with its cash and securities, atomic settlement forgoes the liquidity savings of netting, which reduces many trades to a few net transfers. And atomicity is a technical guarantee, not a legal one. Where the ledger is not the legal record of title, as with a digital twin, ownership passes only when the off-ledger register is updated. Until then the buyer's payment is final and irrevocable, but it does not yet own the asset: exactly the exposure delivery versus payment is designed to prevent.

1 GFTN (Global Finance & Technology Network) (2025). GFTN Global Digital Assets Report. November 2025. https://gftn.co/gftn-insights/gftn-global-digital-assets-report. Unless otherwise stated, figures in this section are drawn from this report.

2 GFTN (2025), op. cit. The user figure refers to more than 300 million active DeFi users across 88 countries as of Q2 2025. The volume figure is cumulative stablecoin transaction volume since 2019 (about US$263.4 trillion, of which US$40.5 trillion was in the preceding 12 months).

3 RWA.xyz (2026). Real-world asset market dashboard, distributed asset value, data as at 9 August 2026. https://app.rwa.xyz. Tokenized US Treasury products accounted for about US$16.2 billion of US$38.2 billion in distributed RWA value, with a further US$1.3 billion in non-US government debt.

[17376] Mafrur, R. (2026). Tokenized but illiquid? Evidence from real-world asset markets. *FinTech*, 5(3), 62. https://doi.org/10.3390/fintech5030062

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Settlement can also transfer only the rights a token already has; it cannot add any. A token can carry the economic exposure of a share without its voting rights, or with a claim only on an intermediary rather than on the issuer, as with several tokenized stock products now on the market.

Each stage changed where the record of ownership lives and what it takes to move it.

TABLE 1.1

How the record of ownership has changed, from paper certificate to token

Dimension	Paper bearer certificate	Digitised record (book-entry)	Tokenized record
What the record is	The paper is the asset; holder owns it	Database entry kept by a CSD, custodian or registrar	Token or smart contract representing the claim; either a digital twin of an off-ledger legal register, or natively issued (the ledger is the register)
Who keeps the ledger	No ledger; possession is proof	Authoritative register at the CSD or registrar; each intermediary keeps its own sub-ledger in a tiered chain	Node operators running a common protocol: open to anyone on public chains; approved institutions or a single operator on permissioned networks. Data may be fully replicated or partitioned, so each party holds only its own records. The issuer or platform usually controls the token's smart contract, often including powers to freeze or reissue tokens.
Proof of ownership	Physical possession	The intermediary's books	Holding recorded on the ledger under the platform's rules, often via a custodian or hosting node; legal recognition depends on jurisdiction and, for digital twins, the off-ledger register
Transfer	Physical delivery, endorsement, courier	Messages between intermediaries; cash and securities settle separately	Token moves; cash and asset can swap atomically if both legs are on the same ledger or linked across ledgers. Many deployments still settle cash off the ledger
Settlement speed	Days to weeks	T+1/T+2; days cross-border	Can be near-instant and 24/7 where both legs are on the ledger, though timing still depends on clearing arrangements; finality depends on the ledger's consensus model and legal designation
Reconciliation	Manual, error-prone	Continuous, across duplicate ledgers	Reduced between counterparties that share a record and rely on it rather than keeping parallel books; persists where records on and off the ledger meet, across ledgers and with firms' internal books
Programmability	None	Automated within each institution's own systems; corporate actions processed separately at each tier of the chain	Rules attached to the asset and run once on the shared ledger (e.g. coupons, transfer restrictions); inputs from off the ledger still needed
Fractionalisation	Impractical	Possible but costly	Cheaper and more granular; may widen access where rules and distribution allow, but does not by itself create demand or liquidity

Source: GFTN.

In today's chain of intermediaries, one transaction can trigger repeated messages, checks and reconciliations before every record agrees. Payments show the same layering: sending US$200 abroad cost 6.36 per cent of the amount on average in the third quarter of 2025, against a G20 target of 3 per cent[4], though much of that cost reflects foreign exchange, compliance and cash-out rather than record-keeping. Limited settlement windows, time-zone gaps and several settlement assets trap liquidity, and cash,

4 World Bank (2025). Remittance Prices Worldwide, Issue 54, September 2025. https://remittanceprices.worldbank.org. Q3 2025 data. The global average total cost of sending US$200 was down from 6.49 per cent in Q1 2025. The 3 per cent target is UN Sustainable Development Goal 10.c, adopted in the G20 Roadmap for Enhancing Cross-border Payments; see FSB (Financial Stability Board) (2020). Targets for Addressing the Four Challenges of Cross-Border Payments: Final Report. October 2020.

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securities and collateral sit on separate systems that often interact only in business hours.

Two changes illustrate what tokenization makes possible.

- **Programmability.** Payments, corporate actions and compliance checks are already largely automated, but separately within each intermediary. With tokenization, coupon payments, transfer restrictions and conditional payments can be written into the token itself, so they apply wherever it is held, provided each ledger carrying the token implements them the same way. That depends on common token standards. And because assets and cash increasingly sit on different ledgers, transactions that span them rely on messaging between ledgers or on shared settlement layers, which brings back a form of reconciliation. Data from off the ledger, such as reference rates or sanctions lists, must still be brought in through trusted data feeds, and exceptions still need people.
- **Collateral moves with fewer hand-offs and fewer cut-offs.** Tokenized bonds, deposits and fund units can be pledged or moved as collateral outside normal cut-off times, provided the receiving party is on the same or a connected ledger, is ready to accept it, and the law recognizes a pledge made on the ledger. Cut-off times are set by operators, not by technology, and conventional systems could extend their hours too. What a shared ledger can remove is the series of hand-offs between intermediaries, each with its own cut-off, that collateral must otherwise pass through.

TABLE 1.2

Who gains from tokenization, and how

Who benefits	How
Investors	▪ Lower minimum investment in assets such as private credit and real estate, which widens access where minimum size, rather than concentrated risk or thin markets was the barrier. ▪ Transfer outside market hours transfer and redemption where fund terms allow, provided the cash leg can also move then. Yield on cash held on the ledger, through tokenized money-market fund units that can be transferred or pledged directly.
Issuers	▪ Potentially lower issuance and servicing costs; ▪ coupons and corporate actions processed once on the shared record rather than at each tier; ▪ wider and cross-border distribution
Banks and intermediaries	▪ Less bilateral reconciliation and back-office cost; ▪ intraday collateral mobility; ▪ new services in custody, key management, tokenized deposits and programmable payments
Central banks and regulators	▪ Potential for more timely, granular supervisory data; compliance rules embedded in the asset, provided each such power has a legal basis, written limits and a route for holders to challenge it (Area 4 of the framework); ▪ a trusted settlement asset that preserves singleness of money
Emerging markets	▪ Cheaper corridors and remittances; ▪ FX settlement for currencies outside CLS; ▪ potential to broaden local investor bases through smaller ticket sizes and foreign participation

Source: GFTN.

Most of these gains depend on the market in which a token trades. They arrive only where that market has enough buyers, sellers, and lenders to be liquid, whether it is the existing market for the asset or a new one, and where cash is on the same ledger or one linked to it. A token added to an existing arrangement, with the same parties doing the same things, may save little and still add risk. Where tokenization changes how a market works, it can lower costs and make new markets practical, such as repo that opens and closes within a few hours in place of intraday overdrafts.[5]

The international bodies that have studied tokenization reach a similar view. The FSB finds that many claimed benefits have yet to be proven, may not be unique to tokenization, or may be offset by trade-offs, and that some depend on trading and settlement taking place on the same platform or on platforms that work together.[6] The IMF expects some inefficiencies to fall, others to remain and new ones to appear.[7] IOSCO finds the gains so far uneven, and the risks mostly familiar ones that show up in new ways.[8] The BIS sees tokenization as able to "improve the old and enable the new", with its full benefits only where central bank reserves, commercial bank money and other assets are brought onto the same platform.[9]

The risks are concrete. Legally, a token may carry fewer rights than it appears to, and where the ledger is not the legal record of title, a

5 DTCC and Finadium (2026). Collateral Infrastructure for Tokenized Capital Markets. White paper, May 2026. Summarised at https://www.dtcc.com/news/2026/may/13/tokenized-collateral-could-unlock-billions-in-capital-and-transform-liquidity-management.

6 FSB (Financial Stability Board) (2024). The Financial Stability Implications of Tokenisation, 22 October 2024. https://www.fsb.org/uploads/P221024-2.pdf. Executive Summary and Section 2.

7 Agur, I., Villegas-Bauer, G., Mancini-Griffoli, T. and Martinez Peria, M. S. (2025). Tokenization and Financial Market Inefficiencies. IMF Fintech Note 2025/001, January 2025. https://www.imf.org/en/Publications/fintech-notes/Issues/2025/01/29/Tokenization-and-Financial-Market-Inefficiencies-561256.

8 IOSCO (International Organization of Securities Commissions) (2025). Final Report on the Tokenization of Financial Assets. November 2025. Key findings in media release IOSCO/MR/18/2025, 11 November 2025. https://www.iosco.org/news/pdf/IOSCONEWS778.pdf.

9 BIS (Bank for International Settlements) (2025a). Annual Economic Report 2025, Chapter III: "The next-generation monetary and financial system". June 2025. https://www.bis.org/publ/arpdf/ar2025e3.htm.

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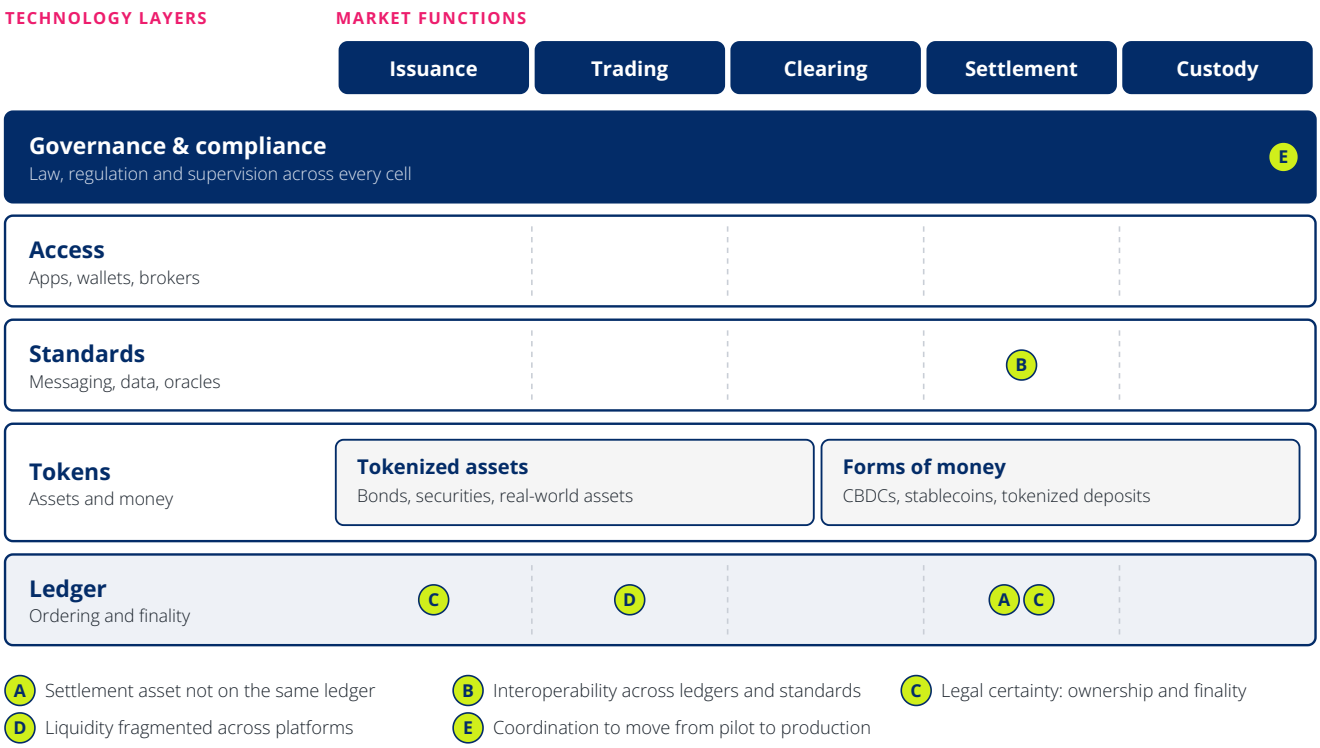
payment can be final before ownership passes. Powers to freeze or claw back holdings cut both ways: stablecoin issuers froze a large part of the US$6.3 billion stolen from Binance in October 2026, but the same powers can strip holders of protections they rely on, so they need the safeguards set out in Area 4. Operationally, keys can be lost, and the largest thefts have come not from flaws in ledgers, but from what surrounds them: compromised staff devices, wallet software and suppliers, which have defeated even multi-signature cold storage, and bridges between ledgers. Code can also fail. Atomic settlement gives up the liquidity savings of netting, and stablecoins used for settlement can suffer runs, as some did in 2022 and 2023. Where one group runs the issuer, the trading venue and the custodian, conflicts of interest and single points of failure follow. And schemes designed to fall outside existing rules can leave holders, especially retail holders, without any authority's protection. The toolkit helps an authority weigh these risks against the gains, scheme by scheme, and reach one of the five outcomes set out above.

A TOKENIZED ECOSYSTEM

Many diagrams of a tokenized ecosystem are adapted from models of decentralised finance. Ours separates the market functions from the technology that performs them.

FIGURE 1.1

The tokenized ecosystem: market functions by technology layer, with recurring challenges marked



Source: GFTN.

Market functions are the same whether or not an asset is tokenized. Tokenization changes how they are delivered and can combine some of them, but each still has to be performed, and someone must be accountable for it.

Market functions

- **Issuance and registration.** Creating the asset and keeping the legal record of ownership. For many tokenized assets this record stays off the ledger, and the token is a digital twin of it; where the law recognizes the ledger as the record, the token is issued natively.
- **Trading.** Exchanges, multilateral trading facilities, dealers and trading protocols on a ledger, through order matching, requests for quotes or internalisation.
- **Clearing.** Confirming trades and calculating obligations, including netting and, where a central counterparty is used, novation, margining and default management.
- **Settlement.** The final transfer of the asset and the cash, in central bank money, commercial bank money or a tokenized equivalent. The settlement system's rules, backed by law, determine when a transfer is final; for a digital twin, ownership passes only when the off-ledger register is updated.
- **Custody and asset servicing.** Safekeeping, key management, corporate actions and collateral management. With tokens, key management becomes a core custody function.

Technology stack

- **Ledger infrastructure.** The ledger, public, permissioned or run by a central bank, where transactions are ordered and validated, with its scaling arrangements. Technical finality on a ledger differs from legal finality, which depends on law and on the system's designation.
- **Asset representation.** Tokens and smart contracts representing claims, such as securities, deposits, stablecoins and central bank money, with their transfer rules and lifecycle events. This is where legal ownership meets its digital record.
- **Protocols and standards.** The common rules that let parties and systems work together, including messaging standards

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such as ISO 20022, token and data standards, identifiers (ISIN, LEI, DTI), links between ledgers, oracles that bring outside data onto the ledger, and standard workflows such as delivery versus payment.

- **Access and applications.** Wallets, trading interfaces, and broker and custodial platforms through which retail and institutional users reach the system.
- Governance and compliance run through both. Identity checks apply at the point of access, transfer restrictions sit in the asset's code, custody rules govern key management, and finality rules apply at settlement.

Each function can sit at different points in the stack. A venue may match orders off the ledger and settle on it or run entirely on the ledger. Operational risk gathers where one firm bundles several functions, as in the collapse of crypto exchanges that combined trading, custody and lending, and where systems on and off the ledger meet, through bridges, oracles and links to off-ledger registers.

Separating money from other assets is a simplification. Central bank digital currencies, stablecoins and tokenized deposits differ in who issues them, the credit risk they carry and their legal status, and each raises its own questions for monetary policy and financial stability. Frameworks such as MAS's stablecoin framework and the EU's MiCA often draw their boundaries along these lines.

The view also marks five recurring challenges: **A**, the settlement asset is not on the same ledger; **B**, interoperability across ledgers and standards; **C**, legal certainty over ownership and finality; **D**, liquidity fragmented across platforms; and **E**, coordination to move from pilot to production.

CONTRIBUTIONS FROM THE PRIVATE SECTOR

A pathways toolkit for tokenized markets would not be complete without the views of the private sector, which supplies what scale requires: issuance volume, liquidity, distribution and the commercial networks that turn pilots into markets. The question we asked was why tokenized markets are not yet scaling. Through GFTN's open call and working groups, we asked firms from across the tokenization chain for specific examples of what holds them back and reviewed most of the resulting problem statements with public-sector participants. The problem statements reflect the views of their contributors, firms with a stake in the outcome, not those of GFTN. The first call identified eight frictions:

- Stablecoin Settlement within Regulated Payment Licences
- Tokenized Market Access for Small Investors, with Investor Protection
- Recognizing AI Agents as Payment Initiators
- Standards and Identity for Cross-Domain Interoperability
- Proportionate Compliance for Banks on Public Blockchains
- Recalibrating FMI Regulation for Tokenized Settlement
- Quantum-Safe Security for Tokenized Assets
- Settlement Coordination for Tokenized Deposits

Seven of these frictions point to coordination between authorities as the main barrier: progress depends on more than one authority acting, within a jurisdiction or across borders. Publishing them puts these issues on the record, so that firms and authorities can judge whether they share them and debate how they might be resolved. They also give each authority a starting point when it assesses a scheme. Section 3 maps each friction against the stylized tokenization chain and the toolkit. Each country should weigh them against its own starting conditions rather than adopt them as given. GFTN intends to update the playbook as further frictions emerge.

THE COORDINATION PROBLEM

At GFTN we think in terms of tokenized markets rather than digital assets, because what a token can do depends on the market it trades in, not only on the asset it represents. A market is the buyers and sellers of an economic exposure, wherever they trade: a share listed on two exchanges and a depositary receipt for it form one market, because each give substantially the same exposure, risks and rights, and traders can move between them. A tokenized bond is part of the bond's market, sharing its price and liquidity, only if its holders have the same claim, the same protection if the issuer fails and the same ability to sell, and if dealers can create and redeem tokens against the bond efficiently. Otherwise, dealers treat the token as a different instrument. It forms a market of its own, usually much thinner, whose price can drift from the bond's. Some schemes fill the gap by paying for trading volume, but that trading may stop when the payments stop; our research on tokenized shares traded on public blockchains found much of their trading driven by such rewards. Beyond price, what a token is useful for depends on who will buy it, lend against it or accept it as collateral, with what money, and under what rules.

Cross-border payments show what is at stake. Banks reach each other abroad mainly through correspondent banking, a web of bilateral accounts with credit and liquidity exposure at each link, pre-funded balances, limited transparency and compliance checks repeated at every step. As banks have cut back these relationships, reach has narrowed in some corridors. Tokenization can replicate this web, linking separate ledgers through intermediaries and bridges that recreate chains of exposure. Or it can replace parts of it with direct access to a common ledger, shared rules and settlement in a safe asset. The outcome is likely to combine the two, since common ledgers also tier access. Either way, what a bank gains depends on which counterparties, assets and forms of money it can reach, and on what terms.

The money used to settle often determines how much tokenization changes. When a tokenized bond settles against cash in a conventional payment system, delivery versus payment is still possible by linking the ledger to the RTGS system, but settlement is then bound to that system's operating hours and processes. Several early DLT bond issuances, beginning with the World Bank's bond-i in 2018,[10] settled cash in this way, which limited their effect on settlement times.

[10] World Bank (2018). World Bank Prices First Global Blockchain Bond, Raising A$110 Million. Press release, 23 August 2018. https://www.worldbank.org/en/news/press-release/2018/08/23/world-bank-prices-first-global-blockchain-bond-raising-a110-million.

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Building such markets runs into obstacles that no single firm can remove. MAS has named three gaps.[11]

- **Reliable settlement assets.** Tokenized assets need a settlement asset on the same ledger, or one that works with it. The BIS warns stablecoins fall short as sound money and, unregulated, threaten stability and monetary sovereignty.[12]
- **Common standards.** Shared standards for tokenized assets, and for connecting ledgers across jurisdictions.
- **Institutional-grade infrastructure.** Wholesale transactions need predictable performance, governance and regulatory compliance, which MAS does not yet see on public networks. MAS's Global Layer One (GL1) initiative is working on shared infrastructure of this kind.

The law must also recognise token-based ownership, settlement finality and insolvency treatment.

Each of these gaps raises the cost of joining a tokenized market, and no firm gains from joining first unless enough others join too. Network effects therefore favour existing arrangements, and schemes stay at the pilot stage. This is a coordination failure, and no single firm or authority can resolve it alone.

The Tokenization Pathways framework does not resolve this failure on its own. It gives an authority a structured way to assess one scheme at a time. For each, it establishes whether ownership and finality have a legal basis, which settlement asset will be used, which market the scheme would join or create, and which authority needs to act at each step. Its questions are there to find what a proposal leaves out, and to turn each finding into a decision to support the scheme, allow it within limits, watch it, send it back or decline it. The framework and its online guide together make up the toolkit. Used consistently across authorities, they make these preconditions clear to firms, which can reduce the uncertainty that keeps each of them waiting for others to move first.

This work has been possible due to the many contributions and dialogues had with stakeholders across the ecosystem. It is not intended to be a final version and we intend to continue to update it with feedback, responses and views as authorities use this and markets start to scale.

A full report and online toolkit are available to authorities upon request.

[11] FIA (2026). Global regulators see momentum in tokenisation but warn hurdles remain to scale. FIA MarketVoice, 23 March 2026, reporting remarks by Ian Chung, Executive Director, Markets, Infrastructures and Intermediaries Department, MAS, at the FIA Global Cleared Markets Conference. https://www.fia.org/marketvoice/articles/global-regulators-see-momentum-tokenisation-warn-hurdles-remain-scale.

[12] BIS (2025a), op. cit. The BIS assesses stablecoins against three tests (singleness, elasticity and integrity) and finds that they perform poorly on all three.

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GFTN · TOKENIZED MARKETS

SECTION 2
TOKENIZATION PATHWAYS TOOLKIT

A country assessment framework

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STATUS AND LIMITATIONS OF THIS PAPER

This paper sets out a method that a competent authority can use to examine a proposal to tokenize an asset. It does not create, amend or interpret any legal or regulatory requirement, and no one may rely on it as a determination.

It is written for the authority, the person who commissions an assessment, and the person who leads it. The proposals it anticipates come from issuers, platform and protocol operators, registrars, transfer agents, custodians and corridor operators.

Each scheme is assessed on its own facts and under its own governing law. A finding about one scheme should not be applied to another that has not itself been assessed. The method does not set international standards, rank jurisdictions, score readiness, or make the authorities' formal decisions.

This paper describes assignment, negotiation, documents of title, control and electronic transferable records as concepts found in many legal systems. What they mean, and whether they apply at all, depends on the law governing the instrument. The assessment team should obtain advice on that law rather than rely on the general description here.

The framework is used on one scheme at a time. Each assessment answers the question the authority has to decide about that scheme, ends in a single recommendation, and leads to the decisions each authority then takes. Deferring or stopping are valid outcomes. Asking the questions does not by itself guarantee a better outcome. Evidence from comparable exercises is mixed: compliance with the Basel Core Principles has not been robustly linked to bank soundness, except for the principles on information provision.[13] The framework is therefore built so that what it finds reaches the people who must act on it.

HOW THE ASSESSMENT WORKS

An authority is usually asked to consider a specific scheme, not tokenization in general. A sponsor proposes that an existing legal instrument, such as a share, a note, a fund unit, a registered title, a deposit, a warehouse receipt, a bill of lading or a receivable, should be operated through actions on a distributed ledger. Where the instrument is new, or mixes features of several categories, its legal features are worked out first and its classification is settled separately.

The framework sets out how the authority establishes whether that arrangement is lawful, effective and safe within its mandate, and what it should then do: support it, allow it within limits, monitor it, or decline it.

The assessment starts with the instrument, its governing law, and where its ownership is recorded today. Without them there is nothing to test the ledger against.

The assessment team then sets the instrument's legal features beside the ledger's actions. The ledger performs some of the features. Others stay off the ledger and are performed by identified parties. And some ledger actions, such as a power to freeze a holding, have no basis in the instrument at all. These are the parts a sponsor's description tends to leave out, and much of the method exists to find them.

The team then asks the assessment questions, in order.

- Which features does the ledger perform, and which powers does the scheme add that the instrument does not provide for?
- Does each ledger action have the same legal effect, under the same conditions, as the feature it performs?
- Can each action be carried out reliably, with the data, authority and records its legal effect needs?
- Who performs the work that stays off the ledger, under what obligation, and how would anyone know if it stopped?

The nine assessment areas cover these questions in detail. Area 1 asks whether the scheme is worth doing, and whether the instrument is sound without it. Area 2 asks what the instrument is, how faithfully the ledger reproduces it, and which record governs. Areas 3 and 4 ask whether the scheme works end to end, and who holds the powers it adds. Areas 5 and 6 cover payment and settlement, and how the scheme works with other systems and countries. Area 7 covers what happens when something fails, Area 8 which authorities are responsible and whether they can act, and Area 9 the effects on public policy and whether the country can implement the scheme.

Each finding is a judgement on the evidence, not a numerical score, and findings are never combined. Because legal findings apply to a single design, the same law can make one design unworkable and another workable. In the worked example in Annex A, the law does not recognize control of an electronic record, so a ledger transfer cannot give a lender clean title to a gold certificate if the ledger is meant to be the register. The same transfer is legally effective if the vault's register remains the legal record of title and the ledger only coordinates the steps.

The assessment ends in a recommendation to the authorities concerned. It says whether the proposal should go ahead, at what stage and scale, and on what conditions, each with an owner, evidence that it has been met, and an authority able to act if it is

[13] Demirgüç-Kunt, A., Detragiache, E. and Tressel, T. (2008). Banking on the principles: Compliance with Basel Core Principles and bank soundness. Journal of Financial Intermediation, 17(4), 511–542. Demirgüç-Kunt, A. and Detragiache, E. (2011). Basel Core Principles and bank soundness: Does compliance matter? Journal of Financial Stability, 7(4), 179–190.

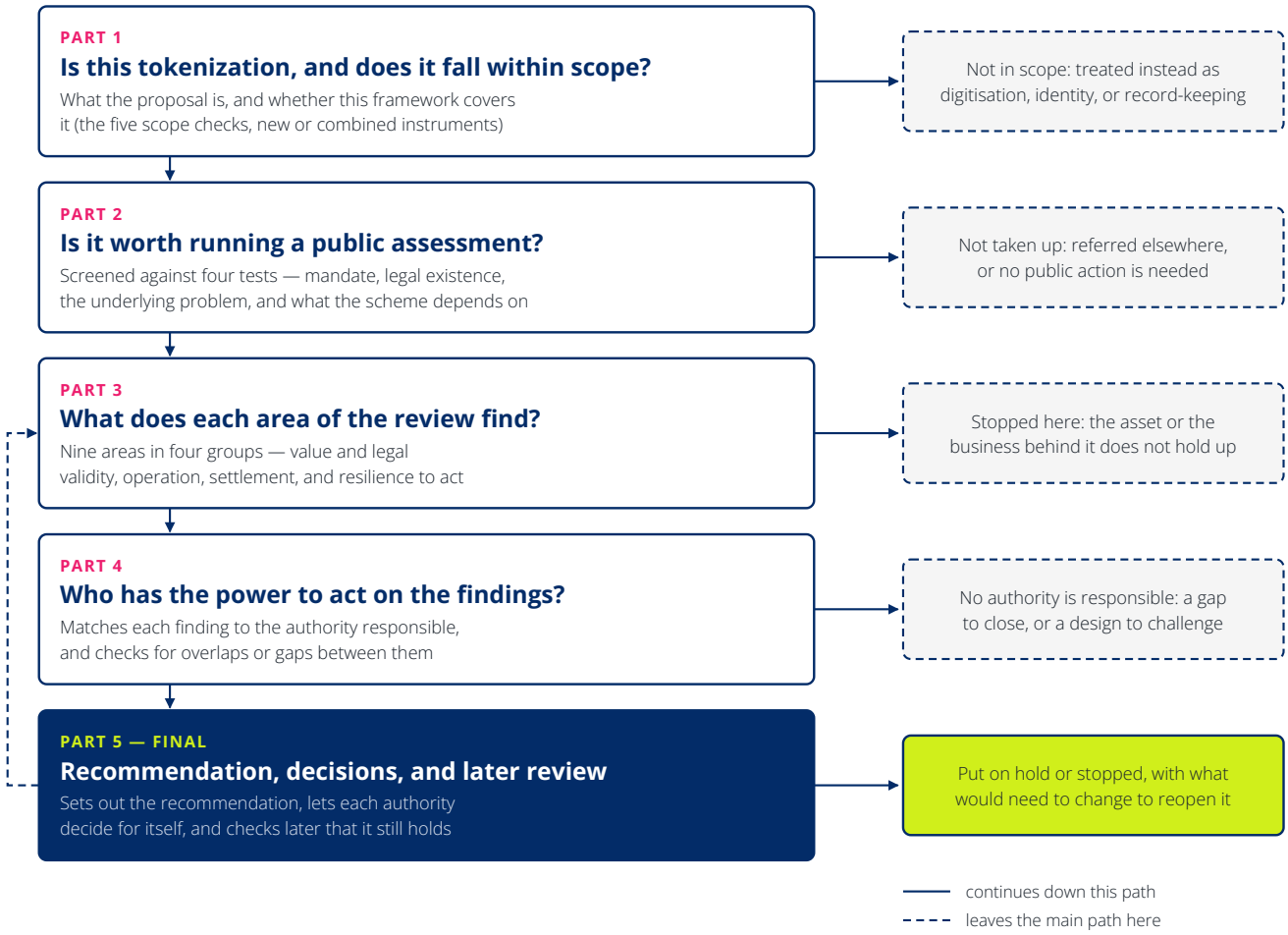
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not (Framework Section 5.7). Where the benefits are real and could not be had another way, the same findings make the case for support, such as access to central bank settlement, a place in a sandbox, public funding or a change in the law. Recommendations are non-binding and each authority makes its own determination.

FIGURE 2.1

The assessment is in five stages

Reviews can end at any stage with an explanation. If something observed later differs from expectations, only the findings directly affected by it are revisited starting again at the third stage "Part 3".



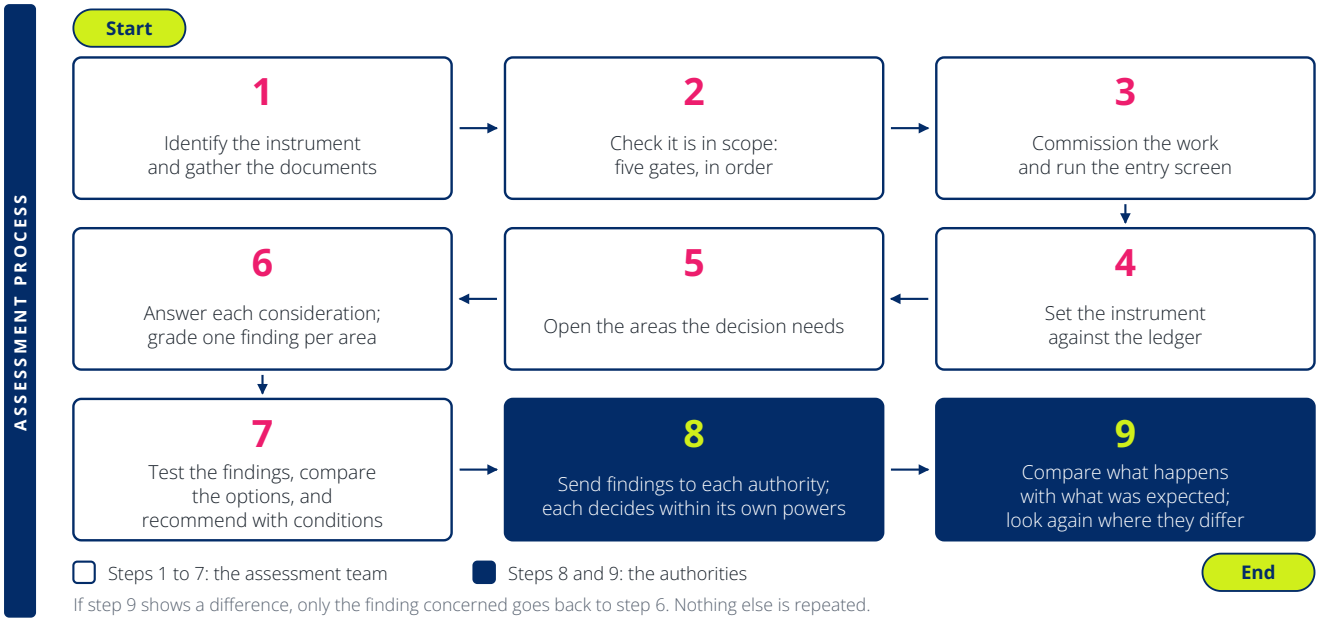
Source: GFTN.

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FIGURE 2.2

The assessment process

Steps 1 to 7 are the assessment team's; steps 8 and 9 belong to the authorities. If what is observed at step 9 differs from what was expected, only the finding concerned goes back to step 6.



Source: GFTN.

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PART 1
DIAGNOSTIC FRAMEWORK

1.1 WHY THE FRAMEWORK IS NEEDED

Authorities receive proposals in payments, collateral management, asset tokenization and market infrastructure. Digitizing each institution's own records removed paper from the process but did not fix coordination between institutions, as the persistence of correspondent banking chains in cross-border payments shows, at a real economic cost.[14] [15]

This framework starts from the view, set out in Section 1, that what a token can do depends on the market it trades in, not only on the asset it represents. An authority assessing a proposal therefore looks at the market the token would trade in, as well as at the asset itself.

Proposals differ in how much they change that market. Many are a lift-and-shift, moving existing bilateral messaging between banks onto a distributed ledger with the same parties and the same process, and rarely save enough to justify the costs and risks of the change. Others change how the market works, such as who keeps the records, how trades settle or who can take part. Some make possible a market that was not practical before, such as repo that opens and closes within a few hours in place of intraday overdrafts.[16] The authority needs to know which kind it is looking at.

The international bodies that have studied tokenization reach a similar view. The FSB finds that many of its claimed benefits have yet to be proven, may not be unique to tokenization, and may involve trade-offs that cancel them out, and that some depend on trading and settlement taking place on the same platform or on platforms that work together.[17] The IMF expects some inefficiencies to fall, others to remain and new ones to appear.[18] IOSCO finds the efficiency gains so far uneven, and the risks mostly familiar ones that show up in new ways.[19] The BIS sees tokenization as able to "improve the old and enable the new", with its full benefits only where central bank reserves, commercial bank money and other assets are brought onto the same platform.[20]

Every kind carries costs and risks. The costs include building the new system, connecting each participant to it, and running the old and new records side by side during the move. The risks include doubt over whether a transfer on the ledger is legally final, dependence on the network's operator and technology providers, holdings lost when keys are lost or stolen, and errors in the code that move assets without legal authority. A buyer's payment can also be final while the token's link to the asset, or some of the holder's rights, is missing (Area 2).

The savings can come from public infrastructure open to everyone, or from a consortium network open only to its members. A consortium network can still deserve approval or public support when its savings for the sector in operating costs, liquidity or capital clearly exceed those costs and risks. It must not draw trading away from existing venues onto one that no authority oversees, and other firms must be able to join it on fair terms. Considerations 4.7 and 4.8 test how revenues, costs and profits shift, and whether access becomes concentrated. Consideration 9.4 sets out what the responsible authorities then need to do.

This framework gives the assessment team a way to weigh those savings against the costs and risks, and to recommend whether approval, support or public intervention is justified.

1.2 WHAT COUNTS AS TOKENIZATION

An asset is tokenized when a legal instrument, whether a claim on an issuer or a right in property, such as a share, a deposit or a registered title, is recorded and transferred as a token on a shared ledger that can run programs. Unbacked crypto-assets such as bitcoin exist only as ledger entries, with no instrument behind them, so they are not tokenized assets in this sense. In some schemes the token mirrors a claim recorded in a register off the ledger, which remains the legal record of title; such a token is often called a digital twin. In others the ledger is itself the legal record of title, which is called native issuance.

To assess a proposal, the framework looks at tokenization from the side of the law. It treats a scheme as a mapping of an existing legal instrument onto the actions a ledger can take and asks whether each action does in law what the instrument requires. The mapping has the following parts.

The instrument. The asset as the law sees it, including the legal documents that create it, its governing law, the register where its ownership is recorded, and the parties with obligations under it.

Legal characteristics. The rights, powers, duties, restrictions, conditions, priorities, defences and remedies the instrument carries, and the events that create, change, suspend or end them.

Ledger actions. What the ledger's smart contracts can do to holdings or records, such as transfer, freeze, redeem or pay out, together with who may start each action and the legal effect it is meant to have.

Mapping means matching each legal characteristic to the ledger action that performs it, where there is one. The word is not used for the process diagrams the assessment also produces.

The programs that carry out ledger actions are called smart contracts. They work differently on different platforms, and a smart contract may or may not be a contract in law. The framework

14 BIS (Bank for International Settlements) (2026). Annual Economic Report 2026. June 2026.
15 DFCRC (Digital Finance Cooperative Research Centre) (2026). Unlocking Australia's $24b Digital Finance Opportunity: The Economic Impact Potential of Digital Finance Innovation in Australia, with the Digital Economy Council of Australia, March 2026. https://dfcrc.com.au/wp-content/uploads/2026/03/260310_DFCRC_Economic_Impact_Report_V10_Single.pdf.
16 DTCC and Finadium (2026), op. cit.
17 FSB (2024), op. cit.
18 Agur and others (2025), op. cit.
19 IOSCO (2025), op. cit.
20 BIS (2025a), op. cit.

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therefore judges each ledger action by what it does in law, not by how it is coded. The same questions apply whether the ledger is a permissioned network, a set of synchronised ledgers or an open public network; only the answers differ.

The definition sets the scope of the assessment. It does not decide how national law classifies the instrument.

A venue or settlement network that carries many instruments is assessed as one scheme. Area 2 is answered for each class of instrument it carries, and the other areas once for the platform.

Some features that often appear in tokenization proposals are treated as follows.

Interchangeable units. Whether units can be treated as interchangeable depends on the legal claim each one carries, not on the token standard used.

Stablecoins. A stablecoin is itself a tokenized instrument, the issuer's promise to pay money. It is assessed on how it is issued, what backs it, how it is transferred and redeemed, and what controls apply to holdings.

Minting and burning. These technical terms describe creating and destroying tokens. What matters is their legal effect, which may be to issue the instrument, pay it off or cancel it.

Digital identity. Identity systems support a scheme but give no rights in the instrument. They are assessed in Area 6.

1.3 RECONCILING THE INSTRUMENT AGAINST THE LEDGER

Setting the instrument against what the ledger does sorts every legal characteristic and every ledger action into one of the groups in Table 2.1.

TABLE 2.1

What the reconciliation produces

Every legal characteristic is either mapped or unmapped, and every ledger action either has a counterpart or does not.

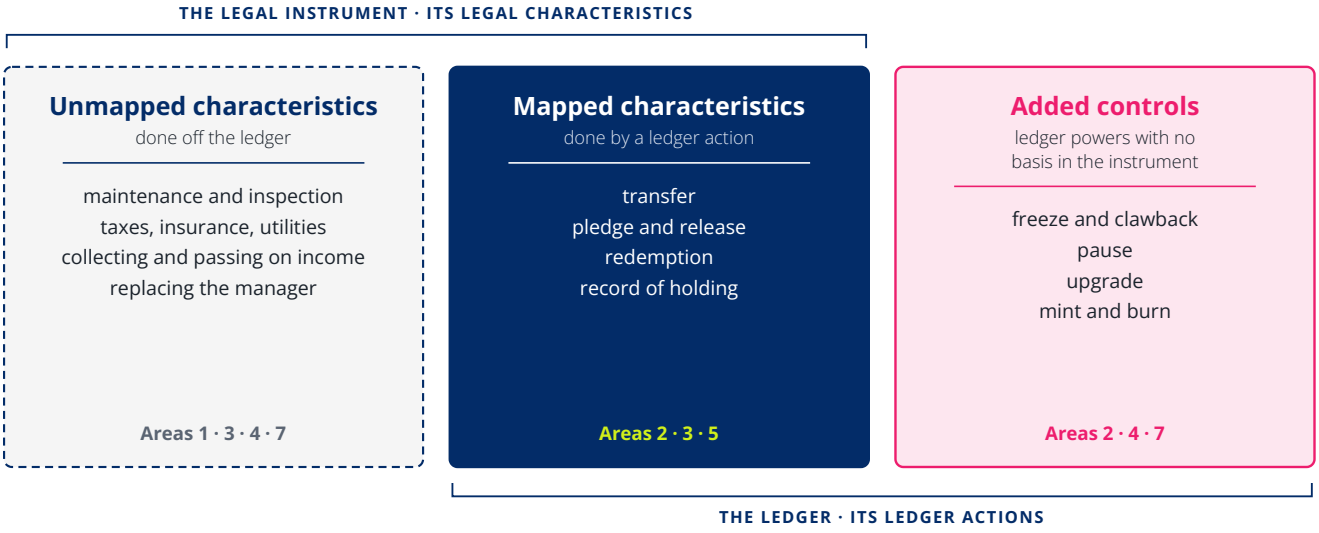
Part of the mapping	What it contains	Where it is assessed
Mapped characteristics	Legal characteristics of the instrument that a ledger action performs	Areas 2, 3, and 5
Unmapped characteristics	Legal characteristics the ledger does not perform, which identified parties continue to perform off the ledger	Areas 1, 3, 4, and 7
Added controls	Actions the ledger can take that have no basis in the legal instrument	Areas 2, 4, and 7

Source: GFTN.

FIGURE 2.3

The reconciliation

The instrument spans the left two panels; the ledger spans the right two. Only the mapped characteristics belong to both.



Every legal characteristic is either performed by a ledger action or not; every ledger action either has a basis in the instrument or does not.

Source: GFTN.

Identify all three before the detailed work begins. The unmapped characteristics include rights and duties as well as operating tasks. Alongside maintenance and the collection of income, they can include a vault's lien for unpaid storage charges, a defence the debtor can raise against a holder, or a right to set one debt off against another. Each needs a party accountable for it, and evidence that reaches the authority. Added controls, such as minting and burning, pausing, clawback, transfer restrictions and contract upgrades, give someone the power to act on holdings at their own discretion. For each, establish its legal basis, who holds it, the conditions on its use, and how a holder can challenge it. An added control can also take away a protection the scheme

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depends on. If someone can reverse a transfer on their own decision, a buyer can no longer rely on taking the asset free of claims that arose before the purchase. Nor can a lender rely on the asset as collateral that keeps its value if the borrower becomes insolvent.

1.4 THE ASSESSMENT QUESTIONS

TABLE 2.2

The four assessment questions

	Question	What it establishes
1	Extent. Which of the instrument's legal characteristics are mapped, and which controls does the scheme add that the instrument does not provide for?	Scope, and the controls created
2	Effectiveness. Does each ledger action produce the same legal effect as the characteristic it performs, under the same conditions? Which governs when the two differ?	Whether the ledger reproduces the legal effect faithfully
3	Feasibility. Can each ledger action be carried out predictably, with the data, authority, visibility, and durability its legal effect requires?	Whether it can be carried out
4	Work off the ledger. What does the ledger not perform? Who performs it, under what obligation, and how would the authority learn that it had stopped?	Where value is produced, and lost

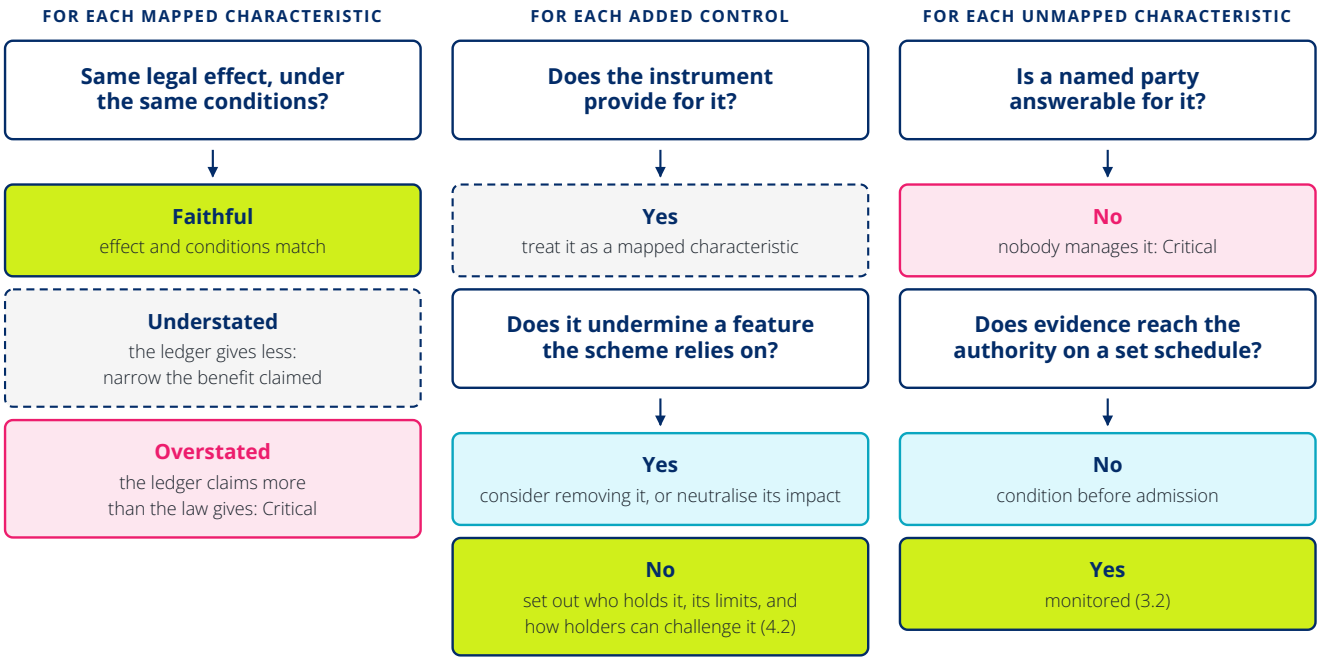
Source: GFTN.

FIGURE 2.4

The tests applied to each item

Each mapped characteristic, added control and unmapped function ends in one outcome, and the outcomes are combined as described in Section 5.5.

Each box under a question is one possible outcome. One applies to each item.



Source: GFTN.

The first three questions on their own only audit the technology. Much of the financial value, the legal recourse and the operational risk sits in the functions that stay off the ledger (question 4), so the assessment has to cover the whole scheme.

Testing effectiveness

Effectiveness is tested on the following points.

I. **Fidelity.** Whether executing a ledger action changes legal rights directly, keeps a legal record alongside another, or only mirrors something done off the ledger.

II. **Condition equivalence.** Whether the conditions in the smart contract match the conditions in the legal terms. They can differ in either direction.

   A. *Overly broad code. The code allows changes the legal terms do not. Exploits of smart contracts are the clearest case. Whether an attacker drains a contract, or someone moves funds out first to protect them, the assets move because the code allows it, without contractual authority. Such a transfer is valid on the ledger but may have no legal authority, in which case a court can set aside its legal effect, but it cannot itself reverse the immutable ledger entry. The remedy falls on*

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the person, not the record - restitution, a freezing order, or civil or criminal exposure, depending on the jurisdiction - unless the scheme's own rules give a legally binding way to correct the ledger itself.

B. *Overly narrow code. The code demands more than the legal terms do. If redemption needs a live external data feed, or every signer of a multi-signature wallet, then a failed feed or an absent keyholder locks the position on the ledger even though the contract allows it to be sold at once.*

III. Precedence and remediation. Before deployment, there must be a rule on which record governs if the ledger and the legal position diverge, and a legally binding way to correct the ledger. A technical override with no legal basis or oversight does not count.

Feasibility

Determinism. The same inputs produce the same result on every node, software version and network condition.

Data. Every outside input a condition depends on has a known source, arrives in time, is verified, and has a defined fallback if it fails.

Authority. The keys or roles that can start the action are known, are granted and withdrawn by a defined process, and belong to the party the instrument entitles to act.

Observability. The authority and the holder can find out afterwards what was done, by whom, and on what basis.

Durability. The cryptography and operations stay adequate for the instrument's whole life, and can be replaced without holders losing rights or evidence.

Test feasibility in proportion to the amounts at stake.

Work done off the ledger

The ledger cannot do the work of servicing an asset, such as maintaining a building, collecting debts, insuring a vault or running a company's governance. People do this work off the ledger. The assessment team confirms who is accountable for each task, the legal duty they work under, how their performance is monitored, and what would show that it has failed. Sound smart contracts do not protect holders if the vault is uninsured, the rent goes uncollected, or the company's governance lapses.

1.5 GATEKEEPING THRESHOLDS AND THE REGULATORY PERIMETER

The assessment team applies the five gates in Table 2.3 in order and stops at the first that is not satisfied, so a proposal that fails is set aside for a single stated reason.

TABLE 2.3

The five gates, and what follows if one is not satisfied

	Question	Consequence if not satisfied
1	Is there an identified legal instrument, with a governing scheme and an applicable law?	An identified legal instrument exists under an established jurisdiction. If not, the asset is outside the regulatory perimeter; a novel or hybrid asset goes to legal characterisation first.
2	Can the instrument's legal characteristics be expressed as conditions that a ledger can execute?	The instrument's rights can be written as conditional logic. If not, the instrument cannot be operated on a ledger.
3	Is every ledger action specified, and linked to the legal effect it is intended to produce?	Each ledger action is tied to an intended legal effect. If not, the proposal is underspecified and goes back for technical work before it can return.
4	Do the ledger actions operate the instrument, rather than report on operations performed elsewhere?	The ledger operates the instrument, rather than reporting on it. If not, the proposal falls under oversight of off-ledger reporting.
5	Is the arrangement distinct from routine internal registry or book-entry modernisation?	The arrangement does something new compared with upgrading an existing register. If not, the proposal goes to the conventional depository or registry regime.

Source: GFTN.

Passing all five gates does not by itself justify public support. The scheme must still show additionality, meaning gains beyond those that a conventional alternative, such as a modern central database, would deliver.

New or hybrid instruments

Some instruments are new, or combine features of several legal categories, so their legal status is unclear. Do not rely on the label the sponsor uses. List the instrument's legal characteristics and compare each with the categories the governing law recognises. That is enough to assess how the instrument would work on a ledger. Which authority should supervise it is a separate question, and it can be left open while the rest of the assessment goes ahead.

Features without equivalence in existing law

Some schemes include a feature with no equivalent in existing law. Ask what users would lose without it, and whether the feature serves any purpose besides its effect on jurisdiction – interoperability with an existing system, a security requirement, or a technical standard, for example. If users would lose nothing and no such purpose is apparent, the feature's only effect is to change which rules apply or which authority has the remit. If the jurisdictional shift is not incidental, refer this finding to the authorities whose remit the feature affects.

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1.6 WHEN ANOTHER COURSE IS PREFERABLE

TABLE 2.4

When another course is preferable, and the consequence recorded

Finding	Consequence
Outside the perimeter. There is no identified instrument, or the ledger's actions have no legal or economic effect.	Treat it as digitisation, identity, or record keeping. The instrument must be fully specified before the framework is applied again.
Weak additionality (no benefit beyond the conventional alternative) No problem is evidenced, upgrading the conventional arrangement would give the same benefit, or the ledger changes nothing that matters.	Recommend keeping or improving the conventional arrangement, unless evidence shows a benefit only the ledger can give.
Mapping needs remediation. The instrument or underlying asset has not been verified, or the law does not allow the intended legal effect.	Recommend deferral, with conditions that establish legal title or enforceability under statute, and state what would reopen the work.
Limited mechanism. Something the mechanism depends on is missing, the underlying market is too thin for the liquidity or exit claimed regardless of tokenization, or existing law already gives the intended effect.	Narrow the recommendation to the functions the ledger supports, and compare other legal and operating routes.

Source: GFTN.

Table 2.4 shows when another course suits the problem better. Whether a public assessment is needed at all is a separate question, settled in Part 2.

1.7 WHERE THE VALUE COMES FROM, AND WHAT EACH SOURCE DEPENDS ON

A working ledger creates value only through the market built around it (Section 1.1). To test a claimed efficiency gain, identify which of the sources of value in Table 2.5 it relies on, and check the economic, operational and legal conditions that source depends on.

TABLE 2.5

Where value comes from, and what each source depends on

Mechanism	Friction addressed and dependency
Shared state (less reconciliation)	Removes duplicate record-keeping between institutions, but only if every participant moves to, and keeps, a single definitive ledger.
Coordinated legs (settling multiple legs on one ledger)	Conventional delivery-versus-payment (DvP) and payment-versus-payment (PvP) already remove principal risk. Settling both legs on one ledger adds settlement at any hour, across asset types, and on conditions written into smart contracts, but only if the cash leg settles on the same ledger, or in a settlement asset that works with it. Settlement is only as sound as the token delivered.
Conditional automation	Automates lifecycle events, such as corporate actions or escrow releases, but needs predictable code, reliable oracles, clear governance, and legal enforceability in proportion to the amounts involved.
Fractional access (smaller minimum investment)	Lets more investors take part, but needs every unit to carry the same legal claim, a credible way to value units, and a workable way to redeem or sell them.
Extended operation (24/7)	Removes limits on operating hours, but needs counterparties and liquidity available at those hours, and a way to settle the money leg then.
Collateral mobility (faster pledges and substitutions)	Speeds up the use and substitution of collateral, but relies on clear legal priority, enforceability across borders, and the transferee taking the asset free of prior claims.
Liquidity (trading close to the underlying's price)	Lets holders buy and sell at prices close to the underlying asset's, but only if firms can create and redeem tokens against it quickly and cheaply, market makers are paid to quote under stated obligations, and capital rules let them hold the token.

Source: GFTN.

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The benefits do not simply add together. Where one link, such as settling the payment, legal recognition or the participation of enough firms, still depends on existing systems, the gain is small.[21]

The benefits can also be undone by the added controls described in Section 1.3. A power to reverse transfers or freeze holdings takes away the clean title that makes a token useful as collateral, however fast it settles. The assessment team sets out which frictions the scheme removes, which new dependencies it adds, and whether the net benefit justifies the new risks.

A token does not inherit the liquidity of the asset it represents. It joins the market for that asset only to the extent that it gives substantially the same exposure, risks and rights (Section 1.1), and firms can create and redeem tokens against the asset quickly and cheaply, with the funding and access to both forms that this needs, as authorised participants do for exchange-traded funds. Otherwise the token trades as a separate and usually thinner market, and its price can drift from the underlying, most of all when the underlying market is closed. Internal GFTN research on tokenized shares traded on public blockchains found trading there small beside trading in the shares themselves, and much of it driven by rewards for trading.

Making a market in the token needs a stock of both the token and the underlying, a way to hedge when the underlying market is closed, authorisation to deal, and capital rules that let banks hold the token at a workable cost. Under the Basel Committee's standard on banks' cryptoasset exposures, a tokenized asset is treated like the asset it represents only if it meets conditions that include legally enforceable rights and settlement finality; otherwise the capital charge is much higher.[22] The Committee began a targeted review of the standard in 2025.

Some schemes pay for trading to get started. Rewards for trading volume, such as points or trading competitions, produce volume that says little about demand and may stop when the rewards stop. Market-making schemes on regulated venues pay instead for meeting obligations to quote, such as a maximum spread, a minimum size and a minimum time at the best price. In the EU, a firm that makes markets by algorithm must sign such an agreement with the venue.[23] The volume a business case relies on should exclude trading that only earns rewards, and the scheme should still cover its costs once the rewards end (consideration 1.10).

1.8 EXCLUSIONS AND BOUNDARIES

Proposals often bundle tokenization with related technology. This framework does not define tokenization by whether the law treats the ledger's record as determining legal title – it may, or that role may belong to a register running alongside it, or to a record held elsewhere, with the ledger only mirroring it; consideration 2.2 settles which. The defining test is different: whether the ledger's actions operate the instrument, producing its legal effects directly, rather than merely reporting on actions carried out elsewhere. That is the test at Gate 4.

Table 2.6 lists technologies that often come with a proposal but are not tokenization on their own.

TABLE 2.6

Adjacent technologies, and why each is not tokenization on its own

Adjacent topic	Why it is not a mapping
Digital identity	Authenticates parties and their authority. An operational dependency, not a mapping of an instrument.
Databases and APIs	Move information about the instrument. The existing register or account process retains definitive legal effect.
Oracles and data feeds	Supply outside information, such as a price, to a smart contract, without carrying any legal right.
Hash anchoring	Proves that data existed at a given time. It does nothing to a holding in law, and so fails Gate 4.
Securitisation alone	Creates or restructures the instrument. The resulting instrument may afterwards be mapped, and that mapping is assessed separately.
Fractionalisation alone	Divides the instrument into smaller units. Dividing it does not on its own make units interchangeable, create demand, give a way to value units, or give a way to sell them.

Source: GFTN.

PERMISSIONLESS NETWORKS AND BEARER CHARACTERISTICS

Putting a tokenized asset on an open, permissionless network makes it behave more like a bearer instrument, which passes to whoever holds it.

On a permissioned network, each participant is tied to an institution that answers for it. On a permissionless network, a transfer goes through on control of a cryptographic key alone. That changes what the authority can rely on. The assessment team examines when a transfer becomes final, how financial-crime rules are applied when tokens can move to wallets no regulated firm controls, and how a court order to recover tokens would be carried out after a key is stolen.

21 FSB (2024), op. cit.
22 BCBS (Basel Committee on Banking Supervision) (2022). Prudential treatment of cryptoasset exposures. December 2022. https://www.bis.org/bcbs/publ/d545.htm.
23 Directive 2014/65/EU on markets in financial instruments (MiFID II), Article 17(3); and Commission Delegated Regulation (EU) 2017/578 on market-making agreements and schemes.

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PART 2
DECIDING TO ASSESS

2.1 DECISION PURPOSE AND INTENDED OUTCOME

Before the assessment starts, the commissioning authority writes down, in one sentence each, the decision it needs and the outcome it is after.

- **The regulatory decision.** The decision the assessment will support, such as admission to a sandbox, regulatory approval, access to a central bank facility, or public funding for infrastructure.
- **The outcome sought.** The main policy objective, such as wider access to capital, faster collateral mobility, lower settlement costs, deeper market liquidity, or financial inclusion.

The authority identifies every institution affected, and the authorities responsible confirm that the outcome is one their mandates allow them to pursue.

The sponsor's proposal is evidence to be tested, not a description to be accepted. At each stage, the assessment checks whether the scheme would deliver the stated outcome.

2.2 WHETHER PUBLIC ASSESSMENT IS WARRANTED

Before committing supervisory resources, the authority checks whether the proposal raises a public policy question, a systemic risk or a statutory duty that justifies an assessment. It admits a proposal only if it can state, in a sentence each, the policy question, why it needs answering now, the decision the assessment will support, and the authorities with power to act on the findings. If it cannot, the proposal is declined for formal review.

The authority gives written grounds, and the conditions on which it would reconsider, naming who monitors the proposal, which indicators and events would prompt a fresh look, and a fixed review date.

Admitting a proposal means its evidence will be tested. It does not prejudge the outcome, which may be no intervention, supervision under existing powers, a change in law to close a gap, or coordinated oversight by several authorities. Each later step is checked against the authority's objectives, such as wider access to capital, faster collateral mobility or lower settlement costs.

2.3 ASSESSMENT TRIGGERS AND THE COUNTERFACTUAL MODEL

An assessment can start for many reasons: persistent friction in how an instrument works today, a proposal from a private firm, a policy review, a market disruption, a supervisory finding or a statutory duty. Whatever the trigger, the method and its standards are the same.

Where no scheme yet operates, the assessment team describes the scheme as it would have to work for the policy question to be answered. This counterfactual model states the simplest legal instrument and technical design that would do, and treats every design choice, dependency and assumption about the market as something to test. The model is what is assessed. The comparison it is judged against is the conventional alternative, at Area 1.

2.4 INTAKE SCREEN AND CHECKPOINT

The entry screen in Table 2.7, answered from preliminary evidence, lets the authority pick out the proposals that justify a full assessment. It comes before the assessment, and keeps the sponsor's claims apart from the review team's own view.

TABLE 2.7

The entry screen

Focus	Question	
Mandate	1. Who needs a decision, and why now?	Establishes who has jurisdiction, why the decision is needed now, and exactly what is to be decided.
	2. What decision is required, and which authority is entitled to take it?	
	3. What outcome is sought, in one sentence, and for whom?	
Legal existence	4. Which legal instrument does the scheme propose to map, under which governing law, and where is its ownership recorded today?	The hard perimeter test. If the instrument and its governing law cannot be named, the evaluation stops.

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TABLE 2.7 (CONTINUED)

Focus	Question	
The proposition	5. What problem affects the instrument, at which step, and for whom?	Tests whether tokenization fixes the actual problem. Code on a ledger cannot fix an unsound asset, broken servicing, or a business model that does not work.
	6. Are this proposal's issuer, operator, and business model sound today, without tokenization?	
	7. Which rights would ledger actions perform, and which would stay off the ledger?	
	8. Which controls or powers does the design add, and who holds them?	
	9. What realistic alternatives address the same problem?	
Dependencies and governance	10. What outside systems, data, and permissions does the scheme rely on, and on what terms?	Identifies the outside services the scheme depends on, any single point of failure, and which authorities must coordinate.
	11. Which authorities and specialists are involved, and what would each have to decide, permit, supervise, or change?	
	12. What decision question must the assessment answer, and what evidence would justify proceeding, narrowing, deferring, referring, or stopping?	

Source: GFTN.

Tokenization changes how an asset is operated. It does not cure badly made loans, weak custody, or cash flows that do not cover costs. If an asset such as illiquid trade receivables, commodities not held separately, or under-collateralised credit is unsound off the ledger, putting it on a ledger carries the same weaknesses over. Table 2.8 sets out the outcomes the authority can reach on the screening evidence.

TABLE 2.8

The proposition checkpoint and its consequences

Finding	Consequence
Insufficient mandate or definition	No clear decision, legal basis or identified legal instrument (fails question 4). Outcome: decline formal review.
Unsound asset or business model	*This proposal's issuer or operator has serious operational or financial weaknesses, whatever the technology (fails question 6 in table 7). This finding is about this proposal, not the asset type – a different issuer of the same instrument may pass where this one fails. Outcome: defer or end the evaluation, and return the proposal for the weakness to be addressed.*
Mismatched diagnosis	*There is a real problem, but tokenization does not address its cause, which may be legal or physical. Outcome: keep or modernise the conventional registry.*
Sound asset with evidence gaps	*The proposal is sound, but some technical or legal assumptions still need evidence. Outcome: allow staged testing limited to closing that gap.*
Sound asset with a plausible efficiency gain	*The instrument is sound, and tokenization shows a credible net gain for the sector over conventional alternatives. Outcome: admit the proposal to the full assessment.*

Source: GFTN.

2.5 WHAT THE ASSESSMENT CONSUMES AND PRODUCES

Inputs. The decision and the outcome sought, the documents listed in Section 2.6, and evidence such as market data, system logs, statements from those involved and stress-test results.

Outputs. The findings for each area, the options compared, and the recommendation with its conditions, set out in the documents described in Section 5.1.

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2.6 WHAT MUST BE ASSEMBLED BEFORE WORK BEGINS

The questions in Part 3 can only be answered from documents. At commissioning, the assessment team establishes which of the documents in Tables 2.9 and 2.10 exist, who holds them, and which must be obtained using a legal power rather than by request.

TABLE 2.9

Documents obtained from the sponsor

From the sponsor	Why it is needed
The legal documents that create the instrument: terms of issue, trust deed, fund or company constitution, certificate or receipt terms, offering document	What rights the holder has (Area 2)
The governing-law clause, and any legal opinion already obtained on what the instrument is and how it transfers	Which country's law applies, and what lawyers have already advised (2.1, 2.5, 2.10)
Evidence of the sponsor's standing in today's register, such as being the registered owner or the issuer	That the sponsor has the right to do what it proposes (2.1)
The functional specification of the smart contracts. For each action the ledger can take, what sets it off, which party may start it, the legal effect it is meant to have, and what happens if it fails	What the ledger actually does, so it can be compared with what the law requires (2.3, 2.4)
The deployed code, its change history, and everyone who holds a special key or role that can override normal transfers	Which extra powers the ledger gives, and to whom (2.3, 4.2, 7.4)
The cost and cash-flow model, with actual figures where the activity already runs	Whether the scheme can pay its way, and the volume it needs to cover its costs (1.5, 1.10)
The method for setting reserves, the insurance documents, and the latest independent audit	Who bears losses, and how much cushion there is (1.5, 1.6)
The custody agreement, including who holds the keys to the tokens	Whether holders control their own tokens, or a custodian controls them on their behalf (2.8)

Source: GFTN.

TABLE 2.10

Documents obtained from public and official sources

From public and official sources	Why it is needed
The law and rules for this type of instrument, and any law on electronic transferable records, digital assets, or control of electronic records	Whether the law allows the legal effect the sponsor intends (2.1, 2.5, 8.4)
The rules of today's register, such as the land registry, the company register, or the central securities depository	What an entry in the register does, and who can change it (2.1, 2.2)
How the law treats the insolvency of each party in the chain, including any company or fund that holds the underlying asset	What holders keep if any one of those parties fails (2.11)
The rulebook of any payment or settlement system relied on, and its finality provisions	When a payment becomes final and can no longer be reversed (5.2)
The tax treatment of each lifecycle event	The tax consequences, and the records needed to report them (6.5, 9.5)
Earlier decisions by any authority on comparable instruments or schemes	What other authorities have already decided, so that the assessment neither contradicts nor repeats it (8.3)

Source: GFTN.

Historical records are obtained separately and are frequently the most informative evidence available. Where the asset or activity already operates, obtain arrears, occupancy or utilisation, default and collection history, maintenance and inspection records, and any enforcement action taken against the operator. Where infrastructure is relied on, obtain its incident history. These establish the operating history at consideration 1.3 and the operator record at 1.4, and they are ordinarily held by municipal, tax, registry, or sectoral authorities rather than by the sponsor.

Where a document cannot be obtained, the assessment team identifies which question it would have answered and what the

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assessment relies on instead. An answer based on the sponsor's summary rather than on the document itself is Preliminary.

2.7 CONTRIBUTOR ROLES

One institution may hold several roles, and one role may be divided among several institutions. The record names the person accountable for each function, each connection between systems, each mandate, and each specialist question. Before the assessment starts, the authority names the following.

- Who commissioned the assessment, and who leads it.
- What the review covers, and the decisions it is meant to support.
- Who decides, and who funds the work.

It also gives each of the following roles to a named party, and keeps them separate.

- **Evidence generator.** Produces the operational, technical or financial data.
- **Independent verifier.** Checks the data the evidence generator produces.
- **Assessment lead.** Reviews the checked evidence and draws the findings together.
- **Condition sign-off authority.** Confirms that a condition has been met.
- **Enforcement authority.** Has the legal power to impose penalties, withdraw approvals or apply other remedies.

TABLE 2.11

Contributor roles

Role	What it supplies
Assessment commissioner	Authority to open the assessment, and the decision it is meant to support
Scheme sponsor	The instrument, the proposed ledger actions, the objective, and the backing of the institutions involved
Assessment lead	Brings together the evidence, the area findings, what they mean for each option, and the recommendation
Resource owner	Time, budget, and specialist capacity
Function performers	Evidence of how each function works today and would work under the proposal, including work done off the ledger
Interface owners	Evidence of how hand-overs between systems work, and how they fail
Public-mandate holders	Legal basis, powers, information rights, and decision rights
Sectoral or municipal authority	Rules for the asset class, local enforcement, and evidence of the asset's condition
Specialists	Answers on law, monetary policy, tax, and technology where a question calls for them
Participant representatives	Evidence on demand, access, protection, and the burden on participants
Independent challenger	Challenge to the baseline, to the comparison, and to who gains and who loses

Source: GFTN.

2.8 COMMON RISKS AND WHERE EACH IS ASSESSED

The risks in Table 2.12 recur across schemes and give the areas a common vocabulary. Each names a kind of cause, not an amount; the amount at risk in a particular scheme is its exposure, measured in the area that assesses it. The list is not closed, and a serious risk outside it is recorded with the others.

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TABLE 2.12

Recurring risks

Each is recorded once at its origin, and its consequences elsewhere are cross-referenced rather than restated.

Risk	What can go wrong	Primary areas
Legal	Rights not recognised, records disputed, no point of final settlement, transfers clawed back in insolvency	2
Credit	Loss of the full value, the cost of replacing a trade, and exposure to the issuer, obligor, counterparty, or settlement institution	5
Liquidity	Pre-funding and lost netting, runs on redemption, changes in funding cost	5
Custody	Lost keys, client assets not kept separate, no way to move holdings, gaps in recovery	2, 7
Operational	Outage, lack of capacity, provider failure, failed migration	7
Underlying-asset and operator integrity	The asset or activity deteriorates, loans are badly made or serviced, the operator is incompetent or dishonest, operating bills go unpaid, or reserves are too small	1, 3, 4, 5
Conduct	Conflicts of interest, manipulation, mis-selling, gaps in surveillance	4
Data and compliance	Privacy breaches, systems giving terms different meanings, gaps in sanctions screening and reporting	6
Market depth	Thin markets, unreliable prices, concentrated holdings, disorderly selling	1, 4
Policy	Loss of national control, capital flows, gaps in authorities' mandates, uneven gains and losses	8

Source: GFTN.

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PART 3
THE ASSESSMENT AREAS

FIGURE 2.5

The nine assessment areas, in four groups

Read together they move from value and legal validity to operation, settlement, resilience, and the country's capacity to decide and act.



GROUP I
Is the scheme worth doing, and does the claim hold in law?
Areas 1, 2

GROUP II
Does the scheme work end to end, and who controls it?
Areas 3, 4

GROUP III
When is payment final, and do the holder's rights move with the holding?
Areas 5, 6

GROUP IV
Does it withstand failure, and can the country decide and act?
Areas 7, 8, 9

Every area is accounted for. Only those the decision needs are opened; the others carry a reason.

Source: GFTN.

Comprehensive assessment guidance can be found in the full report and online toolkit.

3.0 USING THE ASSESSMENT AREAS

Examine only the areas the decision requires. Reviewing all nine is not the default.

When an area or question is left blank, say why.

- **Not applicable.** The scheme does not have the feature the question is about. This is a finding about the scheme.
- **Not reached.** The evaluation stopped before getting to it. This is a finding about the scope of the assessment.

Go as deep as the immediate decision needs, whether that is initial admission, the full assessment, or the use of a particular statutory power.

DRAWING THE STEPS OF A TRANSACTION

Before examining any area, the assessment team draws the steps of a transaction from start to finish, as they work today and as they would work on the ledger. The drawing lines up the legal rights held off the ledger with the logic on it, and shows every settlement step, every dependence on a payment, and every rule on which record prevails. Area 3 later checks that it is complete.

Evidence, applicability, and boundaries

Each area's finding rests on whether the evidence gathered is strong enough for the decision at hand, and on which questions or areas do not apply to this scheme, and why; Table 2.20 (Section 5.5) records both formally for every answer. Two practical tables follow: Table 2.14 gives the triggers that switch a consideration's applicability on or off for a given scheme, and Table 2.15 shows which Area to assess a cross-cutting question in, so it is not assessed twice.

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TABLE 2.13

Three constructed examples of area coverage

The blanks for the residential scheme differ from those for the registry scheme: the registry scheme has questions that do not apply to it, while the residential scheme has areas nobody reached.

Area	Registry modernisation	Tokenized gold collateral	Residential property scheme
1. Purpose and viability	Examined in full	Examined in full	Examined; the instrument was found unsound at 1.3 to 1.6
2. Instrument and mapping	Examined in full	Examined in full	Not examined; work stopped at the proposition checkpoint
3. Operation and lifecycle	Examined in full	Examined in full	Not examined; work stopped
4. Governance and controls	Examined in full	Examined in full	Not examined; work stopped
5. Money and settlement	Examined; 5.1 to 5.8 do not apply, because the scheme creates no payment obligation	Examined in full	Not examined; work stopped
6. Interoperability and reporting	Examined in full	Examined; 6.7 and 6.9 do not apply, because nothing moves across systems or borders	Not examined; work stopped
7. Resilience	Examined in full	Examined in full	Not examined; work stopped
8. Mandates and capability	Examined in full	Examined in full	Examined for the municipal, housing, and tax mandates only, to identify who could act
9. Policy effects and implementability	Examined in full	Examined; 9.6 and 9.7 do not apply, because the issuer, operator, and record are domestic	Not examined; work stopped

Source: GFTN.

TABLE 2.15

Boundary guide

If the question is mainly about	Assess it in
Whether the instrument and the claim exist in law, and whether the ledger reproduces their legal effect	Area 2
Whether a payment or asset obligation is discharged	Area 5
Whether the ledger's actions cover the instrument's whole life	Area 3
Whether two systems remain consistent	Area 6
Who holds the controls the scheme adds	Area 4
What happens when a provider or operator fails	Area 7
Whether the scheme is worth doing	Area 1
Whether an authority has the power to act on a finding, and the means to do so	Area 8
What the scheme does to public policy, and whether it can be implemented	Area 9

Source: GFTN.

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TABLE 2.14

Architectural triggers

Answer each on its own. A consideration that does not apply because of a trigger is recorded with the reason; that is a finding about the scheme, and is not the same as an area the work never reached.

Trigger	What applies if the answer is yes	What does not apply if the answer is no
Payment or settlement Does money change hands through the scheme – whether to buy or redeem its tokens, pay dividends, or because the token itself is a form of money, such as a tokenized deposit or stablecoin, used to make a payment?	Area 5 in full, and consideration 3.5 where the token is used as collateral.	Considerations 5.1 to 5.9. Area 1 still applies, to check fees and how the scheme is funded.
Something off the ledger Does the token depend on something outside the ledger, such as a building, gold in a vault, or a company's shares?	Considerations 1.3 to 1.6, 2.9, 3.1 to 3.4, and 4.5, and Area 7 on the failure or insolvency of the operator.	Consideration 2.9, and the parts of 1.3, 3.1, and 4.5 that concern the asset's condition.
A network the operator does not control Is the network run by parties the operator does not control, such as a public blockchain where independent validators confirm transactions?	Considerations 7.1 and 7.9, and the guidance on networks the operator does not control.	Consideration 7.9. Consideration 7.1 then covers only the operator's own systems.
Retail holders Can members of the public, not only professional investors, hold the tokens?	Consideration 4.5 on disclosure suited to each audience, and considerations 8.7 and 9.4 on investor protection.	Consideration 8.7. Disclosure is then judged against what professional investors need.
Cross-border activity Is any part of the scheme in another country: the asset, the issuer, the operator, or the records?	Considerations 6.7, 9.6, and 9.7, and Area 8 where a foreign authority's mandate is involved.	Considerations 6.7, 9.6, and 9.7.
Use as collateral Is the token pledged or used as security for loans?	Considerations 3.5 and 5.8, and 4.11 on market depth and liquidity.	Considerations 3.5, 5.8, and 4.11.
Software acting for holders Can software act on holdings for a holder, without a person approving each action?	Consideration 7.11 and Extension E1.	Extension E1. Consideration 7.11 then covers only contract rules that execute the same way every time.

Source: GFTN.

GROUP I Is the scheme worth doing, and does the claim hold in law?

AREA 1. PURPOSE, ADDITIONALITY, EFFICIENCY, AND ECONOMIC VIABILITY

> **Objective.** *This area establishes whether the scheme is worth doing. It tests whether a problem is evidenced in how the instrument works today, or demand for a market that does not yet exist, whether the scheme adds real value over realistic alternatives, whether expected demand supports the operating model, and whether the instrument, its operator and its economics are sound without any mapping.*

1.1 Whom does the scheme serve? Which problem in the instrument's present operation does it address, or which market or transaction does it make possible that does not exist today? Which decision must the assessment support?

1.2 What evidence shows that the instrument's present operation causes material cost, delay, exclusion, operational risk, or service failure? At which step does each problem arise? Where the scheme creates a new market, what evidence shows demand for it?

1.3 Does the underlying asset or activity exist, and what condition is it in? Is it operated lawfully, with the licences and permits it needs? What is its operating history?

1.4 Is the operator or manager competent to run this kind of scheme, and financially sound in its own right? What is its track record operating similar schemes or assets? What conflicts of interest does it have – for example, between its own fees or affiliated dealings and holders' interests? If it failed or had to be replaced, is there a practical way to do so, structurally, so the scheme can continue without interruption?

1.5 What revenue does the scheme earn? What does it cost to run, including operating obligations, taxes, insurance, and compliance? What reserves does it hold, and who absorbs losses?

1.6 How does the instrument behave under stress, and how is deterioration detected and reported? What arrangements

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exist to put problems right, replace the manager, and wind the scheme down?

1.7 How does the proposed arrangement compare with the present operation, or with the nearest substitute where the market is new, on capacity, speed, availability, accuracy, cost, ease of use, and service quality?

1.8 For each expected benefit, does the improvement come from the scheme itself, or from another change that could be made without it, such as new law, common data standards, better links between systems, redesigned processes, automation, or a larger market? Benefits include lower cost, more revenue, more customers, steadier earnings, and lower risk.

1.9 Does the scheme perform better than the realistic alternatives? These include improving the present operation, a hybrid model, a narrower scope, deferral, and not proceeding.

1.10 At what volume of activity does the scheme cover the costs established at 1.5? What evidence shows that the market concerned can reach that volume? How much of it depends on rewards to traders or liquidity providers, and does the scheme still cover its costs when they end?

1.11 Which participants, assets and forms of money must the scheme reach for its benefits to arise, and which has it secured? Do the parties it needs, including those performing the unmapped functions, have enough reason to join and perform their roles?

1.12 Who would be affected if the scheme operated or failed, without holding a position under it or being party to its rules? What would they be exposed to? Which authority is responsible for them?

1.13 Where public powers, public infrastructure, or public funding are involved, who gains and who loses, and has that been assessed?

AREA 2. THE INSTRUMENT, THE MAPPING, AND THE AUTHORITATIVE RECORD

> **Objective.** *This area establishes what the legal instrument is, which of its legal characteristics the ledger performs, whether each ledger action has the same legal effect as the characteristic it performs, and which record governs when the two differ. It also establishes how custody, correction, recovery and insolvency are handled.*

2.1 What is the instrument in law in each relevant jurisdiction? Where is its ownership recorded today, and what makes that record legally effective? What legal effect does an entry on the ledger have?

2.2 Which ledger, account, register, document, or legal process decides who holds the instrument? What happens when the records disagree?

2.3 Which of the instrument's legal features are performed by ledger actions, and which are not? Which ledger actions have no counterpart in the instrument?

2.4 For each ledger action, is the legal effect it is meant to produce written down? Does the smart contract impose the same conditions as the law?

2.5 By what legal route can the instrument be transferred? Does the transfer on the ledger give the transferee the legal result that route provides?

2.6 At what point does a transfer become legally binding on the transferor, the transferee, third parties, and a liquidator if either party fails? Under which law?

2.7 What rights does the position give its holder? What does the issuer, obligor, custodian, or any other party owe the holder in return?

2.8 Who controls the accounts or keys? How are client assets kept separate, recovered, and moved between providers? What happens after an unauthorised transfer?

2.9 Where the claim depends on an asset held off the ledger, how is the link between the record and that asset set up, and how is it kept accurate?

2.10 Which law governs the instrument and any underlying asset? Under that law, and given where the participants and the asset are, what makes a holder's claim effective against third parties, who is paid first, and is the claim recognised?

2.11 What happens legally to the position, and to competing claims on it, if the issuer, a legal vehicle, the operator, manager, servicer, custodian, or an intermediary fails or stops doing what it undertook? What happens if a holder dies or loses capacity?

2.12 Is reliable evidence kept? Is there a legally valid way to correct or reverse a record after fraud, mistake, key loss, a court order, administrative action, a mismatch between records, or a dispute?

GROUP II Does the scheme work end to end, and who controls it?

AREA 3. END-TO-END FUNCTIONALITY, SERVICING, LIFECYCLE, DEFAULT, AND EXIT

> **Objective.** *This area establishes whether the ledger's actions cover the instrument's whole life, and which party performs each task done off the ledger, under what obligation. It tests ordinary events, exceptional ones such as default and court orders, and the end of the scheme, including migration, recovery and orderly exit.*

3.1 Is each function the scheme depends on, including operating, maintaining, or servicing any underlying asset, assigned to a party accountable for it? Do rules and records define what each function must produce?

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3.2 For each unmapped function, what obligation requires a party to perform it? What evidence shows it is being performed? How often does that evidence reach the authority and the holder?

3.3 Is each hand-over between functions defined? What moves, when does the hand-over count as complete, and what happens if only part of it succeeds?

3.4 Do the mapped actions cover the instrument's whole ordinary life, from creation to termination, including the operating life of any underlying asset?

3.5 Where the position is used for financing or as collateral, can the scheme support pledge or transfer, valuation, margin, substitution, permitted reuse, default, enforcement, liquidation, release, and return?

3.6 Can the scheme detect, process, and act on personal, corporate, legal, and regulatory events that change who owns or controls a position?

3.7 If a participant defaults, how is the default detected? What happens to its unfinished transactions and to its clients' positions? How do default procedures begin?

3.8 While the same instrument exists both on and off the ledger, does its lifecycle stay complete, with no duplicate claims or conflicting actions?

3.9 Can the scheme be changed over its life, and wound down in an orderly way, without holders losing rights or evidence?

3.10 What volume has the scheme processed in testing, including exceptions and reconciliations, within the required processing windows? What volume is it designed for?

AREA 4. GOVERNANCE, POWERS CREATED, ACCESS, TRANSPARENCY, AND MARKET STRUCTURE

> **Objective.** *This area establishes who holds the controls the scheme adds, on what legal basis and within what limits; how the scheme is governed; what each audience is told about the work done off the ledger; and how the scheme changes the structure of the market.*

4.1 Is it clear and enforceable who decides, who is accountable, how issues are escalated and disputes resolved, and who acts in an emergency? Does the same hold for any outside manager, servicer, or asset operator the scheme depends on?

4.2 For each ledger action among the added controls, which party can trigger it? On what legal basis does that party hold the power? What conditions limit its use? How can a holder challenge it?

4.3 Are the rules for joining, taking part, suspension, and leaving clear and proportionate?

4.4 What risks do indirect participants face because they reach the scheme through direct participants, custodians, settlement institutions, wallets, gateways, or agents?

4.5 Does each audience get the information it needs? Where the claim depends on an underlying asset, do holders learn its condition, liabilities, arrears, and operating performance?

4.6 Do conduct rules and market surveillance cover the trading and selling risks the scheme creates, including incentive schemes that reward trading volume?

4.7 How does the scheme change the market's structure? Which functions remain or disappear, which change, split, or merge, and which move to different providers?

4.8 As the market's structure changes, how are revenues, costs, liabilities, and excess profits redistributed among functions and stakeholders?

4.9 Does the analysis of market structure include the new functions the scheme creates?

4.10 Where does the scheme depend on shared or concentrated services? Who governs that dependence, and how?

4.11 Where will the instrument trade after issue? Who will quote prices, under what obligations, and how are they paid? Can tokens be created and redeemed against the underlying asset, by whom, at what cost and how quickly, including when the reference market is closed? How deep is the nearest comparable market? What trade size would move its price materially? How does the largest expected holding compare with that size?

GROUP III When is payment final, and do the holder's rights move with the holding?

AREA 5. MONEY, SETTLEMENT, CREDIT, LIQUIDITY, AND COLLATERAL

> **Objective.** *This area establishes whether the payment itself is made on the ledger, when it becomes final, and whether the transfer of the instrument and the payment can be made to complete together. It also establishes the exposures between the parties, how losses are shared, the money participants need to settle, and how the token is treated as collateral.*

5.1 Is the settlement asset a clear claim on a sound issuer? Is it safe and accessible, and how is it redeemed?

5.2 At what point is the payment obligation irrevocably discharged? Through which process, and in which settlement asset? Against whom is the discharge effective?

5.3 Is the payment itself made by a ledger action, or does it remain an unmapped function, performed on a separate system with separate operating hours?

5.4 Where two obligations must complete together, how are they coordinated? What exposure remains between them, to the full value or to the cost of replacing the trade? What happens if one leg fails or a participant becomes insolvent?

5.5 Are the financial exposures that arise before and during settlement identified, measured, and controlled?

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5.6 When a participant defaults, how are losses found, contained, and shared out?

5.7 What funding and liquidity does each participant need in normal and stressed conditions, including pre-funding, intraday needs, collateral calls, and redemptions? Which committed facilities cover those needs?

5.8 Where the position is used as collateral, do the rights created over it work legally and operationally from creation to release? Does the lender acquire the priority the arrangement assumes?

5.9 Do the operators and critical providers have enough capital, liquidity, insurance, reserves, or other resources to keep critical services running, or to wind down safely?

5.10 Do the payment and settlement flows the scheme creates comply with the jurisdiction's monetary and capital-flow rules?

AREA 6. INTEROPERABILITY, DATA, IDENTITY, COMPLIANCE, AND REPORTING

> **Objective.** *This area establishes whether the legal characteristics the ledger performs still hold when a holding moves between systems and countries, and whether the ledger and off-ledger versions of the same instrument can exist side by side without duplication or contradiction.*

6.1 Do the connected systems exchange instructions, events, data, and status reliably, at the required performance and security levels? Are targets for throughput, latency, availability, and recovery agreed and met, and how are failed, duplicate, or out-of-order messages handled?

6.2 Do assets, rights, participants, events, and states mean the same thing in every connected system?

6.3 Can each party that must be identified for a function or decision be identified reliably? Can its attributes and its authority to act be verified, and revoked when they lapse? Is disclosure limited to what the function needs?

6.4 Is each compliance obligation assigned to an accountable party at every function and hand-over?

6.5 Is the accounting treatment established? Does the scheme produce reliable data for accounting, tax, regulatory, and other reports, including on the condition, arrears, and compliance of any underlying asset?

6.6 When positions or money move between infrastructures, what ensures that both systems agree on the asset, its state, whether it is locked or available, and when the movement becomes final?

6.7 When a position or its supporting evidence moves to another system or jurisdiction, do the holder's legal rights move with it? Does the receiving jurisdiction recognise them?

6.8 Where the same instrument exists both on and off the ledger, can the two forms coexist without double issuance, inconsistent records, conflicting treatment, or lifecycle processing split between them? Can holders move between the two forms without loss or delay, and does trading split between them?

6.9 Can participants move their data, positions, and credentials where appropriate, under defined switching and exit terms?

GROUP IV Does it withstand failure, and can the country decide and act?

AREA 7. SECURITY, OPERATIONAL RESILIENCE, RECOVERY, AND ADAPTABILITY

> **Objective.** *This area establishes whether each ledger action can be carried out reliably, with the data, authority, records and durability its legal effect needs, and whether the scheme survives incidents, the failure of its operator, migration to new systems, and the whole life of the instrument.*

7.1 Does the security assessment cover every part of the scheme that could compromise a position, a record, an instruction, or an authority to act?

7.2 Does each material ledger action give the same result on every node, software version, and network condition? Where a condition depends on outside data, is the source known, is the data verified, and is it defined what happens if the data fails?

7.3 Are targets for capacity, latency, availability, recovery time, and recovery point defined? Have tests shown they are met under stress and failure?

7.4 Are changes to the scheme, including changes to the ledger actions, designed, tested, approved, and reversible under controlled processes? Who holds the authority to make them?

7.5 Have the critical and shared providers been assessed for concentration, for whether they can be replaced, and for what happens if they fail?

7.6 Are the critical services defined, with recovery targets and fallback arrangements, and have those been tested?

7.7 Can the scheme contain a serious security incident, keep the affected rights and records intact, and recover safely?

7.8 Could a local failure spread through the wider system, and how fast? Which arrangements outside the scheme, such as lending or collateral platforms, can use the token, and who sees the leverage and chains of exposure they create?

7.9 If the ledger splits, reorganises, halts, or is rolled back, could it show two different holders of the instrument, or none? Which record would govern, and who decides?

7.10 Are arrangements defined for moving between providers, ledgers, and keys? Can the record of holdings be rebuilt if the operator fails?

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7.11 Where automated rules or software agents take significant actions, are their authority, limits, and accountability defined and testable?

7.12 Will the security and cryptographic arrangements stay adequate for the whole life of the instrument? Can they be upgraded without holders losing rights or evidence?

AREA 8. MANDATE ALLOCATION AND SUPERVISORY CAPABILITY

> **Objective.** *This area establishes which public mandates the scheme involves, which institution holds each, whether those institutions have the capability to exercise them over this scheme, and whether the scheme can be implemented under existing law.*

8.1 Does the scheme state the economic, financial, social, fiscal, or infrastructure outcome it seeks, and the policy limits it accepts?

8.2 Are all the public mandates the scheme touches identified, including mandates outside the reference library and those touched only by the unmapped functions?

8.3 For each mandate, which authority holds it? What powers and rights to information does it have? Who leads the decision? Where do authorities overlap or leave gaps?

8.4 Does each authority with a mandate over the scheme have the expertise, systems, data access, and staff to exercise it? What does it lack?

8.5 Where the scheme creates or changes a market, what surveillance is needed to detect manipulation, abuse, and disorderly trading? Who conducts it, and with what data?

8.6 How are financial-crime obligations over the arrangement supervised, including identifying the parties to each transfer? Does the supervisor get the transaction data it needs?

8.7 Where retail holders are involved, how are fraud and misrepresentation detected and dealt with, and by whom?

8.8 Can the scheme be implemented under the existing law and regulation? If not, what must change?

AREA 9. POLICY EFFECTS, CROSS-BORDER COORDINATION, AND IMPLEMENTABILITY

> **Objective.** *This area establishes what the scheme does to public policy. It covers the scale at which the scheme would matter, who would notice and what they could do, the tax consequences, where authority sits when the issuer is abroad, and whether the country can implement the scheme.*

9.1 At what scale would the scheme become material to monetary transmission, financial stability, the payment system, currency substitution, or capital flows? In what measure is each scale expressed?

9.2 What indicator would show the scheme approaching that scale? Who watches it, and how often? Does that party have the legal right to the information it needs?

9.3 If a threshold is reached, what corrective action could an authority take, such as capping value outstanding or limiting who may hold the instrument? Which authority holds that power? Could the action take effect before the harm the threshold guards against has occurred?

9.4 Do the findings from Areas 1, 4, and 6 on market structure, shared infrastructure, interoperability, inclusion, and consumer or investor protection call for public action? For each, which authority has the power to act, or does none?

9.5 What are the material tax and other fiscal consequences of each lifecycle event? Who pays, on what basis and valuation, when, and in which jurisdiction? How is the tax collected or withheld, and reported? How does this differ from the conventional alternative?

9.6 Where the issuer, operator, or record is abroad, where do decisions, information, and legal authority sit? What direct powers do the host country's authorities have? What recourse do local holders keep?

9.7 Does cooperation with other jurisdictions give the recognition, information, and enforcement the scheme needs?

9.8 Is there a workable plan to implement the scheme, with clear owners, dependencies, and decision points?

9.9 Is each decision required specified clearly enough for the responsible authority to act within its mandate?

3.9 CROSS-AREA METHODS

Coupling. A finding in one area can change the answer in another. The following links come up often.

- Which record governs affects custody and recovery.
- When a payment becomes final affects how much money participants must hold, and what happens on insolvency.
- How participants are identified affects privacy, access, concentration, and liability.
- A control the instrument does not provide for can change the transfer route, and so whether the instrument works as collateral.

The aim is to avoid recommending on findings that contradict each other, or on a condition that fixes one problem and creates another. Where a design change or condition resolves one finding, check what it does to the other, whether the effect could be seen in time, and whether it could be undone.

Sequencing. Distinguish the kinds of dependency.

- A prerequisite without which the scheme cannot operate lawfully.
- A prerequisite without which it can operate, but impaired.
- Changes that must happen together.
- Steps where a pilot can go ahead before the wider market.
- Exposures that need a credible fallback before they are taken on.

Each stage then requires the following.

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- the instrument, the transfer route, and which record governs, before any live holdings;
- verified asset condition, complete costs, reserves, and operator capacity before issuance or public offering;
- the required settlement arrangement and discharge point before live settlement;
- operational access, and reporting on the work done off the ledger, before admission;
- tested recovery, including the route for key loss, before material exposure; and
- mandate holders able to act on the evidence they receive.

Binding constraint. Identify the finding that controls the recommendation, and test whether resolving it would change the outcome for the scheme as a whole. A change to the record does not change the answer where operating viability, the manager's capability, demand, or payment remains the constraint.

3.10 FROM FINDINGS TO THE RECOMMENDATION

Benefits. A claimed improvement becomes a credible benefit only when tested against its baseline, the mechanism that produces it, who gains, its scale and timing, what it depends on, the comparator, the strength of the evidence, and any offsetting cost or risk. A claimed benefit with no identifiable mechanism is unsubstantiated; without a credible comparator, its added value cannot be established.

Risks. For each claimed benefit, establish which risk falls, which moves elsewhere, and who bears any new one. Check for imbalances between the parties.

- Who has the information, and who bears the loss.
- Who can obtain liquidity cheaply, and who must pre-fund.
- Who can reverse or correct an action, and who bears the consequence when it cannot be reversed.
- Who can change the rules of operation.
- **Recommendation.** State the recommended option with its disposition, stage, and scope. The disposition is one of these.
- Proceed to design.
- Proceed to a conditional pilot.
- Continue without scaling.
- Redesign and return.
- Defer live issuance.
- Stop the option and keep the current arrangement.

Identify also which authorities' decisions and powers the recommendation calls on.



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PART 4

AUTHORITIES AND COORDINATION

4.1 WHY RESPONSIBILITIES ARE SEPARATE FROM ASSESSMENT AREAS

The areas establish what the scheme does. Part 4 establishes which authorities may decide on it, permit it, supervise it or enforce against it, and whether they can act together.

4.2 REFERENCE MANDATES FOR INSTITUTIONAL MAPPING

Table 2.16 lists mandates that recur across countries. Countries combine and divide them differently, and some sit with courts, municipalities, ministries or private bodies that make rules. Start with what the scheme does, the legal effects it has and the decisions it needs, then identify the mandates involved, who holds them, and any mandate the table omits.

TABLE 2.16

Reference mandates

The final row applies to the work done off the ledger in most asset-backed schemes, and is often missed.

Public responsibility	Common basis
Legal recognition and enforceability	Legal certainty for ownership, title, and the effect of records and transactions
Prudential regulation	Capital, solvency, and viability of supervised intermediaries and operators
Licensing and market entry	Grant, condition, limit, or withdraw permission to operate
Market conduct, disclosure, and investor protection	Conduct, disclosure, distribution, suitability, market integrity, and surveillance
Payment-system oversight	Operation, access, and resilience of payment systems
Market infrastructure oversight	Exchanges, central securities depositories, clearing, and depositories
Settlement-asset provision and eligibility	Provide settlement money, or set conditions under which settlement assets may be used
Currency and monetary policy	Singleness of money and the effectiveness of monetary transmission
Foreign exchange and capital flows	Currency conversion, capital flows, and external-sector reporting
AML/CFT and financial crime	Prevention of money laundering, terrorist financing, and related crime
Tax determination and collection	Tax events, bases, and collection responsibilities
Privacy and data protection	Data collection, processing, and cross-border flows
Cybersecurity and critical infrastructure	Minimum controls and designation of critical infrastructure
Accounting and professional standards	Recognition, measurement, valuation, audit, and professional responsibility
Property, insolvency, and succession	Priority, segregation, stays, enforcement, and succession
Recovery, resolution, and compensation	Continuity, transfer of claims, loss reallocation, and compensation for covered claims
Competition and market structure	Access, interoperability, concentration, and market power
Domestic and cross-border cooperation	Recognition, information sharing, and enforcement cooperation
Financial stability and macroprudential policy	Systemic vulnerabilities, interconnected exposures, and procyclicality
Sectoral, municipal, and asset-specific mandates	Building and housing enforcement, land and title administration, environmental regulation, sector licensing, utilities, local taxation, and subsidy administration

Source: GFTN.

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4.3 ALLOCATION: OVERLAP, UNDERLAP, AND UNSETTLED BORDERS

One mandate may sit with several institutions, and one institution may hold several mandates. For each mandate the scheme involves, the assessment team identifies who holds it, the law that gives it, its powers and rights to information, and who leads the decision. It also identifies the roles the holder plays, such as making policy or rules, licensing, supervising, operating, enforcing, adjudicating, resolving failed firms, receiving data, or deciding in an emergency.

Two questions then decide how responsibility is shared. The first is whether one authority or several are responsible for a matter – overlap, where more than one is; the second, whether any authority is responsible at all – underlap, where none is. Administrative lawyers call these exclusivity and completeness, and together they give the four patterns in Table 2.17.[24]

TABLE 2.17

Four patterns of allocation

Pattern	What it means for the scheme	What the assessment team establishes
Exclusive and complete	Each part of the scheme falls to one authority, and together they cover it	The holder of each mandate, and where the boundary between them runs
Exclusive and incomplete	Authority is divided without overlap, but part of the scheme falls to no authority. This is underlap.	What falls in the gap; whether it can be closed by interpretation of an existing mandate; and if not, what would have to change and who would change it
Overlapping and complete	Two or more authorities may act over the same part of the scheme	Whether they hold the same tools over it, whether either has priority, and what happens if they reach different conclusions
Overlapping and incomplete	Both conditions are present: some matters are shared and others fall to nobody	Both of the above, recorded separately

Source: GFTN, drawing on Gersen (2007).

Authorities may hold different tools over the same matter, one making rules and another enforcing them. At times there may appear to be different interpretations of these rules by different authorities.

Overlap is not a defect. Two authorities examining the same arrangement may learn more than one would, and one may act where the other does not need to. What matters is to use this opportunity to resolve the difference to a suitable outcome. An unsuitable outcome would be each holding back because the other might act or where both may act though neither must. The assessment team escalates and looks at channels for debate and ultimate resolution.

Underlap is the more serious finding, because no institution holds the power at all. It is also the harder one to see, since each authority can correctly state that the matter falls outside its mandate. The assessment team identifies what falls in the gap, who would bear the consequence if it were never closed, and whether closing it requires an interpretation, a transfer of function, or new law.

In cases where regulatory responsibility for a component of a scheme is unclear, the assessment team applies the test in Section 1.5 to establish whether the law simply did not anticipate arrangements of this kind, or the arrangement was intended to operate outside existing legal frameworks. In the former case, corrective measures are guided strictly by holder and public protection rather than sponsor preferences. In the latter, the structure itself serves as a key finding, and affected authorities are notified in accordance with Section 4.5.

A finding that no existing mandate applies may lead to new law, because a new regime would be built on it. The assessment team states what it examined, what it did not, and which questions a legislature would need answered, so that the finding is not read as support for rules written around the scheme that created the gap. Where two authorities read a boundary differently, the assessment team establishes the following.

- the specific decision in question, stated as a scenario in which someone must act;
- each authority's view of its own role, and the provision relied upon;
- whether the authorities hold different tools over the matter, and which tool the decision requires;
- whether either has previously acted on a comparable matter, and whether that was challenged;
- whether a coordination arrangement between the authorities can resolve it jointly, and, failing that, which view would prevail under the jurisdiction's own precedence rules between authorities, and whether those rules have been tested; and
- what happens in the meantime, and who bears the consequence of the delay.

4.4 COORDINATION

Knowing who holds each mandate is the starting point. The coordination analysis tests whether those authorities can act together. Take two authorities involved in the same matter, such as a tokenized building whose taxes the city collects and whose tokens the securities regulator oversees. The assessment team establishes whether they can share information lawfully and in practice, and whether their mandates fit together. It also establishes whether their timetables align, whether their

24 Gersen, J. E. (2007). Overlapping and Underlapping Jurisdiction in Administrative Law. The Supreme Court Review, 2006, 201–247.

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emergency procedures can run together, and whether recognition and enforcement would hold across borders.

The assessment authority identifies any lead coordinator, the dependencies between authority decisions, the legal basis for information sharing, conflict and escalation procedures, decision timetables, joint incident arrangements, links between local and national authorities, and cross-border coordination.

Coordination often fails for lack of information rather than lack of power. Where one authority holds evidence that the work off the ledger is failing and another has the power to act, the assessment team establishes whether any process brings the two together, and how long that takes. Two authorities each willing to act, each waiting for information the other holds, leave the matter as unprotected as if no authority were responsible.

Some arrangements exist to span two mandates: a joint committee, a memorandum of understanding, a single intake point, or a supervisory college. Where the scheme relies on one, the assessment team establishes what it may decide, what it may only recommend, whether either authority may act without it, and what happens when it does not reach a view. An arrangement with no decision rights and no deadline adds a step without closing a gap.

Coordination that works lets separate mandates cover a scheme between them. Coordination that fails leaves it unsupervised: each authority can correctly say the matter is partly someone else's, so no one acts. The assessment records this: which authority each finding was sent to, when, and whether it was asked to note, decide, or act. A finding never sent stays in the record, unseen and unactioned. Where it is sent but draws no response, the team notes that, with the date. An authority told but silent is treated differently from an authority that was never told, and this distinction feeds directly into the finding on the country's capacity to act under Areas 8 and 9.

4.5 THE TRANSMISSION REGISTER

Section 4.4 is met by keeping a standing register, not by correspondence held by individuals. The register is kept up to date during the assessment and afterwards, for as long as any condition remains open. It is part of the Country Answer Record, and any authority named in it can ask to see it.

TABLE 2.18

The transmission register

Entry	What it records
Finding reference	The consideration and the finding transmitted
Mandate concerned	The mandate, from the reference library or added by the assessment
Authority addressed	The institution holding that mandate in this jurisdiction
What is asked	To note it, to decide a question within its mandate, or to act
Date provided	When the finding was given to that authority, and by what means
Response	What was received and when, or that nothing has been received as at a stated date
Effect on the assessment	Where there is no response, which decisions cannot be taken without the authority's answer, and which options or stages are held up
When to send it again	The event or date that would mean sending the finding again, such as a change in the scheme or in the law

Source: GFTN.

The design follows a supervisory tool already in use. Under the EU Digital Operational Resilience Act, financial entities keep a register of their contracts with information and communication technology providers and update it throughout the year. They make it available for inspection at any time, and submit it to the competent authority on a set schedule and on request. The register serves the entity's own monitoring, the supervisor's, and that of a body that aggregates the data. Its value comes from being kept up to date all the time, not compiled when someone asks.

The assessment team disbands when the assessment ends, and a register that depends on the team chasing authorities for responses will not be kept up after that. The framework therefore gives the reporting to parties who remain involved, namely the evidence owner named in each condition, who already reports at a stated frequency under Section 5.7, and the holder or participant whose position is affected.

McCubbins and Schwartz[25] distinguish oversight carried out by continuous sampling from oversight prompted by parties with an interest in raising the matter, and argue that the second costs less. Whether one is generally preferable is contested.[26] The framework relies on the narrower point: a reporting obligation with no named owner will not be met.

The effect of registers of this kind on authority behaviour is not established. The instrument they are modelled on has been in application only since 2025, and no outcome evidence is available. The register makes transmission and non-response visible; whether visibility produces action depends on the powers examined under Area 8 and the capability examined with them.

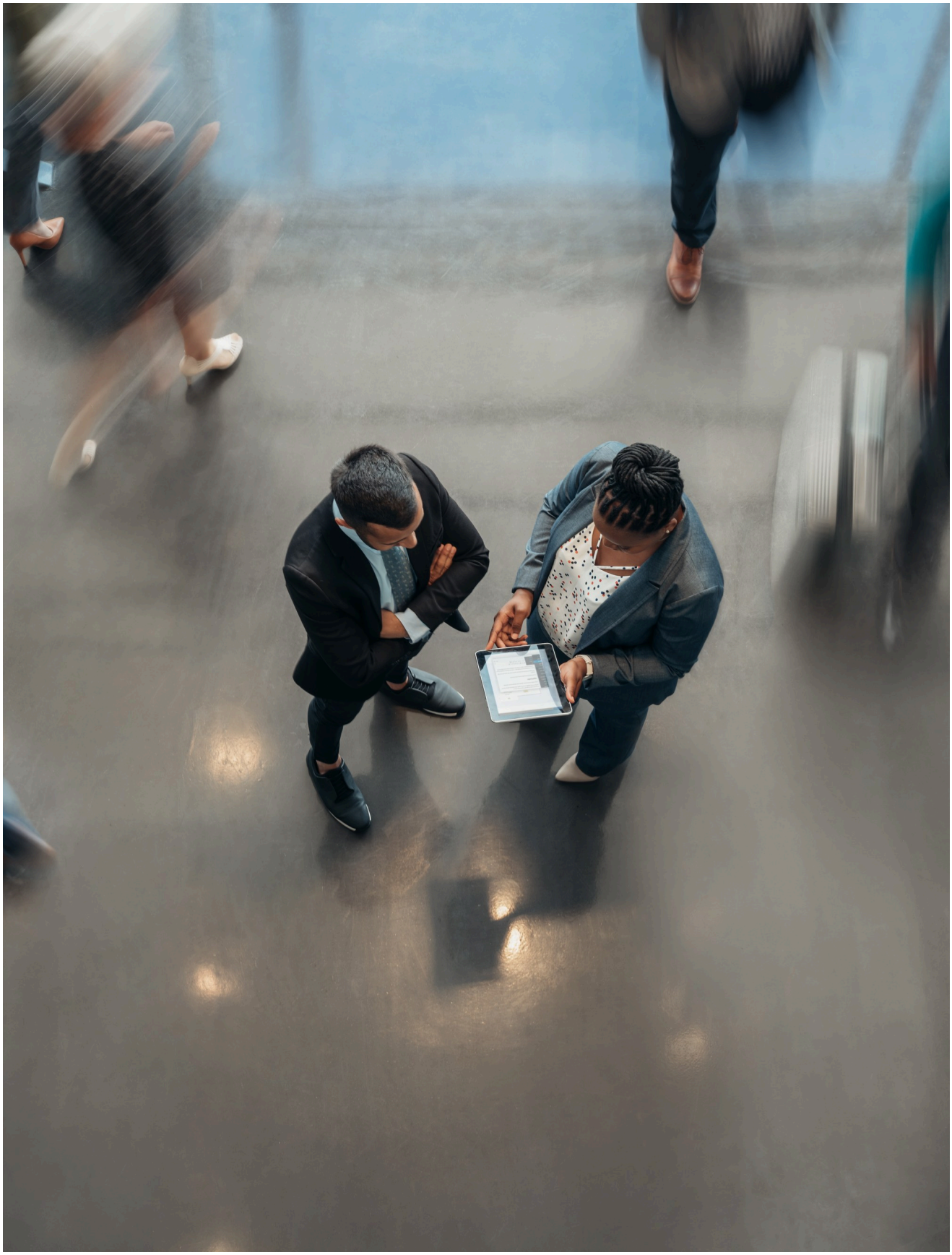
[25] McCubbins, M. D. and Schwartz, T. (1984). Congressional Oversight Overlooked: Police Patrols versus Fire Alarms. American Journal of Political Science, 28(1), 165–179.
[26] Balla, S. J. and Deering, C. J. (2013). Police Patrols and Fire Alarms: An Empirical Examination of the Legislative Preference for Oversight. Congress & the Presidency, 40(1), 27–40.

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4.6 CORRIDORS AND THE MARKET-LED OUTCOME

A corridor assessment applies the same allocation test across the jurisdictions involved. Recognition, supervisory colleges, or corridor-specific agreements become part of the coordination analysis for the single economic transaction.

Where market arrangements already serve the holders concerned, the decision may be that no further public intervention is needed. Existing decisions on licensing, supervision, access, eligibility or recognition stay with the authorities that took them. The outcome is written down with its evidence and the conditions for looking at it again, which name who watches, what would prompt a review, and a review date (Section 2.2). Without someone watching, the decision may never be looked at again.



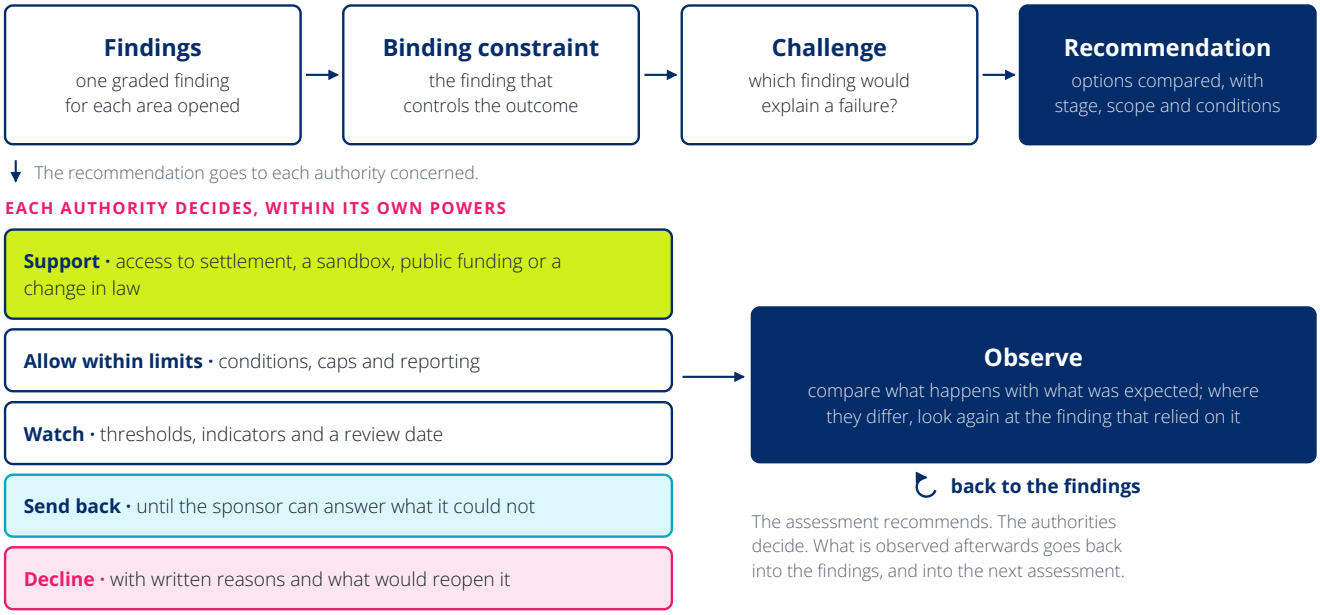
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PART 5
FROM ASSESSMENT TO DECISION

FIGURE 2.6

From findings to decision

The assessment recommends; each authority decides within its own powers, and what is observed afterwards goes back into the findings.



Source: GFTN.

5.1 WHAT AN ASSESSMENT PRODUCES

An assessment produces two documents. The authorities that act on it produce a third, separately and afterwards.

TABLE 2.19

The three documents, and what each settles

Document	Produced by	What it holds	The last word on
Assessment Report	The assessment team	The recommendation, its stage and scope, the reasons for it, the area findings, and the conditions attached	The assessment team's combined view
Country Answer Record	The assessment team	The evidence, the answer to each consideration, the diagrams of the transaction steps and of the authorities' mandates, the registers, and the reasoning connecting them	What was examined, and on what evidence
Authority Decision Record	Each mandate holder, for itself	The decision taken, its legal basis, its scope, its conditions, and when it is reviewed	That authority's determination

Source: GFTN.

None of the three replaces the sources it draws on. The instrument, the register, a legal opinion and any earlier decision by an authority remain authoritative for what they say. The assessment sets out what they say, where it was found and what follows from it, and a reader who needs the underlying position goes to the source.

The Assessment Report is written to be read; the Country Answer Record is written to be checked. Where the report states a finding, the record holds the evidence for it and the determination that produced it. Selected material from the record may be reproduced as appendices to the report, but the workbook is not appended in full.

5.2 WHAT THE RECORD IS FOR

The method asks for a great deal to be written down. Four uses justify it, and no single entry serves all four.

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The first use serves the assessment team directly. A record allows the assessment to stop. An area recorded as not opened, with its reason, is work that cannot be demanded again without a new reason. A consideration answered and closed is a question that cannot be reopened by repetition, which matters because a sponsor whose proposition has been narrowed has reason to raise the same point again in different words. Without a written position there is no defensible endpoint, and the work continues until someone loses patience with it.

The second carries the analysis to the authority that must act. An authority deciding within its own mandate has to see what was established, on what evidence, and what remains open, because it cannot adopt a recommendation it cannot trace. This use is served only by entries that reach that authority, so what matters is sending them, not only writing them down; Section 4.4 sets out how.

The third outlasts the team. Conditions fall due after the assessment team has disbanded, so the entries that matter here are the conditions, who owns each one, who confirms it has been met, and what would prompt a fresh assessment.

The fourth supports the country's next assessment. The same questions about transfer routes, which record governs, custody and access to settlement come up in scheme after scheme, and an answer already worked out is a starting point rather than work to repeat. Section 5.10 sets out how to use it.

Comparison between countries is not a use. Jurisdictional ranking and readiness scoring sit outside this framework, and nothing here is compiled to a common scale that would support them.

The assessment team should write with the use in mind. An entry that serves none of the four is not required, and the volume of the record is not a measure of the quality of the assessment.

5.3 RUNNING THE ASSESSMENT

The assessment runs in a fixed cycle, with room to go back and revise earlier steps. One practical way to run it is as a series of workshops, covering the scope and the outcome sought; the instrument and the reconciliation; the authorities and their mandates; clinics on the areas; benefits, risks, options and alignment; and negotiation, the recommendation and the decisions required. The sequence can be adapted.

Controlled testing. Where a sandbox or other controlled test is used, identify every authority taking part, and the legal basis, scope and limits of any relief from rules. Identify also the questions the test is meant to answer, who owns the evidence, what must be shown before going live, and how conflicting timetables are reconciled. Taking part in a test is not evidence of safety, and does not lead automatically to going live.

5.4 ADJUSTING DEPTH

The depth of the assessment is reviewed as evidence comes in. Go deeper where the scheme performs a critical market function, involves large volumes or concentration, or reaches retail or vulnerable holders, or firms that reach it through intermediaries. Go deeper too where it gives rights across borders, settles in an asset that could suffer a run, reuses collateral, or rests on physical assets or long-lived claims. The same applies where it takes significant automated actions, depends on a few providers, splits records between systems, or has unresolved tax or accounting treatment. Note a change of depth only where it changes the approach or holds up progress.

5.5 HOW DETERMINATIONS BECOME FINDINGS

The answers to individual considerations are not scored or averaged. They are combined into a reasoned finding for the area by identifying which answers support a particular option or stage, which limit it, and which block it until the issue is resolved or an authority takes the decision required.

Each area finding is then read against the realistic options. A finding is not good or bad in itself, only for a particular design, as the gold-certificate example in Annex A shows.

Each answer records the fields in Table 2.20 separately.

TABLE 2.20

The determination fields

The final two locate the determination within the mapping and record whether the scheme claims more or less than the law allows.

Field	Values
Evidentiary state	Established, Preliminary, Disputed, or Evidence gap
Applicability	Applies, Conditional, or Not applicable
Materiality	Critical, Material, or Limited
Option and stage effect	Support, condition, design choice, remediation, redesign, deferral, block, or no material effect
Option affected	All options, the selected option, or named options
Mapping part	Mapped characteristics, unmapped characteristics, added controls, or not applicable
Whether the ledger reproduces the legal effect faithfully	Faithful, understated, overstated, or not yet established

Source: GFTN.

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An overstated mapping is the more serious finding, and it does not show itself. The scheme works normally until a competing claim, a defect in a seller's title, or an insolvency exposes the gap between what the ledger records and what the law recognises.

An answer marked not applicable has no effect on any option or stage. A Preliminary answer can still force a choice between designs, and an Established one may block only the option selected.

Each answer is graded by what would follow if it were wrong or left unresolved, not by the area it sits in (Figure 2.7).

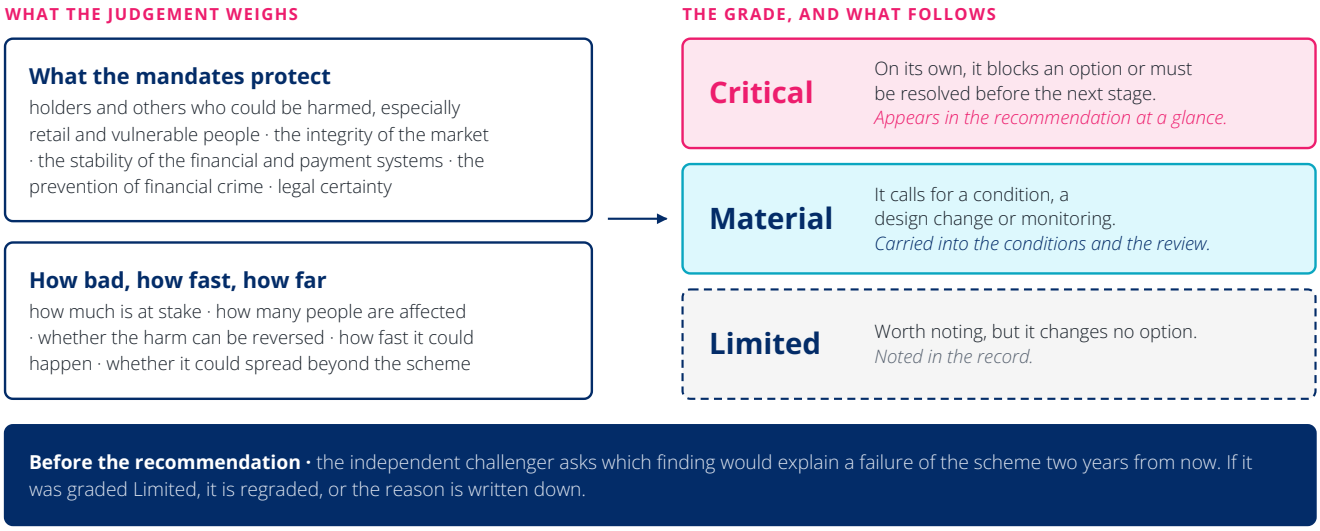
- Critical. On its own, it blocks an option or must be resolved before the next stage, because people could lose rights or money that cannot be recovered, the harm could spread beyond the scheme, or no authority could act in time.
- Material. It calls for a condition, a design change or monitoring, but does not on its own decide the option.
- Limited. It is worth noting, but changes no option.

To judge which applies, start from what the authorities' mandates protect: holders and others who could be harmed, especially retail and vulnerable people; the integrity of the market; the stability of the financial system and the payment system; the prevention of financial crime; and legal certainty. These are the objectives the international standards set for securities regulators and market infrastructures.[27] Then weigh how much is at stake, how many people would be affected, whether the harm could be reversed, how fast it could happen, and whether it could spread beyond the scheme. This follows the method used to assess market infrastructures against the PFMI. Its questions are meant to inform the assessor's judgement, not to replace it or serve as a checklist, and effort goes where the risk is greatest. Each issue found is graded by how serious it is and how urgently it must be put right, from one that warrants immediate attention to one that can be dealt with in the normal course of business.[28]

FIGURE 2.7

Grading a finding

Each answer is graded by what would follow if it were wrong or left unresolved, judged against what the authorities' mandates protect.



Source: GFTN.

Some findings are Critical unless the assessment team gives a reason why not.

- The ledger claims more legal effect than the law gives (2.4 and 2.5).
- There is no binding rule on which record governs, or no legally valid way to correct a holding (2.2 and 2.12).
- A power over holdings, such as a freeze or a clawback, has no legal basis or no limits (4.2).
- Work off the ledger that holders depend on has nobody answerable for it (3.2).
- The same asset could be sold twice, through a copy on another network or a version off the ledger (6.6 and 6.8).
- The asset or business is not sound today, or the scheme cannot reach the volume it needs to cover its costs (1.3 to 1.6, and 1.10).
- Payment is not final when the asset transfer is, and nothing covers the exposure in between (5.4).
- No authority is responsible for part of the scheme, or none could act in time (Section 4.3 and 9.3).

Every Critical finding appears in the recommendation at a glance (Section 5.6).

Before the recommendation is settled, the independent challenger (Table 2.11) reads the Critical and Material findings and asks which one would explain a failure of the scheme two years from now, a technique known as a pre-mortem.[29] Good supervision is sceptical of a firm's own account and follows its findings through to action.[30]

27 IOSCO (International Organization of Securities Commissions) (2017). Objectives and Principles of Securities Regulation. May 2017. CPSS-IOSCO (Committee on Payment and Settlement Systems and International Organization of Securities Commissions) (2012a). Principles for Financial Market Infrastructures. April 2012.
28 CPSS-IOSCO (2012b). Principles for Financial Market Infrastructures: Disclosure Framework and Assessment Methodology. December 2012, paragraphs 3.14 to 3.18 and 3.24.
29 Klein, G. (2007). Performing a Project Premortem. Harvard Business Review, 85(9), 18–19.
30 Viñals, J., Fiechter, J. and others (2010). The Making of Good Supervision: Learning to Say "No". IMF Staff Position Note SPN/10/08, May 2010.

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If the challenger names a finding the team graded Limited, the team regrades it or writes down why not. Where the country has completed earlier assessments, the grades are compared with those given to similar findings then (Section 5.10).

5.6 THE ASSESSMENT REPORT

The report is as long as the decision warrants, and reads as an argument, not as a list of considerations. It follows this order.

- the recommendation at a glance: the decision question, the scheme assessed, the intended outcome, the recommendation, the principal reasons, the proposed stage and scope, and the conditions;
- the instrument, the problem, the baseline, and the mapping reconciliation;
- status and findings across the nine areas, each stated as finding, basis, material unresolved issues, and consequence for the option and stage;
- the cross-area synthesis, identifying the binding constraint and the remaining options;
- the mandates involved, who holds them, and the coordination required; and
- the recommendation, conditions, and decisions required.

5.7 CONDITIONS

Each condition has an owner responsible for meeting it, the stage by which it must be met, and a definition of the evidence that will show it is met. It names a party who confirms that it has been met, and an authority with the power to act if it is not, with the legal basis for that power and the action it will take. The party that confirms a condition is often not the one that can act on a failure, so the two are named separately.

TABLE 2.21

Illustrative conditions

Cash distributions may be suspended only by a party with the relevant contractual or legal authority, after considering obligations to maintenance, taxes, tenants, and creditors.

Issue	Condition	Gate	If unmet
The instrument's transfer route and the record that governs	A legal opinion on what the instrument is, how it transfers, and which record decides ownership	Before any live holdings	Proceed on the narrower route the law supports, or stop
Controls the scheme adds	For each added control, its legal basis, who holds it, the limits on its use, and how a holder can challenge it	Before any live holdings	Remove the control, or narrow the claim that depends on it not existing
Underlying asset, business, or activity	Verify its condition, that it operates lawfully, and that it complies with the rules that apply	Before issuance or public offering	Do not offer or sell
Complete economics	Evidence for the cost and cash-flow model, the method for setting reserves, and the insurance in place	Before issuance	Redesign or defer
Operator and manager	Due diligence on the operator, its track record, and arrangements to replace it	Before offering or sale	Do not offer or sell; replace the manager
Reporting on work done off the ledger	Regular reports on the asset's condition, arrears, and compliance, with the levels that trigger action and who is then told	Throughout	Payments to holders suspended, by a party with the power to do so
Recovery after key loss	Show a legally effective way to recover holdings after a key is lost, consistent with the transfer route	Before material exposure	Do not scale
Settlement liquidity at peak	Measure and evidence the money participants need to settle at peak	Before market launch	Redesign the settlement arrangement

Source: GFTN.

5.8 MINIMUM DECISION BASIS

Before an assessment goes to the authorities, it must cover each of the following, in this order and to the depth the decision needs.

- the instrument, its governing law, where its ownership is recorded today, and the problem evidenced in how it works;
- the reconciliation, and how faithfully the ledger performs each legal characteristic;
- the underlying asset, business and operator, including verified condition and lawful operation, the full cost and cash-flow model, due diligence on the operator and its record, tax and insurance, reserves and liquidity, and the arrangements for reporting, replacing the manager and winding down;
- the conventional alternative, and which cause of the problem the scheme addresses;
- which record governs, and when payment becomes final where the scheme involves payment;

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- which authorities are responsible, the benefits and risks, the conditions, and what happens if the scheme is stopped; and
- the positions reached in any negotiation with the sponsor, including the issue, the public objective, the safeguard or design change proposed, the risk that remains, and any unresolved reservations.

Tests needed only before later stages need not be complete for an earlier decision, but the stage at which each becomes necessary is stated.

5.9 AUTHORITY DECISIONS, CLOSURE, AND REASSESSMENT

No finding of the assessment has legal effect on its own. Once the assessment is submitted, each authority decides within its own powers and states the basis for its decision. It may recognise, approve or permit the scheme, attach conditions, refer it elsewhere, defer it, refuse it, or require changes.

Each authority's decision record states what was decided, under what power, and who decided and when. It sets out the stage, scope and conditions, with the elements of each condition described in Section 5.7. It also states when the decision will be reviewed or expire, what would prompt an earlier review, and the risk that remains and who bears it.

5.10 OBSERVATION AFTER THE DECISION

Where an assessment recommends going ahead on conditions, or a conditional pilot, the assessment team settles certain points before the scheme starts. These are the outcome it expects, the baseline against which that outcome will be measured, and the indicator that will show whether it is happening. They also include who owns the evidence, the date of the review, the conditions that continue to apply, and what would require a fresh assessment. Where these form part of an authority's conditions, that authority confirms or changes them within its own powers.

The same applies to a recommendation to defer or to stop. Each names who will watch for a change, the data or event they will watch, how often they will check, and a date on which the position is reviewed whether or not anything has happened. A scheme that was turned down is looked at again because the evidence has changed, not because the sponsor has applied again.

At the review, the evidence owner reports what happened and the assessment team compares it with what was expected. Where the two differ materially, the finding that relied on the expectation is looked at again, as deeply as the difference warrants. The rest of the assessment stands unless it relied on the same expectation.

In a new market there is little experience to judge by, and not every question can be settled before a scheme starts. Set limits in advance where harm would be fast, large or hard to reverse, such as a run on redemptions, losses to retail holders, or effects on the wider financial system (Area 9). Elsewhere, admit the scheme at a limited scale, with stated caps, a review date and the indicators to watch, and decide what to do from what is observed. The EU's DLT Pilot Regime works this way: it admits firms only within set limits on the size of each issue and on the total held, and requires a plan for scaling back once the total approaches its ceiling.[31] The pilot cap and nine-month review in Annex A follow the same approach. Admitting new activity at a limited scale and adjusting as evidence accumulates is also what the OECD recommends for regulating innovation.[32]

TABLE 2.22

Illustrative comparison of expectation with observation

Expected outcome	Observed result	Consequence
Faster onboarding from reusable credentials	Limited improvement; local document checks remained the constraint	Look again at the finding that reusable identity credentials would make onboarding faster, and at what that finding was used to justify
Lower settlement exposure	Confirmed	The finding stands, and whoever is responsible for confirming the condition can close it
Lower liquidity requirement	Not confirmed; pre-funding rose	Look again at the finding on the settlement design, and at the conditions attached to it

Source: GFTN.

Across completed assessments, an authority may meet the same obstacle more than once, such as the same legal question on transfer routes or which record governs, the same identity requirement, or the same lack of access to settlement. An obstacle that recurs may be worth removing once for all schemes, for example by changing the law or building shared infrastructure.

The same two authorities having to coordinate on the same question in scheme after scheme is one such obstacle. A standing arrangement between them can then be assessed in the same way as any other proposal.

That an obstacle recurs does not show that removing it is worthwhile. Each proposal to remove one is assessed on its own terms first, covering the public value it would create, the authority needed to do it, its cost, the alternatives, and the order in which the work would have to be done. The stage requirements in Section 3.9 still apply to any scheme that later relies on it.

31 Regulation (EU) 2022/858 on a pilot regime for market infrastructures based on distributed ledger technology (DLT Pilot Regime), Article 3.
32 OECD (2021). Recommendation of the Council for Agile Regulatory Governance to Harness Innovation. OECD/LEGAL/0464, October 2021.

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EXTENSIONS

The extensions are used only where their trigger applies.

E1. MACHINE-DRIVEN (AGENTIC) EXECUTION

This extension applies only where software is given authority to act for a holder on a position, and the amounts involved are significant. Examples are trading software, automated treasury tools, and AI agents allowed to move holdings. Ordinary automation, ledger actions that execute the same way every time, and software that only helps a person process work are not agentic under this framework. The risk is that the software does something its rules allow but its principal did not intend, such as selling at a poor price, paying the wrong party, or acting on false data or on instructions planted in material it reads. No one can then be held to account.

Under the mapping definition, an agent is a party authorised to initiate ledger actions. The questions are therefore those of considerations 2.8 and 4.2, asked of software instead of a person. On whose behalf does it act, and can that principal be identified to the standard of consideration 6.3, with each action traceable to it? What may it do: which positions, which actions, to whom, up to what amounts, and for how long? How is that authority granted, and can the principal withdraw it with immediate effect? Is the authority checked when each action is executed, and is the version of the limits that applied recorded? Who bears the loss when an action is within the limits but not what the principal intended? Does whoever offers or runs the software meet the conduct, suitability, and data-protection duties that the jurisdiction applies to a person providing the same service?

Distinguish an agent run inside a regulated institution, whose own controls usually apply, from one with no central operator, such as an AI agent with its own wallet on a public network. For the second, identify the points where someone could still see and stop the agent. They include the principal, the wallet software, the merchant or platform it deals with, the firms that convert money into tokens and back, the protocol, and any policy module that sets the agent's limits. Test whether any of them can observe its actions, intervene, give the principal recourse, and allocate losses. Controls designed for institutions may not reach such an agent; where none of these points can act, state plainly that holders using it have no protection beyond their own settings.

Before agentic execution is admitted, check how the instrument's terms are published. The terms governing what may be done with it, such as who may hold it, transfer restrictions and redemption terms, should be available as structured data that software can check before it acts, not only as a prospectus written for people. Check also that the agent's actions can be stopped under stress, and that when it fails or receives conflicting instructions it stops instead of carrying on.

E2. PROGRAMMABILITY BEYOND STATE TRIGGERS

This extension applies where a scheme's programs do more than react to simple events, for example by calculating amounts, deciding eligibility or reallocating holdings. Before a program may make a change with real consequences, there must be clear authority for it, evidence it relies on, approval, a party liable for errors, a record others can inspect, and a way to recover from a mistake.

The calculation may run on the ledger, in an outside system, or in both. Assess whether it gives the same result every time, how often and how quickly it updates, what data and outside feeds it depends on, its confidentiality, performance and audit trail, its governance, how failures are contained, and how it recovers. The design also needs a governed response to an important rule or fact nobody foresaw when the program was deployed, such as a change in sanctions, a reclassification or a new kind of fraud. Identify who may suspend, update, escalate and recover the process.

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A SPECIMEN RECORD

An assessment answers every applicable consideration against named evidence, tests the sponsor's position rather than adopting it, sets out contrary evidence and unresolved disagreement, and carries each determination with its seven fields. For a scheme of moderate complexity this runs to tens of pages in the Assessment Report, with the consideration-level entries held in the Country Answer Record.

The specimen below shows three considerations worked to that depth. It is constructed, and the citations are illustrative in form rather than references to real documents. Annex A traces one case through the whole method.

SPECIMEN: THREE CONSIDERATIONS WORKED

Consideration 2.5 · By what legal route can the instrument be transferred?

Evidence obtained. Certificate terms of issue, clauses 3 and 11 (sponsor). Vault terms of business, clause 7 (sponsor). The warehouse receipts provisions of the governing jurisdiction. Confirmation from the ministry that no enactment recognising control of an electronic record as possession is in force. Counsel's opinion of 14 March on negotiability and on control.

What the evidence shows. Clause 3 expresses the certificate to be deliverable to the order of the named depositor, which under the governing statute makes it a negotiable document of title. Counsel confirms that a transferee to whom such a document is duly negotiated takes free of prior claims. Counsel also confirms that the jurisdiction has not enacted a regime under which control of an electronic record performs the function of possession, and that the position at common law is untested.

The sponsor's position, and the response. The sponsor submits that transfer on the ledger is final and irreversible and therefore achieves the same result. The assessment does not accept this. Finality of execution determines that a transfer cannot be undone; it does not determine that the transferee takes free of a defect in an earlier holder's title. That consequence is conferred by the law of negotiable documents and requires the electronic record to perform the possession function, which the governing law does not presently recognise. The sponsor has not produced authority to the contrary.

Determination. Evidentiary state: Established. Applicability: Applies. Materiality: Critical. Mapping part: mapped characteristic. Mapping fidelity: overstated. Option and stage effect: blocks. Options affected: the selected option.

Finding. The mapped transfer action assigns; it does not negotiate. A transferee takes subject to earlier claims whatever the ledger records. Moving collateral within the same day, which depends on a lender taking free of earlier claims, is not supported on the present law. A design in which the ledger is linked to the vault's register remains feasible, and the finding is reopened if a law recognising electronic control is brought into force.

Consideration 4.2 · On what legal basis is each added control held?

Evidence obtained. Contract source at commit 8f2c1ad, function freeze() and the FREEZER role. The address holding that role, and the operator's confirmation of the natural persons who control it. Terms of issue, which are silent on suspension. The arrangement's governance charter, version 2.

What the evidence shows. The issuer may suspend transfers of any holding, for any period, without notice. The terms of issue confer no such right and do not mention it. The governance charter records the control as an operational safeguard and specifies no grounds, no maximum duration, no review, and no route by which a holder may challenge its exercise.

The sponsor's position, and the response. The sponsor submits that the control is required for sanctions compliance. The assessment team accepts the purpose and does not dispute it. The question at 4.2 is the basis on which the control is held and the constraints on its exercise, neither of which the purpose supplies. A control exercised for a legitimate purpose without stated grounds or duration is still a control the instrument does not provide for.

Determination. Evidentiary state: Established. Applicability: Applies. Materiality: Critical. Mapping part: added control. Option and stage effect: condition before any live holdings. Options affected: all options.

Finding. The control may be kept, on condition that its grounds, maximum duration, review, and notice to the holder are set out in the terms of issue before any live holdings exist. The control also bears on 2.5. While it has no limits, a transferee cannot take free of earlier claims, and the benefit claimed at 1.8 is narrowed accordingly. The two findings are recorded separately, each referring to the other.

Consideration 3.2 · What obligation requires a party to perform each unmapped function?

Evidence obtained. Vault terms of business, clause 7. Request to the vault operator of 2 April for the reporting arrangement, unanswered as at the date of this record. No reporting specification produced by the sponsor.

What the evidence shows. Clause 7 gives the vault a lien over the gold for unpaid storage charges, taking priority over the holders. Nothing on the ledger records accrued charges, and no arrangement was produced by which a prospective transferee would learn of them. The accountable performer is the vault operator; the obligation is contractual; the evidence that charges are current is not produced to holders or to the authority at any frequency.

The sponsor's position, and the response. The sponsor submits that charges are paid monthly and have never been in arrears. The assessment team treats this as sponsor testimony. It is not evidence that a transferee would learn of arrears if they arose, which is the matter at issue.

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Determination. Evidentiary state: Evidence gap. Applicability: Applies. Materiality: Material. Mapping part: unmapped characteristic. Option and stage effect: condition before admission. Options affected: all options.

Finding. A holder may acquire units subject to an undisclosed lien that ranks ahead of them. Condition: the accrued charge per unit is published at a stated frequency, with the vault operator responsible for the evidence and the securities commission confirming it, before units are admitted to transfer. If the condition is not met, units are not admitted.

TABLE 2.23

Transfer by assignment and by negotiation compared

	Transfer by assignment	Transfer by negotiation
What the transferee acquires	The transferor's title, usually subject to the defences and set-offs that could be raised against the transferor	A new title of its own. A holder to whom the instrument is properly negotiated usually takes it free of earlier claims. Defects in an earlier holder's title, and defences the issuer could have raised against an earlier holder, cannot be used against this holder, who also gets the issuer's direct obligation
Notice to the issuer	Usually required, and in many legal systems decides who wins between two people claiming the same debt	Not required. Priority follows possession or control of the instrument
What the ledger must do	Generate and evidence notice reliably, and stay matched with the issuer's register	Be the only place where control sits, over one authoritative record kept single and intact for the instrument's life
Legal precondition	The assignment rules of the governing law	The instrument is negotiable, and the governing law treats control of an electronic record as equivalent to possession of a paper document
Where value is claimed	Limited. Each transfer still depends on notice, and the transferee remains exposed to earlier claims	Collateral that can be moved the same day, and transfers during the day free of earlier claims, are possible here, because a lender taking the instrument as security takes it free of earlier claims

Source: GFTN.

TABLE 2.24

Settlement options compared on illustrative findings (supports consideration 2.5 and Table A.6)

Option	Finding	Reason
Enhanced conventional settlement	Feasible now	Requires no legal change. It also produces the smallest reduction in the work of reconciling the securities record against the payment record, because both records remain separate.
Linked tokenized record, settled through existing central-bank infrastructure	Feasible, subject to conditions	Requires a stated rule for which record governs on divergence, a reconciliation procedure between the two, and a tested route for recovering positions after failure.
Settlement in a tokenized commercial-bank deposit	Feasible, subject to conditions	Requires an interbank rule ensuring that a deposit held at one bank remains exchangeable at par for a deposit held at another, so that the two are not priced differently.
Settlement in a regulated stablecoin	Not supported for this participant set	The issuer's redemption arrangements are not evidenced, and the powers this jurisdiction would hold over an issuer supervised elsewhere are not established.
Settlement in tokenized central-bank money	Unavailable	Not offered in this jurisdiction at the time of the assessment.
Issuance on a public network	Pilot only	The accountable operator cannot control the order in which transactions are recorded, changes to the network's rules, or the parties who validate them.

Source: GFTN; illustrative.

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STATUS OF THE POSITIONS RECORDED UNDER THIS FRAMEWORK

Findings recorded under this method are the assessment's findings. Formal decisions are made by the authorities responsible, within their own powers, and recorded separately. Nothing recorded here relieves an authority of a responsibility it holds under its own mandate.

This framework may be updated as the consideration set, the law, or observed outcomes from completed assessments develop.

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ANNEX A

A COMPLETE ASSESSMENT, FROM REQUEST TO FIRST REVIEW

This annex traces one case through the whole method. It is constructed. The jurisdiction, the parties and the figures are invented; the sequence, the findings and the form of each output are those the framework requires. It is included because the specimen record shows single answers, not how ninety-four answers come together into one recommendation.

A.1 THE REQUEST

A vault operator and a licensed bank jointly applied to the securities commission for a tokenized gold certificate to be admitted as eligible collateral in the domestic repo market. The vault has operated for thirty-one years, holds allocated bars for approximately 400 depositors, and issues certificates under terms of issue last amended in 2019. The application followed a decline in pledge activity that the sponsor attributed to the time taken to complete a pledge.

The mapping test. The five gates in Section 1.5 were satisfied. An instrument exists, with a governing scheme and applicable law; its characteristics can be expressed as conditions; the ledger actions are specified, each linked to an intended effect; those actions operate the certificate rather than reporting on it; and the arrangement does more than upgrade the vault's own register. Characterisation was not needed, because the certificate is an established category under the Warehousing Act. Whether it is negotiable was in doubt, but that is a question about one characteristic, not about the category, and it is answered at 2.5.

Claim type. The certificate evidences a bailment of identified allocated bars. Each depositor's metal is segregated, numbered and held to that depositor's order, so the holder owns the bars, and on the vault's insolvency they are not available to its creditors. Had the arrangement been unallocated, the holder would have ranked as an unsecured creditor; had it been a pooled co-ownership, any shortfall would have been shared in proportion to holdings. The type was established from the terms of issue and the vault's segregation certificates, and every later finding about holder protection rests on it.

A.2 COMMISSIONING

The commissioning authority is the securities commission. Its commissioning record under Section 2.2 is in Table A.1.

TABLE A.1

The commissioning record

Element	As stated
The question under examination	Whether a tokenized gold certificate can be admitted as eligible collateral in the domestic repo market, and on what conditions.
Why the review is required now	An application is before the commission, and the eligible-collateral list has not been amended since 2011.
The decision the assessment supports	The commission's determination on eligibility, and the central bank's determination on the settlement leg.
The entities entitled to act	The securities commission, the central bank's payments department, and the registry authority for the vault register.

Source: GFTN; constructed example.

The intended outcome, stated in one sentence under Section 2.1: to mobilise vaulted gold as collateral that lenders accept within the business day.

A.3 THE ENTRY SCREEN

The entry screen questions of Section 2.4 were answered in four weeks, from documents supplied by the sponsor and from the commission's own records.

Disposition: proceed to full assessment, narrowed to the collateral use. Two matters entered the record at screening and were carried into the assessment: the settlement system closes at 16:00 while the proposition assumes same-day completion, and lender acceptance of the tokenized form was untested.

What was assembled. Before the areas were opened, the assessment team obtained, from the sponsor: the terms of issue and the vault's terms of business; the specification of the six ledger actions; the deployed contract and the addresses holding privileged roles; the operating-cost model with five years of actuals; the reserve methodology, insurance policy, and the 2025 audit. From public sources: the Warehousing Act and the registry rules; confirmation from the ministry that no electronic transferable records regime is in force; the RTGS rulebook and its finality provisions; and the revenue authority's published treatment of certificate transfers. The vault's ledger of storage charges was requested and not supplied, which became the evidence gap at Area 3.

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TABLE A.2

The entry screen

	Question	What the screen found
1	Who needs a decision, and why now?	The commission, on a live application. Pledge volumes fell 22 per cent over three years.
2	What decision, and which authority?	Admission to the eligible-collateral list. The commission, with the central bank on settlement.
3	What outcome is sought?	Pledges completing within the business day rather than in three to five.
4	Which legal instrument, under which law, on which register?	The gold certificate issued under the vault's terms of issue, governed by domestic law, given effect by the vault's own register.
5	What problem is evidenced, at which step?	Ownership verification, lien registration, and settlement run sequentially. Median completion 3.4 business days, from 214 pledges sampled.
6	Is the instrument sound as it operates today?	Preliminary yes. The vault is solvent, audited annually, and insured to 110 per cent of holdings. The lending market functions.
7	Which characteristics would be mapped?	The record of holding, transfer, and the creation and release of encumbrances.
8	Which controls would the scheme add?	Freeze, clawback, forced transfer, issuance and cancellation, and authority to change the contract.
9	What realistic alternatives exist?	An upgrade to the vault register; tighter sequencing of the three existing steps; doing nothing.
10	What external infrastructure is assumed?	Settlement against central bank money in the domestic RTGS system, which closes at 16:00.
11	Which authorities are involved?	Securities commission, central bank payments department, registry authority.
12	What decision question, and what evidence would justify each disposition?	Whether to admit the tokenized form, and on what conditions. Evidence on legal effect, settlement window, and lender acceptance.

Source: GFTN; constructed example.

A.4 THE MAPPING RECONCILIATION

TABLE A.3

The reconciliation for this scheme

Mapped characteristics	Unmapped characteristics	Added controls
Record of holding	Assay, fineness, and weight verification	Freeze of any holding
Transfer between holders	Segregation and physical custody	Clawback and forced transfer
Creation of an encumbrance	Insurance and its renewal	Issuance and cancellation of units
Release of an encumbrance	The vault's lien for unpaid storage charges	Authority to change the contract
	Physical delivery on redemption	
	Presentment and cancellation of the certificate	

Source: GFTN; constructed example.

Each column came from a different source. The mapped column came from the sponsor's specification of ledger actions, the unmapped column from the vault's terms of business, and the added-controls column from the deployed contract and the addresses holding privileged roles.

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A.5 WHICH AREAS WERE OPENED

TABLE A.4

Area coverage

Area	Treatment	Reason where not opened in full
1. Purpose and viability	Opened in full	
2. Instrument and mapping	Opened in full	
3. Operation and lifecycle	Opened in full	
4. Governance and controls	Opened in full	
5. Money and settlement	Opened in full	
6. Interoperability and reporting	Opened; 6.7 and 6.9 not applicable	No cross-jurisdictional movement is proposed, and there is no second platform to switch to.
7. Resilience	Opened in full	
8. Mandates and capability	Opened in full	
9. Policy effects and implementability	Opened; 9.6 and 9.7 not applicable	The issuer, operator, and record are all domestic.

Source: GFTN; constructed example.

A.6 THE FINDINGS

Each area produced one finding. The basis, the unresolved matters, and the consequence for the options are stated with it. Four are set out in full below; the remainder are summarised in Table A.5.

The transfer route is the binding finding and is given first, out of area order, because the remaining findings are read against it.

Area 2, the binding finding. The reasoning is set out in the specimen record at consideration 2.5. The certificate is a negotiable document of title under the Warehousing Act, but the law does not recognise control of an electronic record as possession, so the ledger transfer assigns the certificate and does not negotiate it. Evidentiary state: Established. Materiality: Critical. Mapping fidelity: overstated. Effect: blocks the selected option.

Area 1, attribution. The sponsor's case for moving collateral within the same day rests on a lender taking the certificate free of earlier claims, which follows from negotiation and not from the transfer being final on the ledger. On the present law a lender takes subject to earlier claims, whatever the ledger records, and would set its haircut accordingly. The shorter pledge cycle, from 3.4 days to within the business day, comes from coordinating three steps on one record, which the linked-record option also achieves. Effect: the benefit claim is narrowed under 1.8.

Area 4, added controls. As in the specimen record at consideration 4.2, the vault operator alone holds the freeze, clawback and forced-transfer functions, which the terms of issue do not provide for and do not limit. The stated purpose, court orders and sanctions compliance, supplies neither a legal basis nor limits. While the controls have no limits, a buyer could not take the certificate free of earlier claims even if the law changed. Effect: condition before any live holdings, on all options.

Area 5, the settlement window. The RTGS system closes at 16:00. The payment is made on that system and not on the ledger, so the transfer and the payment cannot be settled together on the ledger, and the answer to 5.3 is no. A pledge started after 15:30 cannot complete the same day, whichever record is used. The same-day claim is therefore limited by the payment system's hours, not by the ledger. Effect: constrains all options equally, so it is not a reason to prefer one.

A.7 CROSS-AREA SYNTHESIS

The binding constraint is legal, at 2.5. Resolving it would change the outcome for the scheme as a whole. With an electronic transferable records regime in force, and the freeze, clawback and forced-transfer functions limited, the scheme as proposed becomes feasible and the claim of faster collateral movement stands. Without such a regime, the claim fails on every design, and the choice between options turns on the smaller gain from coordinating three steps on one record. No other finding blocks an option; the rest are conditions.

Changing the record does not change when the payment system closes. That limit applies equally to every option and to today's arrangement, and it caps the gain at pledges started before 15:30.

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TABLE A.5

The remaining findings

Area	Finding	Effect
1	Problem evidenced at 3.4 days median. Breakeven at 95,000 pledges a year against 140,000 observed across all participants, so the scheme must reach roughly 68 per cent of the market to meet its costs. Lender acceptance is untested.	Condition: evidence of acceptance from at least four lenders before scale
1.12	No party bears consequence under the scheme without holding a position. The bars are held in a commercial vault, not occupied or used by anyone, and no employment or tenancy depends on them. Recorded as not applicable with that reason, so that a later scheme over an occupied asset is not assessed by analogy with this one.	Not applicable, with reason
3	Assay, segregation, insurance, the storage lien, delivery, and presentment remain unmapped. The vault's lien ranks ahead of holders and nothing on the ledger discloses accrued charges. No reporting arrangement was produced.	Evidence gap. Condition before admission
6	The ledger and the vault register must be reconciled daily. The procedure exists in draft and has not been tested. 6.7 and 6.9 not applicable.	Condition before any live holdings
7	Permissioned ledger, three nodes, all run by the sponsor group. The operator holds the upgrade key. There is no defined way to recover holdings after a key is lost. If transfer is by negotiation, recovery would need the procedure for lost documents; if by assignment, the register decides.	Condition before material exposure
8	Three mandates are involved. The commission has no market-surveillance capability for this instrument and no data feed from the ledger. The registry authority confirms the vault register remains definitive.	Condition: a surveillance data feed before admission
9	Not material at the proposed scale. Threshold set at 5 per cent of the domestic collateral pool, observed monthly by the central bank from existing returns. If crossed, the central bank may require the arrangement to report daily and the commission may narrow the pilot scope; both can be exercised within a fortnight. Transfer of the certificate is not a taxable event, confirmed by the revenue authority.	Supports progression, with the threshold and its action recorded

Source: GFTN; constructed example.

A.8 THE OPTIONS COMPARED

TABLE A.6

Options on the same evidence

Option	Feasible?	What it delivers	What it requires
As proposed: the ledger record operates the certificate as a negotiable document	No, on the present law	The full claim, including a pledgee taking free	Enactment of an electronic transferable records regime, and bounds on the freeze, clawback, and forced-transfer functions
Linked record: the vault register remains definitive; the ledger coordinates the three steps and notice is generated automatically	Yes	Pledges made before 15:30 complete within the business day. The lender takes subject to earlier claims	Conditions at Areas 1, 3, 4, 6, 7, and 8
Registry upgrade: the vault register is modernised, no ledger	Yes	Completion in roughly two days on the sponsor's own estimate	A smaller change, and no new eligible-collateral determination
Defer until the legal position changes	Yes	Nothing now	A stated condition for reopening the question

Source: GFTN; constructed example.

A.9 THE RECOMMENDATION

Disposition. Proceed to a conditional pilot on the linked-record option. Stage: pilot. Scope: pledges between the four largest lenders and the vault, capped at 8,000 ounces outstanding, for twelve months. The benefit accepted for the eligible-collateral decision is a shorter pledge cycle, not that a lender takes the certificate free of earlier claims.

Not recommended. The token-as-negotiable-document option is not recommended and is reopened if an electronic transferable records regime is enacted. The registry upgrade remains in the comparison and is the fallback if the pilot's conditions are not met.

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A.10 CONDITIONS

TABLE A.7

The conditions attached to the recommendation

Condition	Gate	Evidence	Verified by	Who acts if it is not met	If unmet
Bounds on the freeze, clawback, and forced-transfer functions: grounds, maximum duration, review, and a holder's challenge route, in the terms of issue	Before any live holdings	Amended terms of issue	Commission legal division	Securities commission	Do not admit
Record-precedence rule and a tested reconciliation procedure between the ledger and the vault register	Before any live holdings	Procedure and test report	Registry authority	Registry authority	Do not admit
Accrued storage charge per unit published at a stated frequency	Before admission	Reporting specification, first three reports	Commission market division	Securities commission	Units not admitted to transfer
Surveillance data feed from the ledger to the commission	Before admission	Feed specification and a fortnight of test data	Commission market division	Securities commission	Do not admit
Recovery route after key loss, consistent with the transfer route	Before material exposure	Documented procedure and one exercise	Commission and registry authority jointly	Securities commission	Do not scale beyond the pilot cap
Written acceptance of the tokenized form from at least four lenders	Before scale	Signed confirmations	Commission market division	Securities commission	Pilot ends; registry upgrade becomes the fallback
Bounds on the authority to change the contract: approval required, notice to holders, and a tested route to reverse a change	Before any live holdings	Change procedure and amended terms of issue	Commission legal division	Securities commission	Do not admit

Source: GFTN; constructed example.

A.11 AUTHORITY DECISIONS

Three determinations were made, separately, after the assessment was submitted. They are the authorities' own and are not written by the assessment team.

TABLE A.8

Authority decisions, made downstream and recorded separately

Authority	Determination	Basis	Review
Securities commission	Admits the tokenized certificate to the eligible-collateral list for the pilot scope only, subject to the seven conditions. The remaining risk that a lender takes the certificate subject to earlier claims is accepted and disclosed to participants.	Section 14 of the Securities Act, eligible-collateral determination	Twelve months, or on a condition being unmet
Central bank, payments department	Notes the settlement arrangement. No change to RTGS hours. The money obligation continues to be discharged in central bank money on the existing system.	Payment systems oversight mandate	On any application to extend hours
Registry authority	Determines that the vault register remains the definitive record of holdings and liens, and that a ledger entry alone does not create or release an encumbrance.	Warehousing Act, registry rules	On enactment of an electronic transferable records regime

Source: GFTN; constructed example.

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A.12 THE TRANSMISSION REGISTER

TABLE A.9

Extract from the transmission register

The last row is itself a finding: an authority that has been told and has not acted is in a different position from one that was never told.

Finding	Addressed to	Asked to	Provided	Response	Effect on the assessment	When to send it again
2.5, the transfer route	Ministry of justice, commercial law division	Note, for the electronic transferable records workplan	14 March	Acknowledged 2 April; no position taken	None. The finding stands whether or not the ministry acts.	On any consultation on an electronic transferable records bill
3.2, the storage lien	Registry authority	Determine whether the lien must be entered on the vault register	14 March	Determined 28 March: entry required	Closed. The lien is now entered and visible to a transferee.	None
8.4, surveillance capability	Securities commission, market division	Act: specify and procure the data feed	14 March	Feed specified 6 May	Condition before admission cannot close until the feed runs.	Monthly until the feed is accepted
9.1, threshold	Central bank, financial stability	Note and observe monthly	14 March	No response as at 30 June	The threshold has no observer until the central bank confirms. Recorded as incomplete under 9.1.	Monthly, and on the pilot reaching half the threshold

Source: GFTN; constructed example.

A.13 FIRST REVIEW, AT NINE MONTHS

TABLE A.10

Expectation against observation

Expected	Observed	Consequence
Pledge completion within the business day	Same-day completion in 71 per cent of 1,140 pledges. Failures concentrated between 15:30 and 16:00.	The finding at 5.3 is reopened. The payment system's closing time, not the record, is what stops the remaining pledges completing.
Lender acceptance from at least four lenders	Three lenders accepted. The fourth declined, citing the larger haircut it must apply because a lender takes the certificate subject to earlier claims.	The finding at 1.10 is reopened. With three lenders the scheme cannot reach the volume it needs to cover its costs, and the condition before scale is not met.
Reconciliation between the ledger and the vault register holds	No break in nine months	Condition closed by the registry authority.

Source: GFTN; constructed example.

The second row matters most. The lender that declined gave as its reason the legal finding at 2.5, which the assessment had identified as binding and which the pilot was designed to work around rather than resolve. The commission's trigger for reassessment was met, and the matter returns with two options: continue with three lenders below breakeven, or stop and revert to the registry upgrade. The ministry's response on the electronic transferable records workplan, still outstanding, would change the answer.

No part of the assessment was repeated.

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SECTION 3
FRICTIONS IN TOKENIZED MARKETS

Problem statements and perspectives from the private sector

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OVERVIEW OF SECTION 3

This section sets out eight frictions in tokenized markets, as identified by the firms and research partners building them. They were surfaced through GFTN's open call and working groups, and most were reviewed with public-sector participants. The problem statements reflect the views of their contributors, not those of GFTN.

Firms meet these frictions first, in the course of building and operating a scheme. By the time a friction shows up in market data or a supervisory finding, design choices have often been locked in. Surfacing frictions early gives authorities a view of where a scheme is likely to break before it reaches them for assessment. Naming the frictions publicly also shows they are shared, not peculiar to one firm, and that no single firm can remove them alone. That is the coordination problem tokenized markets face.

Read together, the eight show a consistent pattern:

- Every friction engages governance and compliance, not only technology.
- Settlement is the most contested market function: which money settles, and when settlement becomes legally final.
- Seven of the eight point to coordination as the barrier to moving from pilot to production.

The section has three parts:

- **Part 1** presents the eight problem statements: the private sector's view of where the frictions sit and why they arise
- **Part 2** places each on GFTN's stylised view of the tokenized ecosystem, in which five market functions are performed across five technology layers. It shows that no friction stays within one cell.
- **Part 3** reads each against the assessment areas of the Tokenization Pathways framework, naming where the same friction would surface in a country's own assessment.

These are perspectives from parties with a stake in the outcome, and they are presented as such. They are frictions for a country to weigh against its own starting conditions, not conclusions to adopt as given.



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PART 1
PERSPECTIVES FROM PRIVATE SECTOR

READING THE PROBLEM STATEMENTS

Each problem statement was submitted through GFTN's open call, as a completed contribution form, a position set out at a GFTN roundtable held under the Chatham House Rule, or a published paper. Six of the eight have been discussed with public-sector participants at a GFTN roundtable. All are open to further debate in public forums as opportunities arise, so none should be read as a settled conclusion. Contributors are credited collectively in the Acknowledgements. The problem statements are not weighted against one another. Each describes a specific friction observed in practice, not a claim about tokenization as a whole.

Every entry follows the same shape.

- **The friction** sets out what the problem is and why it arises.
- **Where it shows up** points to where it appears: the data, the jurisdictional record, or the operating experience behind it.
- **Why it matters** states what follows if the friction is left unresolved.
- **Signs of movement**, where they exist, record any live development that narrows the gap.

TABLE 3.1

The eight problem statements

01

Stablecoin Settlement within Regulated Payment Licences

A licensed payment provider can usually add a bank partner without a new licence, but using a stablecoin as a settlement rail usually requires one, even when the customer never holds the token. Most of the cost sits at the conversion points at each end, where wider licensing could let more providers compete.

02

Tokenized Market Access for Small Investors, with Investor Protection

More than 4 billion adults hold no equities, bonds or funds, largely because the recurring cost of serving a small account exceeds what it earns. Tokenization could cut custody and settlement costs and let holdings move between venues, but what a saver owns depends on the token's legal wrapper.

03

Recognising AI Agents as Payment Initiators

Payment rules recognise people and licensed institutions as payment initiators, not software. No framework yet lets an agent's authority, and the person behind it, be relied on across institutions and borders.

04

Standards and Identity for Cross-Domain Interoperability

Traditional finance shares a common language for messaging; tokenized markets do not. Without harmonised standards for messaging, identity, compliance, and settlement, tokenized finance risks growing into incompatible systems.

05

Proportionate Compliance for Banks on Public Blockchains

Basic compliance questions about banks' use of public blockchains remain unanswered, so banks take the most conservative reading, at a cost that concentrates adoption among the largest.

06

Recalibrating FMI Regulation for Tokenized Settlement

FMI rules were calibrated to the risks of sequential, intermediated markets. Tokenization changes both the risks and who bears them, and the rules have yet to follow.

07

Quantum-Safe Security for Tokenized Assets

Tokens carry value, not just data, across networks. The cryptography that protects them is expected to be broken by future quantum computers, and migration takes years, so protection has to start now.

08

Settlement Coordination for Tokenized Deposits

Payments between banks' tokenized deposits can move at any hour, but final settlement between banks still waits for existing rails, leaving a gap between paying, crediting, and settling.

Source: GFTN analysis of contributor problem statements.

1.1 STABLECOIN SETTLEMENT WITHIN REGULATED PAYMENT LICENCES

The friction

Cross-border payments pass from bank to bank through correspondent relationships, with currency converted as the payment moves between them. A stablecoin can move the same value on a blockchain quickly and cheaply: in Banca d'Italia's test transfers, the on-chain leg took under 15 minutes in seven of eight

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corridors and cost 0.4 per cent of the amount on average.[33] Such transfers typically take the form of a "stablecoin sandwich": local currency is converted into a stablecoin, the stablecoin moves on-chain, and it is converted back into local currency at the other end.[34] In the arrangement this problem statement concerns, a licensed payment provider performs those steps and the customer never holds the stablecoin. The provider does, for as long as the transfer takes.

A licensed payment provider can usually add a new card scheme or bank partner without a new licence. Using a stablecoin as a settlement rail usually requires one. Most jurisdictions regulate fiat payments and digital-asset activity as separate activity classes, often under different regulators, so the provider must obtain a digital-asset authorisation, set up a separate licensed entity, or work through a partner where the rules allow it. Where no framework exists, or stablecoin activity is prohibited, the flow cannot be offered at all.

The technical integration is no longer the main obstacle, and stablecoin settlement is already in commercial use. Stripe completed its acquisition of Bridge, a stablecoin infrastructure provider, in February 2025.[35] Mastercard completed its acquisition of BVNK in August 2026,[36] and in October launched a platform that holds fiat and stablecoin balances in one account, with conversion between them.[37] For a licensed provider that wants to add the rail itself, the licensing step remains, and in some countries the route is closed or restricted.

The ask

The contributor asks that, where a licensed payment provider's existing permissions and controls cover the activity and its risks, adding a stablecoin settlement rail be treated much like adding a new card scheme, bank partner or local payment method. The customer never holds the stablecoin. The provider remains accountable for the risks, but a change of rail would not, by itself, require a new license or variation; notification and ongoing supervision may be sufficient. The ask applies at both ends of the payment: to the provider that sends through the rail, and to the provider that receives stablecoin settlement, converts it and pays out in local currency.

The activity is narrow: the sending provider buys a stablecoin with the sender's funds and moves it to a licensed provider abroad, which sells it for local currency and pays out. Three features of that activity determine how a regulator will see it.

The provider holds the token. For the minutes or hours between purchase and sale, the provider carries the issuer's credit risk, the risk that the token trades below par, and the operational risk of the chain and the wallets. In a correspondent arrangement the same exposure sits with a supervised bank. A regulator asked to approve the rail is being asked to accept a new counterparty, the stablecoin issuer, inside a payment chain it supervises.

The counterparty abroad needs a licence too. The sandwich works only if a licensed firm at the destination converts the token into local currency and pays out through the domestic rail. Today that firm usually falls under the destination country's digital-asset regime, including its view of foreign stablecoins. The ask covers this receiving side too, and it matters most there, because that is where most of the cost arises.

The tokens in use are issued abroad. Roughly 98 per cent of stablecoin value is dollar-denominated,[38] and the sandwich runs almost entirely on dollar tokens issued in the United States. A country that lets its payment providers settle in those tokens is admitting a foreign-issued instrument, and its foreign supervisor, into its regulated payment chain. That is a different decision from permitting a locally issued stablecoin, and several current reforms cover only the latter.

What the rail changes, and what it does not

The rail by itself replaces only the correspondent leg. It does not change the conversion points or the domestic rail at the destination, where most cost and delay sit. Wider licensing could, however, change how many providers compete at those conversion points.

The headline remittance figure hides a wide spread. The global average cost of sending US$200 was 6.36 per cent in the third quarter of 2025, against a target of 3 per cent by 2030.[39] In the same data, banks averaged close to 15 per cent, digital-only money transfer operators about 3.5 per cent, and the three cheapest qualifying services in each corridor 3.29 per cent.[40] Cheap channels already exist in most corridors. The expensive part of the market is bank channels, cash-based services and the corridors where no cheap digital provider operates.

Banca d'Italia executed real transfers of 200 USDC across ten corridors linking Italy with Argentina, Brazil, South Africa, the United Arab Emirates and Japan. Total costs ranged from 0.30 per cent to nearly 9 per cent; the on-chain transfer accounted for only a marginal share; and the main costs and delays arose in buying, funding, withdrawing and converting at each end.[41] Where instant payment systems existed, end-to-end settlement took under 20 minutes; where standard bank transfers were required, it took one or two business days.

Swift's network data show the same pattern for conventional payments. Around 80 per cent of total processing time is spent in the final domestic stage, after the payment reaches the beneficiary's institution, and the leading causes are regulatory reporting requirements, currency and foreign-exchange controls, operating hours and domestic infrastructure.[42] Swift is an interested party in this debate, but its finding and Banca d'Italia's point the same way from opposite sides.

33 Banca d'Italia (2026). Are stablecoins efficient for remittances? Evidence from a mystery-shopping exercise. Mercati, infrastrutture, sistemi di pagamento, 30 July 2026. https://www.bancaditalia.it/media/notizia/le-stablecoin-sono-efficienti-per-le-rimesse-internazionali-evidenze-da-un-esercizio-di-mystery-shopping-della-banca-d-italia.

34 Banca d'Italia (2026), op. cit. Du, W., Huang, C. and Scharfstein, D. (2026). Competing Rails for Cross-Border Payments: Banks, Fintechs, and Stablecoins. Harvard Business School Working Paper. Cited in Banca d'Italia (2026).

35 Stripe (2025). Stripe completes Bridge acquisition. Stripe Newsroom, 4 February 2025. https://stripe.com/us/newsroom/news/stripe-completes-bridge-acquisition.

36 The Block (2026). Mastercard completes BVNK acquisition to expand stablecoin payments infrastructure. August 2026. https://theblock.co/post/410521/mastercard-completes-bvnk-acquisition.

37 Crowdfund Insider (2026). Mastercard launches Global Money Platform to integrate stablecoin balances with traditional banking and card payments, 17 October 2026.

38 Aldasoro, I., Frost, J. and Ito, H. (2026). The impact of stablecoins on the international monetary and financial system. BIS Papers No 170, 5 May 2026. https://www.bis.org/publ/bppdf/bispap170.pdf.

39 World Bank (2025), op. cit.

40 World Bank (2025), op. cit.

41 Banca d'Italia (2026), op. cit.

42 Swift (2025a). Spotlight on Speed: unlocking last-mile speed in cross-border payments. https://www.swift.com/swift-resource/252489/download.

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A licensed provider that adds the rail still converts at both ends, still meets the destination's reporting and foreign-exchange rules, and still depends on the domestic system that credits the recipient. The gain is real where correspondent fees, pre-funding costs or the withdrawal of correspondent banks make the middle leg expensive or unavailable, which is the case in a number of thin corridors. It may be smaller where a cheap digital provider already operates. The contributor's position that a provider would use the rail only where it is cheaper is sound. The savings on the correspondent leg are therefore limited to those corridors. Any wider effect would come from competition at the conversion points.

The contributor's stronger argument concerns the conversion points themselves. If every regulated payment provider, including banks, wallets and remittance operators, could accept inbound stablecoin settlement much as it accepts inbound dollars, more providers would compete to convert and pay out those funds, deepening liquidity and narrowing spreads. The remittance literature supports the mechanism. Across up to 365 corridors over 2011 to 2020, a one-standard-deviation increase in the number of providers in a corridor is associated with costs about 0.3 percentage points lower, the effect runs through money transfer operators rather than banks, and easing entry for non-bank providers is among the levers the study recommends.[43] Earlier work on 119 corridors found the same relationship.[44] These studies show that greater competition can lower costs. They do not establish the size of the effect from each additional provider, which will vary by corridor. Recent IMF work on the stablecoin sandwich finds that trading fees and on- and off-ramp fees make up most of the cost of a transfer. It notes that costs could change as traditional payment providers integrate stablecoins, and leaves the role of licensing and competition to further research.

Where it shows up

The licensing split exists in each jurisdiction below, but the five cases differ. Two are administrative, one is a deliberate reversal, one runs in the opposite direction from the ask, and one is a closed door.

Singapore treats payment services and digital payment token services as separate activity classes under the Payment Services Act 2019, and a licensee must have its licence varied before adding a new service[45]. This is an administrative step inside one regulator.

Hong Kong can require two licences from two regulators for one flow: a Money Service Operator licence from the Customs and Excise Department for the fiat remittance, and a virtual-asset trading platform licence from the Securities and Futures Commission for stablecoin trading and custody[46]. Issuance of fiat-referenced stablecoins is regulated separately by the Hong Kong Monetary Authority under the Stablecoins Ordinance, in force since August 2025[47]. The split is institutional as well as legal.

Brazil has decided the question the other way. The central bank's Resolution 561, published on 30 April 2026 and in force from 1 October 2026, requires settlement between an eFX provider and its foreign counterparty to run exclusively through a foreign-exchange transaction or a non-resident account in reais, and prohibits the use of virtual assets, including stablecoins, for that step.[48] The rule came after stablecoins had become the working settlement asset for several licensed fintechs.[49] Brazil had the integration in production and the capacity to supervise it, and closed the rail to keep cross-border settlement inside its foreign-exchange reporting. Its separate regime for virtual-asset service providers, in full effect from February 2026, treats exchanges of fiat-pegged tokens as foreign-exchange operations.[50]

The European Union runs the split in reverse. The question there has been whether a crypto-asset service provider transferring e-money tokens for clients also needs a payments authorisation. The European Banking Authority advised in June 2025 that such transfers are payment services, asked national authorities not to enforce the second authorisation until 2 March 2026, and said EU law should in the long term avoid requiring dual authorisation for the same activity.[51] That date closed a supervisory forbearance period rather than MiCA's transition. Whether a licensed payment institution that buys and sells e-money tokens on its own account to settle a transfer is carrying on a crypto-asset service at all is a perimeter question the letter did not resolve.

The Philippines reserves exchange of virtual assets for pesos to virtual-asset service providers licensed by the Bangko Sentral ng Pilipinas[52]. The BSP stopped accepting new applications in September 2022 and in August 2025 extended the moratorium

43 Beck, T., Janfils, M. and Kpodar, K. R. (2022). What Explains Remittance Fees? Panel Evidence. IMF Working Paper WP/22/63, April 2022. https://doi.org/10.5089/9798400205439.001.

44 Beck, T. and Martínez Pería, M. S. (2009). What Explains the Cost of Remittances? An Examination across 119 Country Corridors. Policy Research Working Paper 5072, World Bank. Published as "What Explains the Price of Remittances? An Examination across 119 Country Corridors", The World Bank Economic Review, 25(1), 105–131 (2011). https://econpapers.repec.org/paper/wbkwbrwps/5072.htm.

45 MAS (2025). Guidelines on Licensing for Payment Service Providers (PS-G01), amended 8 October 2025. https://www.mas.gov.sg/-/media/mas-media-library/regulation/guidelines/pso/ps-g01-guidelines-on-licensing-for-payment-service-providers/guidelines-on-licensing-for-payment-service-providers-psg01-amendment-updated-8-oct-2025.pdf. Digital payment token service is listed as its own activity under the Payment Services Act 2019, and MAS approval is required before starting a new payment service. Adding a service to an existing licence uses MAS (2024a). Form 2: Application for the variation or change of a payment service provider licence. https://www.mas.gov.sg/-/media/mas-media-library/regulation/forms-and-templates/pd/form-2---application-for-the-variation-or-change-of-a-payment-service-provider-licence/specimen-form-2-(240826).pdf.https://www.mas.gov.sg/-/media/mas-media-library/regulation/forms-and-templates/pd/form-2---application-for-the-variation-or-change-of-a-payment-service-provider-licence/specimen-form-2-(240826).pdf

46 Customs and Excise Department, Hong Kong (2023). Licensing Guide for Money Service Operators, under the Anti-Money Laundering and Counter-Terrorist Financing Ordinance (Cap. 615). https://eServices.customs.gov.hk/MSOS/download/guideline/Licensing_Guide_en.pdf. Running a remittance business requires a licence from the Commissioner of Customs and Excise. Virtual-asset trading platforms are licensed by the Securities and Futures Commission; see SFC (Securities and Futures Commission) (2023). Guidelines for Virtual Asset Trading Platform Operators, effective 1 June 2023 (G.N. 3121). https://www.gld.gov.hk/egazette/pdf/20232721/egn202327213121.pdf. See also https://www.customs.gov.hk/en/service-enforcement-information/anti-money-laundering/msos/index.html.

47 HKMA (Hong Kong Monetary Authority) (2025). Regulatory regime for stablecoin issuers (Stablecoins Ordinance, Cap. 656, in force 1 August 2025). https://www.hkma.gov.hk/eng/key-functions/international-financial-centre/stablecoin-issuers. The Register of Licensed Stablecoin Issuers shows the first licences granted on 10 April 2026. See also https://www.hkma.gov.hk/eng/regulatory-resources/registers/register-of-licensed-stablecoin-issuers/.

48 Banco Central do Brasil (2026). Resolução BCB nº 561 (international payment or transfer services, eFX), 30 April 2026, in force 1 October 2026. https://www.bcb.gov.br/estabilidadefinanceira/buscanormas.

49 Stablecoin Insider (2026). Brazil's central bank proposes 24-hour hold on large dollar stablecoin transfers.

50 The Paypers (2026). Brazil bans stablecoin and crypto settlement in regulated cross-border payments from October 2026, May 2026.

51 EBA (European Banking Authority) (2025). No Action Letter on the interplay between PSD2 and MiCA (EBA/Op/2025/08), 10 June 2025. https://eba.europa.eu/sites/default/files/2025-07/bde8c438-bb3f-4343-a158-f42b7afc9650/EBA%20Op%202025%2008%20%28No-Action%20letter%20on%20PSD2-MICA%20interplay%29.pdf.

52 BSP (Bangko Sentral ng Pilipinas) (2021). Circular No. 1108: Guidelines for Virtual Asset Service Providers. https://lpr.adb.org/sites/default/files/2024-04/philippines-guidelines-for-virtual-asset-service-providers-circular-1108.pdf. The VASP definition includes exchange between virtual assets and fiat currency, and a VASP needs a Certificate of Authority to operate.

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until further notice, citing consumer protection and cybercrime.[53] Institutions it already supervises may still apply, so the moratorium closes the route only to new entrants outside BSP supervision. Brazil, by contrast, closes the route by rule for the eFX settlement step. In the remaining cases, the route exists but costs time and capital.

Open questions for authorities

Public authorities and other reviewers raised the following questions, which any country would need to answer before extending a payment licence to stablecoin settlement.

Whether the saving reaches the end user. Authorities will want evidence, corridor by corridor, that a provider using the rail passes a lower price to customers and that the saving is not absorbed by exchange spreads at cash-out. Participants with experience of emerging-market remittances noted that stablecoin transfers are not always cheaper once the payment reaches its destination, because the rate at cash-out can be uncompetitive.

Who bears the issuer risk. A payment licence is granted on the basis that customer funds are safeguarded in bank accounts or liquid assets. Authorities will need to decide whether a stablecoin held in transit counts as safeguarded funds, what happens if the issuer suspends redemption or the token trades below par mid-transfer, and whether the provider needs capital against the exposure.

Whether a foreign-issued token belongs in the regulated payment chain. Admitting a dollar token issued abroad into a licensed payment flow is a decision about a foreign instrument and its supervisor, not only about the provider. The United Kingdom's current proposal would treat UK-issued qualifying stablecoins as money-like for payments purposes and leaves open whether tokens issued in recognised overseas jurisdictions could qualify.[54]

Visibility and foreign-exchange controls. The contributor's view is that keeping licensed providers off the rail pushes flows outside the reporting a central bank relies on. Brazil reached the opposite conclusion from the same facts, requiring its licensed providers to settle abroad through foreign-exchange transactions so that the flow stays inside its reporting.[55] A stablecoin leg between two licensed firms is visible to both of their regulators, but it is not a foreign-exchange transaction as most capital-control regimes define one, and it may fall outside purpose-of-payment reporting. Authorities will want to know how the rail reports into balance-of-payments statistics and foreign-exchange monitoring before treating it as a visible channel.

Anti-money-laundering obligations on the on-chain leg. The FATF travel rule applies to transfers between virtual-asset service providers, and screening wallet addresses against sanctions lists is a separate discipline from screening bank counterparties. A payment provider using the rail takes on these obligations even though its customer never touches the token. Authorities will ask whether a payments supervisor has the tools to examine them.

Capacity in emerging and developing economies. As of August 2025, only five of the jurisdictions reviewed by the Financial Stability Board had finalised comprehensive frameworks for stablecoins.[56] The contributor's inference is that activity-based authorisation would help these countries by using the supervisor they already have. The same shortage of capacity makes it harder for that supervisor to assess issuer risk, chain risk and travel-rule compliance in a flow it has not supervised before. The BIS finds that stablecoins are most likely to affect the store-of-value and medium-of-exchange roles of money in economies facing macroeconomic instability, and that integrating them domestically requires significant regulatory capacity.[57] A settlement-only use in which customers never hold the token is less exposed to that risk than retail use, but a licensed on- and off-ramp also makes the token easier to obtain.

What a workable model needs

The choice is not between a payments licence and a digital-asset licence. It is how a supervisor treats a change of rail within an activity it already supervises.

An proportionate regulatory pathway. Where a payments supervisor is satisfied that existing permissions and controls cover the activity and its risks, adding the rail could be handled by notification and ongoing supervision, as a new card scheme or bank partner would be, with the provider remaining accountable for the risks. Where a risk is not covered, the supervisor can attach conditions to the flow or require a variation for that element. The safeguards that carry the risk are: which issuers' tokens may be used, how a token in transit is treated for safeguarding and capital, how the flow reports into foreign-exchange and balance-of-payments statistics, and what the provider must show on travel-rule and sanctions screening. A view expressed by public-sector participants points the same way: rather than asking which licence category a provider falls into, an authority can ask whether its existing toolbox addresses the risks of the flow, whichever category applies.

Issuer recognition. The flow depends on a token the home authority does not supervise. A workable model names the issuers or issuing regimes whose tokens a licensed provider may hold in transit, as the United Kingdom proposes to do for UK-issued and possibly recognised overseas stablecoins. Without that, the authority is approving a rail without knowing what runs on it.

A reporting hook at the conversion point. The point where local currency becomes a token is the point where a country sees the flow, applies outward-flow limits and collects statistics. Brazil's rule shows that a well-equipped authority may prefer a conventional foreign-exchange transaction at that point to a token transfer, because its reporting is built around the former. An activity-based authorisation that reports the token leg as a foreign-exchange transaction, with purpose codes, could address that reporting concern.

Domestic instant payment rails. Both the Banca d'Italia test and the Swift data locate speed in the domestic last mile. A stablecoin leg into a country without an instant payment system

53 BitPinas (2025). BSP extends ban on new crypto exchange VASP license applications. https://bitpinas.com/regulation/bsp-vasp-ban/.
54 Baker McKenzie (2026). United Kingdom: consultation on modernisation of payments regulation, July 2026. Summarises HM Treasury's consultation of 14 July 2026, closing 6 October 2026.
55 Banco Central do Brasil (2026), op. cit.
56 FSB (Financial Stability Board) (2025). Thematic Review on the FSB Global Regulatory Framework for Crypto-asset Activities, 16 October 2025. https://www.fsb.org/2025/10/thematic-review-on-fsb-global-regulatory-framework-for-crypto-asset-activities/.
57 Aldasoro, Frost and Ito (2026), op. cit.

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still ends in a one- or two-day bank transfer. The investment that most shortens cross-border payments is domestic.

Corridor evidence. Authorities can reasonably ask for data on price and speed in the specific corridors a provider wants to serve, rather than on the rail in general. That assessment should consider both savings on the correspondent leg and the potential effect of greater competition at conversion points.

Signs of movement

HM Treasury's July 2026 consultation on modernising payment services regulation proposes to treat UK-issued qualifying stablecoins as money-like for payments purposes and bring them inside the payments perimeter, with the possibility of the same treatment for stablecoins issued in recognised overseas jurisdictions.[58] Firms already authorised would need a variation of permission before providing payment services using tokenized money, a more demanding route than notification.[59] The Bank of England published its policy statement for systemic sterling stablecoins in June 2026 and intends to finalise its code of practice for issuers by the end of the year.[60] Together these close the two-category split for one class of stablecoin, through an activity-based route with conditions attached.

The European Banking Authority's advice that EU law should avoid dual authorisation for the same activity points in the same direction, although the EU's question runs from the digital-asset side.[61]

In Thailand, the central bank runs a sandbox for baht-backed stablecoins, expanded in December 2025, while digital-asset issuance and related services fall mainly to the securities regulator; the central bank is now designing a fully backed baht stablecoin with the securities regulator.[62] This is coordination between a payments mandate and a digital-asset mandate, around a domestically issued token.

Brazil's Resolution 561 is movement in the other direction and belongs in the same picture. An authority with full technical and supervisory capacity examined a working stablecoin settlement rail and chose foreign-exchange reporting over it. Any proposal for activity-based authorisation has to answer the concern that decision expresses.

1.2 TOKENIZED MARKET ACCESS FOR SMALL INVESTORS, WITH INVESTOR PROTECTION

The friction

More than 4 billion adults hold no equities, bonds or funds, the population the Coinbase Institute calls "the unbrokered".[63] Many have a bank account or a mobile wallet but no practical way to invest. Below a certain account size, serving an investor costs more than it earns, so brokers either stay out of a market or set minimums that exclude small savers.

Most of that cost is recurring rather than up-front. Where onboarding is automated, verifying a customer's identity costs little per account. The costs that weigh on small balances are servicing the account, custody, clearing and settlement, and ongoing anti-money-laundering monitoring, including the investigation of alerts. Each is largely fixed per account.

Identity becomes a serious cost, and sometimes a hard barrier, where the investor lacks a usable identity document or where no firm can check one against a national database. That is the case in many of the markets where participation is lowest. Licensing rules, capital controls and confinement to a few small local listings add further barriers.

In high-income markets, small-account access is already partly solved. Discount brokers offer fractional shares and low minimums, and some now offer tokenized exposure to listed shares.[64] They do not reach most of the unbrokered, largely because they are not licensed in those countries and the revenue per account would not cover the cost of serving it there.

What tokenization could change

The contributor's hypothesis is that tokenization can lower the recurring costs that sit in custody, settlement and per-holding compliance. A token would represent a share held in regulated custody and could be divided into small units. The token and the payment could settle together at any hour, cutting clearing and reconciliation work. Rules such as sanctions screening, and the power to freeze a holding where the law requires, could be written once into a shared token standard rather than rebuilt at every venue. Whether these savings are large enough to change the economics of a small account has not yet been demonstrated, and they do not reach account servicing or ongoing monitoring.

Fractional ownership is not what tokenization adds; brokers already provide it. Its distinctive offer is that a holding could move between compliant venues, including across borders, instead of being locked inside one broker's records. That depends on regulators permitting it and on what the token legally is.

"Tokenized share" covers several legal wrappers, and the wrapper decides what the saver owns, who they can claim against and where. The hypothesis assumes the first row; most products currently offered to retail investors use the third or fourth.

For a low-income saver, recourse is practical mainly in the last row. For portability and cross-border reach, only the first two rows deliver, and only where the receiving country's law recognises them.

Where the venue sits matters as much as how the token is built. Roughly half of countries have no functional exchange, and others have no retail brokers. Building that infrastructure takes years and large fixed investment, and small markets rarely reach the liquidity that makes it worthwhile. For savers in those countries, the practical route to a diversified portfolio is access to deep markets elsewhere, and this is where the model offers most: a local

58 Baker McKenzie (2026), op. cit.
59 Buckingham Capital Consulting (2026). UK payment services regulation 2026: what the proposed reforms mean for PIs and EMIs.
60 Bank of England (2026). Sterling-denominated systemic stablecoins: policy statement, 22 June 2026, and draft code of practice for sterling-denominated stablecoin issuers. https://www.bankofengland.co.uk/paper/2026/ps/sterling-denominated-systemic-stablecoin.
61 EBA (2025), op. cit.
62 Crypto Briefing (2026). Bank of Thailand advances 1:1 baht-backed stablecoin plan, June 2026.
63 Coinbase Institute (2026). From the Unbanked to the Unbrokered: Unlocking Wealth Creation for the World. January 2026. https://www.coinbase.com/public-policy/advocacy/documents/from-the-unbanked-to-the-unbrokered.
64 Robinhood (2026). Europe's investment gap: why investors are turning to new technologies to access markets, 22 June 2026. Its disclosures state that Classic Stock Tokens are derivative contracts with Robinhood that grant no rights to the underlying securities, and that investors may lose their full investment on Robinhood's insolvency.

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licensed firm handles identity checks and payments, while listing, trading, custody and settlement run on established platforms abroad. Savers gain access without their country having to build an exchange first.

TABLE 3.2

What a "tokenized share" can mean: six legal wrappers

Wrapper	What the holder owns	Claim is against	Moves between venues?	Where recourse lies
Ledger-based security (Swiss model)	The share itself, as a ledger entry	Issuing company	In principle, where law allows	Issuer's jurisdiction
Custodial claim token (1:1 backed)	A contractual or beneficial claim on shares held by a custodian	Token issuer or custodian	Depends on issuer's design	Issuer's or custodian's jurisdiction
Derivative token (e.g. Robinhood Classic Stock Tokens)	Price exposure only; no rights to the share	Broker	No	Broker's jurisdiction
Debt-note token	A debt owed by the issuer, priced off the share	Token issuer	Sometimes	Issuer's jurisdiction
Tokenized fund units	Units in a regulated fund that holds the shares	Fund	Depends on fund rules	Fund's jurisdiction
Local wrapper (domestic fund or depositary receipt)	A local-law instrument backed by foreign assets	Locally licensed entity	Within the local market	Local courts and regulator

Source: GFTN, drawing on Coinbase Institute (2026) and Robinhood (2026).

The same structure raises questions that each country will weigh for itself. Activity concentrates on a small number of international platforms, the investor's legal relationship sits outside the home country, supervision of the venue rests with a foreign regulator, and the capital-flow and recourse questions below apply in full. Countries that want the access while keeping a domestic anchor have two routes: the local wrapper in the table above, or a domestic venue that connects to foreign ones rather than competing with them.

The ask

The ask is not to remove customer checks. It is that a licensed firm that converts an investor's money into tokens carry out full customer due diligence once and record the result as a verifiable credential linked to the investor's wallet. Other licensed venues, including in other jurisdictions, would be allowed to accept that credential as meeting their identity-verification obligations rather than repeating the check. Ongoing monitoring, and any assessment of whether a product is appropriate for a retail investor, would stay with the venue that sells the product. The ask also includes mutual recognition of disclosures across borders.[65]

Its value lies in reach and convenience. A venue abroad could rely on a locally grounded check by a domestic firm with access to national identity systems, and investors would not repeat onboarding at each venue. Because the identity check is a small part of the recurring cost described above, the ask on its own contributes little to the economics of a small account.

Where it shows up

The following figures are drawn from the Coinbase Institute's January 2026 paper *From the Unbanked to the Unbrokered* and the accompanying announcement.[66]

- The paper estimates about 1 billion capital-market participants out of 5.3 billion adults, and calls the figure conservative. That leaves more than 4 billion adults, roughly four in five, outside equity and bond markets.
- Participation is 55 to 60 per cent in the United States, about a third in the United Kingdom, in the teens across Europe, and below 10 per cent in China and India.
- Even in the United States, 96 per cent of families in the top tenth of the income distribution own stocks, against 17 per cent in the bottom fifth (2022 data, citing the Federal Reserve's Survey of Consumer Finances).
- Approximately half of all countries lack a functional stock exchange, and where exchanges exist they are often small and illiquid.
- Minimum investment sizes keep small savers out. In Rwanda, the minimum non-competitive bid for a treasury bond is RWF 100,000, roughly US$70, against GDP per capita of about US$1,000 a year.

Within this population, the most plausible early users are middle-income savers in countries with usable digital identity but poor market access. Many low-income savers need different products first, as the product-fit question below sets out.

Open questions for authorities

Public authorities and other reviewers raised the following questions, which any country would need to answer.

Whether the economics work. Any tokenized model needs to show which of the recurring costs above it reduces, and by how much. Identity reliance on its own does not affect them.

[65] Coinbase Institute (2026), op. cit.
[66] Coinbase Institute (2026), op. cit. Coinbase (2026). Bridging the Capital Chasm: Unlocking Wealth Creation, by F. Shirzad. Coinbase blog, 19 January 2026. https://www.coinbase.com/blog/bridging-the-capital-chasm-unlocking-wealth-creation.

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What the token gives its holder. Where the law does not treat the ledger entry as the right itself, the underlying share may remain registered to a custodian. The token may then represent only a contractual claim, such as a derivative or a debt owed by the issuer. Voting rights, dividends, recourse and recovery after a custodian failure depend on the token's structure and the law governing it.

Which law governs, and where the investor can seek redress. A share tokenized under one country's law may not be recognised as a share, or as anything, in the buyer's country. If the issuer stops paying dividends or collapses, a retail buyer in Kenya would have to pursue the claim where the issuer or custodian sits, under foreign law, through foreign courts or arbitration. For a low-income investor that is rarely a practical remedy, so the protection has little value in practice. Mutual recognition of disclosures does not address this; a local counterparty under local law, or an enforceable cross-border redress scheme, would.

Whether the code does what it says. A tokenized bond's code can automate an interest payment, provided the issuer funds it, the code matches the advertised terms and its inputs arrive as intended. Who audits a deployment, who bears liability when the code fails, and which law governs the buyer's claim remain unsettled. One response offered was that a token is a different form for the same financial product, so the same disclosure and product rules should apply to the issuer.

Access within national capital-flow rules. Where residents must buy foreign assets through a licensed institution, that institution is where the country sees the flow and applies outward-flow limits and investor protections. A resident who pays a platform abroad directly from a digital wallet falls outside that visibility and both sets of controls. Authorities must decide whether their controls apply at the licensed points where money is converted into tokens.

Third-party reliance for customer due diligence. Anti-money-laundering standards let a firm rely on a third party's customer due diligence only under set conditions, and the relying firm remains responsible[67]. Rules in the European Union and Hong Kong allow cross-border reliance only where the other firm is supervised to equivalent standards,[68] and the relying firm keeps full liability, so in practice reliance is rarely used to carry a retail investor's check between venues in different jurisdictions. Singapore's regulator proposed in 2019 to bar its payments licensees from relying on virtual-asset firms altogether,[69] which are often the firms where money is first converted into tokens.

Reliance moves the cost of the first check rather than removing it. That check must still be done by the licensed firm at the point of entry, and it assumes the investor already holds a usable identity. In many low-participation markets that cannot be taken for granted, and proposals for portable decentralised identity have a poor record of adoption.

Product fit. Participants with experience in emerging markets noted that many savers there prioritise payments and protection from currency volatility over owning equities. Many still use feature phones rather than smartphones. On this view, access to global equities may suit middle-income savers first, while low-income users need products built around how they already pay and save.

What else a workable model needs

Tokenization reaches only part of the cost of serving a small account. Three further levers determine whether the rest becomes viable, and a fourth addresses recourse.

Cheap, shared domestic infrastructure. Where retail participation has grown quickly, it has rested on a whole stack: low-cost digital identity, instant cheap payments, central depositories and exchange-level surveillance that spread fixed costs across the market, and brokers built to run lean. India is the clearest case: unique individual demat holders more than tripled between March 2019 and March 2024, and discount brokers' share of new accounts at the leading depository rose from 24 per cent to 88 per cent over FY17 to FY24.[70] Tokenized rails could form one part of such a stack. They do not substitute for it, and a stack of this kind is largely a domestic policy choice.

Proportionate compliance for low-value accounts. International standards now require countries to allow and encourage simplified due diligence in lower-risk situations.[71] Tiered accounts with balance and transaction limits, as used in mobile money, cut the monitoring cost per account.[72] Regulators would need to extend such tiers to small investment accounts.

Pooled, domestic-first products. A low-income saver is better served by a pooled fund or a government savings instrument sold through the wallet they already use than by direct holdings in foreign equities. Pooling spreads custody and monitoring costs across many savers and keeps the product within local law.

A local counterparty for foreign exposure. Where savers want foreign assets, their claim should run against a locally licensed entity under local law. That entity holds the foreign assets at scale and pursues any foreign recourse on behalf of all its investors. Tokenization can be the plumbing behind such an entity rather than a replacement for it.

Each of these levers sits within national policy and can be pursued with or without tokenization. Cross-border identity reliance adds to them for savers who already hold a usable identity and want access to markets abroad.

67 FATF (Financial Action Task Force) (2012–2025). International Standards on Combating Money Laundering and the Financing of Terrorism & Proliferation (the FATF Recommendations), Recommendation 17: Reliance on third parties. https://www.fatf-gafi.org/en/publications/Fatfrecommendations/Fatf-recommendations.html.

68 EU (2024). Regulation (EU) 2024/1624, Article 48: General provisions relating to reliance on other obliged entities. Official Journal of the EU, 19 June 2024. Hong Kong Companies Registry (2023). TCSP licensing: frequently asked questions on customer due diligence, 3 August 2023. Summarises section 18 of Schedule 2 to the Anti-Money Laundering and Counter-Terrorist Financing Ordinance (Cap. 615), including reliance on intermediaries in equivalent jurisdictions.

69 Conventus Law (2019). Singapore: MAS consultation on AML/CFT requirements for payment services licensees, 23 June 2019. Reports MAS's proposal to preclude licensees from third-party reliance on local and foreign virtual-asset service providers.

70 SEBI (2025). Kalyani H., Shyni Sunil and Prabhas Kumar Rath, "Growth of Individual Investors in Indian Securities Market", SEBI Bulletin, January 2025, pp. 104–109. Unique individual demat holders rose from 282 lakh (March 2019) to 896 lakh (March 2024); discount brokers' share of accounts added by the top ten CDSL participants rose from 24.2 per cent in FY17 to 88.4 per cent in FY24.

71 FATF (2025). FATF updates Standards and consults on guidance to better promote financial inclusion, 25 February 2025. Records the revision of Recommendation 1 to require countries to allow and encourage simplified measures in lower-risk situations.

72 GSMA (2019). Overcoming the Know Your Customer hurdle: innovative solutions for the mobile money sector. Describes simplified due diligence and tiered KYC with transaction limits.

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Signs of movement

Switzerland has legislated for ledger-based securities, under which a right can exist solely as an entry in a qualifying ledger, agreed between the parties in a registration agreement. Such a right can be exercised and transferred only through the ledger, and a buyer who acquires in good faith from the person shown in the ledger is protected[73]. For rights issued in this form under Swiss law, this settles what the token gives its holder. It does not address whether a venue may rely on an investor's identity check carried out elsewhere.

Existing brokers have begun offering tokenized exposure to listed shares to retail customers in many countries. In one such product the token is, by the provider's own disclosures, a derivative contract that grants no rights to the underlying share and exposes the investor to the provider's insolvency.[74] These offers show the reach tokenization can provide, but also how far current products are from portable, rights-bearing holdings.

1.3 RECOGNISING AI AGENTS AS PAYMENT INITIATORS

The friction

Payment rules are built around two kinds of party that can initiate a payment: a person, and a licensed institution acting for them. AI agents are neither. As agents begin to pay for data, buy computing capacity, and settle with other agents, often in very small amounts and at any hour, the question a payment system has to answer changes, from who is paying to whether this agent had authority to pay, and whether it stayed within it.

The tools that would let an agent pay within set limits already work in prototypes: delegation mandates that pre-authorise payments within caps, time limits, and payee restrictions; conditional locks; and multi-signature approval. What is missing is the layer of rules that would let others rely on them. The ask is a basis on which a receiving institution can rely on two things travelling with the agent: the verified identity of the person or firm behind it, and the mandate that sets out what it may do. Two questions follow. Is an instruction an agent executes within that mandate a binding payment instruction? And when an agent acts within its limits but against its principal's intent, who answers to the customer, who bears the loss, and who is at fault? Customers adopt a new way to pay only if they know whom to call when something goes wrong; for an agent, that answer does not yet exist. Agents that hold their own wallets, with no regulated operator behind them, are the harder case: there, even the points at which a rule could apply may be missing.

Where it shows up

In prototyping exercises for a retail central bank digital currency in Europe, a contributor demonstrated delegation mandates with amount caps, time limits, and payee restrictions, under which pre-authorised payments executed without further involvement of the payer. In the contributor's assessment, none of these mechanisms yet has legal standing as a payment instruction in the euro area. The same work showed that frameworks built around a single intermediary that holds custody, verifies identity, and provides the wallet leave no clear place for a party that initiates payments but holds nothing.

Adoption is running ahead of the rules. The Cambridge Centre for Alternative Finance's 2026 survey of 628 organisations across 151 jurisdictions, including 130 central banks and other financial regulators, found that more than 80 per cent of financial services firms are adopting AI to some degree and 52 per cent are experimenting with agentic AI, with data availability and quality the leading barrier. Authorities are further behind in their own use of AI: 48 per cent of those surveyed were still exploring it or not engaged with it. Industry, vendors, and regulators also held divergent views on who is accountable when things go wrong.[75]

A roundtable of a central bank, law enforcement, international and development finance institutions, and industry, held under the Chatham House Rule in Singapore in October 2026, identified where the gap bites:

- **Recognition across borders.** Authorisation, KYC, and anti-money-laundering obligations remain national while agents move value in seconds. Without a shared basis for reliance, checks are repeated at every hop, or each jurisdiction issues its own agent credentials.
- **Enforcement.** Requests for assistance between jurisdictions can take months, while transactions settle in seconds. Law enforcement already relies on voluntary action by service providers, such as stablecoin issuers freezing funds.
- **Readiness.** Economies still building digital public infrastructure, open APIs, and consent protocols cannot leapfrog them, because agentic AI is an orchestration layer, not infrastructure.

Why it matters

Where an agent acts with no operator, the points at which a regulator normally sees and stops a transaction may not exist. The parties that remain in the chain, such as the wallet provider, the merchant, and the firm that converts money into tokens and back, may each see part of the activity, but none may be obliged, or able, to intervene. Settlement on a ledger can be final in seconds, so an erroneous payment may be irreversible before any person has looked at it, and restoring recourse must not undermine the finality that makes the rail useful.

Accountability also depends on a record the agent cannot alter. An agent that has been manipulated, or has acted on bad data, can give a coherent but false account of what it did. Unless its actions are recorded independently, and the reliability of the data it used is labelled, an institution cannot explain afterwards why it acted as it did. Keeping that record has a cost. Logging each authorisation at machine speed adds latency and expense, and it is not yet settled whether that cost falls on the deploying institution, the agent's developer, or the platform it transacts on. Financial law, meanwhile, largely assumes a human in the loop, so there is no clear basis for settling disputes when there is none.

The stakes are practical. Programmable payments could let small merchants importing goods pay as a shipment moves rather than up front, easing their cash flow. Without harmonised rules, however, emerging economies risk being pushed towards a binary

[73] Swiss Code of Obligations (Obligationenrecht, SR 220), Art. 973d–973f, as amended by the Federal Act on the Adaptation of Federal Law to Developments in Distributed Ledger Technology (DLT Act) of 25 September 2020, AS 2021 33. In force 1 February 2021 (Art. 973d–973i); the DLT Act was fully in force from 1 August 2021. Official text: fedlex.admin.ch, SR 220. Unofficial English translation: Art. 973d.

[74] Robinhood (2026), op. cit.

[75] Cambridge Centre for Alternative Finance and Financial Innovation for Impact (2026a). 2026 Global AI in Financial Services Report: Adoption, Impact and Risks, 28 April 2026. https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/2026-global-ai-in-financial-services-report/.

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choice between prohibiting agentic payments, which constrains innovation, and permitting them without adequate consumer protection.

Signs of movement

A practical basis for recognition is emerging. Roundtable participants argued that jurisdictions do not need to recognise a piece of software that is not a legal person. A receiving institution needs to rely on two things travelling with the agent: verified credentials for the person or firm behind it, and the mandate that sets what it was authorised to do. Anti-money-laundering standards already allow reliance on a third party's customer due diligence under set conditions[76], so the record of verification can travel while the decision to accept it stays with the receiving institution. The credentials themselves are the harder part. For firms, standards for verifiable institutional identity exist, such as the verifiable Legal Entity Identifier, but no institution is yet obliged to accept another's credential. For individuals, portable identity depends on national identity systems, and decentralised alternatives have a poor record of adoption, as noted in 02.

Participants also separated three questions often run together: accountability (who the customer turns to), liability (who bears the cost), and culpability (whose fault it was, judged by whether controls were proportionate). They converged on deterministic limits around what an agent may execute, enforced where possible at a signing key the agent cannot reach, and on human approval for decisions that have systemic consequences, affect individual rights, cannot be reversed, are taken in a crisis, or involve ethical trade-offs.

Policy and industry are moving in parallel:

- **Singapore.** The Monetary Authority of Singapore published Safeguards for Agentic Finance at Runtime in July 2026, setting out how agent actions are authorised, how human oversight is activated, and what is recorded at each decision[77].
- **China.** In August 2026, the Payment and Clearing Association of China issued guidelines for agent-driven payments under the People's Bank of China's guidance, introducing a "know your agent" mechanism.[78]
- **United Kingdom.** HM Treasury's consultation on modernising payment services regulation (July–October 2026) asks how the framework should accommodate agentic AI[79].
- **Industry.** Google's Agent Payments Protocol records a user's instructions as cryptographically signed mandates[80], and the x402 protocol for agent payments is now stewarded by a foundation under the Linux Foundation[81].

None of these yet settles who bears the loss when an agent acts within its mandate but against its principal's intent, or how one jurisdiction recognises a mandate issued under another's rules.

1.4 STANDARDS AND IDENTITY FOR CROSS-DOMAIN INTEROPERABILITY

The friction

Traditional finance connects because its systems share a language. A payment message in one country can be read by a system in another because both use ISO 20022, an international standard for structured financial messaging around which market infrastructures and operational processes have been built. Tokenized markets have no equivalent. Token standards such as ERC-20, which defines how a fungible token behaves, and ERC-3643, which adds identity-based eligibility checks and transfer restrictions for regulated assets, work well within their own blockchain environments. But they are not aligned with established financial standards, or with each other across networks.

The gap runs across messaging, identity, compliance, and settlement. When a token moves from one network to another, the second network has no common way to read the permissions granted on the first. When an institution joins a new blockchain application, it is often issued a new identity certificate, even though its identity is already well established. Standards for reusable institutional identity exist, such as the verifiable Legal Entity Identifier, but no platform is yet obliged to accept a credential issued for another. Each institution builds and maintains its own connections, so integration cost rises with every network it joins. The task is not to replace either family of standards, but to extend and align both. The ask is for industry-led alignment of ISO 20022 and token standards, with authorities convening the parties, keeping standards open, and using joint guidance where formal rules would be too slow; and for an institution's established identity to be recognised across platforms rather than reissued on each.

Where it shows up

Most financial institutions still use infrastructure that was not designed for distributed ledgers, tokenized assets, or round-the-clock settlement, and most expect to keep it. In a 2026 survey of 200 senior decision-makers in the United States and Canada, 92 per cent expected digital and traditional assets to coexist for the foreseeable future, and 69 per cent planned to adapt existing infrastructure rather than build fully separate systems.[82] Every such firm must therefore connect old systems to new ones. The Financial Stability Board identifies the lack of interoperability between DLT platforms and legacy systems as one of three constraints on broader adoption, alongside limited investor demand and legal uncertainty,[83] and a 2026 review of tokenized money found that interoperability across networks "remains unresolved, with different ecosystems adopting divergent approaches".[84] The contrast with traditional finance is sharp: since November 2025, cross-border payment instructions on the Swift

76 FATF (2012–2025), op. cit., Recommendation 17.
77 MAS (2026). Safeguards for Agentic Finance at Runtime (SAFR), white paper, 3 July 2026.
78 Caixin Global (2026). China pioneers "know your agent" rules for AI payments, 25 August 2026. https://www.caixinglobal.com/2026-08-25/china-pioneers-know-your-agent-rules-for-ai-payments-102477712.html.
79 HM Treasury (2026). Modernising Payment Services Regulation: consultation, 14 July–6 October 2026. https://www.gov.uk/government/consultations/modernising-payment-services-regulation.
80 Google Cloud (2025). Announcing Agent Payments Protocol (AP2), 17 September 2025. https://cloud.google.com/blog/products/ai-machine-learning/announcing-agents-to-payments-ap2-protocol
81 Linux Foundation (2026). Linux Foundation is launching the x402 Foundation. https://www.linuxfoundation.org/press/linux-foundation-is-launching-the-x402-foundation-and-welcoming-the-contribution-of-the-x402-protocol
82 Broadridge (2026). Tokenized Assets a Key Priority for Financial Services Firms, Broadridge Survey Finds. Press release, 16 July 2026. https://www.broadridge.com/press-release/2026/tokenized-assets-a-key-priority-for-financial-services-firms.
83 FSB (2024), op. cit.
84 Cambridge Centre for Alternative Finance (2026b). Tokenised Money: Use Cases, Interoperability and Regulation, February 2026. https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/tokenised-money-use-cases-interoperability-and-regulation/.

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network have been exchanged only in ISO 20022.[85] In the contributor's experience, where tokenized assets have been connected to existing infrastructure, the result has been disconnected platforms, inconsistent messages and asset representations, duplicated compliance work, limited transaction visibility, and complex reconciliation across jurisdictions.

Why it matters

The burden is greater in markets modernising legacy infrastructure while also exploring digital assets, where participants bear the cost of running established systems as well as connecting to several new ones. Aligning the two families of standards would give these markets a common language with global financial networks, and let them build tokenized markets compatible with internationally recognised standards from the start.

Standards become harder to reconcile once institutions have built systems around them. Public-sector participants were clear that the timing matters: it is better for the market to agree early and adjust in light of experience than to entrench several competing standards for the same thing. They were equally clear about roles. Regulators set regulatory standards where there is a market failure; technical standards are best developed by industry, with the public sector convening the parties where needed, setting performance or governance requirements, and ensuring standards stay open so that one group cannot exclude the rest. Joint guidance and other forms of soft law can carry technical implementation where formal rules would be too slow.

Technical standards allow systems to communicate, but they do not establish which institution may act, whose identity is trusted, or what recourse applies when a transferred instruction is wrong. Participants also stressed that a clear legal foundation, including definitions of securities and of settlement finality, has to sit beneath any technical standard.

Signs of movement

Responses are developing in parallel. Swift has shown a digital asset standards prototype, first presented at Sibos 2025, that extends ISO 20022 to assets issued across multiple blockchains and embraces token standards such as ERC-20 and ERC-3643[86]. Swift's blockchain-based ledger was declared ready for initial use in July 2026 and completed its first interbank tokenized-deposit transaction in August 2026[87]. The BIS's Project Agorá is testing tokenized commercial bank deposits and central bank reserves on a shared platform[88]. Global Layer One, a public–private initiative whose participants include financial institutions, the Bank of England, the Banque de France, and MAS, published toolkits on market-infrastructure controls and programmable compliance in November 2025[89]. In the euro area, the Eurosystem's Appia roadmap, published in March 2026, names interoperability and standards as the first of its six building blocks, with a long-term blueprint due in 2028.[90] These efforts take different architectural routes, and none has yet become the market's common standard.

1.5 PROPORTIONATE COMPLIANCE FOR BANKS ON PUBLIC BLOCKCHAINS

The friction

A bank using a public blockchain faces compliance questions that look simple but have no settled answer. Is front-running a financial transaction on a public network market manipulation? What must a bank do when a token it never asked for arrives from an unknown or sanctioned party? What counts as reasonable effort to stop part of a transaction fee reaching a sanctioned validator, when the bank cannot choose who processes its transactions?

In the contributor's view, the risks are manageable, and banks are managing them. But without clear and practical guidance, banks take the most conservative reading of their obligations, and the processes that follow are costly even when the risk is low. The questions arise because a public network has no operator the bank can direct. In its own systems, a bank owns the technology or binds its supplier by contract. On a public blockchain it controls only the applications and smart contracts it deploys; for everything beneath, it is one user among many, subject to rules it cannot change and to network behaviour it cannot prevent. The ask is for guidance on the three questions above: whether front-running is market manipulation, how to respond proportionately to unsolicited tokens, and what counts as reasonable effort to avoid sanctioned validators, with a safe harbour for institutions that have taken it. The fourth issue, omission, sits in the protocol and is beyond what guidance can fix.

Where it shows up

Four issues recur[91].

- **Front-running.** Pending transactions are visible on many public networks, and whoever assembles the next block can choose their order. When a bank moves to freeze an identifier or pause a token to meet a sanctions obligation, the affected party may see the instruction and move the tokens first by paying a higher fee. It remains unclear whether this counts as market manipulation under existing law.
- **Omission.** The same assembler decides which transactions enter a block. An issuer's instruction to pause transfers during a run of redemptions may wait behind other transactions, so an emergency control may not take effect in time.
- **Unsolicited tokens.** A token can arrive at any address a bank holds, from a sanctioned or unknown party, and these networks provide no universal way to block an incoming transfer.
- **Fee distribution.** Part of every transaction fee can reach the party that processes it. On a network where anyone may take

85 Swift (2025b). 8 reflections from Swift at Sibos 2025. https://www.swift.com/news-events/news/8-reflections-swift-sibos-2025.

86 Ledger Insights (2025). Sibos: Swift's digital asset standards could prove bigger than its blockchain launch. October 2025. Swift's later 2026 hackathon briefing pack, Scaling digital assets through standards, confirms the work continues on the ISO 20022 data model.

87 HSBC (2026). HSBC and Standard Chartered execute first live tokenised deposit transaction on Swift's blockchain ledger, 20 August 2026. https://www.about.hsbc.com.hk/news-and-media/hsbc-and-standard-chartered-execute-first-live-tokenised-deposit-transaction-on-swifts-blockchain.

88 BIS (Bank for International Settlements) (n.d.). Project Agorá: exploring tokenisation of cross-border payments. Accessed October 2026. https://www.bis.org/about/bisih/topics/fmis/agora.htm.

89 Ledger Insights (2025b). Global Layer One launches tokenized asset toolkits with input from JPM, HSBC, others. https://www.ledgerinsights.com/global-layer-one-launches-tokenized-asset-toolkits-with-input-from-jpm-hsbc-others/.

90 Banque de France (2026). Eurosystem unveils Appia roadmap for Europe's tokenised finance, March 2026. https://www.banque-france.fr/en/press-release/eurosystem-unveils-appia-roadmap-europes-tokenised-finance.

91 Toh, W.K., Maurer, M., Valiveti, S., Rajpuria, R. and Narula, N. (2026). Public Blockchains and Regulated Financial Institutions: Key Challenges, Layered Solutions, and a Path Forward. Kinexys by J.P. Morgan and MIT Digital Currency Initiative, June 2026.

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part, that can be a sanctioned party, and the payer cannot choose who receives it.

The unsolicited-token case shows how the cost builds up. Tokens sent to banks are often promotional "dust" with no value, which most public-blockchain users treat as spam. A bank applying its existing obligations treats them as funds received that must be returned. Because one address on an EVM-compatible network is valid on every other EVM network, a bank that has transacted on one such network must monitor its addresses across all of them, every day, including networks it does not use. Returning a token means calling the token's own smart contract, which must first be reviewed for vulnerabilities. A token with no value can trigger monitoring, legal review, sanctions screening, and code checks that cost far more than the asset.

Layer 2 networks, which batch transactions and post them to a public blockchain, offer a partial route. Where one known operator orders and includes transactions, a bank can contract with it on terms close to those it agrees with traditional infrastructure providers, and the paper sees this as a pragmatic entry point. The exposure does not disappear, however. Batches still post to the underlying public network, where fees can still reach a sanctioned validator, and a user's fallback, if the operator fails, runs through that network too.

Why it matters

In the contributor's assessment, the result is that public-blockchain adoption is concentrated among the largest institutions, which can bear the cost of compliance. Smaller banks are less able to, and banks in emerging and developing economies are likely to be even less able or willing to spend on it.

The constraint cannot be removed by any one institution. The solutions most accessible to banks, at the application and smart contract layers, "primarily mitigate symptoms rather than solve the root causes", while "more effective and durable solutions reside at the protocol and governance layers", where banks have limited control.[92] A regulator can act against identifiable services within its reach but cannot direct a decentralised network to change, and because banks in different countries transact on the same infrastructure, one supervisor's rule can reach participants supervised elsewhere. Each bank meanwhile bears the cost of a conservative interpretation until its own authorities settle the questions within their mandates.

Signs of movement

The Kinexys–MIT DCI paper sets out three regulatory asks: guidance on whether front-running financial transactions on public blockchains is market manipulation; clarity on whether receiving unsolicited tokens is a regulatory concern and what an acceptable, proportionate response is; and a standard of reasonable effort for avoiding sanctioned validators, with safe-harbour provisions for institutions that have taken demonstrable steps but still interact inadvertently, given that sanctions carry strict liability.[93] Public-sector participants who reviewed this problem statement recognised it as a live concern, and pointed to joint guidance and other forms of soft law as a practical route.

Guidance addresses the near term. The longer-term question is whether the answer lies in network design. Kinexys and MIT DCI's next phase of research starts from the thesis that public blockchains, as they exist today, are not fit for purpose for scaled use by regulated institutions, and asks what an ideal institutional public blockchain would look like. It frames three trade-offs: control against decentralisation, privacy against composability, and compliance against openness. It argues that if every requirement institutions want were implemented, the resulting networks would resemble traditional centralised systems. A discussion paper is due in November 2026, followed by roundtables with financial institutions, central banks, and regulators, and a final paper at Point Zero Forum in June 2027.

Protocol-level change is also being proposed. Ethereum's planned Hegotá upgrade includes FOCIL (EIP-7805), aimed at "making sure that a valid transaction gets into a block even if the people building blocks would rather leave it out".[94] Mainnet is expected in the second quarter of 2027, with the date not yet confirmed. It would address omission, but it also shows the trade-off at the centre of this problem: a rule that guarantees inclusion makes it harder for anyone to exclude a transaction.

1.6 RECALIBRATING FMI REGULATION FOR TOKENIZED SETTLEMENT

The friction

Financial market infrastructure (FMI) regulation was calibrated to a market in which trading, clearing, settlement, and asset servicing happen in sequence, each performed by a central intermediary that holds custody and bears counterparty risk. The rules do not mention technology, but they are built on assumptions that tokenization breaks. If settlement happens at the moment of trade, there is no clearing. If a program exchanges money and assets atomically, no central counterparty bears the settlement risk. If settlement takes place outside a designated system, its legal finality is unclear. And if rules attach to the operator of a facility, it is unclear how they apply when no single operator runs it.

Tokenization removes some risks, shifts others between participants, and adds new ones in smart contracts, oracles, platform differences, and key management. Regulation of tokenized assets and money has advanced in many jurisdictions; regulation of the infrastructure that settles them lags. In the contributor's view, applying the existing regime case by case, through tailored conditions on licences that do not quite fit, does not scale. The task is to recalibrate: lighter where tokenization reduces risk, heavier where it introduces or concentrates risk, and reallocated where responsibility moves between participants. Different risks may need different regulation to achieve the same regulatory outcome. The ask is for a route from sandbox to licence for tokenized FMIs, legal finality for settlement on qualifying ledgers, and one coordinated process across the authorities that hold the relevant mandates.

The same assumption of a single system runs through the rules on settlement across ledgers. Atomic settlement without a trusted intermediary is possible only within one ledger, but a tokenized market will run across many, so settling across them needs a coordinating institution or a technical mechanism that the rules do not yet recognise. Bridges, the most common mechanism so far, have a difficult track record.

92 MIT DCI (2026), op. cit.
93 MIT DCI (2026), op. cit.
94 ethereum.org (n.d.). Hegotá upgrade roadmap. Accessed October 2026. https://ethereum.org/roadmap/hegota/.

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Where it shows up

Australia's experience shows the problem in both forms. The Reserve Bank of Australia (RBA) and the Digital Finance Cooperative Research Centre (DFCRC) ran a pilot central bank digital currency across 16 use cases in 2022–23, under pilot-specific regulatory exemptions.[95] The pilot raised "questions about whether certain obligations in the existing licensing and regulatory framework for CS [clearing and settlement] facilities… would be appropriate" for atomic settlement.[96] In the contributor's assessment, hashed time-locked contracts were available for settlement across ledgers but rarely adopted, because asymmetric failure modes made them fragile, while wrapped central bank money worked but added an issuance and reconciliation layer.

Project Acacia followed, with industry participants "developing and testing 20 wholesale tokenised market use cases across multiple asset classes", settled in exchange settlement account balances, a pilot wholesale CBDC, tokenized bank deposits, and stablecoins.[97] It identified "areas of remaining legal and regulatory uncertainty relating to tokenised assets and new infrastructure arrangements" as a barrier to large-scale adoption.[98] Issuing central bank money directly onto third-party platforms proved "technologically feasible" but raised "significant operational, security, governance and compliance considerations".[99] In the contributor's view, synchronisation operators linking asset platforms to existing central bank settlement were closer to production.

The questions also divide across four public mandates. The securities regulator oversees market and facility licensing, the prudential supervisor capital treatment, the central bank payment-system law and finality protection, and the anti-money-laundering authority money-laundering controls. None holds all four.

The contributor estimates the digital finance opportunity for Australia at A$24 billion a year, about 1 per cent of GDP, but expects only around A$1 billion a year to be captured by 2030 on the current trajectory. It identifies regulatory barriers, uncertainty, and coordination challenges as the primary constraints.[100]

Why it matters

Atomic settlement redistributes risk rather than removing it. Neither party waits exposed to the other, but without netting, the cash for each trade must be available in full at the moment of settlement. Cash that cannot be netted stays tied up on each platform, and liquidity fragments across platforms that do not interoperate. Acacia highlighted further work on interoperability as important "to minimise liquidity fragmentation across multiple trading venues and having liquidity inefficiently tied up in pre-funded trades".[101]

Not every benefit depends on tokenization. Acacia found that interim or complementary reforms, such as wider use of existing fast payment rails and central bank settlement infrastructure, and better alignment of operating hours with global financial centres, could also deliver meaningful gains. A country weighing FMI reform needs to know which gains it is pursuing.

For emerging and developing economies, resolving FMI treatment early is an opportunity to avoid building parallel depository, clearing, and market-operator infrastructure for each new asset class, and to design a perimeter that captures tokenized activity on platforms operated abroad. Choices made by leading jurisdictions in the next two years may set precedents others follow.

Signs of movement

Coordination between regulators is itself a sign of movement. Project Acacia was overseen by a steering committee of the RBA, the DFCRC, the securities regulator, the prudential regulator, and Treasury, and the securities regulator granted project-level relief from licensing requirements on an opt-in basis rather than case by case.[102] The project's successor programme includes an expanded industry advisory group, exploration of a digital FMI regulatory sandbox "to provide industry with a more structured pathway from experimentation to commercialisation", and continued industry-led work on interoperable bank deposit tokens.[103]

Industry need not wait for a wholesale CBDC or an entirely new settlement system before building. In BlockchainAPAC's reading of the RBA's findings, a material share of the potential benefits can be achieved through existing central bank money in exchange settlement accounts, combined with synchronisation arrangements and other links between tokenized platforms and established infrastructure[104]. A sandbox matters only if it leads somewhere, however: without a practical route from experimental conditions to licensing, supervision, and scalable settlement, participants risk building for the sandbox rather than for the market.

1.7 QUANTUM-SAFE SECURITY FOR TOKENIZED ASSETS

The friction

Tokenization moves value, not just data, across networks, so the cryptography that protects a token protects the asset itself. That cryptography includes the public-key methods that sign transfers and secure the channels between ledgers, and it is expected to be broken by future quantum computers. Cryptographers describe such machines as "cryptanalytically relevant": able to defeat the widely used RSA and elliptic-curve methods.

The nearest risk is to confidentiality. Transaction data protected by today's key exchange, including data passing between ledger environments, can be collected now and decrypted once a capable machine exists. The risk to integrity comes later, when a machine able to forge signatures or derive private keys exists. Migration takes years, and building post-quantum methods directly into a ledger can slow it, because post-quantum keys and signatures are larger and can increase block size and signing time. The task is to

95 RBA and DFCRC (2023). Australian CBDC Pilot for Digital Finance Innovation: Project Report, August 2023. https://dfcrc.com.au/wp-content/uploads/2023/08/australian-cbdc-pilot-for-digital-finance-innovation-project-report.pdf, pp. 12, 26.
96 RBA and DFCRC (2023), op. cit., p. 27.
97 RBA (Reserve Bank of Australia) (2026). Project Acacia: Exploring the role of digital money in wholesale tokenised asset markets. Final Report, May 2026. https://rba.gov.au/payments-and-infrastructure/central-bank-digital-currency/pdf/project-acacia-final-report.pdf, p. 1.
98 RBA (2026), op. cit., p. 2.
99 RBA (2026), op. cit., p. 35.
100 DFCRC (2026), op. cit.
101 RBA (2026), op. cit., p. 2.
102 RBA (2026), op. cit., pp. 14, 48.
103 RBA (2026), op. cit., p. 3.
104 BlockchainAPAC (2026). The National Dialogue 2026: Observations and Insights from Conversations across Australia's Financial Services and Digital Asset Markets. Synthesis Report, 7 September 2026. https://www.blockchainapac.com.au/wp-content/uploads/sites/12/2026/10/national-dialogue-synthesis-report-2026-.pdf.

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start protecting tokenized assets now without re-architecting the ledgers they run on, while planning the full migration of transaction signing before the threat materialises.

Where it shows up

The consensus is that cryptanalytically relevant quantum computers may still be a decade or more away, but an emerging view holds that they could arrive sooner[105]. Modernising the cryptographic infrastructure of a global organisation will take considerable time and effort, so migration has to begin well before the threat materialises.

Governments and regulators are already treating migration as a present obligation. The United States enacted the Quantum Computing Cybersecurity Preparedness Act in December 2022,[106] and the Office of Management and Budget directed federal agencies to begin migrating to post-quantum cryptography the month before.[107] The United Kingdom's National Cyber Security Centre has published migration guidance,[108] and the Monetary Authority of Singapore has issued an advisory to financial institutions on addressing the cybersecurity risks of quantum computing.[109]

Why it matters

Exposure accumulates silently. Passive collection of encrypted data leaves no trace in the ledger or system it came from, so a country cannot tell which records have been taken or how much has been gathered. For confidential data already collected, replacing the cryptography stops new exposure but does not remove what has already been taken.

The exposure is greatest for long-lived records. A bond with years to maturity, a deposit held for decades, or an asset register maintained indefinitely may need its evidence to remain trustworthy for longer than its cryptography remains secure. Where settlement records, custody, holder identity, or the enforceability of a claim rely on cryptographic evidence, that evidence must hold for as long as the right survives. A country's exposure therefore depends on which records remain sensitive, how long their protection must last, how quickly its issuers, operators, and custodians can change algorithms and keys, and which records sit with operators or foreign issuers beyond its direct reach.

Signs of movement

Practical first steps exist. HSBC, working with Quantinuum, trialled quantum-safe protection for tokenized physical gold: tokens were moved between two distributed ledgers over a post-quantum encrypted network, with keys strengthened by quantum-generated randomness.[110] Measured latency and throughput were unaffected, with throughput between 31 and 40 transactions per second across nodes in the United Kingdom, the United States, and Japan.[111] HSBC describes the approach as "a cost-effective approach of protecting existing production DLT in the short and medium term, without needing to rearchitect the DLT".[112] The intended end state is post-quantum cryptography throughout the system, especially for transaction signing, and "provided such a migration is completed before powerful quantum computers exist, nothing is lost from a security perspective".[113]

Central banks are testing the same approach in payments. The BIS's Project Leap applied a hybrid of classical and quantum-resistant encryption to payment messages between the Banque de France and the Deutsche Bundesbank. A second phase, completed in December 2025 with the Bank of Italy, Nexi-Colt, and Swift, tested post-quantum signatures on liquidity transfers in the Eurosystem's TARGET2 payment system, and found significant performance differences between classical and post-quantum algorithms.[114] The records of long-lived claims created by tokenized markets remain outside that work.

1.8 SETTLEMENT COORDINATION FOR TOKENIZED DEPOSITS

The friction

Banks are building tokenized deposits, but each bank's token is a claim on that bank and usually sits on its own platform, so one bank's system often cannot accept another's token. One consequence matters most across borders: a payment passes through several banks, ledgers, operating windows, and settlement arrangements. That opens a gap between the moment a payment is initiated, the moment the customer is credited, and the moment the banks settle with each other.

One response separates payment coordination from final settlement. A shared orchestration layer records each bank's payment commitments, calculates and nets the obligations between them, and leaves only the residual to be settled later through existing real-time gross settlement (RTGS) or correspondent banking arrangements. Banks do not need to use the same token platform or settlement asset. The ask is for legal clarity on whether a commitment recorded on the shared layer is a payment or only an instruction to pay, and for agreed liability and exception-handling arrangements before the model moves to production.

105 Malik, P., Williamson, M., Intallura, P., Rajan, D. (HSBC), Jones, D., Merriman, B. and Fewell, K. (Quantinuum) (2024). Asset tokenisation in the Quantum Age: Future-proofing gold tokens with post-quantum security. https://www.gbm.hsbc.com/-/media/media/gbm-global/pdf/articles/asset-tokenisation-in-the-quantum-age-future-proofing-gold-tokens-with-post-quantum-security.pdf, p. 4.

106 United States Congress (2022). Quantum Computing Cybersecurity Preparedness Act (H.R. 7535), enacted 21 December 2022. https://www.congress.gov/bill/117th-congress/house-bill/7535.

107 Office of Management and Budget (2022). Migrating to Post-Quantum Cryptography (M-23-02), 18 November 2022. https://www.whitehouse.gov/wp-content/uploads/2022/11/M-23-02-M-Memo-on-Migrating-to-Post-Quantum-Cryptography.pdf.

108 NCSC (National Cyber Security Centre) (2023). Migrating to post-quantum cryptography, 3 November 2023. https://www.ncsc.gov.uk/blog-post/migrating-to-post-quantum-cryptography-pqc.

109 MAS (2024b). Advisory on Addressing the Cybersecurity Risks Associated with Quantum (MAS/TCRS/2024/01), 20 February 2024. https://www.mas.gov.sg/regulation/circulars/advisory-on-addressing-the-cybersecurity-risks-associated-with-quantum.

110 HSBC (2024), op. cit., pp. 9–12.

111 HSBC (2024), op. cit., pp. 14–15.

112 HSBC (2024), op. cit., p. 15.

113 HSBC (2024), op. cit., p. 9.

114 BIS (2025b). Project Leap phase 2: quantum-proofing payment systems, December 2025. https://www.bis.org/publ/othp107.htm.

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Where it shows up

Swift announced in July 2026 that its blockchain-based ledger was ready for initial use, with "17 banks across six continents preparing to pilot live transactions using tokenised deposits".[115] In August 2026, HSBC and Standard Chartered executed the first interbank transaction on it. The obligations were recorded on each bank's own tokenized-deposit infrastructure, and the ledger "acted as a secure orchestration layer", enabling them "to be matched and netted between the two banks prior to final settlement" through existing systems.[116]

A participating bank facilitated live transactions with partner banks during the minimum viable product phase, in Singapore dollar and Hong Kong dollar flows among others. In the contributor's account, the transactions covered three connected stages: recording payment commitments, calculating and optimising interbank liabilities, and settling residual obligations through existing infrastructure. The work tested an operating model with segregated responsibilities, maker-checker approvals, and reconciled hand-offs between conventional payment processes and tokenized-deposit actions. It demonstrated the mechanics of payment coordination and bilateral netting, and confirmed that the benefit depends on flows running in both directions.

The underlying interoperability gap is also visible domestically. A 2026 synthesis of closed-door sessions with Australian regulators, banks, and market infrastructure providers reported that "several banks possess deposit-token capability, but their systems cannot accept one another's tokens", and that a deposit token operating only within one institution's perimeter "reproduces the closed loop it was intended to escape".[117]

Why it matters

Where payment instructions move quickly but funds are not usable until interbank settlement is available, customers and banks may need to hold additional liquidity buffers to cover the gap. Netting reduces that need only where flows between two banks offset one another, so that only the residual obligation is settled. Actual benefits will depend on customer demand, corridor economics, infrastructure readiness, regulatory frameworks, and participating banks' risk arrangements.

Before commercial deployment, further work is required on reconciliation, exception handling, legal and liability arrangements, risk governance, service levels, and the production operating model. Until those are settled, the shared layer records commitments faster than the systems beneath it can discharge them, and the exposure between the two sits with the banks.

Signs of movement

Several shared infrastructures for tokenized commercial bank money are now live or in testing, each taking a different route. In the United Kingdom, seven banks completed retail live pilots of tokenized sterling deposits in September 2026, on a platform built "as a shared UK industry infrastructure for tokenised commercial bank money".[118] The BIS's Project Agorá is testing a design that records "central bank reserves and commercial bank deposits on a shared platform".[119] In Australia, the successor programme to Project Acacia includes industry-led work on interoperable bank deposit tokens.[120] The Swift ledger pilots coordinate across banks' own platforms rather than moving deposits onto one.

The designs differ in where final settlement happens: on a shared domestic platform, on a unified ledger alongside central bank reserves, or off the ledger on existing rails. None yet operates as a production network across borders.

115 Swift (2026). Swift's blockchain ledger ready for use as 17 banks set to pioneer tokenised cross-border payments on trusted global infrastructure. Press release, 9 July 2026. https://www.swift.com/news-events/press-releases/swifts-blockchain-ledger-ready-use-17-banks-set-pioneer-tokenised-cross-border-payments-trusted-global-infrastructure.
116 HSBC (2026), op. cit.
117 BlockchainAPAC (2026), op. cit., pp. 8, 26.
118 UK Finance (2026). Tokenised sterling deposits (GBTD). https://www.ukfinance.org.uk/tokenised-sterling-deposits.
119 BIS (n.d.), op. cit.
120 RBA (2026), op. cit., p. 3.

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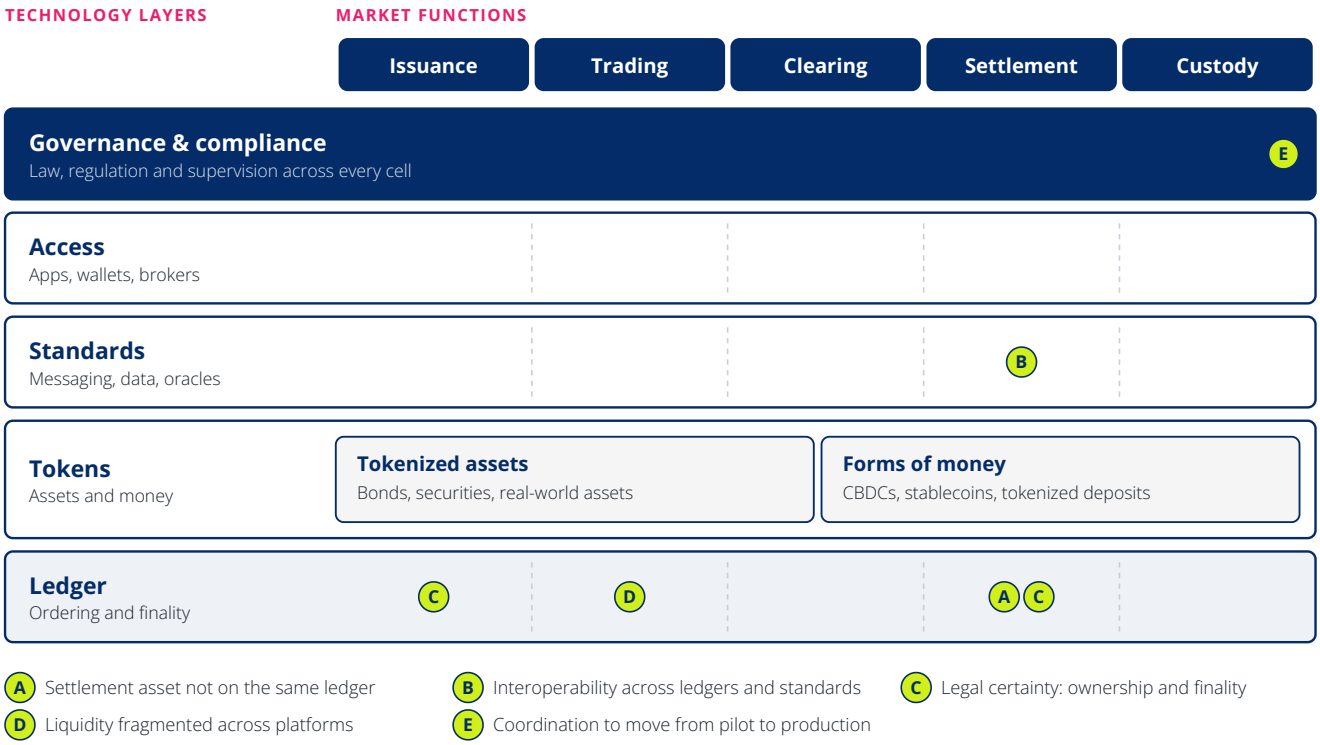
PART 2

MAPPING AGAINST THE TOKENIZED ECOSYSTEM

2.0 USING THE STYLISED ECOSYSTEM VIEW

FIGURE 3.1

The tokenized ecosystem: market functions by technology layer, with recurring challenges marked



Source: GFTN.

Section 1 sets out GFTN's stylised view of the tokenized ecosystem (Figure 3.1). It separates what a market does from the technology that does it. Five market functions run across the top: issuance, trading, clearing, settlement, and custody. Five technology layers run down the side: governance and compliance (law, regulation, and supervision across every cell); access (apps, wallets, and brokers); standards (messaging, data, and oracles); tokens (tokenized assets, and forms of money such as CBDCs, stablecoins, and tokenized deposits); and the ledger (ordering and finality).

The view also marks five recurring challenges: **A**, the settlement asset is not on the same ledger; **B**, interoperability across ledgers and standards; **C**, legal certainty over ownership and finality; **D**, liquidity fragmented across platforms; and **E**, coordination to move from pilot to production.

This Part places each problem statement on that grid: the layers it engages, the market functions it affects, and the recurring challenges it expresses. A problem statement is not assigned to a single cell. Where its friction moves across layers or functions as a transaction proceeds, each is recorded, because the friction is often the movement itself rather than any one point in the chain. Section 2.9 then reads all eight together.

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2.1 STABLECOIN SETTLEMENT WITHIN REGULATED PAYMENT LICENCES

Layers	Governance and compliance (primary); access (payment providers, conversion points; primary); tokens: forms of money (stablecoin); ledger (on-chain leg)
Market functions	Settlement (primary); custody; issuance
Recurring challenges	A (primary); D; E

The stablecoin sandwich moves through the grid rather than sitting in one cell. The stablecoin is a form of money in the tokens layer. The payment providers that convert local currency into the stablecoin and back sit in the access layer. The ledger records the on-chain leg and decides when that leg is final. Governance and compliance determines who may handle each leg, and under which licence.

Read on the grid, this is challenge A in its plainest form. Only the middle leg settles on the ledger; the money at each end settles in local currency on conventional rails, under a different licence category. The friction sits at the two conversion points, where the settlement function crosses from the ledger to the access layer and back. The licensing split falls mainly on settlement, but it also reaches custody, since holding the stablecoin for clients needs its own authorisation, and issuance, which is regulated separately in some jurisdictions. Thin liquidity at the conversion points is challenge D, and reliance on sandboxes while licensing catches up is challenge E. The last-mile frictions that can erode the cost gain, such as foreign-exchange conversion and reporting, sit in the governance and access layers rather than on the ledger.

2.2 TOKENIZED MARKET ACCESS FOR SMALL INVESTORS, WITH INVESTOR PROTECTION

Layers	Access (primary: licensed firm, wallet); governance and compliance (primary); tokens: tokenized assets; standards (shared token standard); ledger
Market functions	Issuance and custody (primary); trading; settlement
Recurring challenges	C (primary); B; D

This problem follows one investor's purchase from the point of entry to the point of legal claim. The licensed firm where the customer converts money into tokens, and the wallet that receives them, sit in the access layer. The token representing the share or bond sits in the tokens layer. The shared token standard is a standards question: it must carry the compliance rules every venue applies. Whether one venue may rely on another's identity check is a governance question as much as a technical one. The ledger is engaged because the network decides which transactions enter the record, and so whether an administrator's freeze or forced transfer executes as intended.

Read by function, the problem is first an issuance and custody question. Whether the token is the share itself or a contractual claim on a custodian is settled at issuance; voting rights, dividends, and recovery on a custodian's failure are settled in custody. That is challenge C: the access benefit cannot be assessed until it is clear what the access confers. Identity checks that do not travel across borders are challenge B. Fractional units widen who can buy, but they do not create buyers, so small holdings stay hard to sell without a deep market, which is challenge D. The grid also shows the limits of the ask. Reliance on one identity check moves the cost of that check to the licensed point of entry in the access layer; the recurring costs of custody, settlement and monitoring sit in the tokens, ledger and governance layers, which is where the contributor expects tokenization to lower them.

2.3 RECOGNISING AI AGENTS AS PAYMENT INITIATORS

Layers	Access (primary: the agent itself); governance and compliance (primary); standards (mandates, credentials, agent identity; primary); tokens: forms of money; ledger
Market functions	Settlement (primary); custody (signing keys); trading
Recurring challenges	B (primary); C; E

An AI agent enters the grid at the access layer, where a person or institution would normally sit. It holds a wallet, initiates the payment, and may execute a trade. The tokenized money it uses sits in the tokens layer, and the ledger settles the transfer, often with finality in seconds. The credentials and mandate that show whose agent it is and what it may do are a standards question: the merchant, the receiving institution, and the regulator on the other side must be able to read and rely on them. Custody is engaged because the proposed controls enforce the mandate at the

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signing key. Governance and compliance is engaged because every rule it applies assumes an accountable party at the access layer.

The view shows what changes. In the other problem statements, the access layer is occupied by a licensed firm, a broker, or a bank. An agent without an operator leaves that cell occupied by software alone, so the governance row has nothing to attach to at the point of entry. Making the principal's credentials and the mandate travel with the agent is challenge B applied to identity and authority rather than to assets. Irreversible settlement of an erroneous payment, with liability unsettled, is challenge C. Adoption running ahead of data, talent, and supervisory capability is challenge E. The problem mirrors 05: there, the ledger has no accountable operator; here, the access layer has none.

2.4 STANDARDS AND IDENTITY FOR CROSS-DOMAIN INTEROPERABILITY

Layers	Standards (primary); tokens (token standards such as ERC-20 and ERC-3643); access (each institution's connectors and identity certificates); governance and compliance; ledger
Market functions	All five, with settlement and custody most affected
Recurring challenges	B (primary); E

This problem sits where the figure places challenge B: the standards layer, at settlement. Two families of standards meet here. Banks exchange ISO 20022 messages, while tokens follow standards written for their blockchain, such as ERC-20 and ERC-3643, which sit between the standards and tokens layers because they define how the token itself behaves. Each institution builds its own connector between the two at the access layer, and is often issued a new identity certificate on each platform. Governance and compliance is engaged because the roles of regulators and industry in setting these standards have to be agreed, and because legal definitions must sit beneath them.

Unlike most problem statements, this one runs across every market function. A credential not recognised by the next platform repeats onboarding at issuance and trading. An inconsistent message or asset representation complicates reconciliation at settlement. A permission that does not travel limits what a custodian can move. The responses now under way take different architectural routes, and until one is widely adopted, each new network adds a connection the market must maintain, which is why challenge E follows challenge B here.

2.5 PROPORTIONATE COMPLIANCE FOR BANKS ON PUBLIC BLOCKCHAINS

Layers	Ledger (primary: where the friction originates); governance and compliance (primary: where the obligation sits); tokens (the bank's issued tokens; unsolicited tokens); access (the bank's own applications)
Market functions	Settlement (primary); custody; issuance; trading
Recurring challenges	E (primary); C

The friction originates at the bottom of the grid and the obligation it creates sits at the top. All four issues begin in the ledger layer, where ordering, inclusion, incoming transfers, and fee distribution are set by software maintained across jurisdictions with no single operator. The obligation sits in governance and compliance, and it is the absence of clear, proportionate guidance there that turns manageable risks into costly processes. Between the two, the bank controls only the access layer, its own applications, and the smart contracts it deploys in the tokens layer.

By function, each issue lands in a different column. Front-running affects trading. Omission affects settlement, and an issuer's ability to pause during redemptions. Unsolicited tokens affect custody, because they arrive at addresses the bank holds. Fee distribution affects every transaction the bank settles. A Layer 2 network with one known operator moves ordering and inclusion into a cell the bank can contract with, but where its batches post to a public Layer 1, the settlement function returns to a ledger the bank cannot control. The result is challenge E: only the largest banks can carry the cost of conservative compliance, so most stay out and activity stays at the pilot stage.

2.6 RECALIBRATING FMI REGULATION FOR TOKENIZED SETTLEMENT

Layers	Governance and compliance (primary: rules calibrated to the old sequence); ledger (primary); tokens: both tokenized assets and forms of money; standards (oracles; synchronisation operators); access (trading platforms)
Market functions	Trading, clearing, and settlement (primary, merged into one event); custody
Recurring challenges	C (primary); A; D; E

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This problem arises from compression, and the grid shows it as three columns becoming one. In a conventional market, trading, clearing, and settlement are separate functions performed by separate regulated institutions. On a single ledger, where both the tokenized security and the money that pays for it sit in the tokens layer, the three can complete in one atomic event. The function columns merge at the ledger layer, while the rules governing each stay separate in the governance row, divided across four public mandates. The recalibration this problem statement calls for is work on that row: matching each rule to where the risk now sits.

It is also the problem statement that engages the most recurring challenges. Unclear legal finality outside a designated system is challenge C. Same-ledger atomicity depends on the money being on the ledger, which is challenge A; across ledgers it needs a coordinator, such as a synchronisation operator in the standards layer. Without netting, cash for each trade is held in full on each platform, which is challenge D. Pilots that concluded under exemptions, without the licensing regime a live market needs, are challenge E.

2.7 QUANTUM-SAFE SECURITY FOR TOKENIZED ASSETS

Layers	Ledger (primary: signing and key architecture); standards (primary: key exchange between ledger environments); tokens (long-lived claims); access (wallets and keys); governance and compliance (migration requirements)
Market functions	Custody (primary); settlement; issuance
Recurring challenges	C (primary); E

This problem sits beneath every cell of the grid, and adds a dimension the figure does not draw: time. The standards layer carries the key exchange that protects data moving between ledger environments, which is where the nearest exposure lies and where HSBC's interim protection applies. The ledger layer holds the signing and key architecture, whose migration is the longer task and where larger post-quantum keys and signatures can affect performance. The tokens layer holds the long-lived claims that may outlast the cryptography protecting them.

By function, the problem lands first on custody. With tokens, key management is the core custody function, and a key that can be derived is an asset that can be taken. Signatures authorise transfers at settlement, and registers maintained from issuance must stay trustworthy for as long as the right survives. That makes this a long-run form of challenge C. Coordinating migration across issuers, operators, and custodians, some beyond a country's reach, is challenge E.

2.8 SETTLEMENT COORDINATION FOR TOKENIZED DEPOSITS

Layers	Tokens: forms of money (primary); ledger (each bank's platform, and the shared orchestration ledger; primary); standards (messaging between platforms); governance and compliance (legal, liability, and risk governance)
Market functions	Clearing and settlement (primary)
Recurring challenges	A and B (primary); D; E

A tokenized deposit sits in the tokens layer as a form of money, but on each issuing bank's own platform, so two banks' tokens do not meet on a common ledger. The orchestration response places a shared record above the banks' platforms: obligations are recorded on each bank's own infrastructure, and the shared layer matches and nets them. Final settlement of the residual then leaves the ledger for RTGS or correspondent banking. Governance and compliance is engaged through the legal and liability arrangements, risk governance, and service levels still to be settled.

The view shows this design is the deliberate opposite of 06. Where 06 merges clearing into settlement on one ledger, this response pulls them apart: the shared layer performs a clearing function, recording commitments and netting obligations, while settlement stays where it was. That keeps each bank on its own platform, which addresses challenge B, but accepts challenge A by design. Liquidity buffers held against the gap between commitment and settlement, and netting that helps only where flows offset, are challenge D. The production operating model still to be built is challenge E.

2.9 READING THE EIGHT TOGETHER

Table 3.3 places all eight problem statements on the grid. A filled circle marks a layer where the problem's friction originates or concentrates; an open circle marks a layer it engages. Primary challenges are listed first.

What the pattern shows

Governance and compliance is engaged by all eight, and is a primary locus in five. In most cases the binding friction is the allocation of authority and the clarity of rules, not the technology.

No problem stays in one cell. Every problem statement engages at least four of the five layers. The friction usually sits at a boundary, where a function crosses from one layer to another: the conversion points in 01, the gap between network behaviour and

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the bank's obligation in 05, the hand-off from the shared ledger to RTGS in 08.

TABLE 3.3

The eight problem statements on the stylised ecosystem view

Problem statement	Gov.	Access	Stds	Tokens	Ledger	Primary functions	Challenges
01 Stablecoin settlement	●	●		○	○	Settlement	A, D, E
02 Small-investor access	●	●	○	●	○	Issuance, custody	C, B, D
03 AI agents	●	●	●	○	○	Settlement	B, C, E
04 Standards and identity	○	○	●	○	○	All five	B, E
05 Banks on public blockchains	●	○		○	●	Settlement, custody	E, C
06 FMI regulation	●	○	○	●	●	Trading, clearing, settlement	C, A, D, E
07 Quantum-safe security	○	○	●	●	●	Custody	C, E
08 Tokenized deposits	○		○	●	●	Clearing, settlement	A, B, D, E

● friction originates or concentrates here ○ layer engaged

Source: GFTN analysis of contributor problem statements.

Settlement is the most contested column. It is a primary function in six of the eight and engaged in all of them. It is where challenges A and C meet: which money settles, and when the settlement is legally final.

Two opposite designs answer the same question. 06 compresses trading, clearing, and settlement onto one ledger and needs money on that ledger. 08 separates clearing from settlement and leaves money where it is. Neither is right in general. The choice depends on whether a country can bring a settlement asset onto the ledger (challenge A), and on whether its flows net (challenge D).

Every model assumes someone stands behind the transaction. 05 and 03 are mirror images: 05 has no accountable operator at the ledger layer, and 03 has none at the access layer. The governance model in every other cell assumes an accountable party at both.

The grid is a snapshot; 07 adds time. It is the only problem whose exposure grows while nothing visible happens. Long-lived claims require each cell to be read across the life of the instrument, not at the moment of issuance.

Challenge E appears in seven of the eight. Moving from pilot to production is the common end point of the other frictions, and the reason most of the experience in Part 1 comes from pilots, sandboxes, and minimum viable products rather than live markets.

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PART 3
TYING BACK TO THE TOKENIZATION PATHWAYS FRAMEWORK

3.0 READING A PROBLEM STATEMENT AGAINST THE FRAMEWORK

Each problem statement in Part 1 is read here against the nine assessment areas of the Tokenization Pathways framework. As countries consider scaling tokenization, these problem statements are what industry reports as the frictions in the way. Reading them against the framework shows how they stack up: where, in a country's own assessment of a comparable scheme, the same friction would surface, and under which area it would be examined. The purpose is not to resolve the problems, and none of the framework's considerations is answered on its behalf.

For each problem statement, this Part identifies the area or areas it stress-tests, the considerations engaged, and, where the material supports it, how the six dispositions set out at Section 3.10 of the framework would likely read across the jurisdictions it covers: proceed to design; proceed to a conditional pilot; continue without scaling; redesign and return; defer live issuance; and stop the option and keep the current arrangement. Where a jurisdiction's own arrangement already closes the gap, that is recorded as a sign of movement, not as a sign that the friction has gone away.

3.1 STABLECOIN SETTLEMENT WITHIN REGULATED PAYMENT LICENCES

This problem statement is a live catalogue of Area 8's mandate-allocation question (8.3): for each mandate, which authority holds it, and where are the overlaps or gaps?

- Singapore splits payments and Digital Payment Token activities into separate licence classes; adding the service is a licence variation within one regulator.
- Brazil has closed stablecoin settlement to its licensed eFX providers from October 2026, requiring a foreign-exchange transaction so the flow stays inside its reporting.
- The EU runs its payment-services rules beside MiCA, with the question running from the digital-asset side: whether a crypto-asset service provider also needs a payments authorisation.
- Hong Kong can require two licences from two authorities for one payment: Customs and Excise (remittance) and the SFC (trading and custody), with the HKMA regulating issuance separately.
- The Philippines has closed new VASP licensing since 2022.

In each case, no single mandate holder has both the powers and the information to authorise the flow end to end. In the framework's terms (Section 4.3), Hong Kong's arrangement is overlapping, with two licensing authorities over one flow and a third over issuance. The Philippines' closure is not underlap, since the central bank holds the mandate, but it leaves a new entrant no route to it.

Underneath that, Area 5 (5.3) explains why the split falls where it does. The fiat legs discharge the money obligation as an unmapped function on conventional rails, while only the stablecoin leg is an action on a ledger, so the two obligations must be coordinated across separate systems (5.4). Area 6 (6.3, 6.4) is where the compliance burden lands: verifying authority, and allocating compliance obligations, at each hand-off between the fiat and stablecoin legs. Area 1 (1.7, 1.8) applies the caveat on cost: the comparison with the present operation must include last-mile costs, and a benefit that arises only in some corridors should be credited only there. The comparison should also count the potential effect of wider licensing on competition at the conversion points, where most of the cost sits.

Read against the six dispositions, most jurisdictions here would sit at defer live issuance: the mandate gap is identified but not yet closed, and the record should state what would close it. The UK's proposals are the case moving towards a conditional pilot, by naming which mandate resolves which condition, and Thailand's joint rule-making between its central bank and securities regulator points in the same direction. Brazil has, in effect, chosen to stop the option and keep the current arrangement, and any proposal elsewhere has to answer the reporting concern behind that choice.

3.2 TOKENIZED MARKET ACCESS FOR SMALL INVESTORS, WITH INVESTOR PROTECTION

This problem statement is a live test of Area 1's attribution question (1.8, 1.9): for each expected benefit, does the improvement come from the scheme itself or from another change, and does the scheme perform better than realistic alternatives? The claimed benefit is access, and the contributor's hypothesis is that tokenization lowers the recurring cost of serving a small account, in custody, settlement and per-holding compliance; Area 1 asks for that saving to be shown cost by cost. Consideration 1.8 applies in its plainest form: fractional ownership, proportionate due diligence and pooled domestic products can all be had without tokenization, so only benefits that depend on the ledger, such as a holding that moves between venues, should be credited to it. The ask for reliance on a single identity check engages 6.3 as well: whether a receiving venue may rely on a check performed elsewhere, and who performs and pays for the first

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one. On its own, reliance moves the cost of the first check rather than removing it. Area 4's guidance that access is an outcome[121] applies directly. Broader access requires naming the first realistic group of new users and the channel through which they would take part, because being able to hold a token in a wallet does not by itself show inclusion.

Area 2 (2.1, 2.7) determines what the token gives its holder. Where the law treats the ledger entry as the right itself, as in Switzerland, the claim type is settled and holder protection follows. Where it does not, voting rights, dividends, and recovery on a custodian's failure depend on a contractual claim the token only evidences. The question authorities raised about whether code does what it says maps onto 2.4 and the framework's tests of effectiveness: whether the smart contract imposes the same conditions as the legal terms. Area 6 (6.3, 6.7) is where the cross-border identity problem lands, and Area 8 (8.6) and Area 9 (9.6, 9.7) cover the capital-flow concern: where a purchase bypasses the licensed conversion point, the country's outward-flow limits, reporting, and investor protections do not attach.

Read against the six dispositions, a jurisdiction that has not settled its claim-type question under Area 2 sits at redesign and return or defer live issuance: access cannot be assessed as a benefit until it is clear what the access confers.

3.3 RECOGNISING AI AGENTS AS PAYMENT INITIATORS

This problem statement is the case the framework's Extension E1 (machine-driven execution) is written for, and the architectural trigger for software acting for holders (Table 2.14) brings it into scope through consideration 7.11. Under the framework's definition, an agent is a party authorised to initiate ledger actions, so the questions are those of 2.8 and 4.2 asked of software instead of a person: on whose behalf it acts, what it may do and up to what amount, how that authority is granted and withdrawn, and who bears the loss when it acts within its limits but not as its principal intended. Consideration 6.3 asks whether the principal can be identified and its authority verified and revoked, which is exactly the recognition question the roundtable addressed: the principal's credentials and the mandate, not the software, are what another institution must be able to rely on.

E1 draws the distinction this problem statement turns on. An agent run inside a regulated institution usually inherits that institution's controls. For one with no central operator, the assessment identifies the points where someone could still see and stop it: the principal, the wallet software, the merchant or platform, the firms that convert money into tokens and back, the protocol, and any policy module that sets its limits. Where none can act, the framework asks the assessment to state plainly that holders have no protection beyond their own settings. E1's requirement that the instrument's terms be published as structured data that software can check, and that an agent stop rather than proceed when it meets conflicting instructions, matches the roundtable's deterministic limits and human-approval categories.

The liability gap is, in the framework's terms, underlap (Section 4.3): each authority can correctly say the agent falls outside its mandate. Where activity crosses borders, 9.6 and 9.7 test what recognition and enforcement cooperation provide, and 8.4 tests whether supervisors have the systems and staff to observe activity at the speed agents act.

Read against the six dispositions, an agent operating inside a regulated institution, with its mandate checked at execution and an independent record of each action, could support proceed to a conditional pilot. An agent with no operator and no point of intervention would more likely sit at defer live issuance or redesign and return.

3.4 STANDARDS AND IDENTITY FOR CROSS-DOMAIN INTEROPERABILITY

This problem statement stress-tests Area 6 most directly. Consideration 6.2 asks whether assets, rights, participants, events, and states mean the same thing in every connected system; two families of standards that are not natively aligned fail that test by construction. Consideration 6.3 covers identity: whether a party's attributes and authority can be verified across systems, and revoked when they lapse, which a certificate issued per application does not achieve. Consideration 6.9 asks whether credentials move with a participant when it switches provider.

Area 1 (1.8) applies with particular force. The framework lists common data standards among the changes that could deliver a benefit without tokenization at all, so where a claimed gain depends on aligning standards, the assessment asks whether it would arise from that alignment alone. Area 4 (4.10) covers lock-in: where a scheme depends on a standard owned by one consortium, the assessment establishes who governs that dependence. Consideration 9.4 asks which authority could act on an interoperability finding. The framework notes that interoperability rarely has an authority of its own; the public-sector view that authorities should convene, keep standards open, and use soft law fits the nearest powers it identifies, such as payment-system access, competition, and licence conditions.

Read against the six dispositions, a scheme confined to one network can proceed to a conditional pilot on this problem alone. A scheme whose business case depends on credentials and permissions being recognised across networks would sit at redesign and return until that recognition is in place.

3.5 PROPORTIONATE COMPLIANCE FOR BANKS ON PUBLIC BLOCKCHAINS

This problem statement is the worked case for the framework's guidance on control over an external network, under Area 7. The framework's own example matches it closely: an issuer answerable for preventing transfers to sanctioned persons "cannot stop independent validators confirming one; it can only freeze its own token afterwards."[122] Where an institution is answerable for more than it can control, the framework gives three responses: close the gap by design, accept and disclose it to holders, or treat it as blocking the option. The architectural trigger for a network the operator does not control (Table 2.14) brings in 7.1 and 7.9.

The problem statement's emphasis on proportionality engages the framework's grading of findings (Section 5.5): an issue is graded by what would follow if it were wrong or left unresolved. A risk that is real but low, such as a valueless unsolicited token, should be

[121] GFTN (2026). Tokenization Pathways Toolkit: a country assessment framework, full version. Available to authorities on request. Section 2 of this report summarises it; this guidance is drawn from the full version.
[122] GFTN (2026), full version, op. cit.

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graded Limited or Material, not treated as if it were Critical. Area 4 (4.2) governs the controls the bank relies on, and the framework is clear that a legitimate purpose such as sanctions compliance does not by itself supply their legal basis or limits. Consideration 6.4 asks whether each compliance obligation is assigned at every hand-over; fee distribution is the case where it cannot be. Area 8 (8.3, 8.6) records the mandate split between securities regulators and sanctions and anti-money-laundering authorities, and 9.7 asks whether cooperation across jurisdictions supports a consistent treatment.

Read against the six dispositions, a scheme on a Layer 2 network with a known operator, whose residual exposure on posting to Layer 1 is measured and disclosed, could proceed to a conditional pilot. A scheme on a public Layer 1 where the bank's obligation exceeds what it can control, with no design response and no regulatory clarity, would sit at continue without scaling or redesign and return. Clear, proportionate guidance on the three regulatory asks would move many schemes up a disposition without any change to the technology.

3.6 RECALIBRATING FMI REGULATION FOR TOKENIZED SETTLEMENT

This problem statement tests the framework's approach to regulatory fit as much as any single area. The framework assesses what each ledger action does in law, not how it is coded, and asks which authority holds each mandate; recalibration is the policy counterpart of that method. Area 2 (2.6) and Area 5 (5.2) hold the two finality questions the framework deliberately keeps apart, compared under 5.4: when the transfer becomes legally binding, and when the payment becomes final. Where same-ledger settlement makes them coincide technically, the assessment still asks whether the law recognises that moment. Consideration 2.2 asks which record governs, and 7.9 what happens if the ledger splits, halts, or is rolled back.

The liquidity consequence is a direct test of 5.7. The framework asks for real transactions to be replayed through the proposed design, because "settling each trade instantly usually ends netting and requires pre-funding."[123] Area 4 (4.7, 4.9) covers the compression itself: which functions disappear, merge, or move, and whether the analysis includes functions the scheme creates, such as a synchronisation operator. Area 1 (1.8) carries Acacia's finding that some gains need no tokenization. Area 8 records the four-mandate split (8.3) and asks whether the scheme can be implemented under existing law (8.8). The framework is explicit that "taking part in a test is not evidence of safety, and does not lead automatically to going live" (Section 5.3), the same condition the problem statement sets for a sandbox.

Read against the six dispositions, a scheme of this kind would most likely sit at continue without scaling or defer live issuance. The pilots establish that the mechanics work, but the licensing regime, finality designation, and capital treatment a live market needs are conditions no exemption has yet met.

3.7 QUANTUM-SAFE SECURITY FOR TOKENIZED ASSETS

This problem statement engages the consideration in the framework written for it, 7.12: will the security and cryptographic arrangements stay adequate for the whole life of the instrument, and can they be upgraded without holders losing rights or evidence? The same test appears as durability among the feasibility criteria in Section 1.4. The framework's guidance matches HSBC's approach closely: what matters is "a tested path and an agreed end state"[124] before the current cryptography becomes inadequate, not the choice of one algorithm in advance.

Consideration 2.12 asks whether reliable evidence is kept; for a long-lived claim, that evidence is only as durable as the signatures behind it. Consideration 6.6 covers data moving between infrastructures, where the nearest exposure lies and where interim protection of the kind HSBC trialled applies. Where records sit with operators or foreign issuers, 9.6 asks what direct powers the host country's authorities have over them. Section 5.4 already lists long-lived claims among the features that call for a deeper assessment.

Read against the six dispositions, this problem rarely blocks an option today. It is better carried as a condition: a scheme can proceed to design or a conditional pilot provided it holds a cryptographic inventory, protects data in transit, names an owner for migration, and has a tested path to post-quantum signing.

3.8 SETTLEMENT COORDINATION FOR TOKENIZED DEPOSITS

This problem statement is a direct test of the framework's treatment of tokenized deposits under Area 5. The framework states that a tokenized deposit discharges an obligation "on the terms of the arrangement, which must say whether moving the token pays the debt or only records an instruction to pay."[125] The orchestration design answers that question explicitly: a commitment on the shared layer records the obligation, and the debt between banks is paid only when the residual settles through RTGS or correspondent banking (5.2). The payment remains an unmapped function on a separate system with its own hours (5.3), and the exposure between commitment and settlement is what 5.4 asks the assessment to measure, cover, or disclose.

Consideration 5.7 tests the liquidity claim with real data; the finding that one-way flows produce no netting benefit is the kind of result the framework's replay analysis is designed to surface before scale. Area 3 (3.3) tests the reconciled hand-offs between conventional payment processes and tokenized-deposit actions, including what happens when a hand-off only partly succeeds. Area 4 (4.10) asks who governs a shared orchestration utility on which many banks would depend. Area 1 (1.8, 1.9) asks whether the benefit could come another way, for example through wider use of fast-payment or central bank systems and aligned operating hours.

Read against the six dispositions, the design as tested would sit at proceed to a conditional pilot, conditional on the legal and liability arrangements, exception handling, and service levels still to be settled, and narrowed to corridors where flows net.

[123] GFTN (2026), full version, op. cit.
[124] GFTN (2026), full version, op. cit.
[125] GFTN (2026), full version, op. cit.

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3.9 SUMMARY

Table 3.4 summarises where each problem statement would surface in a country's own assessment.

TABLE 3.4

Where each problem statement would surface in a country's assessment

Dispositions are indicative and depend on each jurisdiction's own conditions.

PS	Primary areas	Key considerations	Likely disposition
01	8, 5, 6, 1	8.3, 5.3, 5.4, 6.3, 6.4, 1.7, 1.8	Defer live issuance; the UK and Thailand moving towards a conditional pilot; Brazil has stopped the option
02	1, 2, 4, 6, 8, 9	1.8, 1.9, 2.1, 2.4, 2.7, 6.3, 6.7, 8.6, 9.6, 9.7	Redesign and return, or defer, until the claim type is settled and cross-border reliance is permitted
03	E1, 2, 4, 6, 7, 8, 9	2.8, 4.2, 6.3, 7.11, 8.4, 9.6, 9.7	Conditional pilot inside a regulated institution; defer where no operator
04	6, 1, 4, 9	6.2, 6.3, 6.9, 1.8, 4.10, 9.4	Conditional pilot on one network; redesign where cross-network recognition is assumed
05	7, 4, 6, 8, 9	7.1, 7.9, 4.2, 6.4, 8.3, 8.6, 9.7; Section 5.5	Conditional pilot on a known-operator Layer 2; continue without scaling on a public Layer 1
06	5, 2, 4, 1, 7, 8	2.2, 2.6, 5.2, 5.4, 5.7, 4.7, 1.8, 7.9, 8.3, 8.8	Continue without scaling, or defer live issuance
07	7, 2, 6, 9	7.12, 2.12, 6.6, 9.6	Carried as a condition; rarely blocks
08	5, 3, 4, 1	5.2, 5.3, 5.4, 5.7, 3.3, 4.10, 1.8	Conditional pilot, narrowed to corridors where flows net

Source: GFTN analysis of contributor problem statements.

Read across the eight, Area 8 or the mandate questions of Part 4 of the framework appear in five of the eight entries. The consistent finding is that the binding constraint is rarely whether the technology works. It is whether an authority holds the power to act on what the assessment finds, and whether a country's authorities can act together.



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CONCLUSION AND NEXT STEPS

This report has looked at tokenized markets from three positions. Section 1 set out where adoption stands. Activity is growing, but most tokenized asset value sits in government debt and money-market funds that trade little after issue, and few pilots have reached lasting production. Section 2 gave authorities a method for assessing one scheme at a time, from a sponsor's proposal to a decision with reasons. Section 3 recorded eight frictions reported by the firms building these markets and placed each one within that assessment.

Read together, the three sections point to the same conclusion. The gains tokenization promises depend on conditions that no single firm controls. Settlement needs an asset on the ledger. Ownership and finality need law that recognises the ledger as the record. The authorities involved need to be able to act together. Until these conditions are met, each firm waits for others to move first, and schemes stay at the pilot stage. Section 3 shows how this plays out today. In none of the eight problem statements would a scheme proceed without conditions, and in five of them the authorities' mandates are among the main areas of assessment. Some jurisdictions are already changing the answers. Hong Kong has granted its first stablecoin issuer licences, and the United Kingdom and Thailand are moving towards conditional pilots for stablecoin settlement. For banks on public blockchains, clear and proportionate guidance would move many schemes to a better outcome with no change to the technology. Section 1 noted that authorities can lower barriers to entry and support early activity. The toolkit gives them a way to do that scheme by scheme, and the effect is greater where authorities assess schemes the same way and share what they find.

GFTN will keep the toolkit and the problem statements under review as authorities apply them and as schemes move from pilot to production. The full report and online toolkit are available to authorities on request, and we invite authorities and firms to bring new frictions and completed assessments to this work, so that each one informs the next.

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GLOSSARY

Terms are defined as this report uses them. Where a term also has a settled meaning under the law governing an instrument, that meaning controls for that instrument.

Added control A ledger action for which the legal instrument provides no basis. Control here means the ability to act on a holding, not a safeguard against risk.

Additionality The part of a claimed improvement attributable to the mapping itself, over and above what a realistic alternative would deliver. Tested as two questions: attribution, at consideration 1.8, and comparison with alternatives, at 1.9. The term is used here in that sense only, and not in the development-finance or carbon-market sense of an effect that would not have occurred without public support.

Assessment Report The assessment team's combined view and recommendation. Written to be read.

Atomic settlement Settlement in which both legs of a transaction, typically the asset and the cash, transfer together or not at all.

Authority Decision Record A determination made by one mandate holder within its own powers, recorded separately from the assessment.

Bridge Software that moves tokens or messages between separate ledgers, usually by locking an asset on one ledger and issuing a representation of it on another.

Canton Network A permissioned blockchain network for financial institutions that partitions data, so that each party holds only the records it is entitled to see.

CBDC (central bank digital currency) Central bank money in digital form. Wholesale CBDC is used for settlement between financial institutions; retail CBDC is available to the public.

CCP (central counterparty) An entity that becomes the buyer to every seller and the seller to every buyer through novation, and manages the resulting exposures through margin and default resources.

Clearing Confirming trades and calculating the obligations of each party before settlement, including netting and, where a CCP is used, novation and margining.

CLS The settlement system operated by CLS Bank, which settles foreign exchange transactions on a payment-versus-payment basis in a limited set of eligible currencies.

Conditional pilot A disposition permitting live operation at limited scope and scale, subject to stated conditions. It does not imply regulatory relief; a sandbox or other controlled test is a separate arrangement, treated at Section 5.3.

Correspondent banking An arrangement in which one bank holds accounts for, and makes payments on behalf of, another bank, typically across borders.

Counterfactual model Where no scheme yet exists, a specification of the scheme as it would have to exist for the policy question to be answerable, with every design parameter recorded as an assumption. It is the subject of the assessment. The comparison against which a scheme is judged is the conventional comparator, at Area 1.

Country Answer Record The working record of the evidence, the answer to each consideration, the diagrams and the registers. Written to be checked.

CSD (central securities depository) An entity that keeps the authoritative record of securities issued (the notary function), maintains securities accounts and usually operates a securities settlement system.

Custody Safekeeping of assets on behalf of others. For tokenized assets, this includes managing the cryptographic keys that control them.

DeFi (decentralised finance) Financial services, such as trading and lending, delivered through smart contracts on public blockchains, typically without a central intermediary.

Demat account In India, an account that holds securities in electronic (dematerialised) form with a depository participant.

DFCRC Digital Finance Cooperative Research Centre, an Australian research centre that worked with the Reserve Bank of Australia on its CBDC pilot and Project Acacia.

Digital twin A token that mirrors a claim recorded in an off-ledger register, which remains the legally authoritative record of ownership.

DLT (distributed ledger technology) Technology that lets multiple parties keep consistent records under shared validation rules. Blockchains are one type of DLT.

DTI (Digital Token Identifier) An ISO standard identifier (ISO 24165) for digital tokens.

DvP (delivery versus payment) A settlement mechanism that ensures the asset is delivered if, and only if, payment is made.

Evidentiary state How well a determination is supported: Established, Preliminary, Disputed, or Evidence gap.

EVM (Ethereum Virtual Machine) The environment that runs smart contracts on Ethereum. EVM-compatible networks run the same code and use the same address format.

Finality (settlement finality) The point at which a transfer becomes irrevocable and unconditional. Technical finality follows from the ledger's consensus rules; legal finality depends on the law and on the designation of the system.

Gates (mapping test) The five ordered questions at Section 1.5 of the framework that establish whether a scheme falls within its perimeter.

GL1 (Global Layer One) An MAS-led initiative with financial institutions to develop common standards and shared ledger infrastructure for tokenized assets across jurisdictions.

Hashed time-locked contract (HTLC) A smart contract that releases an asset only if the recipient presents a secret within a set time; otherwise the asset returns to the sender. Used to coordinate transfers across ledgers.

ISIN International Securities Identification Number (ISO 6166), the standard identifier for securities.

ISO 20022 An international standard for financial messaging, used by many payment and securities settlement systems.

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KYC (know your customer) Checks that financial institutions carry out to verify the identity of their customers and assess related risks.

Layer 2 A network that processes transactions separately and posts them in batches to an underlying public blockchain (Layer 1).

Ledger action Something the ledger's smart contracts can do to a holding or record, such as transfer, freeze, redeem or pay out. Each comes with the party allowed to trigger it and the legal effect it is meant to have.

Legal characteristic A right, power, duty, restriction, condition, priority, defence, or remedy the instrument carries, or an event that creates, alters, suspends, or extinguishes one.

Legal instrument The instrument the scheme proposes to map, with the legal documents that create it, its governing law, the register where its ownership is recorded today, and the parties with obligations under it.

LEI (Legal Entity Identifier) An ISO standard identifier (ISO 17442) for legal entities that are parties to financial transactions.

Mapped characteristic A legal characteristic of the instrument that a ledger action performs.

Mapping The matching of the instrument's legal characteristics to ledger actions. It does not mean drawing process diagrams, although the assessment produces those as well.

Mapping fidelity Whether a mapped characteristic is faithful, understated, or overstated: whether the ledger action produces the same legal effect under the same conditions as its counterpart, less, or more.

Margining Collecting collateral to cover current and potential future exposures between counterparties.

MiCA The EU Markets in Crypto-Assets Regulation, which sets rules for issuers of crypto-assets, including stablecoins, and for crypto-asset service providers.

MMF (money market fund) A fund that invests in short-term, high-quality debt instruments such as government bills.

Native crypto-asset A token created on a blockchain that represents no claim on an issuer or underlying asset, such as bitcoin or ether. It is not a tokenized asset in the sense used in this paper.

Natively issued asset An asset issued directly on a ledger that the law recognises as the register of ownership, so no separate off-ledger record exists. It is still a claim on an issuer, such as a bond or fund unit.

Netting Offsetting obligations between parties so that only net amounts are settled, reducing the liquidity needed for settlement.

Nostro account An account that a bank holds with another bank, usually abroad and in a foreign currency, to make and receive payments.

Novation Replacing an existing obligation with a new one. In clearing, a CCP replaces the contract between two parties with two new contracts, one with each party. In a transfer, the obligor agrees to owe the obligation to a new holder in place of the old one, so the old obligation ends and a new one begins; this is one of the transfer routes the framework assesses (Area 2).

Option and stage effect What a determination does to the options under consideration: support, condition, design choice, remediation, redesign, deferral, block, or no material effect.

Oracle A service that brings external data, such as prices, reference rates or sanctions lists, onto a ledger for use by smart contracts.

Overlap Two or more authorities holding authority over the same matter.

PFMI Principles for Financial Market Infrastructures: the CPMI-IOSCO international standards for payment, clearing and settlement systems.

Post-quantum cryptography Cryptographic methods designed to resist attack by future quantum computers.

Pre-funding Holding the full amount of cash or assets in advance of settlement, rather than relying on credit or netting.

Programmability The ability to attach rules to an asset or to money that execute automatically, such as coupon payments or transfer restrictions.

Project Guardian An MAS-led collaboration between policymakers and the financial industry, launched in 2022, to test asset tokenization across asset classes.

Rollup A scaling technique for public blockchains that executes transactions off the main chain and posts compressed results back to it.

RTGS (real-time gross settlement) A payment system that settles transfers individually and immediately, usually operated by the central bank in central bank money.

RWA (real-world asset) A conventional financial or physical asset, such as a bond, fund unit or property, represented as a token on a ledger.

Singleness of money The principle that different forms of money in the same currency, such as central bank money and commercial bank deposits, are exchanged at par.

Smart contract A program on a ledger that carries out actions on holdings or records when set conditions are met. Despite the name, it may or may not be a contract in law. Platforms implement smart contracts differently, so the framework assesses what each action does in law, not how it is coded.

Stablecoin A token issued by a private entity that aims to keep a stable value relative to a reference asset, usually a fiat currency.

T+1 / T+2 Settlement one or two business days after the trade date.

Takes free of prior claims A characteristic of some instruments under which a transferee acquires the position without being subject to claims or defences that could have been raised against an earlier holder.

Tokenization / tokenized asset Recording ownership of an asset as a token on a programmable, shared ledger. The term covers both digital twins and natively issued assets. To assess a proposal, the framework treats tokenization as the mapping of an existing legal instrument, and the scheme governing it, to ledger actions carried out by smart contracts, so that it can test whether the token does in law what the instrument requires.

Tokenized deposit A commercial bank deposit recorded as a token on a ledger. It remains a liability of the issuing bank.

Transmission register The standing record at Section 4.5 of which findings were provided to which authority, when, what was asked, and what response was received.

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Travel rule The FATF requirement (Recommendation 16) that originator and beneficiary information accompany a transfer, applied to virtual-asset transfers between service providers.

Underlap Part of a scheme falling within no authority's mandate. Distinguished from an untested boundary, where a mandate may cover the matter but no one has had cause to establish it.

Unmapped characteristic A legal characteristic that no ledger action performs, so that an identified party continues to perform it off the ledger.

VASP (virtual asset service provider) A business that exchanges, transfers or safeguards virtual assets for others, as defined by the FATF.

Wallet Software or hardware that holds the cryptographic keys used to control tokens.

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