Banc Ceannais na hÉireann
Central Bank of Ireland
Eurosystem

DLT & Tokenisation in Financial Services

Discussion Paper 12

March 2026

Contents

Feedback to this Discussion Paper

A number of questions are posed throughout this Discussion Paper. Stakeholders are invited to provide written responses to the questions as well as any general observations on the matters discussed or issues raised.

The Central Bank of Ireland requests that written responses are submitted by 5 June 2026.

Unless requested otherwise, the intention is to publish written contributions submitted. The Central Bank will consider the feedback received and the intention is to publish a feedback statement covering some or all of the topics raised in the written responses.

1. Introduction

1. Distributed Ledger Technology (DLT) has the potential to have profound implications for the financial system. The integration of DLT into mainstream finance presents clear potential benefits for providers and users of financial services, but also challenges that need to be managed.

2. Understanding how tokenisation interacts with existing financial infrastructures, legal frameworks, forms of money and settlement, and market practices is therefore critical to ensuring that innovation supports and effects positive change, while maintaining monetary and financial stability, consumer protection and market integrity.

3. The Central Bank of Ireland is issuing this Discussion Paper (DP) to stimulate informed dialogue on the future role of DLT and tokenisation applications within the Irish and European financial services ecosystem. We believe DLT and tokenisation – if enabled and deployed correctly – can change the financial system for the better, including by helping the EU deliver on its objectives to integrate and deepen its financial markets.

4. Our aim here is to engage stakeholders— including market participants, technologists, academics, innovators, investors, consumers, peers and policymakers — to examine the implications of DLT for financial market functioning. We also want to use this DP to help inform our view on how the potential benefits of this technology can be realised, and the risks managed.

5. Given the borderless nature of the technology, we also are closely engaged with the European Central Bank (ECB), the European Commission (EC), the European Supervisory Authorities (ESAs), International Organisation of Securities Commissions (IOSCO) and the Bank for International Settlements (BIS).

Balancing Innovation and Stability

6. The modern history of finance is one of continued adoption of technological innovations to deliver better services. Innovation has the potential to deliver many benefits for consumers, businesses and society and is an essential component of a competitive economy and a well-functioning financial system.

7. In order to effectively engage on innovation the Central Bank strives to:

    - Deepen our understanding of innovation in the financial services sector, which allows us to better understand the opportunities and risks for consumers and the economy.
    - Better inform our regulatory approach, ensuring that our regulation is aligned with a well-functioning financial system based on good levels of competition and innovation.
    - Embed a regulatory culture in nascent and fast-growing firms to ensure they are properly prepared for the responsibilities that come with being regulated, once authorised.
    - As part of the Eurosystem, ensure that the provision of our core infrastructures remains fit for purpose amid a rapidly changing technological landscape.

8. Ultimately, our objective is to allow innovation in financial services to deliver efficiency, transparency, inclusion and broader economic benefits, while ensuring that risks are appropriately managed. Effective coordination among central banks, regulatory authorities and industry will be essential to maintain coherence and responsiveness as tokenisation becomes integrated into financial services.

9. Regulatory frameworks must remain flexible and forward-looking, capable of adapting to innovation. Our regulatory philosophy is built on six key principles, which are:

    - forward-looking in identifying opportunities and risks;
    - connected to those we serve;
    - proportionate in balancing costs and benefits;
    - predictable in our expectations;
    - transparent in our explanations; and
    - agile in adapting to changing environments.[1]

[1] Better Rules, Better Outcomes - Remarks by Governor Gabriel Makhlouf at the Financial System Conference 2025

Next Steps

10. We want to leverage the insights from this Discussion Paper to inform our thinking on, and approach to, DLT and tokenisation in financial services, across the breadth of our mandate. We will use this Discussion Paper as a basis for structured engagement with domestic and international stakeholders on the opportunities, challenges, enablers and risks arising from these technological innovations.

11. We will publish a feedback statement outlining the insights we have gathered through this engagement and assess whether existing policy and regulatory approaches are fit for purpose to enable the realisation of the benefits – and management of the risks – stemming from the integration of DLT in financial services.

2. What is DLT and tokenisation?

13. DLT can be understood as a technological solution that achieves a single, shared 'source of truth' through a common ledger. It has the potential to replace multiple independent ledgers with a synchronised digital record, in which transaction data are shared, validated, and replicated across a network of distributed nodes. DLT nodes are independent computer servers that join and maintain the shared ledger based on the common rules of the network. Each node holds a complete or partial replica of all transactions on a distributed ledger.[2]

14. Tokenisation in the context of this Discussion Paper refers to the issuance or representation of assets in the form of digital tokens, using technologies such as DLT. We consider two types of tokens: (i) those issued solely or directly on DLT by the issuer (sometimes referred to as "digitally native" tokens); and (ii) those that are digital representations of existing assets that have originally been issued elsewhere (sometimes referred to as "non-native" tokens).

15. This technology represents a marked departure from the current model, which entails a multitude of databases that store information and rely on a number of processes and administrative entities for their operation, management, interaction, and reconciliation.

16. In practice, DLT systems are very diverse, depending on their precise design and architecture. The operational dynamics, user privileges, and permitted interactions vary depending on the structure adopted by the DLT system in question.

17. DLT systems can be broadly categorised as being public or private, and permissioned or permissionless.

    - A public DLT system is not managed by any one entity or group. Such systems neither restrict who may become a node nor impose identification requirements on their participants.

[2] See Regulation 2022/858 of 30 May 2022 on a pilot regime for market infrastructures based on distributed ledger technology

- A private DLT is managed either by a single entity (fully private DLT) or a group of entities (consortium/federated DLT) who retain control over access to the system.
- In a permissionless DLT system, decentralisation and open access are at the core, with anyone able to run a node on the network. The actions of the nodes are governed by the protocol. The rules of the network could be determined by a governance foundation at protocol level.
- In a permissioned DLT, access to the network requires permission to access from a governance body that provides the permission to access and operate on the network, rather than a decentralised protocol with open access and programmed rules governing the nodes it operates.

18. A blockchain is a specific type of DLT that has a particular set of features, organising its data in a "chain of blocks". Each block contains data that are verified, validated, and then "chained" to the next block.

19. Consensus mechanisms or foundational protocols underpin the effective operation of the technology, ensuring a single, consistent and true ledger. The design and implementation of consensus mechanisms, which determine how, when and by whom transactions are effected on-chain, varies across blockchains and impacts their usability across the financial system with respect to issues such as scalability, operational resilience or finality.

20. DLT systems enable the operation of smart contracts, which could play a central role in transforming how financial services operate, enabling programmability through executable contractual and procedural actions based on pre-defined criteria.

3. Benefits of tokenisation

21. DLT and tokenisation applications offer the potential to transform the underlying infrastructure of finance and make the provision of financial services more efficient, transparent, and accessible, as well as lead to the provision of new, innovative financial services. In this section, we consider these potential benefits in more depth.

22. Ultimately, these benefits stem from the fact that there is something qualitatively novel in DLT. It allows for the possibility of a shared ledger, operated collectively by a number of agents, which are functionally independent from each other.

Efficiency

23. Conventional financial markets operate on a two-step model: trade execution, followed by payment and settlement. The asset changes hands upon agreement of the trade, while ownership transfers only upon final settlement. Under the current system, this process involves a number of different market participants. In doing so, it introduces potential counterparty and settlement risks, if one party fails to deliver as agreed. It also adds time and costs to the execution of transactions.

24. Similarly, conventional payments rely on multiple parties and processes to settle, as financial intermediaries need to update and reconcile their own ledgers. This also adds time and costs to payments, especially for cross-border transactions. This has been a focus for international policymakers for some time and despite progress being made, significant efficiency gains have yet to be realised.[3]

25. DLT offers the possibility to improve these existing models. It can collapse the two-step model of trading and settlement into a single process by embedding transaction records directly into a shared ledger and remove or reduce the need for various reconciliations in payments. In DLT systems, both trade and settlement occur simultaneously. For this "atomic" settlement to be achieved in full, however, both the asset and the corresponding payment instrument must exist and be recorded on distributed ledgers.

[3] https://www.fsb.org/2025/10/g20-roadmap-for-cross-border-payments-consolidated-progress-report-for-2025/

26. Tokenisation therefore offers the potential for real-time or near-instant settlement, continuous (24/7/365) system availability, and lower operational costs, by reducing intermediary layers. This can entail a number of economic benefits for the users of financial services. For example, in markets, DLT has the potential to reduce counterparty exposure and collateral obligations, in light of almost real-time settlement. Similarly, tokenised systems could result in more seamless cross-border transactions, by reducing existing frictions in correspondent banking networks.

Supporting Financial Innovation and Unlocking New Economic Opportunities

27. Tokenisation can also support innovation in product design, service and distribution, with benefits in terms of the provision of financial services to households, businesses, and the broader economy.

28. For example, tokenisation could deliver an additional way to achieve fractionalisation of ownership of assets, making investments that were once illiquid or inaccessible available to a wider range of participants. Allowing ownership to be divided into smaller digital units has the potential, amongst others, to increase diversification, or broaden participation in financial markets. In turn, this could facilitate the flow of private financing from capital owners to companies.

29. Tokenisation can also enable programmability and the operation of smart contracts. Smart contracts could have a range of applications in finance, both in wholesale financial markets as well as in retail financial services. For example, smart contracts could facilitate corporate actions (e.g. coupon or dividend payments), collateral management (e.g. exchange of ownership interest), and they could enable linking payments to specific, predefined events.

30. In tandem with the programmability of smart contracts, advances in Artificial Intelligence (AI), including agentic AI, could expedite innovation, leading to the provision of new financial services. These could involve autonomous agents initiating, authorising, and completing financial transactions on behalf of users, with the potential to transform aspects of commerce.

Transparency and auditability

31. Tokenisation has the potential to strengthen the security and integrity of financial data through immutable transaction

records. Participants can access and update the shared ledger in accordance with predefined rules, ensuring transparency, security, and auditability. Although the ledger is not physically located in any single place, it provides a consistent and verifiable record to all authorised participants.

32. Financial market functioning could benefit from the data integrity, immutability and automatic auditability that are inherent to many DLT-based systems. In addition, DLT-based systems may provide a clearer record of beneficial ownership across the financial system.

Greater Integration in European Capital Markets

33. The potential benefits of tokenisation are particularly relevant for Europe, where existing infrastructure, processes, service provision and products have evolved incrementally over recent decades, often in line with cultural, national and legislative norms. Indeed, there is broad consensus that to deliver on the ambitions of the Savings and Investment Union in Europe, technology will play a key role and can act as a critical enabler.

34. The possibility of extensive integration of tokenisation and DLT into finance offers the potential to transform Europe's underlying market structures. If the new ecosystem was designed in a more integrated and harmonised manner this could help reduce fragmentation in European capital markets.

35. Overall, there are a number of potential benefits stemming from the integration of DLT and tokenisation in finance. At this stage, though, many potential use cases within financial markets remain at an early stage, and these benefits have not yet been proven. Moreover, while the potential benefits of DLT and tokenisation are considerable, their realisation depends on the establishment of a robust enabling environment. This is the focus of the next section.

4. Realising the Benefits of Tokenisation

36. While the applications of DLT and tokenisation in finance is evolving rapidly, it is still unclear precisely what shape the future landscape will take. What is clear, though, is that the technology and associated applications – in and of themselves – will not deliver the promised benefits for the financial system and users of financial services.

37. This section considers in more depth a number of enablers and conditions which, from a public policy perspective, the Central Bank believes are important to leveraging the benefits of DLT and tokenisation for the benefit of users of financial services.

Legal and Regulatory Clarity

38. Clear and coherent legal and regulatory frameworks are fundamental for DLT-based infrastructures and applications to enable the tokenisation of financial assets. Tokenisation can fundamentally alter the technical architecture through which ownership, transfer, settlement and post-trade processing are affected. While tokenisation does not change the legal or economic substance of financial instruments, it may change the way in which legal claims are represented, reconciled and operationalised across market participants. Its relevance therefore lies in potential changes to market infrastructure, legal systems and processes.

39. From a legal standpoint, for example, a key evolving question is what represents enforceable claims — whether to an underlying asset, a payment obligation, or a right within a contractual arrangement. Legal recognition of tokenised financial instruments as valid representations of ownership or rights will be essential to ensure that token transfers correspond to final and irrevocable settlement. Some steps have already been taken at an EU level as well as many individual Member States in providing this clarity, but this is an area that requires further attention, including in Ireland.

40. Equally, the legal status of smart contracts — which can automate execution and settlement — needs to be clearly defined. Questions concerning enforceability, liability, and recourse in the event of operational or coding errors remain open in many jurisdictions, including Ireland.[4]

41. Without legal clarity, tokenised markets risk creating opacity that may in and of itself deter institutional participation and have the effect of inhibiting the realisation of the benefits of this innovation in finance.

42. Policy is also adapting to assess how tokenised assets fit within existing regulatory classifications[5] — for example, clarifying whether they constitute securities (i.e. financial instruments under MiFID), deposits, e-money tokens or other regulated instruments – with certain types of tokenised assets creating hybrid considerations.[6]

43. When assessing the tokenisation of financial instruments, a substance over form approach applies. As a result, when assessing a tokenised fund unit for example, represented on-chain through a token as a digital twin representation, the result is a duplicate, referential financial instrument on-chain tied to the underlying actual financial instrument off-chain.

44. Close coordination between National Competent Authorities (NCAs) at ESMA is ongoing to ensure a consistent approach to the classification of tokenised assets and the appropriate regulatory classification and applicable framework.

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[4] Developments in the UK Jurisdiction Taskforce and the Law Commission surrounding the legal enforceability of smart contracts are notable in this regard.
[5] Beyond legal classifications in a financial services regulatory context, questions around ensuring effective tax treatment in DLT infrastructures may also become relevant.
[6] For example, ESMA and NCAs have undertaken extensive work on the topic of classification of crypto assets. ESMA Guidelines on the conditions and criteria for the qualification of crypto-assets as financial instruments.

45. The deployment of tokenisation applications with clearly defined rules on custody, settlement finality, disclosure, investor protection, and Anti-Money Laundering / Countering the Financing of Terrorism (AML / CFT) will be critical to maintaining market integrity and protecting end-users.

Interoperability and Standardisation

46. For tokenisation to achieve scale and efficiency, interoperability across systems, networks, and jurisdictions will be essential. Fragmented DLT ecosystems could recreate the very silos and frictions that the underlying technology has the potential to remove.

47. Indeed, there is a risk that – absent public policy interventions – DLT and tokenisation applications in financial services result in the emergence of 'walled gardens', closed loop systems and a complex system of intermediaries and fragmented market structures. This absence of interoperability would harm efficiency in financial markets and lead to suboptimal public policy outcomes by limiting the potential benefits of this technology for users of financial services.

48. In particular, without harmonised standards, the transfer of tokenised assets across platforms would be complex, costly, and exposed to additional risk. As such, the development of common technical, operational, and messaging standards that allow different protocols to communicate seamlessly and intuitively, would enable shared ledgers and improve interoperability, delivering greater benefits for markets and investors.[7]

49. Central banks can also play a key role in enabling interoperability through the provision of their core infrastructure. For example, the efforts underway at Eurosystem level to enable settlement of DLT transactions in central bank money (see section 7) can contribute to the development of common standards and harmonious protocols.

50. European and international standard-setting bodies will also play an important role in aligning data formats, messaging protocols and identity management frameworks, thereby reducing fragmentation and supporting integration with existing financial market infrastructures. The public sector will play an important role in ensuring that the benefits can be

[7] This could include, for example, standards for data structures, transaction formats, digital identify verification, and rules related to settlement.

realised, while remaining alert to private sector actors' roles and incentive structures.

Tokenisation of Assets and Money

51. To unlock the true potential of tokenisation in finance, it is important to consider the role of digital forms of money— whether privately issued or public sector-backed— as well as the tokenisation of assets, and how these might interact within a DLT-based ecosystem.

52. Delivery versus Payment (DvP) in a DLT environment necessitates having tokenised assets and tokenised money available on-chain to facilitate the exchange (i.e. the delivery of the asset for the payment) in an "atomic" swap / settlement.

Settlement in Central Bank Money

53. The safe and efficient settlement of financial asset transactions depends on their integration with wholesale payment systems in central bank money. In that regard, as the financial system shifts to a tokenised infrastructure, it is essential that central bank money remains as the ultimate settlement asset across the financial system.

54. Settlement in central bank money is crucial in any future tokenised financial infrastructure. Central bank money settlement supports the reduction of counterparty and credit risk, ensures finality of settlement, prevents fragmentation of the money system and is an essential underpinning of both monetary and financial stability. This will continue to be the case in a system of tokenised assets and infrastructure.

55. Exploratory work by the Eurosystem on DLT-based settlement using central bank money has demonstrated both market interest in tokenisation and the importance of settlement mechanisms in central bank money. Between May and November 2024, the Eurosystem conducted exploratory trials to test DLT-based settlement in central bank money using three interoperability solutions. This initiative involved 64 participants, including central banks, market infrastructures, financial institutions and DLT operators, and comprised more than 50 experiments and real settlement trials. This initiative has laid the foundations for the Eurosystem's work to enable settlement in central bank money of transactions on DLT (see Chapter 7).

Operational Resilience and Scalability

56. Operational resilience is a prerequisite for financial services, and DLT-based systems are no exception. In an EU Context, the Digital Operational Resilience Act (DORA) has established a clear framework to manage and mitigate digital operational resilience risks. The distributed nature of DLT can enhance resilience by removing single points of failure, though it also introduces new operational resilience challenges including network congestion and the ability to scale.

57. Like all systems, a DLT platform must be able to maintain continuity of service in the face of hardware or network failures, malicious attacks, and unexpected stress events. This requires robust data recovery mechanisms, redundant node architectures, and clear contingency procedures.

58. Cybersecurity is particularly critical given the potential for vulnerabilities in smart contracts, cryptographic keys, and consensus mechanisms. The immutability of transactions on DLT, while a strength from an auditability perspective, also means that security breaches or coding flaws may be difficult to reverse once executed. Continuous monitoring, testing, and code review must therefore be institutionalised.

59. Operational resilience is a critical precondition for scalability, particularly in a DLT-context. Tokenised markets will only achieve critical mass if DLT platforms can handle high transaction volumes with predictable latency.

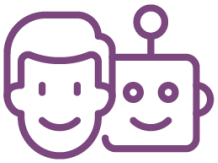
Digital Identity, Verification and Trust Infrastructure

60. The operation of DLT-based financial systems depends on reliable and verifiable digital identity frameworks. Participants must be confidently authenticated to ensure that every transaction originates from a legitimate and authorised entity.

61. Digital identity solutions must comply with data protection and privacy standards, support cross-border interoperability, and be capable of linking on-chain activity to off-chain legal entities when required for regulatory or supervisory purposes.

62. A trusted identity infrastructure is needed, particularly where identity verification underpins access to tokenised forms of money or securities. Without such frameworks, it would be difficult to prevent illicit activity or ensure accountability in decentralised environments.

Transparent and Accountable Governance



63. Transparent and accountable governance is essential for sustaining trust in DLT networks. Participants must have clarity over how and by whom the system is managed, how consensus mechanisms operate, and how changes to the protocol or rulebook are decided.

64. In permissioned systems, there is typically a single accountable legal entity or a number of accountable legal entities. Governance structures should clearly define the roles and responsibilities of validators, operators, and overseers. Mechanisms for dispute resolution, rule enforcement, and system upgrades must be predictable and publicly disclosed.

65. In permissionless systems, governance is decentralised. Public permissionless ledgers do not have a clear locus of accountability, a feature that is not consistent with current regulatory regimes, which are built around regulated entities that are accountable for complying with legal requirements.

66. This creates different challenges from a governance and risk management perspective. For example, public permissionless networks rely on crowd sourced security. Furthermore, some operational fragilities may be more pronounced in permissionless networks, including issues related to settlement finality, immutability and the possibility of forks (i.e. where the rules of the protocol are altered).

67. In practice, there is a great degree of variation and flexibility in the design and rules within these governance models, and permissioned and permissionless platforms may sometimes share common traits.

68. As markets develop, regulatory authorities may need to consider encouraging adoption of regulatory reporting nodes or take on more embedded supervisory oversight functions within permissioned and permissionless networks to facilitate supervisory insight.

69. Central banks and public authorities will need confidence that governance arrangements meet standards of fair access, transparency, risk management and operational accountability, similar to those applied to existing financial market infrastructures. Governance that is opaque or dominated by a narrow or unknown group of actors could inherently pose risks to market integrity and financial stability.

For Discussion

1. Beyond the enablers outlined in the discussion paper, what additional enablers are required to realise the potential of tokenisation in financial services?

2. Which elements of the current Irish or EU framework may constrain scalable tokenisation?

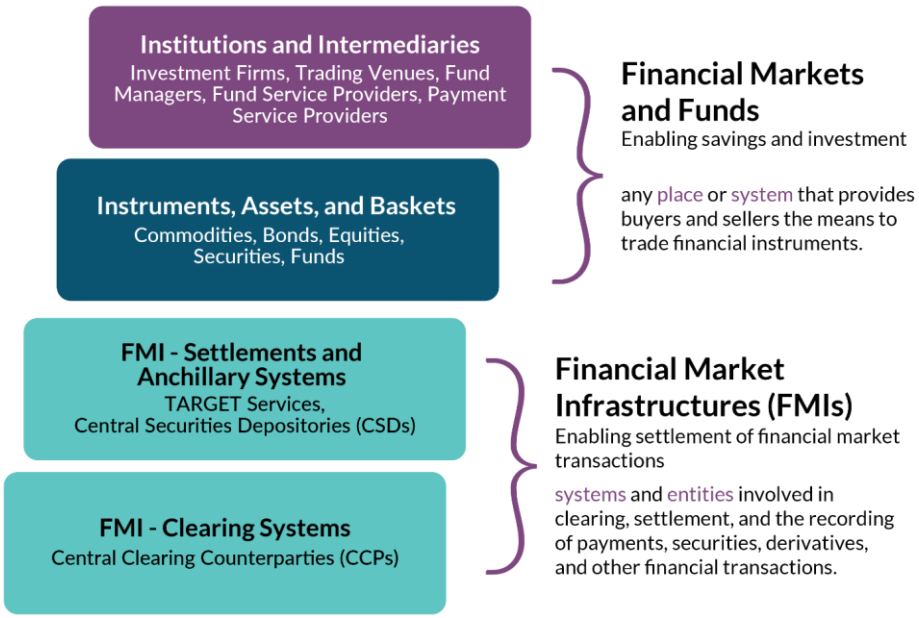
3. What legal clarifications are needed regarding ownership, settlement finality and smart contract enforceability, particularly cross-border?

4. What governance arrangements are appropriate for tokenised markets, including permissionless networks?

5. Are existing operational resilience standards sufficient for DLT-based infrastructures? Where might gaps arise?

5. Tokenisation in Markets

70. In considering tokenisation in markets, our aim is to better understand how tokenisation may affect the issuance, holding and settlement of financial instruments and assess the potential implications for market structure, market integration, investor protection and financial stability.



71. Tokenisation can be understood as a further step in the long-term evolution of market infrastructure. Like earlier waves of digitisation, it does not alter the economic substance of financial assets or the rights of investors but changes the way in which those rights are recorded, transferred and operationalised.

72. A useful historical parallel is replacement of physical securities with electronic book-entry records maintained by regulated infrastructures, most notably CSDs. This transition was incremental, legally grounded and closely overseen by public authorities. It delivered significant efficiency gains, reduced operational risk and enabled the scale and cross-border integration of modern securities markets. Importantly, these benefits materialised only once legal certainty around ownership, transfer and settlement finality had been established, and hybrid arrangements persisted for extended periods.

73. Tokenisation raises comparable issues. It represents a potential change in the form of the record of ownership, rather than a change in the underlying asset in substance. Future states will likely see an evolution where tokens

natively issued on DLT become the asset rather than a representation of a parallel record. As with previous evolutions, the extent to which tokenisation delivers efficiency or integration benefits will depend on legal recognition of tokenised records, the governance of the infrastructures that maintain them, and the clarity of roles for regulated intermediaries.

Tokenisation and the development of EU Financial Markets

The EU financial markets landscape emerged organically out of Member States' domestic infrastructures. These tended to be closed, vertically integrated systems with differing processes, standards and practices that made cross-border access very difficult.

Following the Global Financial Crisis (GFC), regulatory measures were introduced to break down existing vertically integrated silos and open up domestic infrastructure to intra-EU access and competition. By requiring issuers to issue directly in Central Securities Depositaries (CSDs) and mandating settlement in central bank money via Target2-Securities (T2S) the intent was to remove the bank risk from the settlement and custody layer.

The vision at the time was the emergence of an "internet of assets" represented by the network of interoperable CSDs, allowing users to access any financial instrument in any issuer CSD from any entry point in the EU with the same ease. This, coupled with the removal of cross-border barriers, should have promoted competition and driven consolidation and the organic emergence of a pan-European Financial Market Infrastructure.

Over a decade later, however there are 27 authorised CSDs and 14 Central Counterparties (CCPs) providing services to over 300 trading platforms and systematic internalisers across the EU and EEA. Market consolidation has not materialised. Instead, banks and other market participants have increased their role as internalisers and as bridges between CSDs and CCPs. This fragmented landscape of clearing and settlement systems is relevant for Ireland, which has no CSDs or CCPs domiciled here. Technological evolutions in trading, clearing, payments and settlement have the potential to alter the future state of the financial market's ecosystem.

Public sector actors will have a key role in ensuring the future landscape delivers on the long-term goal of interoperable shared ledgers as public goods, bringing benefits to consumers and the broader financial system.

DLT, Tokenisation & the SIU

The European Commission's SIU initiative seeks to deepen EU capital market integration, improve the mobilisation of savings and enhance the

competitiveness of European financial markets. Several elements of the SIU relate to enabling DLT and tokenisation to scale in the EU.

The Central Bank supports efforts by the European Commission to improve the DLT Pilot Regime and the recent upgrades proposed in the Market Integration Supervision Package (MISP) published in early December 2025 and developing a fit-for-purpose framework building on the clear advice provided by ESMA.

In addition, proposed adaptations to the Settlement Finality Directive (SFD) and the Central Securities Depositories Regulation (CSDR) for settlement on DLT systems, will bring further clarity regarding the use of DLT in post-trade architecture across the EU.

Tokenisation Infrastructure

74. At the infrastructure level, DLT can support core functions such as issuance, trading, clearing, settlement, custody and collateral management. This layer may involve tokenised settlement assets, shared registries or interoperable post-trade systems.

75. Regulatory considerations include:

    a. oversight of market infrastructures,

    b. settlement finality,

    c. access arrangements, and

    d. consistency with existing legal and regulatory mandates for CSDs, payment systems and other critical infrastructures.

76. Key operational considerations we are seeking to better understand include scalability, interoperability with legacy systems, operational resilience and cyber risk.

77. Infrastructure level tokenisation has the greatest potential to reduce fragmentation and drive meaningful consolidation, while also carrying with it the need for careful consideration of the systemic implications.

78. Financial markets rely on layered post-trade processes, typically involving trading venues, CCPs, CSDs, custodians and other service providers. These processes are often sequential and batch-based, with reconciliation performed across multiple ledgers.

79. Tokenisation may enable alternative technical configurations, including shared or synchronised ledgers, where changes in beneficial ownership are recorded in near real time. When

combined with appropriate settlement assets, tokenised instruments may support DvP at shorter settlement intervals, potentially reducing counterparty exposure, margin requirements and intraday liquidity needs.

80. From a regulatory perspective, such configurations raise questions regarding settlement finality, the role of central clearing, and the allocation of responsibility across infrastructures. Tokenisation does not remove the need for trusted intermediaries but may change how their functions are implemented and supervised.

Tokenisation of Financial Assets

The Instrument Level

81. Instrument level tokenisation could be implemented alongside existing market structures, particularly in pilot or hybrid arrangements.

82. With digitally native financial instruments tokenised, for example equity instruments, there would appear to be two cohorts –

- Tokens issued by the actual equity issuer in the primary market; and
- Tokens issued by a third party, unaffiliated to the equity issuer – either synthetically or asset-backed.

83. The second cohort introduces a certain level of third-party credit risk, unlike direct ownership of the actual token from the issuer.

84. Key operational considerations we are seeking to better understand at the instrument level include the integrity of the issuance process, the linkage between the token and the underlying legal claim, and the mechanisms for transfer, redemptions and corporate actions.

85. Wider considerations which require further clarity centre on legal certainty of ownership, enforceability of rights, settlement finality and alignment with existing frameworks governing issuance, custody and investor protection.

86. Tokenisation enables efficient fractional ownership and may lower minimum investment sizes, potentially broadening retail investor access to investment funds. This could support greater participation in capital markets, including on a cross-border basis.

87. At the same time, increased accessibility may expose a wider set of investors to risks associated with liquidity mismatch, leverage or valuation uncertainty. Greater retail participation may also increase the sensitivity of investment flows to market sentiment, particularly if tokenised financial instruments are easily transferable or tradable.

88. These considerations underscore the continued importance of investor protection frameworks, including disclosure, suitability and conduct requirements. Tokenisation may require these frameworks to be applied in new distribution channels but does not diminish their relevance.

The Portfolio Level

89. At the portfolio level, tokenisation may be applied to collections of instruments, such as investment fund portfolios or segregated pools of collateral. In this case, the tokens may represent a claim on a changing portfolio rather than a single instrument. This layer is particularly relevant for investment funds, where ownership interests are linked to portfolio valuation, liquidity management and risk controls.

90. Key operational considerations we are seeking to better understand include valuation, rebalancing (in the case of Exchange Traded Funds (ETFs) tracking an index), liquidity management and the interaction between on-chain representations and off-chain assets or processes.

91. Wider regulatory considerations focus on governance, transparency, risk management and the maintenance of existing safeguards including depositary oversight and valuation controls.

92. Portfolio level tokenisation will also depend on reliable instrument level representations and robust data integration and timing.

For Discussion

6. What infrastructure developments are critical for scalable tokenisation of financial instruments?

7. How should regulation distinguish between tokenisation at instrument, portfolio and infrastructure levels?

6. Tokenisation in Funds

93. Ireland is one of the largest global domiciles for investment funds, with a strongly international investor base and extensive cross-border distribution. The Irish funds ecosystem relies on integrated global market infrastructures and on the ability to operate at scale across jurisdictions. For a small open economy, innovations that reduce fragmentation and support interoperability are of particular relevance.

94. Ireland hosts a significant proportion of Europe's Money Market Funds (MMFs) and ETF activity.[8] These sectors are operationally intensive and closely linked to market liquidity and settlement systems. As a result, changes in market infrastructure—whether efficiency-enhancing or disruptive—can have system-wide implications.

95. The Department of Finance recommended developing a pathway to adoption of tokenisation in its Funds Review 2030.[9] Alongside our extensive engagements on the topic with industry and regulatory authorities, we are beginning to see a shift from conceptual conversations to tangible efforts to deploy tokenisation in funds.

96. Investment funds depend on accurate and timely processing of subscriptions, redemptions, transfers and corporate actions. These processes involve complex data flows between fund managers, administrators, transfer agents, depositaries and distributors.

97. Tokenisation may allow certain elements of these workflows to be automated through programmable rules embedded in tokenised fund units, such as eligibility checks, dealing cut-offs or class-specific fee structures. It could also facilitate more consistent data across participants by reducing duplication of records.

98. Fund-level tokenisation does not alter the need for independent valuation, liquidity management, depositary oversight and investor disclosure obligations which must be preserved, regardless of the technical form of the ownership record.

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[8] See ESMA Statistics on Securities and Markets Report (December 2025) https://www.esma.europa.eu/sites/default/files/2025-12/ESMA11-239717167-20877_ESMA_statistics_on_securities_and_markets.pdf

[9] Funds Review 2030 Report (October 2024) https://assets.gov.ie/static/documents/funds-sector-2030-a-framework-for-open-resilient-and-developing-markets.pdf

99. Tokenisation of funds will also rely on, and benefit from, adjacent developments, such as the development of tokenised settlement assets, collateral management platforms or intraday liquidity arrangements. These applications are technically linked to developments in tokenised money and payment systems and need to be assessed in conjunction with broader monetary and financial stability considerations. The Central Bank is keen to understand and assess the micro-macro relationships between these developments.

100. In the past 18 months, Irish authorised funds and their fund managers have more actively explored the deployment of tokenisation applications in existing and new fund offerings. Initial use cases have tended to focus on the digital representation of an investor's share or unit in an investment fund in the form of a token, typically using a digital twin model. This is distinct from a future state where we might see the tokenisation of the underlying assets or digitally native tokenisation of instruments within a digitally native fund portfolio.

Liquidity Management in a Tokenised Environment

101. Liquidity mismatch between fund assets and redemption terms is a well-established source of financial stability and investor protection risk. In a digitally native future state, tokenisation may affect both the perceived and actual liquidity of investment fund units, with implications for liquidity transformation and the use of liquidity management tools (LMTs).

102. Tokenisation raises operational and legal questions regarding the application of LMTs. Tools such as swing pricing, anti-dilution levies, redemption gates or notice periods are typically designed to operate within traditional dealing and settlement cycles. In a tokenised environment with potentially continuous or near-continuous interaction with the fund, transferability, ensuring the timely and enforceable application of LMTs may be more complex.

103. These considerations suggest that tokenisation does not diminish the importance of liquidity risk management and may, in some cases, increase the need for clear and robust liquidity management frameworks.

104. Tokenisation can coexist with established liquidity management frameworks, but only where system design explicitly aligns token functionality with the fund's liquidity profile. Tokenisation may improve the operational execution of LMTs but does not

substitute for sound liquidity risk management or regulatory oversight.

Liquidity Management Tools in a Future Tokenised State

In a tokenised environment, LMTs would need to remain available to the fund in accordance with existing regulatory requirements. Tokenisation affects how LMTs are operationalised rather than whether they apply.

- Swing pricing and anti-dilution levies:

When net subscriptions or redemptions exceed predefined thresholds, some funds apply swing pricing or an anti-dilution levy. These adjustments could be automatically reflected in the token issuance or redemption price through embedded logic, ensuring consistent application across all transactions processed during the dealing window.

- Redemption gates and notice periods:

If a redemption gate or notice period is activated, the smart-contract logic governing token redemptions could enforce the restriction by limiting the volume of tokens eligible for redemption or delaying settlement. In a digitally native future state, secondary transfers of tokens may also be restricted to ensure the LMT is applied on these peer-to-peer transfers.

- Suspension of dealings:

In stress conditions, funds may suspend redemptions and transfers. The token infrastructure could reflect this decision by temporarily disabling transfer and redemption functions, while maintaining an immutable record of ownership.

Tokenisation may enhance the timeliness and consistency with which LMTs are applied. Automated enforcement reduces operational risk and limits scope for discretionary or delayed implementation. The shared ledger also provides a real-time view of investor flows, potentially supporting earlier identification of liquidity pressures.

Risks and policy considerations

Tokenisation also introduces new considerations. If token transfers were permitted outside controlled dealing cycles, investors might perceive the fund tokens as more liquid than the underlying assets, exacerbating liquidity mismatch.

For example, the portfolio may consist of illiquid assets (such as real estate) which may not align with the perceived liquidity of the tokenised fund units. In that regard, there is a risk that secondary markets for tokenised fund units could undermine the effectiveness of LMTs if not appropriately constrained.

From a policy perspective, this highlights the importance of ensuring that tokenisation does not weaken existing liquidity risk controls. Legal clarity is required to ensure that LMTs applied through tokenised mechanisms are enforceable and cannot be bypassed. Supervisory access to relevant data and governance arrangements will also be critical.

Money Market Funds (MMFs)

105. Money market funds (MMFs) are closely linked to short-term funding markets and rely on highly standardised instruments and settlement processes. Tokenised MMFs (TMMFs) are beginning to warrant attention given their rapid growth and potential. As at the end of 2023, TMMFs had roughly $770 million in assets. By end December 2025, that figure had climbed to almost $10 billion. In a future state, MMF units representing ownership of fund share tokens may be natively issued on-chain without a parallel traditional infrastructure acting as the actual ledger of record.

106. There is also a potential that tokenisation changes some of the underlying uses of MMFs. For example, there is ongoing exploration by market participants as to whether TMMF units could be accepted as eligible collateral by CCPs or bilateral counterparties, subject to conservative haircuts and concentration limits.

107. Tokenising MMFs for use as collateral could materially improve the efficiency and responsiveness of collateral management, while also introducing new risk transmission channels. This should be supported by robust governance, legal clarity and supervisory oversight, essential to ensure that any efficiency gains do not undermine liquidity resilience or financial stability.

108. Tokenisation could also lead to closer inter-linkages and associated fragility with the crypto-asset markets. Early signs of these are being observed, with tokenised MMFs increasingly being used as stablecoin reserve assets or collateral for crypto related transactions.[10]

109. Throughout this section, we outline illustrative use cases to support reflection on the potential benefits of different types of fund tokenisation, as well as the risks that will need to managed effectively.

[10] IOSCO Tokenisation Report (November 2025)
https://www.iosco.org/library/pubdocs/pdf/IOSCOPD809.pdf

Potential Use Cases for MMFs

Use Case 1:
MMF units are issued or represented in tokenised form on a permissioned DLT platform and are eligible for use as collateral in secured transactions, such as margining arrangements, securities financing transactions, or intraday liquidity facilities, subject to applicable eligibility criteria.

Tokenisation could enable MMF units—already widely used as cash-management and liquidity instruments—to be mobilised as collateral with greater operational speed, precision and transparency, while remaining subject to the requirements of Regulation (EU) 2017/1131 (MMF Regulation).

Operational Arrangements

- MMF units would be issued as tokens on a permissioned ledger operated by regulated entities, including the fund administrator and transfer agent. The ledger serves as the primary record of investor ownership, with token transfers subject to embedded eligibility and compliance rules.
- Investors would access the fund through regulated distributors, and the depositary retains oversight of asset custody and cash flows.
- Tokenised MMF units would be held in digital wallets operated by regulated entities (e.g. credit institutions, investment firms or financial market infrastructures).
- Token transfers would be permitted only during defined dealing windows aligned with the fund's NAV calculation cycle. Transfers outside these windows are either restricted or queued for processing at the next valuation point. This design would ensure that tokenisation does not introduce secondary market activity inconsistent with the fund's liquidity profile.[11]
- Smart contracts would govern the pledging, substitution, valuation and release of collateral, based on predefined rules.
- Oracles would provide trusted external data inputs, such as MMF net asset values (NAVs), liquidity metrics or market stress indicators, to support valuation and margining processes.
- Collateral eligibility, haircuts and concentration limits would be enforced automatically, in line with contractual or regulatory requirements.

[11] This is a design feature that guards against the risk of deviation between traded price and NAV.

- Settlement and collateral movements would occur on a near-real-time or intraday basis, using regulated settlement assets.

Benefits

- Improved collateral mobility and efficiency, allowing MMF units to be mobilised rapidly and precisely.
- Reduced operational risk through automation of margining and collateral management processes.
- Enhanced transparency and auditability of collateral positions for counterparties and authorities.
- Potential reduction in liquidity buffers required for operational reasons, subject to risk controls.

Key Risks and Supervisory Considerations

- Liquidity and procyclicality risks: Increased use of MMFs as collateral could amplify liquidity stress at a systemic level during periods of market tension, particularly if rapid margin calls or collateral substitution occur.
- Valuation and data dependency risks: Reliance on oracles for NAV and liquidity data introduces new operational and governance dependencies.
- Legal certainty and enforceability: Clear recognition of security interests over tokenised MMF units across jurisdictions.
- Operational resilience: Robust governance of the DLT infrastructure supporting collateral management, including stress scenarios.
- Interconnectedness: Potential for tighter linkages between short-term funding markets, collateral markets and DLT infrastructures.

EU Regulatory Context

- MMF Regulation: Continued compliance with liquidity thresholds, valuation rules and portfolio constraints; assessment of implications for MMF liquidity management tools.
- MiFID II / SFTR: Applicability to collateralised transactions and reporting obligations.
- DORA: Relevance for ICT risk management and oversight of critical third-party service providers, including oracle operators.
- DLT Pilot Regime: Possible relevance where collateral mobilisation occurs via DLT-based market infrastructures.

Use Case 2:
Natively Issued Tokenised MMFs with Automated Subscription and Redemption - enhanced automation with potential implications for liquidity management

MMF units are issued natively on a permissioned DLT platform, with subscriptions and redemptions processed through smart contracts. The MMF remains within a controlled and regulated environment, but key operational processes are increasingly automated.

This model is particularly relevant for MMFs used as treasury management or cash-equivalent instruments by institutional investors.

Operational Arrangements

- MMF units would be created and redeemed on-chain in response to authorised investor instructions.
- Smart contracts would automate eligibility checks, dealing cut-offs and references to valuation data.
- Settlement may occur on a near-real-time basis using tokenised settlement assets or regulated settlement money.
- Governance frameworks would define escalation and intervention mechanisms in stress scenarios.

Benefits

- Faster subscription and redemption processing, potentially improving liquidity management for investors.
- Reduced operational risk and enhanced straight-through processing.
- Improved timeliness of reporting for supervisory and risk management purposes.

Key Risks and Supervisory Considerations

- Liquidity management risk: Accelerated redemption capabilities could amplify first-mover advantage dynamics.
- Run risk and procyclicality: Automation may increase the speed of investor reactions in stressed conditions.
- Governance of smart contracts, particularly regarding suspension of redemptions or activation of liquidity management tools.
- Consistency with MMF Regulation safeguards, including fees, gates and liquidity buffers.

EU Regulatory Context

- MMF Regulation: Continued application of liquidity thresholds, stress testing and redemption management tools.
- Settlement Finality Directive: Assessment of legal certainty for DLT-based settlement processes.
- MiCA: Not applicable where tokenised MMF units qualify as financial instruments.

Exchange Traded Funds (ETFs)

110. ETFs rely on a specific market structure combining primary market creation and redemption with secondary market trading and arbitrage. Tokenisation of investment fund units may blur the functional distinction between traditional open-ended funds and ETFs.

111. If tokenised fund units were to support efficient secondary trading, they could replicate some features of ETFs, including intraday transferability and improved liquidity. This could increase competitive pressure between fund structures and potentially affect the role of authorised participants and the ETF arbitrage mechanism. Differences in transparency, pricing frequency and liquidity provision between ETFs and tokenised mutual funds could also give rise to investor confusion or misaligned expectations.

112. From a policy perspective, these developments raise questions regarding the consistency of regulatory treatment across economically similar activities. They also highlight the importance of preserving the mechanisms that underpin ETF liquidity and price formation, particularly in stress conditions.

113. ETFs present a particularly relevant case, as they operate across both fund and market infrastructures. Tokenisation may be applied to components of the ETF lifecycle, such as the settlement of creation and redemption baskets between authorised participants and the fund, or the settlement of secondary market trades.

114. Technically, in a future state, this could involve tokenised ETF units interacting with tokenised baskets of assets or tokenised settlement assets (e.g. wholesale Central Bank Digital Currencies (CBDC)), enabling more automated DvP processes. From a policy perspective, the critical issue is whether such arrangements preserve the effectiveness of the arbitrage mechanism at the Authorised Participant (AP) that underpins ETF liquidity and price alignment with the NAV.

Potential Use-Cases for ETFs

Use Case 3:
Natively Issued Tokenised ETFs with Automated Post-Trade Processes - Enhanced automation processes within a controlled environment

ETF units are issued natively on DLT, with issuance, redemption and settlement automated, leveraging smart contracts. Authorised participants interact directly with the DLT for creation and redemption, subject to predefined rules.

Operational Arrangements

- ETF tokens would be created and extinguished on-ledger in response to authorised instructions.
- Smart contracts would automate elements such as issuance conditions, compliance checks and references to valuation data (e.g. NAV).
- DVP settlement would be achieved in an atomic manner using tokenised settlement assets including wholesale CBDC.
- Clear governance frameworks would be in place for the lifecycle management of smart contracts.

Benefits

- Increased straight-through processing and reduced reliance on manual intervention.
- Reduced counterparty and settlement risk.
- Enhanced transparency for oversight purposes, including potential near-real-time reporting.

Key Risks and Supervisory Considerations

- Smart contract governance, including validation, auditability, and change management.
- Settlement finality, and alignment with EU frameworks governing finality and insolvency protection.
- Operational and cyber resilience, particularly where core post-trade functions depend on DLT infrastructure.
- Co-existence with legacy arrangements during transitional phases.

EU Regulatory Context

- UCITS & AIFMD: Ongoing applicability of valuation, liquidity management and risk control requirements.
- DLT Pilot Regime: Potential relevance if the tokenised ETF is admitted to trading or settling on a DLT market infrastructure.

- Settlement Finality Directive: Assessment of legal certainty for DLT-based settlement arrangements, noting current amendments proposed in the MISP package.
- MiCA: Not applicable where tokenised ETFs qualify as financial instruments under MiFID II.

Use Case 4:
Interoperable Tokenised ETFs in a Broader Digital Financial Ecosystem – substantive tokenisation with enhanced ecosystem interdependencies

Tokenised ETFs could soon serve as interoperable and programmable instruments operating within a broader digital financial ecosystem. ETF tokens interact with third-party service providers and other DLT-based financial infrastructures, while remaining subject to applicable regulatory requirements.

Portfolio level tokenisation of ETFs offers exposure to baskets of underlying tokenised assets. This model introduces a higher degree of composability and functional integration across market segments.

Operational Arrangements

- Oracles would provide external data inputs (e.g. index values, NAVs, FX rates, corporate actions) to smart contracts governing ETF operations.
- In primary markets, tokenised ETFs may be mobilised as collateral within regulated DLT-based liquidity or margining arrangements.
- Interoperability mechanisms would enable transfer of ETF tokens across regulated DLT market infrastructures.
- A range of third-party service providers (e.g. oracle operators, digital identity providers, analytics firms) would become integral to the operating model.

Possible Benefits

- Improved capital efficiency through programmable collateral and real-time risk management.
- Enhanced cross-border distribution capabilities, supported by automated compliance processes.
- Greater scope for innovation through modular, composable and interoperable market infrastructures.

Key Risks and Supervisory Considerations

- Third-party and outsourcing risk, including reliance on oracle providers and other critical service providers.

- Data quality and integrity, particularly where automated processes depend on external data feeds.
- Increased interconnectedness, potentially amplifying contagion and procyclicality.
- Supervisory access and oversight, ensuring authorities retain effective monitoring capabilities.

EU Regulatory Context

- UCITS / AIFMD: Continued compliance with liquidity, leverage and risk management requirements.
- MiFID II: Classification of tokenised ETFs as financial instruments, with associated transparency and trading obligations.
- DORA: Applicability to ICT risk management and critical third-party service providers.
- DLT Pilot Regime: Applicable where DLT-based market infrastructures are used.

115. Across all use cases, tokenisation raises common issues relevant to the EU financial system, including:

- Legal certainty and enforceability of DLT-based records;
- Operational and cyber resilience of market infrastructures;
- Governance and oversight of critical service providers; and
- Implications for settlement efficiency and financial stability.

For Discussion

8. What high-value use cases could tokenisation deliver for investment funds?

9. What new liquidity, valuation or interconnectedness dynamics could emerge as tokenised fund markets scale?

10. How can regulators effectively monitor these developments?

11. How can cross-border interoperability be supported without creating regulatory fragmentation?

Markets & Funds

Tokenised Assets

- Equities
- Bonds
- Funds
- Real Assets

Brokers-Dealers, Trading Venues, Fund Managers

Transactions on DLT DVP (Delivery Vs Payment)

Financial Market Infrastructures

Tokenised Money

- Wholesale CBDC (ECB Projects Pontes and Appia)
- Private Settlement Assets (Stablecoins)
- Tokenised Deposits (BIS Project Agorá)

Clearing Counter Parties

Central Securities Depositories

Securities Settlement Systems

7. Tokenisation in Money and Payments

DLT and the Evolving Money and Payments Landscape

116. As highlighted above with respect to capital markets, tokenisation also has the potential to be transformational for payments and settlement and fundamentally alter how money moves across the financial system.

117. For centuries, the monetary system has operated under a two-tier architecture in which central bank money serves as the foundation of trust and stability. Central banks issue public money—cash and reserves—anchoring the system. Commercial banks and other entities issue private money, in the form of deposits or e-money, with the promise of convertibility into central bank money at par. This architecture has relied on a comprehensive framework of policies and safeguards, including monetary policy operations, Real Time Gross Settlement (RTGS), prudential supervision, deposit insurance and lender-of-last-resort functions.

118. Technological innovations are reshaping the payment landscape, driving innovation among incumbents and enabling the emergence of new private providers of digital monies. Alongside traditional bank deposits, new forms of private money and private settlement assets — such as stablecoins[12] — are emerging, often issued by non-banks. These developments raise important questions about how to realise the benefits of tokenisation and DLT in payments and money, while maintaining monetary and financial stability, and ensuring the financial system operates in the best interests of consumers.

119. As the financial system shifts to a tokenised infrastructure, it is essential that central bank money remains as the ultimate settlement asset across the financial system. Central bank money is the foundation of both monetary and financial stability. Decreasing use of central bank money in favour of privately-issued tokenised assets for wholesale settlement purposes could disrupt monetary transmission, financial

[12] Central Banks generally do not consider stablecoins as private money because of the volatility in their market price which does not satisfy the singleness of money and because of the limits in their scalability owing to the need for reserve backing. We therefore refer to stablecoins as private settlement assets.

stability, consumer protection, operational resilience and – ultimately – impact upon the welfare of society as a whole.

120. Central banks have been given the mandate to safeguard monetary and financial stability. This means that we need to be prepared to deliver our mandate as the financial system continues to evolve. In that context, the Eurosystem's work to enable settlement of wholesale DLT transactions in central bank money, and the issuance of a digital euro, are key initiatives to help safeguard the role of central bank money in an increasingly digital world, reducing the likelihood of adverse economic outcomes.

121. Of course, there will clearly be an important role for private forms of money on-chain. These will need to meet certain critical conditions, including being well regulated and governed, meeting the highest standards of financial and operational resilience, providing certainty of settlement finality and scalability for high volume transactions.

Achieving Desired Outcomes in Payments

122. Ireland's National Payment Strategy[13] references the future use of alternative payment forms, and the costs and benefits these may bring to consumers, retailers, and others. In particular, it explores how they may be used for domestic and cross-border transactions, for Irish consumers and for Irish business exporting, with the associated speed, cost and safety implications.

123. DLT and tokenisation technologies developments do not alter the core objectives of the Central Bank with respect to payments and settlement. The Central Bank will continue to work towards, and advocate for, an integrated, competitive and innovative payments landscape that benefits consumers and businesses, in Ireland and on a pan-European basis. This is vital to boost the efficiency of European payments, for fostering financial inclusion and for improving users' choice and experience.

124. The Eurosystem retail payments strategy[14] establishes the aim to achieve a higher level of efficiency, strategic autonomy and resilience in retail payments in Europe, as well as supporting digitalisation and innovation. Strategic

[13] https://www.gov.ie/en/department-of-finance/publications/national-payment-strategy/
[14] https://www.ecb.europa.eu/paym/integration/retail/retail_payments_strategy/html/index.en.html

autonomy[15] and increased resilience for European payments remain a focal point, as the EU seeks to safeguard stability and continuity in an era marked by heightened geopolitical uncertainties. The digital euro is key for supporting a competitive and resilient European payments ecosystem.[16]

125. The possibilities that may exist as DLT and tokenisation technologies develop will not alter the objectives of the Eurosystem with respect to payments, but it may change how these core objectives will be met requiring a comprehensive strategy to deal with emerging issues. Work is currently underway in this regard with an updated strategy expected to be published in H1 this year.

126. Some of the use cases for tokenisation in payments could be met by enhancements to existing infrastructures. These include, for example, longer operating hours for T2, shorter settlement cycles and interlinking fast payment systems across borders, reducing the costs and increasing the speed and transparency of cross-border payments, including remittances.[17]

127. For example, the Eurosystem has launched two initiatives to enhance cross-border payments, within the EU and beyond. The first initiative concerns the implementation of a cross-currency settlement capability in TIPS that allows instant payments originating in one TIPS currency to be settled in another TIPS currency in central bank money. Initially, settlement will be available in three currencies: Euro, Swedish kronor and Danish kroner. The go-live of the TIPS cross-currency service occurred in October 2025.

128. The second initiative aims to establish links with partners outside the EU to improve cross-border payments globally. It involves the implementation of a cross-currency settlement service for the TIPS platform based on the European Payments Council's One-Leg Out Instant Credit Transfer scheme; the exploration of the connection of TIPS to Project Nexus, a multilateral network of instant payment systems led by the Bank for International Settlements; as well as

[15] EU open strategic autonomy refers to the capacity of the EU to act autonomously – that is, without being dependent on other countries – in strategically important policy areas.
[16] https://www.imf.org/en/publications/fandd/issues/2025/09/point-of-view-why-europe-needs-a-digital-euro-philip-lane
[17] Interlinking refers to connecting two or more payment systems so they can work together allowing users from one system to send or receive money to/from other users in another system, while interoperability allows different payment systems to operate seamlessly with one another.

exploration of establishing bilateral links between TIPS and other fast payment systems, including India and Switzerland.

129. Interlinking fast payment systems can enhance efficiency, benefiting both businesses and consumers. It also improves financial integration, by harmonizing processes and reducing frictions, creating a more integrated financial market in Europe. And it aligns with the G20's goal of enhancing cross-border payments globally.

130. The digital euro also offers opportunities to unlock innovation in the payments space and in October 2024 the ECB launched the digital euro innovation platform [18] to foster collaboration with the market in order to test ideas and explore the innovative potential of the digital euro.

131. Overall, while some of the key benefits of tokenisation in payments could, in principle, be achieved through enhancements to existing infrastructure (some of which are already ongoing) if financial market activity moves increasingly on-chain, settlement assets will also need to be available on-chain. This means that both central bank money and private money will need to evolve.

Enabling Tokenisation in Payments by Evolving Central Bank Money

132. In June 2025 the ECB's Governing Council approved a plan that will enable settling DLT transactions using central bank money. The initiative follows a two-track approach: the first track ("Pontes") provides a short-term offering to the market – including a pilot phase. The second track ("Appia") [19] focuses on a potential long-term solution.

133. In the lead up to this, three interoperability-based solutions were tested: the Trigger Solution, provided by the Deutsche Bundesbank; the Full DLT Interoperability solution, provided by the Banque de France; and the TARGET Instant Payments Settlement (TIPS) Hash-Link solution, provided by the Banca d'Italia.

134. At a high level, (i) the Trigger Solution consisted of a DLT infrastructure that acted as technical bridge between TARGET Services (specifically the T2 RTGS system) and market DLT platforms, (ii) the Full DLT Interoperability solution was a proprietary DLT platform that enabled the

[18] https://www.ecb.europa.eu/euro/digital_euro/timeline/profuse/shared/pdf/ecb.deprep250926_innovationplatform.en.pdf
[19] https://www.ecb.europa.eu/paym/dlt/appia/html/appia.en.html

settlement of wholesale financial transactions in central bank money in a DLT-based account held on a Eurosystem-provided DLT platform, and (iii) the TIPS Hash-Link solution enabled settlement of wholesale financial transactions in central bank money in accounts on a TIPS-like platform set up for the Eurosystem. The use cases below outline some examples of the types of trials and experiments[20] that took place during the exploratory work.

Potential Use Cases for Money and Payments

Use Case 5: Primary issuance of bonds by financial institutions, corporates or sovereigns and delivery-versus-payment (DvP) settlement

In this DvP use case, utilising the TIPS Hash-Link Interoperability solution with an external DLT platform, covering the issuance, primary distribution, coupon payments, and redemption at maturity of a digital bond, Cassa Depositi e Prestiti (CDP) acted both as the issuer and the DLT Market Operator, while Intesa SanPaolo participated as the investor. The asset-leg of the transaction was implemented on the Polygon blockchain (a public, permissionless, layer-2 solution based on Ethereum).

The objectives of the trial were, among others, to contribute to a new model that can ease the fund-raising process and potentially expand the investor base, by issuing bonds in digital form as well as to assess the use of DLT technology for a concrete decentralisation of the processes underlying the trading and settlement of financial instruments.

The experiment demonstrated how on-chain processes on a public, permissionless blockchain can be combined with off-chain operational steps to support primary issuance of bonds under a regulated framework. It also sought to verify and validate the benefits of atomicity of settlement, with programmability through smart contracts offering the potential to bring automation to securities life cycle events such as coupons, redemptions etc. thereby making securities processing more efficient and less susceptible to operational risk by removing manual steps.

Use Case 6: Cross-currency payment-versus-payment transactions with another central bank – Hong Kong Monetary Authority (HKMA)

This use case involved the Eurosystem full DLT interoperability solution, alongside the HKMA (as the external central bank) and

[20] https://www.ecb.europa.eu/pub/pdf/other/ecb.exploratoryworknewtechnologies202506_annex02.en.pdf

SWIFT (as the interoperability solution provider deployed on national central banks (NCBs) cash DLTs). The learning objectives of the trial were, amongst others, to demonstrate cross-border PvP with atomic and instantaneous settlement across different networks and assess the scalability of the tested solution.

The trial connected two different simulated CBDC networks: the Hong Kong Dollar Ensemble Network operated by the HKMA and the Euro DL3S Network operated by the Banque de France through an orchestrated payment-versus-payment (PvP) messaging layer using Swift's Transaction Manager Simulator (sending and receiving ISO20022 messages).

Several bank wallets were involved on each side, and the setup enabled coordinated cross-border transactions where a pair of custodians exchanged EUR against a transfer of HKD between the related correspondent banks.

Potential benefits to be derived from the use case include enhanced risk controls from atomicity in the cross ledgers and therefore elimination of settlement risk (Herstatt risk), reduction in settlement times and the number of intermediaries required.

135. Looking ahead, Pontes will offer a Eurosystem DLT-based solution, linking DLT platforms and TARGET Services to settle transactions in central bank money. The Eurosystem plans to launch a pilot for Pontes by the end of the third quarter of 2026. It will offer a single Eurosystem solution which incorporates features used in the Eurosystem's exploratory work on DLT in 2024. During the pilot, the Eurosystem will also explore the feasibility of further enhancements in line with the TARGET Services operational, legal and technical standards.

136. The Pontes project aims to support innovation and ensure the Eurosystem payments infrastructure remains central to the financial system amid rapid technological change. It intends to enable interoperability and build bridges between eligible market DLT platforms and Eurosystem services, enabling seamless and automated processing.

137. Appia focuses on a long-term approach for an innovative and integrated ecosystem in Europe that also facilitates safe and efficient operations at the global level. The project aims to make financial markets more efficient and competitive without compromising safety and to support the development of a sustainable digital capital market in Europe. The initiative aims to eventually support international operations, such as foreign exchange settlement. Appia will be built on

the Eurosystem's exploratory work on new technologies and will aim to be integrated with the existing TARGET Services.

138. Another key development relates to access of non-bank payment service providers (PSPs) to the payments system, allowing non-bank PSPs to settle transactions in central bank money. Traditionally, TARGET could be accessed by central banks and commercial banks that have an account with a Eurozone NCBs. The Eurosystem has recently defined a harmonised policy to allow non-bank payment service providers (PSPs) to access central bank-operated payment systems, including TARGET.[21]

139. The policy follows the enactment of the Instant Payments Regulation, which amended, inter alia, the Settlement Finality Directive to broaden the scope of entities eligible to participate in designated payment systems to include non-bank PSPs. The broader access criteria for TARGET are aimed at enhancing the efficiency of the European retail payments market, fostering competition and innovation in the European payments landscape, and supporting the uptake of instant payments in the European Union.

140. Since Q4 2025, non-bank PSPs meeting certain requirements are able to access TARGET, including T2 (for settling payments) and TIPS (for settling instant payments). The requirements are set out in the TARGET Guideline and aim to ensure the smooth operation of T2 and TIPS by only granting access to non-bank PSPs which have the relevant safeguards in place and have demonstrated their ability to meet the operational and technical requirements already applicable to current participants.

Evolution of Private Money and Settlement Assets

141. In addition to tokenisation of markets, infrastructure and assets and initiatives related to wholesale and retail central bank digital money, new forms of private money and private settlement assets have emerged.

142. **Tokenised deposits** represent a promising pathway for innovation within the regulated banking sector. Tokenised deposits are tokens, on distributed ledgers, that are backed by traditional deposit liabilities. Therefore, they offer the potential efficiency benefits of DLT in payments and settlement, while preserving the traditional two-tier

[21] Non-bank PSPs include payment institutions (PIs) and electronic money institutions (EMIs), which are defined under the Payment Services Directive and the Electronic Money Directive respectively.

monetary system as well as the full set of protections and safeguards that apply to traditional commercial bank money.

143. To date, exploration of tokenised deposits has been relatively limited, globally and in Ireland. The Central Bank is keen to understand what factors may be constraining the exploration of tokenised deposits, including any potential regulatory challenges. For example, if there is ambiguity regarding the applicable legal and regulatory frameworks – including depositor protection, deposit guarantee coverage, and consumer rights – clearer definitions and harmonised supervisory guidance could mitigate legal uncertainty and support the development of commercial bank money in tokenised forms.

144. **Stablecoins** have been growing at a much faster pace than exploration of tokenised deposits. Yet – depending on their design – their adoption at scale could have far-reaching implications for monetary and financial stability, credit creation and the broader framework of financial regulation.

145. The expansion of stablecoin use in remittances, e-commerce and cross-border payments illustrates their potential for efficiency gains, but also their disruptive capacity. Indeed, international card schemes and large global merchants are increasingly exploring stablecoin-based settlement arrangements that operate outside the traditional banking system.

146. The distinction between bank-issued and non-bank-issued stablecoins is important for assessing potential disintermediation effects. Bank-issued stablecoins can be structured as on-balance-sheet liabilities, thereby preserving the existing credit creation channel. Conversely, persistent shifts of retail bank deposits into stablecoins issued by non-banks or electronic money institutions (EMIs) could erode the retail funding base of commercial banks, with implications for the cost of credit to the economy.

147. Overall, if stablecoins were to evolve from niche instruments to widely used payment and savings tools—effectively competing with commercial bank money—that could entail macro-financial implications, including in terms of the cost of credit to the economy. It could also raise concerns from a consumer protection perspective, in part because deposit guarantee scheme protections are not available for stablecoins.

148. Going in the other direction, properly regulated euro-denominated arrangements could help meet legitimate market needs—particularly in cross-border payments. And they could also act as a source of competition and innovation in the payments ecosystem, with broader economic benefits.

For Discussion

12. What factors constrain the development or adoption of tokenised deposits in Ireland or internationally?

13. Are there particular use cases or market needs that are better met by stablecoins relative to tokenised deposits in a future DLT-based financial system? If so, why?

14. What implications do current Eurosystem exploratory initiatives (Pontes and Appia) have for market development and risk management?

8. Potential Risks

149. For the Central Bank, as an integrated central bank and regulator, a key policy consideration centres around whether the "same activity, same risk, same regulatory outcome" principle can continue to be applied consistently amid the integration of tokenisation in financial services. Are there new risks that could materially affect how central banks and regulatory authorities deliver the desired outcomes?

150. Further, while being technology neutral, this should not be perceived as being technology agnostic or in any way diminishing the need to monitor and evaluate emerging technologies which have the potential to transform financial services. This is particularly important when considering new risks presented by DLT.

151. The manifestation of vulnerabilities unique to DLT-based systems may require new, adapted or supplementary controls. These could include amongst other things, enhanced assurance over smart contract design, validation of token reference data, new governance requirements for decentralised platforms, and updated standards for digital custody and key management.

152. While tokenisation may deliver efficiency gains, programmability, and enhanced settlement times, it also introduces a set of risks that differ in nature, distribution and scale from those present in existing financial market infrastructures. These risks arise both from the intrinsic characteristics of tokenised systems and from the transitional interaction between tokenised and legacy arrangements.

153. In that context, in addition to the risks already highlighted earlier in this paper in relation to markets, funds, money and payments, this section delineates and evaluates some key cross-cutting risks associated with tokenisation in finance, grouped into four categories: (1) new and structurally-distinct risks; (2) technological and operational risks; (3) transition and integration risks; and (4) supervisory and regulatory risks.

New and Structurally Distinct Risks

Disintermediation and Reallocation of Roles

154. As outlined earlier, tokenisation may significantly alter the role of established and regulated intermediaries—such as CSDs, custodians, transfer agents, clearing houses and

payment system operators—by embedding certain functions directly into smart contracts or distributed ledgers.

155. While this disintermediation can reduce operational frictions, it may also reallocate roles and associated activity away from institutions subject to robust governance, regulatory and oversight frameworks toward technological components or private actors subject to weaker oversight frameworks.

156. In tokenised markets, activities may become increasingly dependent on:

- Validators responsible for transaction ordering and ledger finality;
- Protocol developers controlling smart contract logic and upgrades;
- Oracles supplying off-chain data critical to valuation, settlement and corporate actions;
- Bridge operators enabling interoperability across ledgers or between tokenised and non-tokenised systems.

Failures or misconduct at any of these points may have system-wide consequences, particularly where functions previously separated across institutions become technologically bundled.

New Concentration and Governance Risks

157. Although tokenisation is often associated with decentralisation, in practice many tokenised systems exhibit significant concentration:

- Validator sets may be small or economically concentrated.
- Governance rights may be skewed toward early participants or infrastructure providers.
- Critical smart contracts may be controlled by a limited number of administrators with emergency or upgrade privileges.

158. Such concentration can have implications for market integrity, raise risks of censorship or preferential access, and complicate the attribution of responsibility in stress events.

Technology and Operational Risks

Smart Contract Risk

159. Tokenised financial instruments rely heavily on smart contracts to automate issuance, transfer, settlement, and

lifecycle events. Errors in code, incomplete specifications, or unforeseen interactions between contracts can lead to:

- Irreversible loss or misallocation of assets;
- Incorrect execution of fund subscriptions/redemptions or corporate actions;
- Legal uncertainty regarding the enforceability of outcomes.

160. Unlike traditional operational errors, smart contract failures may be difficult to halt or reverse, particularly in systems designed to minimise discretionary intervention.

Oracle Risk

161. Oracles provide a critical interface between tokenised systems and external data sources (e.g. prices, reference rates, NAVs, FX rates, or real-world events). Oracle failures—whether due to technical outages, data manipulation, or governance weaknesses—can propagate rapidly through tokenised markets and funds, triggering incorrect settlements, margin calls or liquidation of positions.

162. The reliance on oracles introduces a new class of systemic dependency that will need to be closely monitored by market participants and regulatory authorities. Concentration risks may develop, or data sources may not be adequately diversified, especially where a small number of oracle providers serve multiple platforms.

Validator and Consensus Risk

163. In permissionless or semi-permissioned systems, validators play a central role in transaction validation and settlement finality. In that context, potential risks that need to be understood and managed include:

- Collusion or coordinated failures among validators;
- Incentive misalignment leading to censorship or re-ordering of transactions;
- Cyberattacks targeting validator infrastructure.

164. In payment systems, such risks could directly impair settlement finality and confidence, while in markets they may undermine fairness and orderly trading.

Bridge and Interoperability Risk

165. Bridges that transfer value or data across ledgers or between tokenised and conventional systems represent a significant

vulnerability. They often involve complex cryptographic mechanisms or custodial arrangements that have historically been subject to exploits and failures.

166. Given their role as aggregation points, bridge failures may result in sudden and large-scale losses, with limited recourse for users and potential spillovers across markets and jurisdictions.

Transition and Integration Risks

Fragmentation and Liquidity Risk

167. During the transition phase, tokenised and non-tokenised versions of similar instruments may coexist. This can fragment liquidity, complicate price discovery and introduce basis risks between representations of the same underlying asset.

168. In funds, parallel tokenised and traditional share classes may raise operational and valuation challenges. In markets, fragmented settlement rails may increase complexity rather than reduce it.

Leverage, reuse and potential risk amplification

169. While tokenisation does not inherently increase leverage, it may reduce frictions associated with the use of fund units or portfolio claims in financing and collateral arrangements. Tokenised representations of fund interests may be more easily pledged, transferred or embedded in structured transactions.

170. This could increase the velocity of collateral reuse and potentially amplify leverage in the financial system, even where fund-level leverage remains constrained by regulation. In stress conditions, rapid unwinding of such arrangements could contribute to pro-cyclical deleveraging dynamics.

171. From a supervisory perspective, these developments raise questions regarding leverage measurement, transparency and the adequacy of existing reporting and stress-testing frameworks in capturing indirect leverage and interconnectedness.

Operational Complexity and Resilience

172. Hybrid models—where tokenised instruments depend on legacy systems for custody, cash settlement, or legal enforceability—may increase operational complexity and create new failure modes at the interfaces between systems.

173. The end-to-end resilience of tokenised arrangements will depend not only on DLT infrastructure but also on off-chain processes, legal agreements and governance frameworks that may not evolve at the same pace.

Migration and Legacy Risk

174. The migration of existing assets, funds or payment flows to tokenised infrastructures poses risks related to data integrity, reconciliation, legal continuity and customer protection. Errors or disputes arising during migration could undermine confidence in both new and existing systems.

Market structure, scale and competition

175. By altering cost structures and data flows, tokenisation may affect market structure and competition dynamics. Shared infrastructures or common technical standards may support economies of scale and consolidation in certain post-trade functions. At the same time, modular or interoperable designs may enable new entrants to provide specialised services.

176. From a regulatory perspective, this raises questions regarding oversight of critical functions, concentration risk and operational resilience. These considerations are particularly relevant in a funds-centric jurisdiction with a high degree of cross-border intermediation.

Risks to Effective Supervision and Regulation

Opacity and Accountability

177. Tokenised systems may obscure traditional lines of accountability, particularly where key functions are performed by decentralised or cross-border actors without a clear legal presence. Supervisors may face challenges in identifying:

- Responsible entities for operational failures or misconduct;
- Applicable legal regimes in multi-jurisdictional arrangements;
- The locus of effective control over protocols and governance mechanisms.

Regulatory Perimeter and Consistency

178. Tokenisation may enable functionally equivalent activities to be conducted outside existing regulatory perimeters or under fragmented regimes. This raises risks of regulatory arbitrage

and uneven application of prudential, conduct and market integrity standards.

179. Ensuring consistency between tokenised and traditional activities—particularly in funds distribution, trading venues and payment services—will be critical to maintaining a level playing field.

Supervisory Capacity and Data Challenges

180. The supervision of tokenised markets and payment systems requires new technical capabilities, including the ability to assess smart contracts, governance frameworks, and on-chain data. While DLT would enhance transparency in some respects, data may be:

- Highly granular but difficult to interpret;
- Pseudonymous, limiting user identification;
- Stored or processed outside supervisory reach.

181. Tokenised systems may generate more granular and time-stamped data on ownership and transactions. In principle, this could improve transparency and support more timely supervision. In practice, the extent of these benefits depends on system design, data standards and supervisory access arrangements.

182. From a regulatory perspective, questions arise regarding data ownership, confidentiality, cross-border data access and alignment with existing reporting regimes. Tokenisation does not automatically improve data quality or availability; these outcomes depend on governance and standardisation choices.

For Discussion

15. What additional risks arise from tokenised finance that may not be fully captured today?

16. To what extent are existing regulatory frameworks sufficient, and where might targeted adaptations be warranted?

Conclusion

183. Leveraging our broad mandate, in this discussion paper we have explored the benefits, the enablers, sectoral considerations and risks associated with DLT and tokenisation in financial services, and how regulation, supervision and the nature of central bank money may need to evolve in response.

184. In markets, funds and payments, tokenisation challenges existing assumptions about intermediation, settlement finality, governance and oversight. A key consideration for us as an integrated central bank and financial regulator is how to preserve the benefits of trusted intermediation, robust governance and systemic resilience while accommodating technological innovation and new market structures.

185. Risks associated with tokenisation are not uniformly higher or lower than those in "traditional" finance; rather, they are redistributed across new actors, new roles, technologies and interfaces.

186. The Central Bank wants to understand stakeholders' perspectives on how the integration of this technology in finance can be achieved in a way that ultimately benefits consumers of financial services and the broader economy.

187. This discussion paper will serve as a platform for informed dialogue. It forms part of our broader engagements on innovation and is one of a number of tools we will use to seek input and garner insights from stakeholders in the ecosystem.

Discussion Questions

1. Beyond the enablers outlined in the discussion paper, what additional enablers are required to realise the potential of tokenisation in financial services?
2. Which elements of the current Irish or EU framework may constrain scalable tokenisation?
3. What legal clarifications are needed regarding ownership, settlement finality and smart contract enforceability, particularly cross-border?
4. What governance arrangements are appropriate for tokenised markets, including permissionless networks?
5. Are existing operational resilience standards sufficient for DLT-based infrastructures? Where might gaps arise?
6. What infrastructure developments are critical for scalable tokenisation of financial instruments?
7. How should regulation distinguish between tokenisation at instrument, portfolio and infrastructure levels?
8. What high-value use cases could tokenisation deliver for investment funds?
9. What new liquidity, valuation or interconnectedness dynamics could emerge as tokenised fund markets scale?
10. How can regulators monitor these developments effectively?
11. How can cross-border interoperability be supported without creating regulatory fragmentation?
12. What factors constrain the development or adoption of tokenised deposits in Ireland or internationally?
13. Are there particular use cases or market needs that are better met by stablecoins relative to tokenised deposits in a future DLT-based financial system? If so, why?
14. What implications do current Eurosystem exploratory initiatives (Pontes and Appia) have for market development and risk management?
15. What additional risks arise from tokenised finance that may not be fully captured today?
16. To what extent are existing regulatory frameworks sufficient, and where might targeted adaptations be warranted?

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