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A LONG-AWAITED REVOLUTION

ARE THE DLT PROMISES READY TO TURN INTO REALITY?

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ABOUT OMFIF

With a presence in London, Washington and New York, OMFIF is an independent forum for central banking, economic policy and public investment – a neutral platform for best practice in worldwide public-private sector exchanges.

Where the public and private sectors meet to shape the digital future of finance

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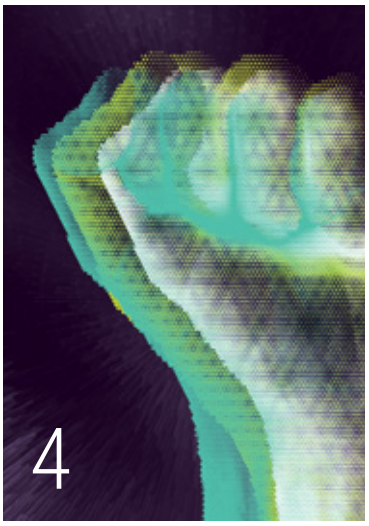
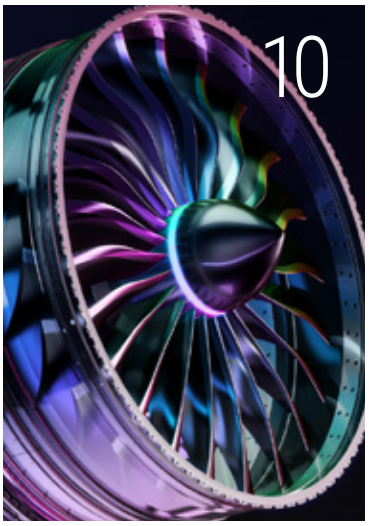
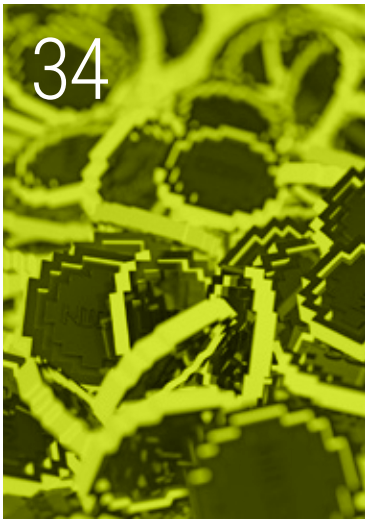






A LONG-AWAITED REVOLUTION

ARE THE DLT PROMISES READY TO TURN INTO REALITY?

IT is tempting to think of blockchain as a new technology. But with the Bitcoin whitepaper turning 16 on 31 October 2024, the journey from a core technology emerging to its full-scale adoption in institutional business processes has proven long and complex.

It did not take long for those in traditional finance to catch on to the possibility that distributed ledger technology might be the key to simpler and more efficient financial market infrastructure. The possibility of securely and instantly exchanging value between counterparties with no intermediaries sounded like a remarkable innovation and work began.

Early signs of progress surfaced in 2017 with the bond-i – the World Bank's blockchain-operated new debt instrument. From then, the blockchain takeover seemed imminent and inevitable, causing market participants to swiftly begin looking beyond bond markets at other asset classes.

Tokenisation, representing the ownership of an asset with a token on a blockchain, seemed like the next evolution of market infrastructure – a means of simply migrating any given asset class into a blockchain environment, from cash to equity or real estate.

Complicated capital markets

The peer-to-peer ethos of blockchain conflicts with the way finance has historically been run – relying on trusted, regulated intermediaries to oversee activity and provide security. While disintermediation is a trickier proposition, policy-makers are open to the possibility that it will make markets more efficient and are launching pilot regimes and sandboxes to test that proposition.

Both promises of blockchain – immediacy of settlement and disintermediation – conflict with the present organisation of markets. But that does not mean they are not desirable. Policy-makers have long discussed making a move to shorter settlement windows, and the US adopted T+1 settlement windows as of May 2024.

Desirability for regulators is as much of a consideration as for market participants on the ground. In this spirit, OMFIF conducted a survey of issuers, banks and investors. The 26 respondents (a majority of whom are public sector bond issuers) provide a valuable insight into the opinions of capital market participants on the introduction of new technologies.

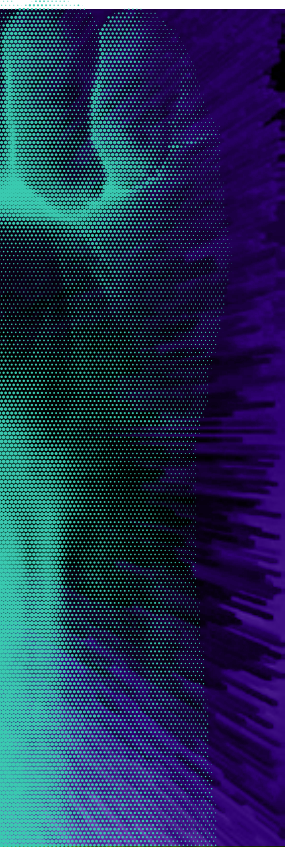
The share of the community that is looking to adopt DLT for debt issuance is growing, as is the share of respondents that believes DLT will form the future infrastructure of capital markets. However, there is still a distinct coolness towards the notion of shorter settlement times and the operational challenges this would bring, and a sense that current infrastructure, such as traditional central securities depositories, will not be abruptly replaced.

The OMFIF Digital assets survey has gathered the opinions of a range of market participants, including how the settlement of cash for tokenised assets should be accomplished, when they believe tokenisation will arrive and what new challenges that process will bring.

The first chapter, on settlement cycles, explores the inefficiencies in bond issuance and the most desirable solutions to address this. Chapter 2 explores the potential and barriers to various tokenised cash settlement solutions for settlement, where survey participants clearly prefer wholesale central bank digital currencies over other forms of tokenised cash. There is potential for various asset classes to be tokenised – Chapter 3 explores the factors affecting the tokenisation of these, which would most likely occur in at least three years. Finally, Chapter 4 explores how DLT may transform market structures, particularly the role of central securities depositories. Adapting DLT to meet capital markets participants' needs is an immensely complex challenge. But one of the most striking elements of the development of the crypto-asset market has been realising the reasons for various conventions and regulations to ensure development continues.

We would like to thank the representatives from KfW, Slovenia's Ministry of Finance, Banque de France, Swiss National Bank and the Hong Kong Monetary Authority for enhancing this report with their insights and experience.

Finally, we wish to thank our partners R3 and Stellar for their thought leadership. Their guidance and insight were invaluable in the creation of this report.



KEY NUMBERS

16%

of respondents indicated a preference for T+0 or T+1 settlement.

42%

of respondents agree that blockchain will become the dominant form of financial market infrastructure.

59%

would prefer wholesale central bank digital currencies for settling most securities transactions over private tokenised money solutions.

92%

of survey respondents think a substantial degree of tokenisation in financial markets is still more than two years away.

36%

of survey respondents believe that pilot regimes will show DLT can perform the functions of a CSD.

65%

of survey respondents believe that bonds are the asset class that are most likely to be tokenised.

28%

of survey participants believe that workflow processes are the single biggest inefficiency in the bond issuance process.

39

digital bonds issued from 2022 until the end of July 2024, totalling up to $3.83bn, were analysed for the 2024 digital bond rankings.

KEY QUOTES

'In particular, we see opportunities for the industry to automate areas that are inefficient in typically non-standard instruments. For example, DLT could provide unique value to the private markets (private equity, private credit) by fostering more transparency and increasing efficiency.' Nadine Chakar, global head, DTCC Digital Assets

'The use of technology allows us to shorten settlement cycles, but we need even more mature and fully developed infrastructure, which could make settlement even quicker.' **Tim Meirer, senior manager, capital market innovation, KfW**

'We're a long way from the systemic adoption of stablecoins.' Natalie Lewis, partner, Travis Smith

'What we need is some form of consolidation or "co-opetition" between the platforms: a basic layer of shared technical infrastructure to reduce the number of chains that need to be interconnected.' **Philippe van Hecke, head of product management, Luxembourg Stock Exchange**

'There's no regulation that says a trade has to be settled in three or five days, it's just a matter of habit and tradition.' Raja Palaniappan, co-founder and chief executive officer, Origin Markets

'The future is not a binary choice between the replacement of CSDs by DLT infrastructure and the continuation of the status quo. CSDs are also working hard on the adoption of the technology some think will disintermediate them.'

'To preserve the level of stability necessary for institutional confidence, stablecoins will need to be backed by combinations of cash and high-quality liquid assets – particularly short-term government bonds.'

'The future of tokenised cash lies in achieving global standards and interoperability.'

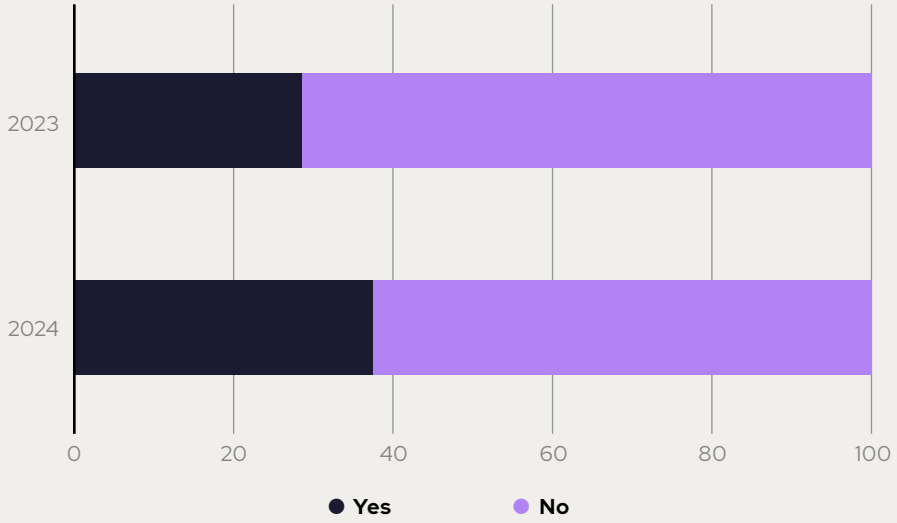
DLT ADOPTION NEARS

THE primary markets provide ample evidence that adoption of distributed ledger technology is gathering pace. As of 31 July, there have been 14 blockchain bonds totalling $1.2bn. This is almost as many as the 16 bonds issued in 2023 reaching $1.7bn, and almost double the number of bonds issued in 2022, with only nine bonds totalling $909m. A more detailed breakdown of blockchain bonds issued in the last two years can be found in the league tables (see page XX).

Our survey reveals a story of slowly shifting attitudes. The share of survey participants who are considering adopting DLT and/or blockchain has increased by 9% to 38% this year from 29% in 2023. The increase in issuance is more pronounced, indicating that those already active with blockchain debt issuance are accelerating more rapidly than new entrants.

Share of respondents looking at adoption of DLT advances

Are you looking at adopting DLT and/or blockchain in debt issuance? Share of respondents, %

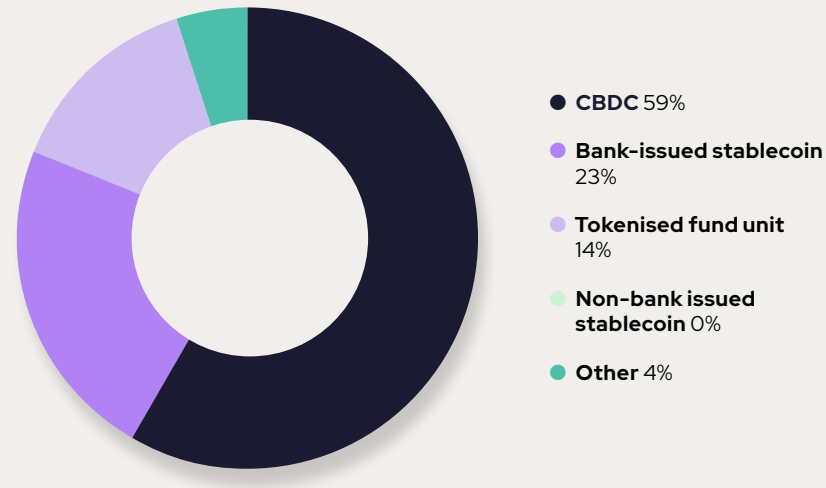


Source: Digital assets and market infrastructure survey 2023-24

CBDCs FAVOURED OVER OTHER SETTLEMENT SOLUTIONS

Clear preference for CBDC as settlement solution

What solution do you favour as a solution for cash settlement in financial market transactions involving tokenised assets? Share of respondents, %



Source: Digital assets and market infrastructure survey 2024

SURVEY participants demonstrate a strong preference for central bank digital currencies as a cash settlement solution for tokenised assets. CBDCs were chosen by 59% of respondents but only 23% favoured bank-issued stablecoins.

While stablecoins can provide a means of settling cash on-chain, their relative novelty means that market participants are reluctant to embrace the new risks they may present. One survey participant highlighted this concern stating, 'only CBDCs completely remove unnecessary credit/counterparty risk'. Another said, 'only CBDCs issued by trusted central banks will be accepted for financial transactions'. No survey respondents selected 'Non-bank issued stablecoin' as an option, suggesting there is a reluctance to trust non-banks for financial market transactions involving tokenised assets.

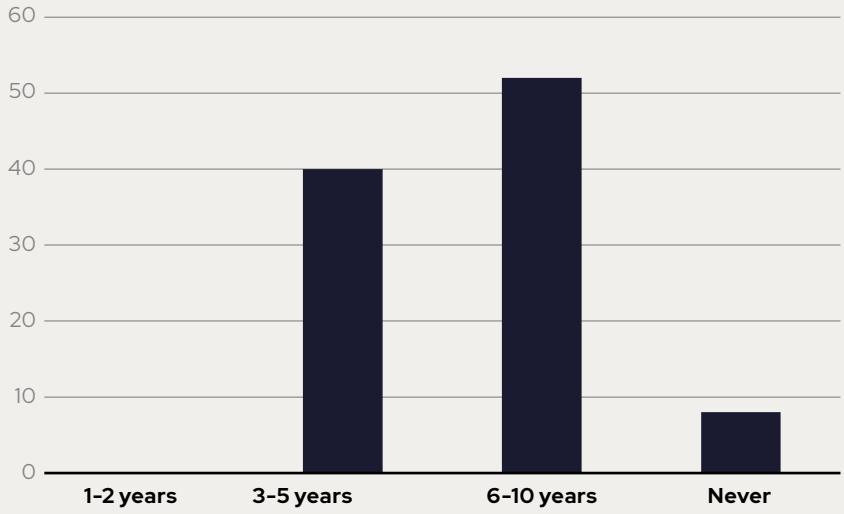
TOKENISATION MAY BRING CHANGES TO MARKET STRUCTURE

SURVEY respondents are confident that tokenisation is on the way: 92% believe that financial markets will experience a substantial degree of tokenisation at some point, although all said that it is at least three years away. The largest share of respondents believes that substantial tokenisation will occur within 6-10 years (52%). One survey respondent added the caveat that it would 'depend on uptake and the direction of technology'.

Survey participants' activities also demonstrate this thinking – 65% are not working on incorporating tokenised assets into their own operations, while 15% are considering it. The final 20% are presently testing use cases.

Tokenisation still more than two years away

What timeframe will financial markets experience a substantial degree of tokenisation within? Share of respondents, %

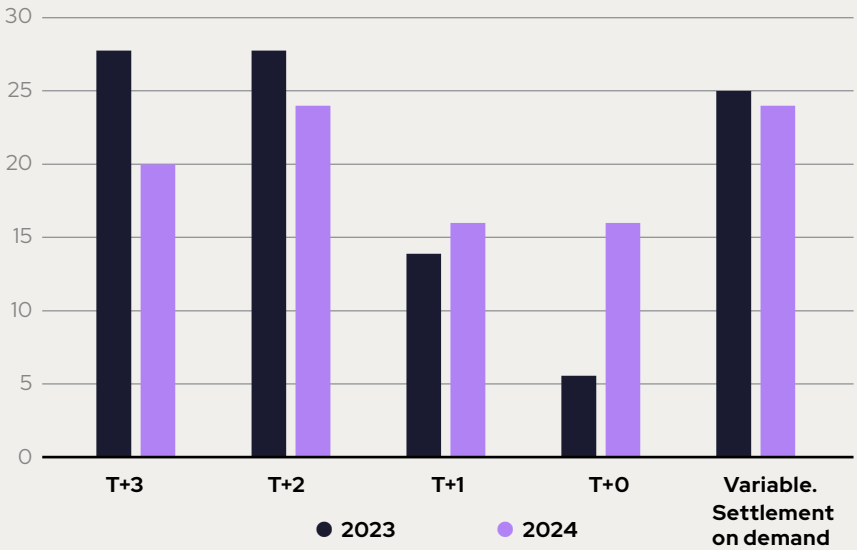


Source: Digital assets and market infrastructure survey 2024

MARKET MAY NOT BE READY FOR FASTER SETTLEMENT

No consensus on ideal settlement cycle

What is the most desirable settlement cycle for syndicated issuances? Share of respondents, %



Source: Digital assets and market infrastructure survey 2023-24

OPINIONS on the most desirable settlement cycle continue to vary. Policy-makers tend to prefer shorter settlement times over longer ones. The US Securities and Exchange Commission adopted amendments to move the standard settlement cycle to T+1 from T+2 in the US market earlier in 2024.

Respondents still showed a preference for longer settlement cycles. T+2 and T+3 settlement cycles were chosen by 24% and 20% of respondents. Though shorter settlement cycles are beneficial for avoiding settlement risk, they bring additional operational challenges. Because of this, 24% of respondents believe that settling on demand might be the best option. 'We must stay flexible on the settlement cycle because it can be difficult for some issuers to reduce the cycle. However, [it] should be possible,' stated one survey participant.

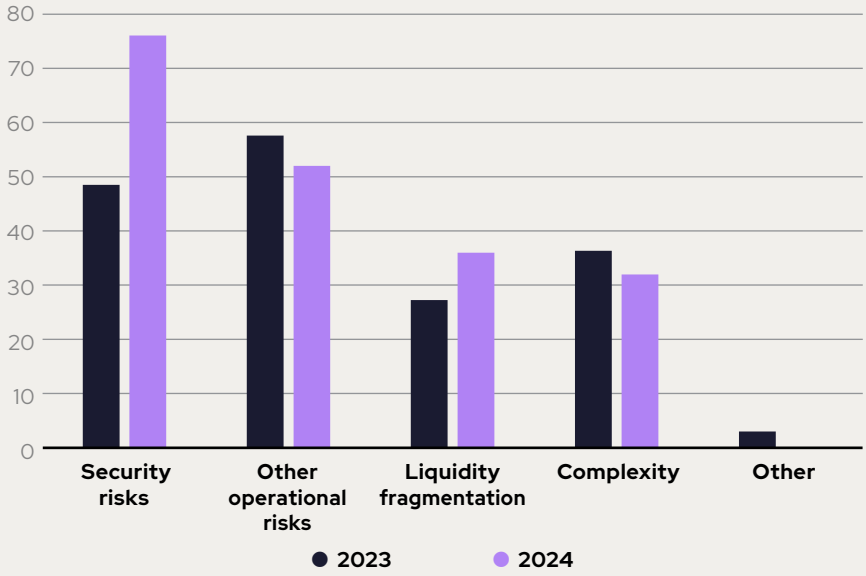
SECURITY RISKS A LEADING CONCERN FOR DIGITALISATION

PERCEPTIONS of cybersecurity risks are growing: the share of survey participants that identified it as a risk of digitalisation increased to 76% from 48% in 2023.

Innovations that may be incorporated into digitalised systems might expose new vulnerabilities. A survey participant explained this risk in the context of artificial intelligence: 'the combination of AI and quantum computing can make all existing security arrangements inadequate'. A similar issue may emerge for the operational functionalities of a digitalised capital markets system, which was an opinion shared by 52% of survey participants. Digitalisation might 'increase the exposure to operational deficiencies and vulnerabilities such as technical settlement failure,' said one respondent to last year's survey.

Heightened concerns for security risks

What risks might digitalisation cause? Share of respondents, %

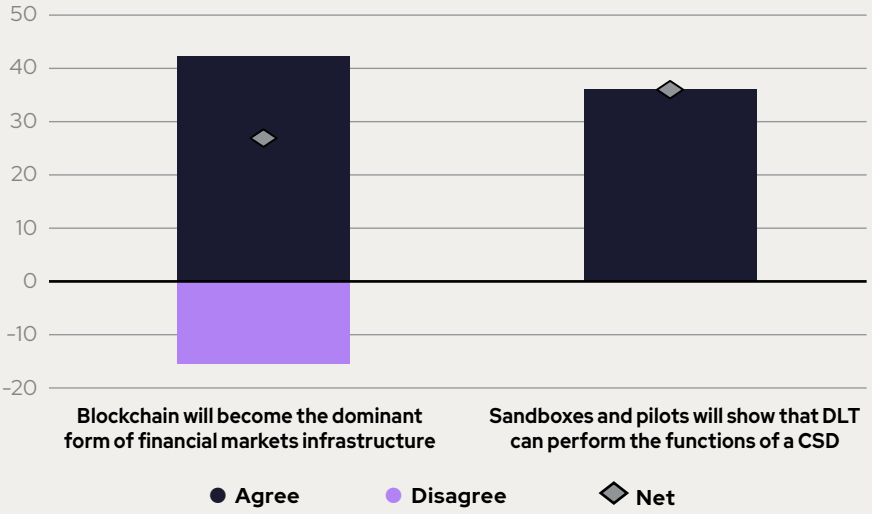


Source: Digital assets and market infrastructure survey 2023-24

ATTITUDES TO POTENTIAL ROLE OF DLT ARE SOFTENING

DLT increasingly viewed favourably

Blockchain will become the dominant form of infrastructure for financial markets; Initiatives like the digital securities sandbox and blockchain pilot regime will show that DLT can perform the functions of a CSD, share of respondents, %



Source: Digital assets and market infrastructure survey 2024

MARKET participants are eyeing the growing role for DLT in capital markets infrastructure. Some 42% of respondents believe that blockchain will become the dominant form of financial markets infrastructure. A net 27% viewed the role of DLT positively, with the remaining 42% remaining uncertain.

However, the progress of the UK Financial Conduct Authority's digital securities sandbox and the European Union's blockchain pilot regime may shift opinions. These projects present the opportunity for testing whether DLT architecture can perform the functions of a CSD. At present, 36% believe that it can. All other respondents were uncertain, but it is notable that no respondents were sure that DLT will not be able fulfil that role.

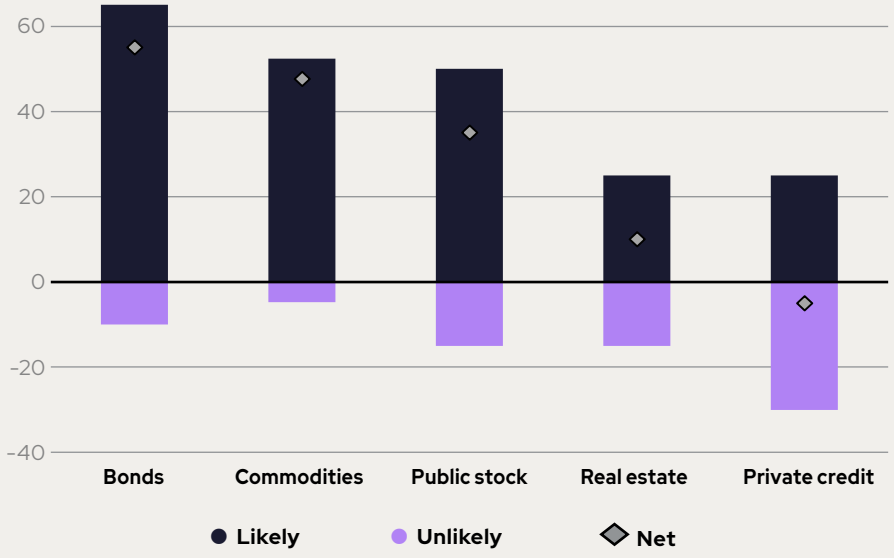
BOND MARKETS WILL LEAD THE PATH TO TOKENISATION

THE likelihood of tokenisation for various asset classes is not uniform. Given the positive outcomes of numerous tokenised bond projects, it is not surprising that 65% of survey respondents believe that bonds are prime candidates. Survey participants also expect commodities (52%) and public stock (50%) to be tokenised. However, the net opinion for public stock is much lower (35%) due to the extensive regulatory hurdles that need to be overcome before tokenising public stock becomes feasible.

One survey respondent highlighted the distinction that these assets 'have high transaction costs and rely on asymmetric information of investors and/or managers, and are very unlikely to be tokenised. Other asset classes where public information is paramount are more likely to be tokenised'.

Bonds most likely to be tokenised

Which asset classes are most likely to be tokenised? Share of respondents, %

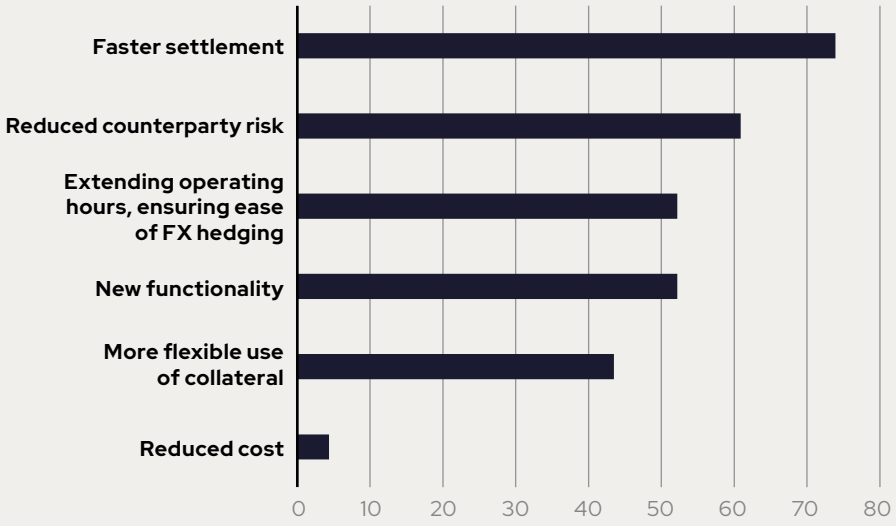


Source: Digital assets and market infrastructure survey 2024

FASTER SETTLEMENT AND REDUCED COUNTERPARTY RISK

Faster settlement a clear benefit for tokenisation

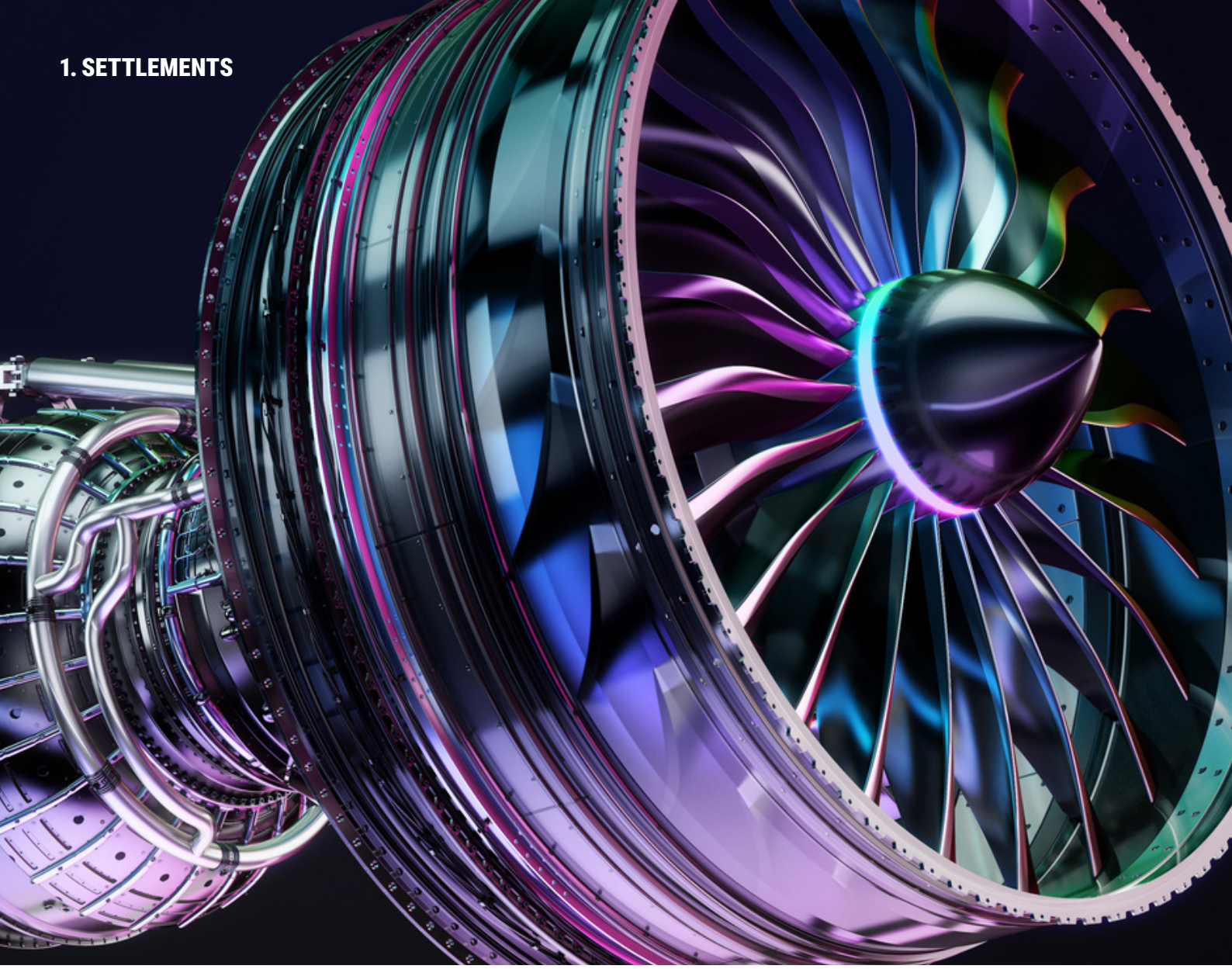
If financial assets are tokenised, what benefits do you see this bringing? Share of respondents, %



Source: Digital assets and market infrastructure survey 2024

SURVEY respondents generally see asset tokenisation bringing a range of benefits. Most notably, 74% of participants selected faster settlement, followed by reduced counterparty risk at 61%. The use of smart contracts may support these benefits as they facilitate transactions without the need for intermediaries and lower transaction costs. These top two benefits highlight the priority for balancing faster settlement with reduced counterparty risk.

One survey respondent explained that 'tokenisation and blockchain-based trading and settlement infrastructure greatly increases transparency, and thus lowers the possibility for abusive trading practices and failure to deliver'.



EMBRACING FASTER SETTLEMENT

The move to one-day settlement for primary bond markets brings obvious benefits, but there are also risks and not all investors are fully on board.

KEY FINDINGS

1. Workflow processes were identified by survey respondents as the single biggest inefficiency in the bond issuance process, particularly the manual preparation of documentation.

2. Automation was the joint-most desirable solution for improving efficiencies in issuance. This will speed up documentation processes, making faster settlement achievable.

3. Faster settlement was listed as one of the top two solutions to improve efficiencies in post-trade processes, marginally behind the standardisation of investor identification and classification.

4. Only 16% of respondents indicated a preference for T+0 or T+1, highlighting the risks and concerns for a significantly reduced settlement period. The most popular response was T+2 or a variable settlement period.

‘THE REALITY IS THAT THIS STANDARDISATION IS UNNECESSARY. ORGANISATIONS ARE ALWAYS GOING TO WORK IN DIFFERENT WAYS.’

Charlie Berman, co-founder and chief executive officer, Agora

AT the end of May, the US – the world’s biggest capital market – moved from a two-day settlement period to one-day, or what is known in the industry as ‘T+1’, for the trading of securities including equities, corporate bonds and municipal bonds. This was enforced by the Securities and Exchange Commission to reduce market and liquidity risks from unsettled trades.

On the face of it, it makes sense to reduce settlement periods and raises the question of whether Europe and the primary syndicated international bond markets will follow. But while there are obvious benefits for a one-day settlement period in bond markets, there are risks too.

Admin woes

The bond markets have long been criticised for being behind other areas of financial markets in terms of innovation and technology. The settlement period is one stark example, where typical syndicated bond transactions in the primary market take five days or sometimes even longer for cash to change hands between issuers and investors.

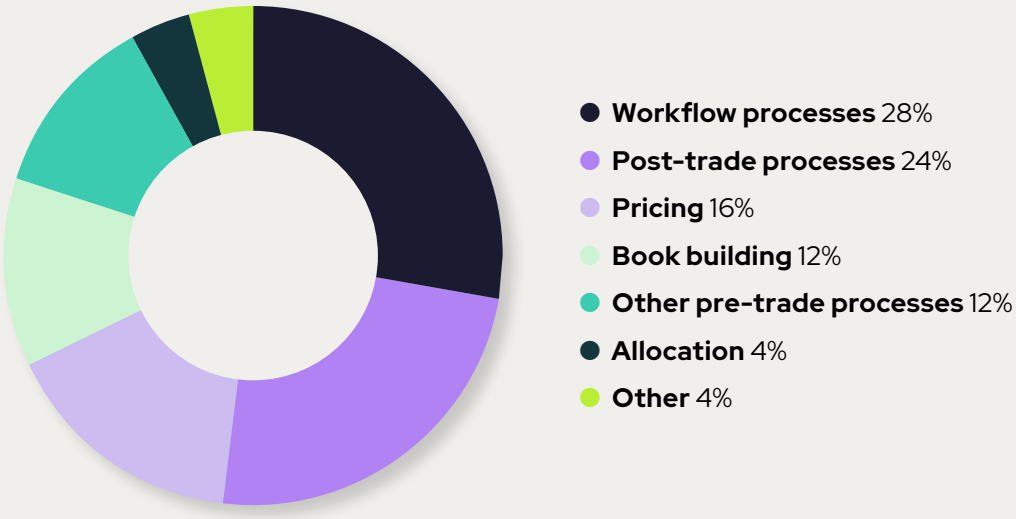
‘There’s no regulation that says a trade has to be settled in three or five days, it’s just a matter of habit and tradition,’ said Raja Palaniappan, co-founder and chief executive officer at Origin Markets, a fintech aimed at digitalising debt capital markets.

As well as habit and tradition, it is also down to the time it takes to get all the admin done for a transaction, the vast majority of which is documentation in terms of preparing it, signing it and admitting to lawyers, issuer and paying agents, and central securities depositories. A period of five to seven days allows ample time to get all this done manually, which has been the case for decades.

Documentation is ubiquitously seen as the most inefficient area of bond markets. In OMFIF’s 2024 Digital assets and market infrastructure survey, workflow processes were identified as the single biggest inefficiency in the bond issuance process, followed by post-trade processes (Figure 1.1).

1.1. Workflow processes single biggest inefficiency in bond issuance process

Where are the biggest inefficiencies in the bond issuance process? Share of respondents, %



Source: Digital assets and market infrastructure survey 2024

'The actual pricing of a bond takes 20 seconds – you get on a call and agree on a price,' said Alexander Malitsky, director, fixed income syndicate and origination at TD Securities. 'But it's everything after that which requires a few days on everyone's side.'

Automating documentation

Survey respondents identified automation as the joint-best solution for improving inefficiencies in issuance, alongside common templates and frameworks (Figure 1.2). But while issuers and market participants have toyed with the idea of automation, it has not really taken off.

The biggest obstacle to widespread use of automating documentation processes is often said to be the lack of standardisation for legal documents due to the various types of issuers, deals and issuance programmes used in the bond markets. The need for the standardisation of legal documents was identified as the main area where improvements could boost efficiencies in pre-trade processes by survey respondents. But is this lack of standardisation really a bottleneck?

'It is a challenge to get lawyers to harmonise their different terminologies, let alone adopt standardised documents, and it is quite difficult to see all issuers doing that' said Charlie Berman, co-founder and chief executive officer of Agora, a fintech focused on digitalising debt capital markets by connecting all major market participants with the use of distributed ledger technology.

'The reality is that this standardisation is unnecessary,' said Berman. 'Organisations are always going to work in different ways. Our platform is designed to each issuer's natural language programme documents so it's not generic or standardised, but rather an easy-to-use user interface which allows document creation bespoke to each issuer's specifications and requirements.'

This view is shared by Palaniappan. 'You don't need to standardise documentation across different types of issuers,' he said. 'You just need documentation that is digitally native and can be automatically, rather than manually, drafted.'

Therefore, the technology is there, ready and available. But the issue seems to be more about getting market participants on board with a newer way of doing transactions and moving away from legacy infrastructure. The bond markets are still very manual in the way they operate with documentation and workflow processes, such as the use of emails and physical signatures.

However, there have been developments to modernise this. In April, Euroclear and Clearstream announced the launch of electronic global notes that will allow all documents associated with issuance under this format to be signed electronically. 'These moves away from physical and manually signed documents will allow for the scalable transition to shorter settlement periods for bond transactions, if that's what suits the needs of issuers and investors as well as the intermediaries that serve them,' said Berman.

This could be the start of embracing a modern way of operating in the bond markets. 'Over the last few years, there hasn't been a catalyst to start changing,' said Malitsky. 'Hence, we don't see a broad adoption in the automation of documentation processes, although individual internal improvements are clearly happening.'

Risks to financial system

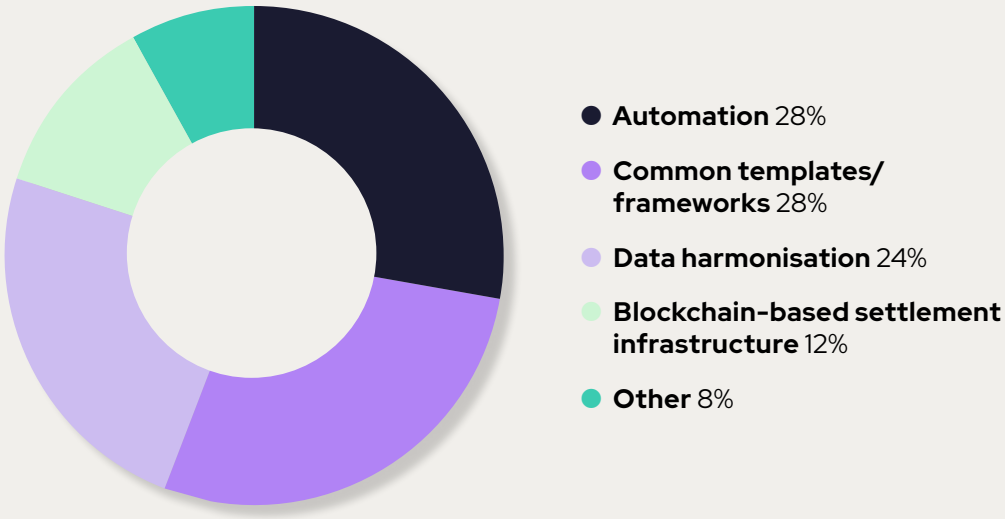
Why is faster settlement needed? On one level, it is about making bond markets more efficient and reducing settlement and counterparty risks, with issuers receiving cash sooner, dealer/bank balance

'The actual pricing of a bond takes 20 seconds – you get on a call and agree on a price. But it's everything after that which requires a few days on everyone's side.'

Alexander Malitsky, director, fixed income syndicate and origination, TD Securities

1.2. Automation and common frameworks identified as solutions to inefficiency

What is the most desirable solution to improve inefficiencies in issuance? Share of respondents, %



Source: Digital assets and market infrastructure survey 2024

sheets being freed up and investors receiving the bonds quicker to trade or fit into their portfolios.

But there is a more profound need that goes beyond bond markets. 'Having a long settlement period brings risks to the financial system overall,' said Malitsky. 'If an issuer has a settlement period of five days, there is a risk that, over those next five days, a syndicate bank or investor could fail or any individual part of the complex transfer of cash versus assets could fail too. This is a risk not just for the issuer but for the entire transaction.'

This is a very important point that particularly strikes home given the collapse of Silicon Valley Bank and Credit Suisse last year. Banks and financial institutions can fail, so reducing the risks associated with this are crucial.

'It's not just about speed but about risk reduction, security, resilience and reliability,' said Berman. 'If you look at the amount of capital tied up in banks and other institutions to support the possibility for failures, it's enormous. The goal is atomic settlement where transfer of legal title and payment happens simultaneously, removing many of the key risks of the existing system'.

Finding the right balance

But while the goal might be instant settlement or T+0, is it achievable and the most desirable cycle? Only 16% of survey respondents indicated a preference for T+0 and T+1. The most popular response was T+2 or a variable settlement period/settlement on demand with both receiving 24% of the responses.

The reason for a preference for other settlement cycles over T+0 and T+1 is partly due to the lack of automation in documentation processes and the legacy infrastructure and technology currently in place in bond markets. But there are other issues too. 'While I do think we will see shorter settlement periods, I think it's a mistake to assume it would be beneficial to push it all the way down to T+0 or even T+1,' said Palaniappan. 'You have to consider the investor on the other side of the transaction.'

Most investors do not have cash readily available to settle a big primary market transaction immediately when a bond is priced. Investors will typically make portfolio adjustments in the secondary market to raise cash to put into the primary transaction and these processes take a few days. Offshore investors buying dollar bonds will find it particularly difficult to find hedges for their foreign exchange exposure on such compressed timelines. This might result in them having to pre-fund the deal, making it a more costly transaction from a liquidity perspective.

'With T+0 you exclude a number of investors that don't have liquidity ready on the same day a bond is priced' said Malitsky. 'For primary markets, you must look at the minimum of T+1 or T+2 to allow all kinds of investors to participate and find the perfect way in between.'

There are also other risks to consider with a same-day or one-day settlement period. These include higher operational risks, more pressures on back-office functions and issues with investors in multiple time zones for globally distributed deals.

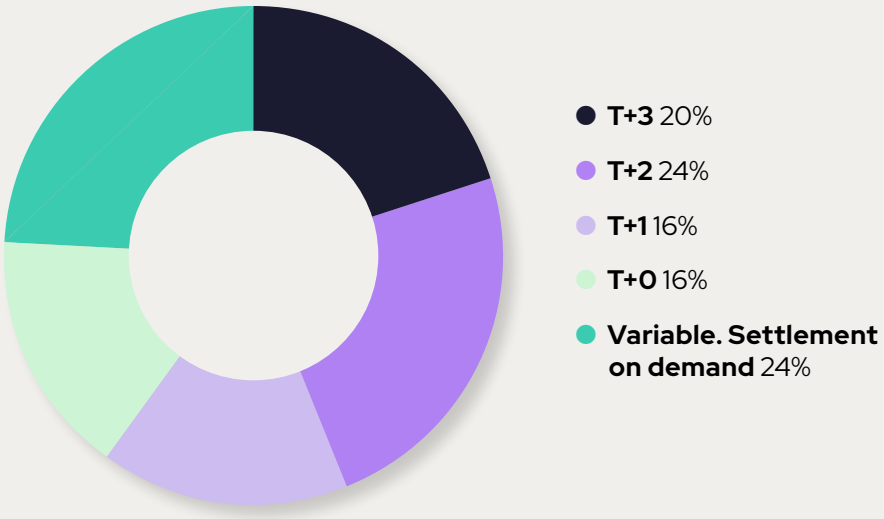
The key then is perhaps being flexible and opting for settlement on demand rather than a fixed period. The move to T+1 in the US capital markets is for secondary trades and this works because secondary transactions take less time to settle than primary, allowing investors to rebalance their portfolios. A number of government bond markets also settle in one or two days for auctions as well as domestic issuances by Canadian sub-sovereigns, but these are different types of transactions to syndicated deals that are sold to a global investor base.

'The use of technology allows us to shorten settlement cycles, but we need even more mature and fully developed infrastructure, which could make settlement even quicker.'

Tim Meirer, senior manager, capital market innovation, KfW

1.3. Respondents divided over which settlement cycle is most desirable

What is the most desirable settlement cycle for syndicated issuances? Share of respondents, %



Source: Digital assets and market infrastructure survey 2024

'The question is what's the big added value for primary bond markets in Europe? Does it add much value for liquidity management or is there a significantly greater risk between T+5 and T+2?'

Achim Linsenmaier, vice chairman of global public sector at Deutsche Bank

However, not everyone is in favour of quicker settlement. 'We are seeing shorter settlement cycles being pushed in the US,' said Achim Linsenmaier, vice chairman of global public sector at Deutsche Bank. 'The question is what's the big added value for primary bond markets in Europe? Does it add much value for liquidity management or is there a significantly greater risk between T+5 and T+2?'

Alex Caridia, head of public sector markets at RBC Capital Markets, was also sceptical. 'Settlement risk is a consideration of course but currently it's not an obstacle to business at all and generally more of an issue when facing investors versus sovereign, supranational and agency or public sector entities,' he said.

These are valid comments but, nevertheless, the survey's results point to a clear preference for faster settlement albeit without a clear preference for what the new settlement period should be. Respondents identified a faster settlement cycle as the second-biggest improvement to post-trade processes, just after standardising investor identification and classification (Figure 1.4).

Development of digital bonds

Blockchain is at the forefront of technology that may be implemented to speed up settlement processes. It is being widely tested by issuers such as KfW, which has been one of the leaders in the development of digital and blockchain bonds. This summer, KfW achieved significant milestones with the first syndicated blockchain-based digital bond in Germany as well as the biggest digital bond with a separate €4bn transaction. The benchmark bond was the first high-volume digital bond and was issued on Deutsche Borse's digital D7 platform. Meanwhile, the €100m syndicated pilot transaction was sold through a consortium of bookrunners with Union Investment as the anchor investor.

'For KfW's first blockchain-based digital bond, we were able to shorten the settlement cycle from T+5 to T+2, so we have made progress but it's not the end of the road,' said Tim Meirer, senior manager, capital market innovation at KfW. 'The use of technology allows us to shorten settlement cycles, but we need even more mature and fully developed infrastructure, which could make settlement even quicker.'

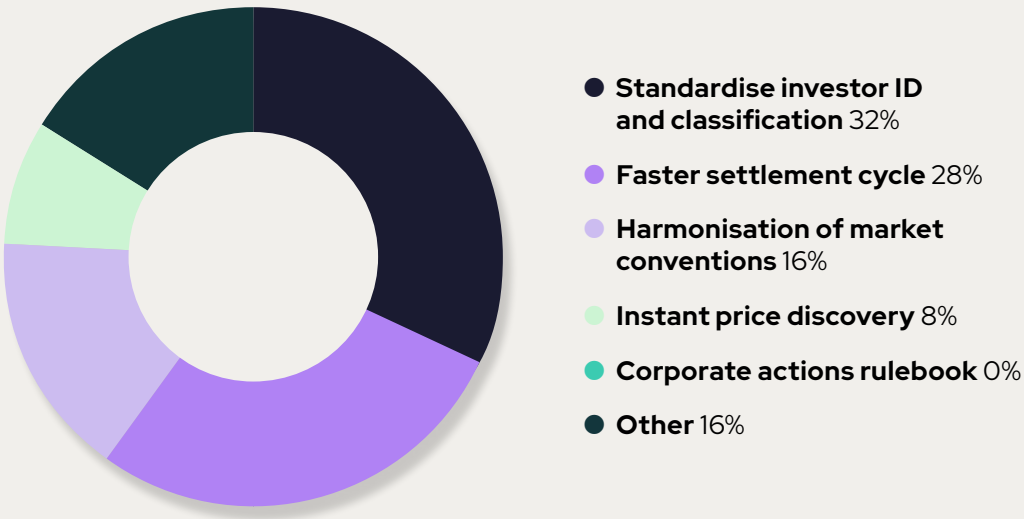
The development of the digital and blockchain bond market still has a way to go. 'Mainstream adoption is probably not going to happen quickly,' said Michael Chapman, head of tokenisation at Deutsche Bank, one of the bookrunners on KfW's syndicated blockchain bond. 'Potentially, we will see growth in the next three to five years,' he said. 'The big challenge with adoption with new technology is always a level of hesitancy but the market is clearly moving in this direction.'

Increasing investor participation and confidence in these types of bonds is perhaps the biggest obstacle and that can only really happen with the creation of a secondary market. 'The big challenge for investors at the moment is that if they buy these bonds, they probably can't sell it,' said Chapman.

'Besides the need for DLT-based central bank money, secondary market liquidity is clearly one of the most important points in the scalability of blockchain-based digital bonds,' said Meirer. 'We need a number of different aspects to increase and strengthen the secondary market,' he added. 'For example, trading venues are not yet fully ready to handle blockchain-based digital bonds crypto securities and we need crypto custodians to be involved, too.' Nevertheless, progress is clearly being made and investors, custodians and other market participants are increasingly being more involved in these transactions.

1.4. Standardisation and faster settlement would most improve post-trade processes

Which of the following would most improve efficiencies in post-trade processes? Share of respondents, %



Source: Digital assets and market infrastructure survey 2024

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PIONEERING NEW FORMS OF ISSUANCE

KfW has issued two digital new bonds this year, demonstrating its innovative approach to primary issuance.

KfW, the German development bank, has become a pioneer in new forms of bond issuance, emboldened by Germany's Electronic Securities Act 2021. The agency – one of the largest bond issuers in the world – gave the market two examples of its innovative approach to primary issuance earlier this year. On 25 June, KfW sold a three-year bond, raising €4bn with a 2.75% coupon. The bond was KfW's first benchmark to be processed via Deutsche Börse's digital securities platform, D7. The agency completed a €20m two-year pilot transaction in December 2022.

Although the bond was fully digital – unlike the majority of KfW's bonds – it was still a central register security and the settlement process was similar to the traditional process. That was not the case for KfW's first blockchain-based bond. The bond was priced on 2 July and raised €100m. The bond matures in December 2025 and carries a 3.125% coupon.

Lewis McLellan, OMFIF's Digital Monetary Institute editor, spoke to Tim Meirer, senior manager, capital market innovation, and Normen Günther, senior manager, capital markets at KfW, to find out more.

Lewis McLellan: This was a busy and innovative period for you. Can you tell us how that came about?
Normen Günther: KfW is a frequent issuer, so we've been carefully watching market developments. When the German Electronic Securities Act arrived in 2021, that was an important development. In effect, it is a dematerialisation law. Before that, all securities in Germany had to be paper-based, which is quite outdated.

That law has two aspects, and we wanted to test both of them. First the central register security which, unlike in the classic format with a traditional global note, gives the issuer the option to replace the physical certificate with an entry in the D7 Clearstream database. Alternatively, it gives issuers the option to make use of novel technologies and print a blockchain-based note.

LM: Let's start with the first option then. This was KfW's second deal in that format. What was new this time?
NG: Yes, in December 2022 we printed a small pilot transaction. For this deal, a full benchmark was the next logical step for us. The process is much more efficient than the paper-based system. Going forward, we want to make this the standard way of issuing our bonds.

LM: Does it require significant changes to your systems to move over to a dematerialised workflow?
NG: It's essentially a data management project for us. Clearstream has built the infrastructure for issuing digital bonds, which requires the transfer of data from our system to D7. Hence, we needed to get that requirement from them and make sure we understand it correctly to match the data in our system to their data model so that we could ultimately create a digital security.

LM: Let's talk about the other deal then. This is a true blockchain instrument. What are the major differences between that instrument and the central register security?
Tim Meirer: The central register security makes

KFW'S FIRST DIGITAL BOND OFFERINGS

	FIRST DIGITAL BENCHMARK	FIRST BLOCKCHAIN-BASED DIGITAL BOND
ISSUER	KfW	KfW
SIZE	€4bn	€100m
PRICING DATE	25 June 2024	2 July 2024
MATURITY	Three years	18 months
COUPON	2.75%	3.125%
PLATFORM	D7	
BOOKRUNNERS	BNP Paribas, Bank of America, Crédit Agricole, LBBW	DZ BANK, Deutsche Bank, LBBW, Bankhaus Metzler

'The use of technology allows us to shorten settlement cycles, but we need even more mature and fully developed infrastructure, which could make settlement even quicker.'

Tim Meirer, senior manager, capital market innovation, KfW

'The process is much more efficient than the paper-based system. Going forward, we want to make this the standard way of issuing our bonds.'

Normen Günther, senior manager, capital markets, KfW

the issuance process – generating the bond – more efficient and automatic than conventional bonds, but it doesn't affect the settlement process. For KfW's first blockchain-based digital bond, we were able to shorten the settlement cycle from T+5 to T+2 so we have made progress but it's not the end of the road. The use of technology allows us to shorten settlement cycles, but we need even more mature and fully developed infrastructure, which could make settlement even quicker.

LM: What infrastructure components are still missing or need more development?
TM: It's a whole ecosystem. There is a large number of parts on the investor side that need to come into place to facilitate especially the secondary market. The investors need to be internally capable of buying and managing the securities.

At present, secondary market liquidity for these instruments is not comparable to the liquidity for traditional instruments, so both buy and sell sides need to learn together from deals like this one.

LM: What about the cash side of the transaction?
TM: At this point, there's no standardised, scalable distributed ledger technology-based central bank money, so all the payment flows for this deal are processed off-chain. However, the European Central Bank is currently doing exploratory work for wholesale settlement and we'll be an active participant in the second wave of that. We expect our next blockchain-based digital bond to be issued using the Bundesbank trigger solution. That will allow us to achieve delivery-versus-payment settlement.

This is an important component. We believe that blockchain-based digital bonds are not going to become viable unless there is a cash solution that is capable of communicating and exchanging information with the DLT the asset is on. The ECB's exploratory work is very important for this.

LM: Tell us more about the technology you used?
TM: The bond was issued on polygon, which is a layer 2 solution on Ethereum. It's a public and permissionless blockchain. That wasn't an active choice for us. It's simply the blockchain protocol that our cryptosecurities registrar is running the register on. Another major deal under German law – a siemens €60m bond – was also issued on Polygon.

A market standard regarding the different types of blockchains has not yet emerged. Trying different protocols and testing the benefits of each will be part of the learning process.

LM: How did you select your registrar and your banks?
TM: Given the German Electronic Securities Act (eWpG) came into place in June 2021 and thus is still very young, there aren't many licenced registrars yet. We looked at comparable transactions and, based on the Siemens deal, Cashlink seemed like the market leader.

We worked with four bookrunners. The rationale behind the composition of the syndicate was to have representatives from all German banking sectors: co-operative, savings, large universal banks and private banks.

LM: What other improvements are necessary for this asset class to take off?
TM: Besides the need for DLT-based central bank money, secondary market liquidity is clearly one of the most important points in the scalability of blockchain-based digital bonds. The bond we issued is over-the-counter tradable with market-making capabilities from the bookrunners who quote on Bloomberg. However, we need a number of different aspects to increase and strengthen the secondary market, such as ECB eligibility. Moreover, trading venues are not yet fully ready to handle blockchain-based digital bonds and we need crypto custodians to be involved, too.

For our deal, investors don't have to interact with the blockchain directly. They have custody relationships with the bookrunners and DZ BANK will keep hold of the tokens throughout the lifecycle.

SLOVENIA BREAKS GROUND WITH FIRST EUROPEAN SOVEREIGN DIGITAL BOND

OMFIF spoke to Marjan Divjak, director general of the Treasury directorate at Slovenia's Ministry of Finance, and Amélie Frémy, innovation chief operating officer for global markets at BNP Paribas, about the first sovereign digital bond issuance in Europe and the bank's role in helping Slovenia structure the deal.

'Issuing bonds based on DLT has in the long run the strategic benefit of expanding the investment base for Slovenia's bonds.'

Marjan Divjak, director general of the Treasury directorate at Slovenia's Ministry of Finance

Expanding the investor base

OMFIF: Why did Slovenia decide to do this experiment? What were the main reasons and motivation behind this transaction?
Marjan Divjak: In the management of public debt, Slovenia is committed to transparency and efficiency and follows innovative approaches to achieving these goals. The Treasury received the Government Risk Manager of the Year 2017 award for its innovative approach to public debt risk management. The pioneering use of new technologies in sovereign debt management fits well with our debt management strategy.

OMFIF: Who were the key partners and institutions that you worked with in this transaction and what role did they play?
MD: This important step for Slovenia was part of the European Central Bank's money settlement experimentation programme, and BNP Paribas played an important role in this.

BNP Paribas' and the Banque de France's solutions contributed to the success of this historic transaction. Banque de France's tokenised cash solution is the only solution in the ECB trial that is completely on-chain and thus fully interoperable with the use of smart contracts for trading and/or settlement without T2 intermediation. While it is true that such setup adds another layer of complexity, we believe it should be considered as a possible development of distributed ledger technology platforms for securities' trading. In addition to that BNP Paribas is at the top of the ranking list of banks' market-makers for Slovenian bonds.

OMFIF: How far are we from digital bonds becoming a reality and part of issuance programmes?
MD: I think there is still some way to go. However, I believe that it will soon be possible to offer the reference bond of Slovenia to investors in both traditional and digital forms of settlement.

OMFIF: What are the main benefits of issuing digital bonds, particularly for a debt management office?
MD: Issuing bonds based on DLT has in the long run the strategic benefit of expanding the investment base for Slovenia's bonds. These types of issuance attract the international attention of technologically advanced investors and younger generations. Investors, on the other hand, can invest in settlement systems of their choice. DLT-based solutions have the potential to offer greater market efficiency and transparency. They could also be cheaper for both issuers and investors.

Without diminishing the importance of traditional securities settlement and custody systems, the development of new systems, in our view, is important from the point of view of efficiency and security in bond settlement. We will continue with this approach.

Breaking ground

OMFIF: Could you summarise the key aspects of the placement and how it was structured?
Amélie Frémy: This transaction was issued off the European Central Bank's wholesale central bank money settlement experimentation programme. From our side, we did a few transactions for the bank last year as well as one in June. The Slovenia digital bond and the transactions for BNP Paribas were connected to the Banque de France platform, which provided the experimental cash tokens.

For us, this was the opportunity to do a transaction with on-chain settlement, as well as a great opportunity to access the digital euro. The ECB's Central Bank Money (CeBM) trial started in May and will run until November where market participants can access the digital euro through three different settlement solutions in Banque de France, Bundesbank and Banca d'Italia. We will be testing all three solutions as part of the programme, and BNP Paribas Global Markets is planning another transaction with the Bundesbank solution.

OMFIF: Why was Slovenia keen to do this transaction? Could digital bonds bring about significant cost-savings for issuers?
AF: Slovenia was very motivated to demonstrate how innovative it is by opening up this space in Europe from a sovereign standpoint. We were contacted in late 2023 to work with Slovenia to proceed with a digital bond as part of the ECB's CeBM with access to a cash central bank digital currency and settlement with a traditional currency.

Digital assets are at an early stage so there is no cost reduction at this time but we can see how in the future it could provide real benefits from an operational perspective. These experiments enable sovereigns to test the set-up and market.

OMFIF: How did investors engage in this transaction?
AF: We had a few types of investors who relied on custodians; others will prefer to directly settle through Neobonds, BNP Paribas Global Markets' private tokenisation platform, and the Banque de France platform.

OMFIF: Do you have a preference between private and public blockchain?
AF: At this stage, private technology allows financial institutions to meet current regulatory requirements but there are also opportunities with public blockchain. We want to be in a position to get familiar with both technologies. Neobonds is a private blockchain, canton-based and as secure as any other service or platform used within the bank. It is therefore fully permissioned.

OMFIF: What were the lessons learned from this experiment? Do you expect other sovereigns and issuers to follow Slovenia?
AF: The real positive from these transactions is the speed of settlement and the capacity to settle immediately. We have also identified that it is probably achievable to have fewer intermediaries with the use of smart contracts and being able to automate coupon payments. This will bring significant improvements to the current bond issuance process.

We hope others will follow. We have received a lot of questions since the beginning of the ECB's CeBM about accessing the digital euro and the benefits for not just sovereign, supranational and agency borrowers but other issuers, as well as investors. They all want to be educated in this.

We have been talking about digital assets for a while but the pace of development has been quite slow until now. With the ECB's CeBM, we see an acceleration by all market players who want to learn more about these products and more questions being asked. It is quite encouraging to see this traction.

We are open to the possibility of making use of the European Union blockchain pilot regime, but at present there are no registered or licenced trading or settlement systems. Until those licences are granted, we can't experiment in that area, but it's something we're interested in exploring.

'The real positive from these transactions is the speed of settlement and the capacity to settle immediately.'
Amélie Frémy, innovation chief operating officer for global markets at BNP Paribas

SOLVING FOR CASH IN A DIGITAL WORLD

Realising the value of tokenised cash will require an overhaul of the cash settlement infrastructure.

KEY FINDINGS

1. Market participants would prefer wholesale central bank digital currencies for settling most securities transactions over private tokenised money solutions, with 59% of survey respondents selecting this option.

2. Other forms of tokenised cash, such as stablecoins and tokenised money funds, will have their own use cases and applications, but they are not yet ready for financial markets.

3. The adoption of tokenised cash will depend on a clear and robust regulatory framework. Credit ratings could also help to boost investor confidence and ensure widespread adoption.

‘ONLY 23% OF MARKET PARTICIPANTS FAVOUR STABLECOINS FOR CASH SETTLEMENT OF SECURITIES TRANSACTIONS.’

TOKENISED cash, or digital representations of traditional fiat currencies, is not merely a convenient alternative form of money but a fundamental building block for the digital asset ecosystem. Respondents to OMFIF’s survey of market participants generally expect blockchain to become an important component of financial markets, with 42% agreeing it will be the dominant form of financial market infrastructure (Figure 2.1).

As the development of tokenised securities and blockchain-based financial instruments accelerates, one thing is becoming clear: realising the value of this kind of infrastructure requires an overhaul of the cash settlement infrastructure.

Allowing cash and security tokens to exist within the same platform mitigates settlement risk. It enables cash and assets to be exchanged on a delivery-versus-payment basis. Atomic settlement – where settlement of one leg of a transaction cannot take place without settlement of the other – mitigates risk, freeing up liquidity that must otherwise be posted as collateral against the risk of trade failure.

This also raises the question of whether instant settlement is desirable. For transactions to settle instantly (rather than on a net basis at end of day, for example) requires them to be pre-funded, which may prove even more costly on a liquidity basis than the present settlement model. However, while instant settlement may not be appropriate for some asset classes, tokenised cash can settle versus tokenised assets on demand, allowing the parties more flexibility in managing liquidity and giving them time for due diligence and regulatory compliance.

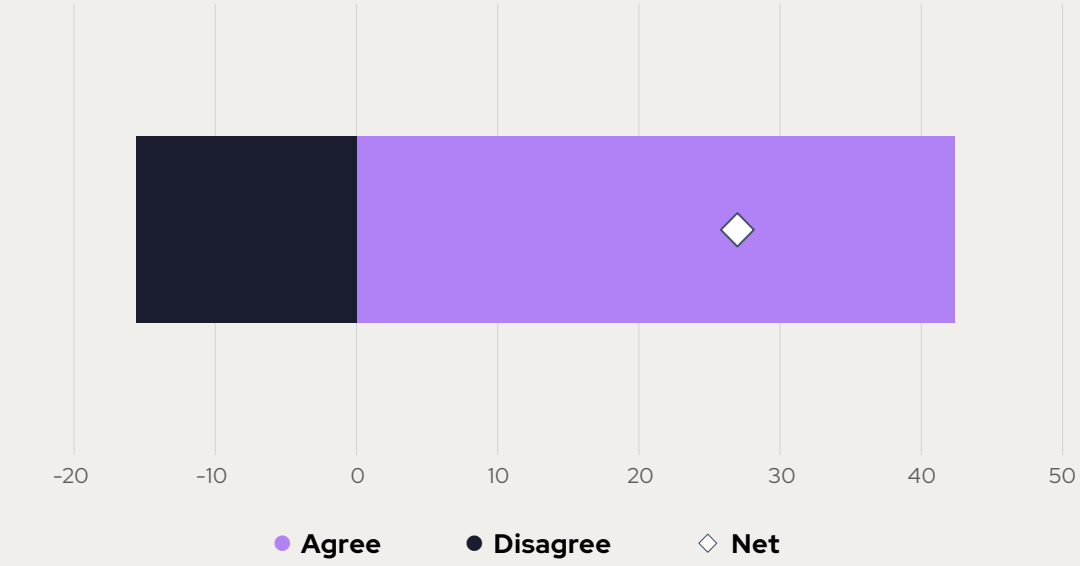
Furthermore, tokenised cash offers the opportunity to streamline the process of managing payments throughout a given transaction’s entire life cycle, reducing friction in the digital asset marketplace by lowering costs. Delivering a solution for the settlement of cash is a core part of the development of a digital asset ecosystem. Tim Meirer, senior manager, capital market innovation at KfW, said ‘We believe that blockchain-based digital bonds are not going to become viable unless there is a cash solution that is capable of communicating and exchanging information with the distributed ledger technology where the asset is.’

Stablecoins: promising but not yet ready

There are several different categories of tokenised cash solutions already present in the digital asset ecosystem. The first category is probably the most well-known: stablecoins. These come in multiple forms but, at root, they are cryptocurrencies designed to maximise price stability. Often, this is accomplished by pegging a given stablecoin’s

Figure 2.1. Market participants expecting blockchain takeover

Do you agree that blockchain will become the dominant form of infrastructure for financial markets? Share of respondents, %



Source: Digital assets and market infrastructure survey 2024

'To preserve the level of stability necessary for institutional confidence, stablecoins will need to be backed by combinations of cash and high-quality liquid assets – particularly short-term government bonds.'

value to a stable asset. Tether, the world's largest stablecoin provider, issues one stablecoin that is pegged to the value of the US dollar and one that is pegged to the price of gold. MakerDAO's Dai stablecoin is a crypto-collateralised stablecoin, pegged to the dollar but backed by Ethereum and other cryptocurrencies worth about 155% of the value of Dai in circulation.

Algorithmic stablecoins are not necessarily tied to any reserve asset; their value is kept stable through algorithmically controlled supply, not unlike a central bank. However, they do not have central banks' key advantages of established monetary policy and credibility as recognised issuers of legal tender and are unlikely to prove suitable for institutional adoption.

Stablecoins have come under close scrutiny from regulators and policy-makers. The US Senate has introduced a bill to create a regulatory framework for stablecoins: the Lummis-Gillibrand Payment Stablecoin Act would prohibit stablecoins being issued by anyone other than a registered non-depository trust or an authorised depository institution. The European Union has already gone further. Its 2023 Markets in Crypto-Assets Regulation essentially banned algorithmic stablecoins, required other stablecoins' assets to be held by a third party and established strict liquidity regulations, requiring reserves to be liquid and held in a 1:1 ratio to stablecoins. Regulatory suspicion may impede the wider adoption of stablecoins for institutional use.

There are also a number of unresolved, fundamental questions regarding stablecoins. It is unclear whether a stablecoin ultimately represents a claim on the reserves of assets held by the issuer or a claim on the credit of the issuer. In the first case, the ability to redeem a stablecoin is independent from the fortunes of the issuer. In the second case, the stablecoin becomes much closer to a traditional bank deposit and, if the issuer goes bankrupt, holders may find themselves unable to redeem their holdings for fiat. This is a risk in traditional banking, but users are protected by state deposit guarantee schemes.

In either case, the robustness of the instrument depends on transparently audited reserves. This can bring its own risks. The collapse of Silicon Valley Bank, which held a substantial portion of the reserves backing Circle's USDC instrument resulted in its peg breaking (in the secondary market. No USDC were redeemed at the issuer for under $1). Nevertheless, this is a vulnerability that may hurt stablecoin adoption, particularly among institutions.

Institutions' confidence in stablecoins might be bolstered if they can obtain credit ratings. Transparent, robust ratings from well-known institutions might improve trust in the instrument as a means of settlement. It should be noted that even the fact that they need a credit rating differentiates them from central bank digital currencies, which offer a means of settlement entirely free of credit risk. However, it is possible that not every jurisdiction's central bank will choose to issue a CBDC suitable for broad institutional use.

Scaling stablecoins may also prove challenging depending on the composition of their reserves. To preserve the level of stability necessary for institutional confidence, stablecoins will need to be backed by combinations of cash and high-quality liquid assets – particularly short-term government bonds. The scale of these assets required to back a stablecoin large enough to be valuable for use in capital markets use would demand a substantial proportion of these assets. 'We're a long way from the systemic adoption of stablecoins,' said Natalie Lewis, partner, Travis Smith.

Tokenised bank money popular for corporate use

The second category of tokenised cash solutions is tokenised commercial bank money. These tokens are digital representations of commercial bank deposits, which have the advantage of being a form of money many are already familiar with and can offer a flexible and scalable solution for tokenised cash.

TBM adoption would prevent a scenario in which non-bank digital cash solutions proliferate, potentially fragmenting the money supply with non-fungible cash tokens. They would also most likely be regulated under existing electronic money rules and would not require specific regulation to deliver a new form factor of an existing type of money. Many banks are presently exploring this solution – notably a consortium comprising DZ BANK, Deutsche Bank, Commerzbank, Unicredit and Helaba.

But there are significant challenges. For most institutional capital markets, market participants generally prefer to transact in risk-free central bank money, rather than a form of money that represents a claim on another financial institution. This requires holders to price risk for each TBM and to hold collateral against counterparty default.

This may make TBM more suitable for corporate payments, rather than for use in financial markets. The UK's Digital Securities Sandbox enables the use

SYNTHETIC CBDCs

One potential solution that addresses some of the challenges stablecoins face is the creation of synthetic central digital bank currencies. Each stablecoin would be backed by reserves of fiat currency held at a central bank at a ratio of 1:1. In effect, a synthetic CBDC would leverage private sector issuance of digital currencies but with full backing by central bank reserves. This model would ensure that the stablecoin maintains a steady value, as it is fully backed by central bank reserves and would potentially reduce the risks associated with the issuer's creditworthiness, providing confidence to users and regulators.

One firm attempting to solve some of the issues associated with stablecoins is Fnality International, a company developing peer-to-peer digital payments based on blockchain technology. Fnality has launched a sterling payments system, which allows participants to settle the cash leg of securities transactions in tokens backed by reserves held in a Bank of England omnibus account.

PROJECT AGORÁ

Among the BIS's most important projects is Agorá, which aims to unite tokenised bank money and tokenised central bank money on a single platform. The concept draws heavily on the idea of the Regulated Liability Network, which proposes using DLT to enable the recording, transfer and settlement of regulated liabilities – central bank, commercial bank and e-money – denominated in national currencies. It aims to combine the purported benefits of DLT, such as programmability and operational efficiencies, with the existing legal and regulatory frameworks governing traditional financial instruments. RLN proposes a world in which regulated entities tokenise the liabilities on their balance sheets. Inter-bank transfer would involve messaging between institutions and the extinguishing of tokens at the sender's institution and the minting of tokens at the recipient's institution, with final settlement handled at the FMI level. By tokenising regulated liabilities and recording them on a shared ledger, RLN could potentially streamline cross-border payments, enhance liquidity management and foster innovation in financial services. The proposed network would adhere to established regulatory principles and standards, ensuring compliance with KYC and AML and sanctions regulations.

of TBM (and stablecoins) for cash settlement of DLT-based securities transactions, which may make the solution acceptable for market participants.

Central bank money for a new era

Central bank money is the most stable and secure form of cash. Figure 2.2 shows that, at present, 59% of survey respondents prefer it over any other private tokenised cash alternative. While this might develop as regulations and technology gradually change attitudes, it is clear that central bank money is regarded as having a unique importance in financial markets.

Delivering it in a form suitable for widespread adoption in capital markets is a challenge central banks are rising to. Multiple pilot programmes for wholesale CBDCs are already in development, including a token deployed by the Swiss National Bank to settle digital currency transactions, and a forthcoming pilot by the Monetary Authority of Singapore aimed at facilitating domestic interbank payments.

The Swiss pilot programme has been extended for a further two years, with a goal of including more financial institutions and a wider range of transactions. The project, now named Helvetia III, relies on tokenised municipal bonds from Basel-Stadt, Zurich, Lugano and St Gallen, settled in wholesale digital Swiss francs.

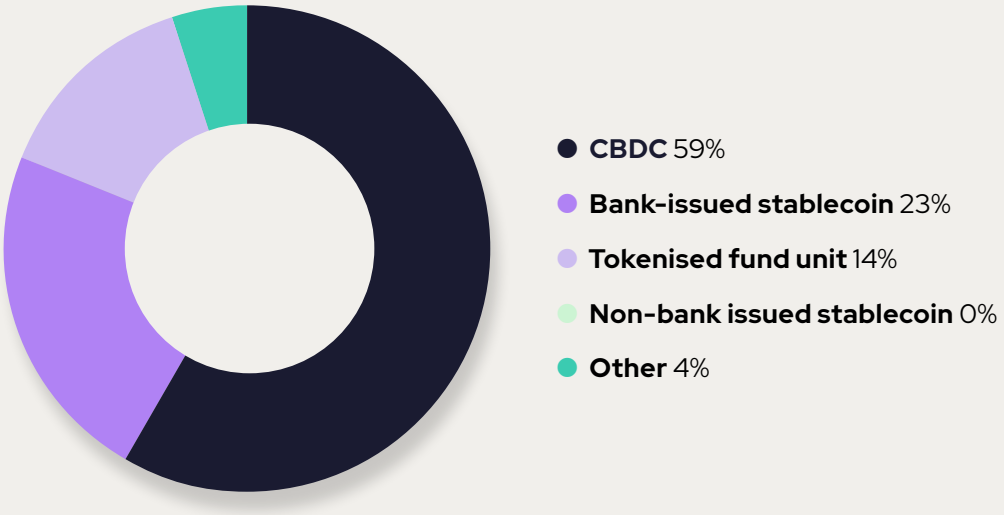
The European Central Bank is conducting a series of experiments in delivering a means of settling wholesale financial transactions in central bank money using DLT platforms. The programme will run until November 2024. Amélie Frémy, innovation chief operating officer for global markets at BNP Paribas said: 'We will be testing all three of the ECB's central bank money solutions during the programme.'

There are three different experiments taking place. First, the Bundesbank is experimenting with the Trigger solution: a DLT infrastructure provides a technical bridge between DLT platforms and T2, the euro area's real-time gross settlement system. KfW announced that it intends to issue a bond using this system in August 2024. Second, Banca d'Italia's Target Instant Payment System Hash-Link system can interoperate with market DLT platforms via an application programming interface gateway. Third, the Banque de France is trialling DL3S – a system in which central bank money is held in a DLT-based account held on a DLT platform – a wholesale CBDC. Slovenia's blockchain bond, issued in July 2024, made

59% of respondents prefer CBDCs over any other private tokenised cash option.

Figure 2.2. Market participants prefer CBDCs for cash settlement of securities transactions

What do you favour as a solution for cash settlement in financial market transactions involving tokenised assets? Share of respondents, %



Source: Digital assets and market infrastructure survey 2024

‘BY OFFERING RELATIVELY FRICTIONLESS EXCHANGES, WCBDCs COULD REVOLUTIONISE WHOLESALE PAYMENTS AND SETTLEMENTS BETWEEN BANKS.’

use of the Banque de France solution (see page 32).

There are many factors to consider in responsibly implementing wCDBCs. Security risks are paramount, as the digital infrastructure that enables them is potentially vulnerable to malicious actors engaging in cyberattacks and fraud. Similarly, operational risks like electrical outages, natural disasters and loss of network communication could threaten the stability of the system.

However, the potential advantages of wCBDCs are significant. By offering relatively frictionless exchanges, wCBDCs could revolutionise wholesale payments and settlements between banks. For example, Project Cedar, a wCBDC prototype developed by the Federal Reserve Bank of New York, found that its blockchain-enabled payments system was able to settle foreign exchange transactions in under 15 seconds and improve the safety of these transactions by using separate, homogenous ledger networks including both private and central sector banks. Faster and safer payments will reduce costs for users, and bringing multiple currencies into a single system would vastly improve the transparency of the financial system by allowing direct transactions between participants.

Many of these benefits apply to other forms of tokenised money, but what makes the use case of CBDCs valuable is their status as the ultimate settlement asset: there are no credit risks attached to a transaction in central bank currency, as well as no liquidity constraints. According to the Principles for Financial Market Infrastructures set by the Committee on Payments and Market Infrastructures and the International Organization of Securities Commissions, settlement should take place in central bank money whenever possible. Recent updates have begun to take the possibilities of wCBDCs into account.

Tokenised funds: familiar but risky

The final category of tokenised cash is tokenised fund units, digital shares of money market funds. Their main advantage over other digital assets is that money markets are already a very familiar and clearly regulated investment vehicle, potentially providing a stable and versatile form of tokenised cash for institutional investors. Pensions or sovereign funds that seek reliable supplies of short-term liquidity could tokenise their assets into TFUs, rather than rely on deposits of fiat currency.

The UK Treasury has suggested that TFUs would be particularly useful as collateral, due to the much faster settlement times compared to traditional fund units, the fact that TFU transactions are recorded on a distributed ledger, providing an immutable record, and their interoperability with many different platforms and systems.

There are two main considerations holding up the wider adoption of TFUs. The first, which is a consideration common to all tokenised cash alternatives, is a relatively uncertain regulatory landscape, which may evolve differently across jurisdictions. The second is the risk of redemption runs, where large numbers of investors simultaneously attempt to redeem their TFUs for cash. These can lead to liquidity crises within a given money market, with delays or even the inability to offer redemptions. Runs can also lead to asset prices being forced downward, causing losses for investors and depressing confidence in the market.

While the risk of redemption runs is hardly unique to TFUs, the advantages offered by tokenised cash alternatives – the reduction of friction in transactions and easier cross-institutional and cross-border transactions – exacerbate the potential of a run occurring.

The path to global coherence

The future of tokenised cash lies in achieving global standards and interoperability. This will require extensive collaboration between central banks, commercial banks, fintech firms and regulators on a number of different fronts.

First, common standards must be established that ensure the fungibility and interchangeability of different tokenised cash formats, which includes meeting the challenges of technological and operation implementation. Potential solutions each come with challenges. Blockchain bridges, which allow tokens from one blockchain to be used on another, are vulnerable to hacking as well as being complex and resource intensive. Locking tokens on one platform and creating representations of them on another chain pose the challenge of ensuring the validity of representations and maintaining liquidity on the original platform. It is unclear how robust either method is, due to the issues mentioned above, regulatory questions and the fact that neither has yet demonstrated the ability to scale seamlessly.

Second, regulatory challenges must be met head-on to prevent markets from splintering or jurisdictions from engaging in ‘race to the bottom’ regulatory arbitrage. This is more of a concern for retail markets rather than institutional ones, but the legal and logistical issues posed by a patchwork landscape of regulation will still create risks for institutional markets. Finally, these standards and regulatory frameworks must permit experimentation with and exploration of new technologies and use cases for what is still a novel technology.

These challenges are beginning to be met. Swift has conducted a series of experiments in collaboration with several financial institutions that test how Swift’s existing infrastructure could be adapted to the tokenised asset market. The experiments found that Swift’s systems could be adopted to serve as a ‘single access point’ that links tokenisation platforms, cash leg payment types and participants interacting with tokenised assets.

In the past year, many jurisdictions have moved to publish and implement guidelines for digital assets, including the European Union, the UK, Japan, Hong Kong, Singapore and the United Arab Emirates. Established banks and financial services companies are also adding digital asset capabilities, as tokenised cash is increasingly in circulation and high interest rates have boosted the importance of high capital efficiency. While there is much work still to be done, the tokenised cash future is nearly here – what will matter is implementation.

FUTURE OF PAYMENTS

A new generation of payments takes shape

OMFIF is excited to present our latest Future of payments report, featuring an extensive survey of central banks uncovering their beliefs about cross-border payments and the various solutions being proposed.

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DIGITAL BOND RANKINGS

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A global ranking of digital bond deals since 2022

IN the debt capital markets, many of the world's leading banks, technology companies, advisers, consultants, law firms and platforms are devoting significant resources to the development of digital bonds and the creation of a market that brings speed and efficiency for issuers and investors. To date, that investment has resulted in a growing, but still limited, number of digital bond deals, many of which have been important pilots and learning processes for those involved.

Even as the technology and infrastructure of distributed ledger technology-based and other forms of digital bonds develop and a tipping point for widespread adoption fast approaches, it's not easy to assess which firms are leading the way in this future world of finance.

Traditionally in bond markets, league tables have provided an invaluable insight into which banks do the most business, and they are used as the accepted form of

EXCHANGES

■ Top by deal number

	Exchanges	No. of deals	Volume $m
1	Luxembourg Stock Exchange	8	1383.10315
2	SDX	8	1331.40085
3	Hong Kong Stock Exchange	4	751.2234

LEGAL ADVISORS

■ Top by deal number

	Exchanges	No. of deals	Volume $m
1	Clifford Chance	5	1070.8522
2	Lenz & Staehelin	1	375.0375
3	Linklaters	6	338.341
4	Ashurst	6	318.861
5	Allen & Overy	7	196.3921

accreditation. The universe of digital bonds has now reached sufficient scale to create league tables in this important market.

OMFIF's Digital Monetary Institute has thoroughly researched and analysed all digital bond deals launched in the past two years. From this research, we have created league tables based on accepted models (such as equal apportionment) that rank – by volume and number of deals – for the period of 1 January 2022 to 25 July 2024. These league tables are not just for bookrunners and issuers, but also for law firms, platform providers and exchanges that have participated in the deals to date.

Each table is interesting in its own way. Issuers have to take a leap into the unknown, entering a new medium without compromising the integrity of their debt franchise. Platform providers do a great deal of the technical heavy lifting of creating the new format, while legal advisers work to ensure the new instruments are compliant with existing regulation. Although the job of a bookrunner changes little with the new format, their participation in digital deals might indicate a desire to learn more and develop experience. Finally, we have exchanges, which play a pivotal role in creating the infrastructure for a liquid secondary market for digital bonds.

Institutions from Switzerland and Hong Kong are well-represented in the results, thanks in no small part to the hand that their monetary authorities are taking in the digitalisation of the markets. As monetary authorities around the world follow suit, we will see their markets burst into life.

This market is likely to rapidly mature over the coming years. We expect the number of participants to grow, but those who have taken early leads may have acquired early advantages of experience and comfort with the operational challenges of a new medium. In one area in particular, a few institutions have taken an early lead: some legal advisers have carved out a reputation for their digital bond services. Perhaps other categories will follow suit in years to come.

Many market participants are just dipping their toes in the water. For some, that means only one or two deals, with a great deal of preparation time. Others have participated in many more deals but of smaller sizes. Which strategy will prove more fruitful in building up the experience and expertise required to excel in this market will become clear over the coming years.

ISSUERS

Top by deal number

	Exchanges	No. of deals	Volume $m
1	EIB	3	1104.5445
2	HKSAR Government	5	853.149
3	UBS	2	539.2725
4	World Bank	2	328.956
5	Lugano city	2	220.768
6	Union Bank of the Philippines	1	209.2871
7	Societe Generale	5	178.10195
8	KfW	2	129.0702
9	Canton of Basel City	1	120.02235
10	Canton of Zurich	1	114.307

BOOKRUNNERS

Top by deal number

	Exchanges	No. of deals	Volume $m
1	Crédit Agricole	6	620.2723
2	SEB	1	469.587
3	Commerzbank	1	223.056
4	Basler Kantonalbank	3	195.8010167
5	UBS	6	191.2095667
6	HSBC	6	171.3308
7	Goldman Sachs	6	163.07942
8	Zurcher Kantonalbank	3	152.094
9	ICBC	4	125.2039
10	Bank of China	5	112.5281667

PLATFORM PROVIDERS

Top by deal number

	Exchanges	No. of deals	Volume $m
1	so|bond	1	939.174
2	HSBC Orion	5	813.1599
3	SDX	5	684.72135
4	STACS	1	209.2871
5	GS DAP by Goldman Sachs	2	205.3596
6	SG Forge	5	178.10195
7	SWIAT	4	109.122
8	Cashlink	1	107.916
9	R3's Corda	1	107.407
10	Euroclear D-FMI DLT platform	1	105.9

HONG KONG AS A DIGITAL ASSETS HUB

Georgina Lok, head of market development at the Hong Kong Monetary Authority, spoke with OMFIF about the benefits of distributed ledger technology and the HKMA's experience of issuing tokenised bonds.

OMFIF: What do you see as the key advantages to adopting DLT infrastructure in financial markets?

Georgina Lok: What motivated the HKMA's work in bond tokenisation was the value of embracing innovation to further develop the financial market. We assisted the Hong Kong Special Administrative Region government in issuing the world's first tokenised government green bond in 2023, followed by a second issuance in February 2024. This was the world's first multi-currency (Hong Kong dollar, renminbi, US dollar and euro) digital bond. To share our experience, we published a report setting out the considerations of our first issuance, as well as the potential benefits offered by DLT in bond markets.

In our view, a key advantage of DLT in financial markets is to bring different parties (in the context of a bond issuance: the issuer, underwriting banks, custodians and agents) onto a single platform, providing an immutable, single source of truth that eliminates the need for synchronising information across different parties.

DLT and smart contracts also hold the potential to automate workflows (in the context of a bond life cycle, this could include issuance and settlement, principal repayment and coupon calculations), resulting in efficiency gains, lower costs and enhanced transparency. For instance, our digital bond issuances achieved shortened settlement cycles from the typical five business days (T+5) to one business day (T+1).

OMFIF: In many jurisdictions, we are seeing individual platforms springing up. Are you concerned about fragmentation? What do you see as the HKMA's role in establishing market standards?

GL: It is encouraging to see the market actively exploring and adopting technology innovation. To fully reap the benefits of tokenisation and enhance liquidity for a robust market, interoperability will be key. Generally speaking, there are two angles to interoperability: the interoperability of digital platforms with existing market processes and systems, and interoperability across digital platforms.

In our tokenised issuances, we attempted to address both angles. For instance, our second issuance featured a groundbreaking investor access model. This allowed investors to access the bond via traditional market infrastructure based on largely business-as-usual processes through Hong Kong's central securities depository for debt securities, the Central Moneymarket Unit, and its existing linkages with Euroclear and Clearstream. This lowered the technological and operational barriers for investors, making it more accessible to a wider range of investors.

Our second issuance also adopted the International Capital Market Association's Bond Data Taxonomy. This is a set of standardised and machine-readable language for a bond's key economic terms, dates and relevant information, which could facilitate more efficient information exchange between parties, systems and platforms when adopted more broadly.

Throughout our tokenisation journey, we have been collaborating with a diverse range of industry partners to facilitate knowledge exchange. We believe this is crucial for establishing common ground and enhancing our ecosystem, thereby supporting collaborative development.

OMFIF: DLT infrastructure comes in many varieties (private, permissioned, public)

'TO FULLY REAP THE BENEFITS OF TOKENISATION AND ENHANCE LIQUIDITY FOR A ROBUST MARKET, INTEROPERABILITY WILL BE KEY.'

Georgina Lok, head of market development at the Hong Kong Monetary Authority

‘We want to collaborate with stakeholders to enhance our ecosystem and explore further use cases to promote the adoption of this technology, with a view to strengthening Hong Kong’s position as a global digital assets hub.’

and each has its own advantages and disadvantages. Can you discuss the HKMA’s thoughts on the different protocols?
GL: Both public and private blockchains have their advantages, depending on the use case and objective. For instance, public blockchains generally offer greater transparency and scalability, while private blockchains generally provide a higher degree of data confidentiality.

Conventional bonds are typically traded over the counter, which means that trading information, such as price, volume and frequency, as well as holding information, remains private. It is not uncommon for digital bonds to be issued on private, permissioned blockchains. At the same time, there are also middle-ground models that strive to increase transparency while preserving privacy, like registering digital bonds on a private blockchain with a mirrored record on a public blockchain on an anonymised basis.

OMFIF: Our survey indicates a strong preference for wholesale central bank digital currencies as a means of settling the cash leg of tokenised securities trades. What is your thinking on this topic?
GL: There are various forms of payment tokens that can be used to settle tokenised securities trades. These include CBDCs issued by a central bank, stablecoins or tokenised deposits issued by commercial banks. Each has its own merits and implications. For example, commercial tokens can provide more flexibility in allowing customisation but may also be subject to higher counterparty, credit, operational, volatility and liquidity risks.

In our first tokenised green bond issuance, Hong Kong dollar cash tokens were used to settle the tokenised bond on the digital platform. The Hong Kong dollar cash tokens were minted by the HKMA in exchange for fiat cash provided by banks.
We will continue to explore potential synergies across different areas of technology innovation, including between bond tokenisation and the use of CBDCs.

OMFIF: What are your strategic aims for the advancement of capital markets infrastructure going forward?
GL: We have come a long way since the beginning of our tokenisation journey in 2021 where we concept-tested tokenised green bonds in Hong Kong with Project Genesis in collaboration with the Bank for International Settlements Innovation Hub Hong Kong Centre. We have since moved beyond the proof-of-concept stage with real-money transactions, showcasing Hong Kong’s flexible and conducive environment for innovative issuance formats with our first issuance, and achieving wider market participation and scalability with our second, the size of which was comparable to benchmark issuances in traditional format.

However, we are not stopping here. Moving forward, we aim to continue soliciting feedback and ideas from the industry. We want to collaborate with stakeholders to enhance our ecosystem and explore further use cases to promote the adoption of this technology, with a view to strengthening Hong Kong’s position as a global digital assets hub.

CENTRAL BANKS AND THE FUTURE OF MONEY

Antoine Martin, member of the governing board at Swiss National Bank, spoke with OMFIF about how tokenised assets are still in a niche, but their growth relies on the private sector finding valuable use cases that drive adoption.

OMFIF: Our survey indicates a strong preference from market participants to be able to settle tokenised securities transactions in central bank money. Can you expand on the SNB's work in this area?

Antoine Martin: Financial institutions prefer to settle virtually all large-value transactions in central bank money. This is true for both traditional and tokenised financial transactions. From a financial stability perspective, this preference is welcome as private-sector actors can hardly create and maintain a stable and efficient monetary system on their own. Only a central bank can provide risk-free money.

Just like traditional financial instruments, tokenised financial instruments require a means of payment that is widely accepted and has a stable value. To understand risks and benefits, the SNB has worked with market participants and field experts to explore the suitability of three models for settling tokenised assets with central bank money. Through experiments, pilots and analysis, we investigated wholesale central bank digital currency, a real-time gross settlement link and bankruptcy-remote private money.

Wholesale CBDC, a tokenised form of central bank money issued by the SNB, is integrated directly into the DLT infrastructure that also settles the tokenised securities. The tight integration allows for secure and efficient atomic settlement.

The RTGS-link synchronises the RTGS system and the distributed ledger technology platform that settles tokenised securities using the delivery-versus-payment mechanism. We learned that while it is possible to exchange money and goods simultaneously on a DvP basis in distinct infrastructures, the challenge remains how to coordinate processes across sometimes disparate systems.

The bankruptcy-remote private money enables integrated settlement, like wholesale CBDC. In contrast to wholesale CBDC, this form of money is private-sector Swiss franc token money, but privileged under bankruptcy law. It is structured legally in such a way that, in the event of bankruptcy of the token issuer, it would have a risk profile comparable to that of central bank money.

All three models raise operational, legal and policy questions. These policy questions concern, for example, the requirements for third-party platforms, the risks of liquidity fragmentation arising from the issuance of wholesale CBDC or bankruptcy-remote money, and the governance arrangements needed around these settlement arrangements.

OMFIF: Can you give your thoughts on the future role of central securities depositories in the market?

AM: Today, financial market infrastructures are typically tailored to a specific type of asset and a specific use case, including payments systems, securities settlement systems and currency settlement systems. In the case of CSDs, their four core economic functions have remained largely unchanged over the years, despite significant technological advancements, such as the dematerialisation of securities. These functions comprise issuance, central safekeeping of securities,

'Decisions made by central banks regarding the cost of settlement in central bank money on token platforms will influence the spread of tokenisation in the financial system.'

Antoine Martin, member of the governing board at Swiss National Bank

their mobilisation and processing of securities' events.

With tokenisation, this might change. Tokenisation may enable the consolidation of various types of assets on a single platform in the future and their settlement – including money itself as a settlement asset.

Furthermore, tokenisation bears the chance of efficiency gains. Standardised representation in digital form can simplify the process of issuing, transferring and storing securities. The automation of business processes through smart contracts could lead to further efficiency gains. Finally, a uniform, tamper-proof database could simplify the recording of asset values across FMIs and internal systems of financial institutions.

OMFIF: What do you think the journey to DLT becoming a widespread market utility looks like?

AM: Currently, tokenised assets on DLT platforms are still in a niche. The few existing regulated DLT platforms, such as the SDX in Switzerland, have little economic significance at this stage. Like every financial market, tokenised asset markets are driven by network effects. Novel platforms can only generate the necessary gravity if they can demonstrate their innovation potential against exiting arrangements. This is why the SNB has decided to support private sector innovation through the issuance of wholesale CBDC in the above-mentioned experiments.

The adoption of tokenised asset markets within the regulated financial system will be driven by a multitude of factors. The promoting factors include, in particular, expected efficiency gains, new business opportunities, better risk mitigation and robust legal and regulatory frameworks. On the other hand, hindering factors include significant up-front investment expenditures, non-trivial coordination problems among market participants and the prevailing lack of harmonisation of legal and regulatory frameworks on an international level. Also, decisions made by central banks regarding the cost of settlement in central bank money on token platforms will influence the spread of tokenisation in the financial system.

OMFIF: What is your perspective on the different blockchain architectures (private, permissioned, public…)?

AM: The design of DLT platforms may or may not impose access restrictions, and it may provide users with varying degrees of participation in the consensus process for transaction and data validation.

Hence, all DLT architectures and individual projects must be carefully analysed by the central bank to ensure that they meet a central bank's requirements for the issuance and use of central bank money as a settlement asset, including central bank legal, operational and governance requirements.

For public, permissionless DLTs, it must be ensured that the required controls by the central bank can be implemented, for example, on access to central bank money for the settlement of transactions between involved parties. Technical solutions may be possible, as demonstrated by Project Mariana, however, more work will be needed.

OMFIF: What do you feel the central bank's role should be in shaping the trajectory of capital markets development?

AM: As long as tokenised asset markets are economically of little significance, settlement in central bank money is not strictly required. However, central banks may support innovation by providing a safe and efficient settlement asset.

The success of tokenised markets depends crucially on the drive and innovation of private sector and whether the potential benefits materialise. The private sector needs to find the interesting and valuable use cases that will drive adoption.

Ideally, central banks may support the innovation efforts of the private sector by enabling settlement in wholesale CBDC, like the SNB is doing with the Helvetia pilot. The pilot enables the wholesale CBDC settlement of tokenised asset transactions on the SDX platform until at least June 2026. This provides planning certainty for the private sector, while maintaining options for the SNB to exit the platform if the desired success of the platform does not materialise.

FUTUREPROOFING FINANCIAL MARKET INFRASTRUCTURE

Emmanuelle Assouan, director general, financial stability and operations at Banque de France, spoke with OMFIF about the bank's involvement in the European blockchain pilot regime as well as the experimental approaches needed to prepare for the digital transition.

OMFIF: Our survey indicates a strong preference from market participants to be able to settle tokenised securities transactions in central bank money. Can you expand on the Banque de France's position on this topic?
Emmanuelle Assouan: Since the 2008 financial crisis, central bank money has proven to be a powerful and necessary asset to secure the settlement of financial assets, and thus mitigate liquidity and counterparty risks. Therefore, market participants have a strong preference for having the possibility to settle tokenised securities transactions in central bank money. This power to provide security is an integral part of central banks' monetary sovereignty function, regardless of technological developments.

The emerging trend of tokenisation of finance once again raises questions about the assets used to settle transactions in tokenised assets. If central bank money is not available on distributed ledger technologies, private assets would be used to settle such transactions and this potentiality poses a risk of market fragmentation.

Given market participants' needs and the risks for financial stability, the Banque de France – since 2020 – along with the Eurosystem, the Bank for International Settlements and other central banks, are currently exploring ways to settle tokenised asset transactions in central bank money as a means of safeguarding its central role in financial markets.

OMFIF: The blockchain pilot regime gives the market the opportunity to test whether DLT market infrastructure can replace traditional central securities depositories. As yet, it remains untested. Can you give your thoughts on this experiment and the role of CSDs in the market?
EA: To be precise, the European blockchain pilot regime does not give the market the opportunity to replace the role of CSDs. It will not abruptly replace the current infrastructures – including traditional CSDs – which have been meticulously developed and already provide state-of-the-art services for most use cases in payments and securities settlement.

CSDs remain essential to the functioning of market infrastructures and to financial stability. They ensure the security and efficiency of securities transactions and by centralising the custody of securities, CSDs provide a safer and more reliable system. They streamline the settlement process by automating the transfer of securities and payments and enhance market liquidity and transparency by facilitating quick and efficient transfers between participants and centralising information on securities ownership.

However, we need to plan ahead and ensure that our infrastructures are not only up to date but futureproof. The pilot regime extends the pioneering experimental approach taken by the Banque de France since 2020 on wholesale central bank digital currency. Its aim is to enable innovations made possible by tokenisation within a simplified regulatory framework and to take advantage of the benefits of tokenised finance while controlling its risks. It authorises the issuance, registration, transfer and storage of tokenised instruments, and guarantees financial stability.

'WE NEED TO PLAN AHEAD AND ENSURE THAT OUR INFRASTRUCTURES ARE NOT ONLY UP TO DATE BUT FUTUREPROOF.'

Emmanuelle Assouan, director general, financial stability and operations at Banque de France

‘AS PUBLIC AUTHORITIES, WE HAVE A REGULATORY ROLE, BUT WE ARE ALSO AN ACTIVE PARTICIPANT IN THIS INNOVATIVE ECOSYSTEM.’

OMFIF: Many institutions are setting up their own DLT platforms for the use of their clients. What do you think the journey to DLT becoming a widespread market utility looks like?
EA: This momentum reflects the potential of DLT. The technology can improve transparency, ease data reconciliation and reduce costs and inefficiencies thanks to smart contracts’ ability to optimise processing and function on a 24/7/365 basis. This could significantly shorten transaction time specifically for cross-border transactions over different time zones.

In the case of DLT becoming a widespread market utility where many institutions would create their own, uncoordinated DLT platforms, the main risk would be that of market fragmentation that entails a risk for financial stability.

Regarding the settlement asset, safeguarding the anchoring role of central bank money on financial markets is crucial for financial stability. In this context, the BIS Innovation Hub and central banks, starting with the Banque de France, have launched experimentation programmes that explore the possibilities offered by the settlement of tokenised financial assets in central bank money.

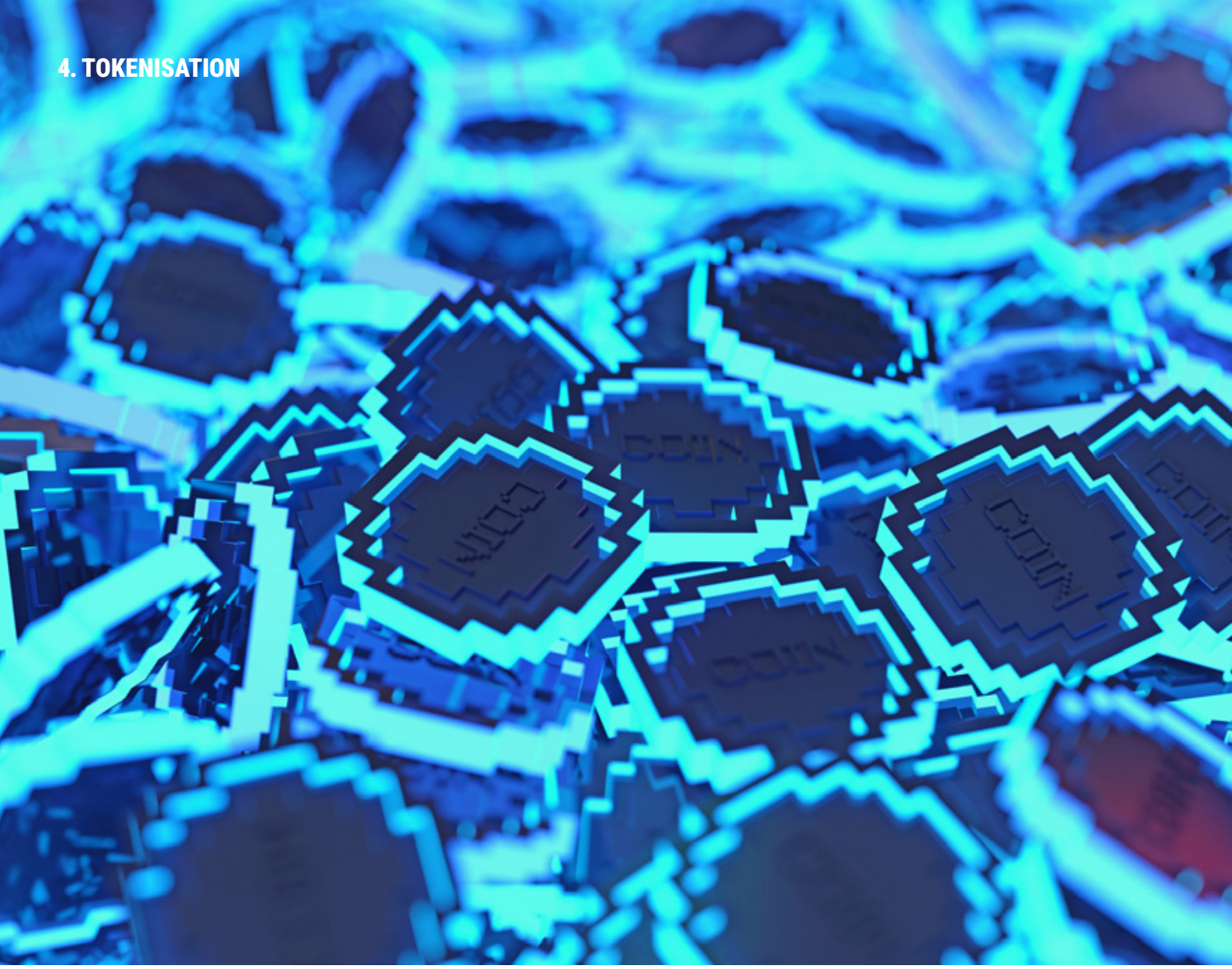
OMFIF: What is your perspective on the different blockchain architectures (private, permissioned, public…)?
EA: Regarding the adoption of a specific technology, it is currently not feasible to make a definitive recommendation. Experiments conducted by the Banque de France have involved testing various types of DLTs, including private or public, permissioned or permissionless blockchain.

However, further research is required to conduct a comprehensive comparative analysis, particularly in terms of security, which is a crucial criterion for public policy decisions, and heavily dependent on the technology employed. Other criteria play significant roles in assessing the models’ effectiveness and efficiency, such as contribution to, and effectiveness in, preserving the two tier monetary system as well as considerations related to other settlement assets, scalability, programmability, fragmentation and cross-currency capability.

OMFIF: What do you feel the central bank's role should be in shaping the trajectory of capital markets development?
EA: As public authorities, we have a regulatory role, but we are also an active participant in this innovative ecosystem. The BIS Innovation Hub and central banks have a growing interest in the concept of unified ledgers, a new kind of financial market infrastructure, which could combine tokenised central bank money, tokenised commercial bank money and also potential tokenised financial assets on a common seamless programmable platform. This is Project Agorá’s aim, a public-private partnership coordinated by the BIS Innovation Hub (which focus is on the first two).

Our participation in this project as the representative of the Eurosystem is of particular interest for the enhancement and development of the Capital Markets Union with the potential creation of a European unified ledger. It would be an infrastructure operated by European governance standards, on which tokenised financial instruments and tokenised settlement assets including CBDC, currently being explored by the Eurosystem, would coexist.

A European unified ledger could contribute to deepening the CMU and have a catalyst effect of improving the efficiency of post-trade in Europe through increased interoperability for market participants. It has the potential to encourage the development of products issued directly on DLT, such as securities for innovative companies and green bonds, thus facilitating the allocation of European household savings to finance the green and digital transitions.



TURNING TO TOKENS

While challenges are being overcome and infrastructure is starting to emerge, we are some way off a fully tokenised financial system.

KEY FINDINGS

1. Tokenisation is coming but not yet, and it will arrive for different asset classes at different times, depending on market forces. Most survey respondents expect it to arrive over the next 5-10 years.

2. Demand is a more important determiner than supply. Tokenising a new asset class might be feasible, but unless there is a community wanting to trade in that format, it will not succeed.

3. Infrastructure for tokenised ecosystems is emerging, and technical challenges are being overcome, but regulators need to set standards for mass adoption of distributed ledger technology for systemically important asset classes.

‘92% OF SURVEY RESPONDENTS THINK TOKENISATION IS STILL MORE THAN TWO YEARS AWAY.’

A GREAT deal of work has already been done on the tokenisation of the bond market, but bonds are by no means the only asset class where tokenisation is contemplated. Agustín Carstens, general manager of the Bank for International Settlements, and Nandan Nilekani, co-founder and chairman of the board at Infosys, articulated a vision of financial markets powered by a network of shared ledgers, where multiple financial assets – including fiat currencies – are tokenised and brought together in a single venue. Such a system would ‘vastly reduce the need for lengthy messaging and clearing processes, thereby delivering more efficient and reliable services for users,’ they said in ‘Finternet: the financial system for the future’.

OMFIF’s digital assets and market infrastructure survey found that the overwhelming majority of market participants do expect tokenisation to happen, but that it is not yet imminent. Its arrival was predicted to come in the next 3-5 years and 5-10 years by 40% and 52% of survey respondents, respectively (Figure 4.1).

Delivering on this vision will be a task of enormous complexity. Tokenisation offers a technical means of representing ownership of any asset on a shared ledger. In relatively small scales, this is already happening. An institution need simply take custody of an asset or security, then immobilise it and issue tokens representing its ownership. In August 2024, Ripple partnered with Archax to launch an exchange and matching engine, enabling 24/7 trading of tokens representing a mix of funds, securities and other assets.

With scale and a broader range of assets and participants, the task of harmonising the overlapping legal frameworks and developing a robust model for governance to bring a broad array of assets together in a single platform is daunting. Even leaving aside the technical challenge of ensuring that a venue of such systemic importance would be operationally resilient and secure from cyber-attack, the challenge is immense.

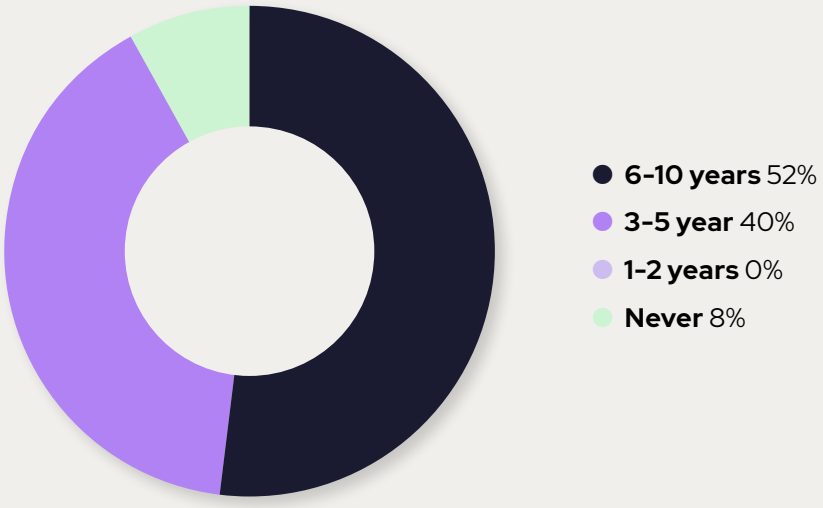
Market participants agree that we are not on the road to a single ‘Finternet’ infrastructure with one master blockchain. The complexities and the concentration of risks would be too severe. But the efficiency savings of token infrastructure are broadly appreciated and can be realised via incremental progress. Each asset class will implement token-based systems separately, when market forces determine that it is appropriate, and only when each infrastructural component that the market requires has been deployed and given regulatory approval.

Where will tokenisation provide value?

The Bank for International Settlements has created what it calls the tokenisation continuum, mapping what makes an asset class suitable for being

Figure 4.1. Tokenisation is coming, but it won’t be here soon

What timeframe will financial markets experience a substantial degree of tokenisation within? Share of respondents, %



Source: Digital assets and market infrastructure survey 2024

'The challenge of drawing a regulatory perimeter around a public blockchain is undeniable, but the qualities of its reach and scale might end up making it the most appropriate foundation.'

overhauled with token infrastructure (Figure 4.2).

In OMFIF's digital assets survey, respondents' beliefs about the likelihood of which asset classes are most likely to be tokenised largely follow the BIS's principles. High flow, effectively digitalised asset classes like equity markets will present fewer challenges to tokenisation, with respondents choosing bonds, commodities and public stock as the asset classes most likely to be tokenised (Figure 4.3). Private assets, which have no secondary market trading infrastructure, will prove much more challenging.

It is worth considering that developing a trading infrastructure for private credit and equity might yield a great deal of value. With fewer and fewer companies electing to go public, the proportion funded via private markets is growing, and demand for ownership of these assets is growing too. While pension funds and other investors can get exposure to private asset classes via investments in private equity firms, a trading infrastructure rendering such instruments as liquid, tradeable assets would be immensely valuable.

Nadine Chakar, global head of DTCC Digital Assets, said: 'In particular, we see opportunities for the industry to automate areas that are inefficient in typically non-standard instruments. For example, DLT could provide unique value to the private markets (private equity, private credit) by fostering more transparency and increasing efficiency.'

By contrast, tokenising highly liquid asset classes with efficient trading venues will produce relatively small efficiency savings. Given the high volume involved, these might add up to material, decisive savings, but building adoption will be difficult, argued Duncan Trenholme, managing director and global co-head of digital assets, TP ICAP. 'You can tackle the fixed-income market, or the equities market, or the commodities market,' he said. 'It's possible to build an alternative system, but at that point you have to go to major traders and get a critical mass of them to move over, which is going to be difficult.'

'There's no shortage of projects for tokenising various different assets,' he added. 'But the key focus should be on demand, not supply. Just because an asset can be tokenised doesn't mean that there will be people interested in using the tokens.' He advocates a different approach, pointing out that there is a user base with a clear need for tokenised assets: crypto traders.

'They've built their infrastructure around handling tokens, but often, for risk management reasons, they want to hold conventional assets, particularly Treasury instruments,' said Trenhome. 'For that, they need accounts with clearing and settlement systems, which are not necessarily simple or easy to get. Tokenising the instruments that they need means catering to a clear demand.'

The eventual ceiling on tokenisation for this clientele naturally depends on the adoption of blockchain and cryptoassets, since this will determine the proportion of firms that develop their primary trading infrastructure around this technology.

Tokenised funds

Funds with fixed unit prices, like money market funds, are often used as a substitute for cash in deposit accounts by institutional investors. However, typically only cash is acceptable as collateral, meaning these MMF units are not as valuable as they might be. The UK's Investment Association suggests that 'this may be due to the time required to transfer units between parties'.

Creating tokenised versions of MMF units and allowing these to be posted to meet margin requirements not only improves settlement times but also improves efficiency. This is because, previously, MMF holders would have to sell their holdings to raise cash and post collateral. This kind of activity can put selling pressure on MMF issuers, creating volatility. A freely exchangeable tokenised form of collateral allows for much more flexible and frequently adjusted variation margins.

It is possible such instruments could also be used to purchase tokenised securities, like blockchain bonds. But, as discussed in Chapter 2 (Cash settlement), survey respondents indicated they would prefer to interact with wholesale central bank digital currencies.

Beyond the market-based and regulatory complexities of delivering a tokenised ecosystem, there is a variety of technical considerations. It is not yet clear what form the precise nature of the underlying settlement architecture will take, and who

Figure 4.2. What makes an asset class suitable for tokenisation?

BIS highlights the qualities that make an asset class suitable for tokenisation

Source: Bank for International Settlements https://www.bis.org/publ/bisbull72.pdf

owns and operates it will depend on developments and policy decisions over the next few years.

Two considerations are worth discussing here. The first is what the blockchains that provide the settlement infrastructure of a tokenised ecosystem will look like and where they will sit on the spectrum of public, private and permissioned.

Types of blockchain

Most agree that, since such a system will never exist on a single chain, the answer will involve some combination of different protocols with different characteristics that make them suitable for a given asset class.

Public chains offer two main advantages. First, allowing anyone to join the network ensures that they have the broadest reach – a valuable consideration for assets distributed to retail investors, but less important for assets reserved for the institutional community. Second, the greater number of participants contributes to the security of the chain, meaning that it will be difficult for private chains to match the resilience of public infrastructure.

However, there are challenges associated with the use of public chains. Asset classes that are traded with extremely high frequency – such as foreign exchange – might find the settlement times on public chains unsuitably long, although it is possible that technological development might remove this challenge.

A more fundamental challenge is the very openness that defines public blockchains. Using Ethereum as an example, validators receive fees known as 'gas' for processing transactions. Validators are anonymous and almost certainly include criminal elements. It remains to be seen whether regulators will deem the validator relationship to be a counterparty to banks and issuers creating blockchain-based assets that settle on Ethereum.

The challenge of drawing a regulatory perimeter around a public blockchain is undeniable, but the qualities of its reach and scale might end up making it the most appropriate foundation.

Wallet infrastructure

The other component required for the widespread adoption of tokenised finance will be the universal availability of infrastructure with which to hold tokenised assets. Adoption will need to be near-universal in order to avoid compromising the liquidity of an asset. Given there will be no single chain hosting all financial assets, this means that a critical mass of investors will need access to multiple chains.

Blockchain infrastructure was originally intended to give people the opportunity to hold assets directly without intermediaries. While this may still be appealing to some, the majority of institutional market participants is comfortable with the use of intermediaries. This moves the burden of the technical lift of standing up nodes on multiple blockchains from thousands of investors to a much smaller group of custody organisations.

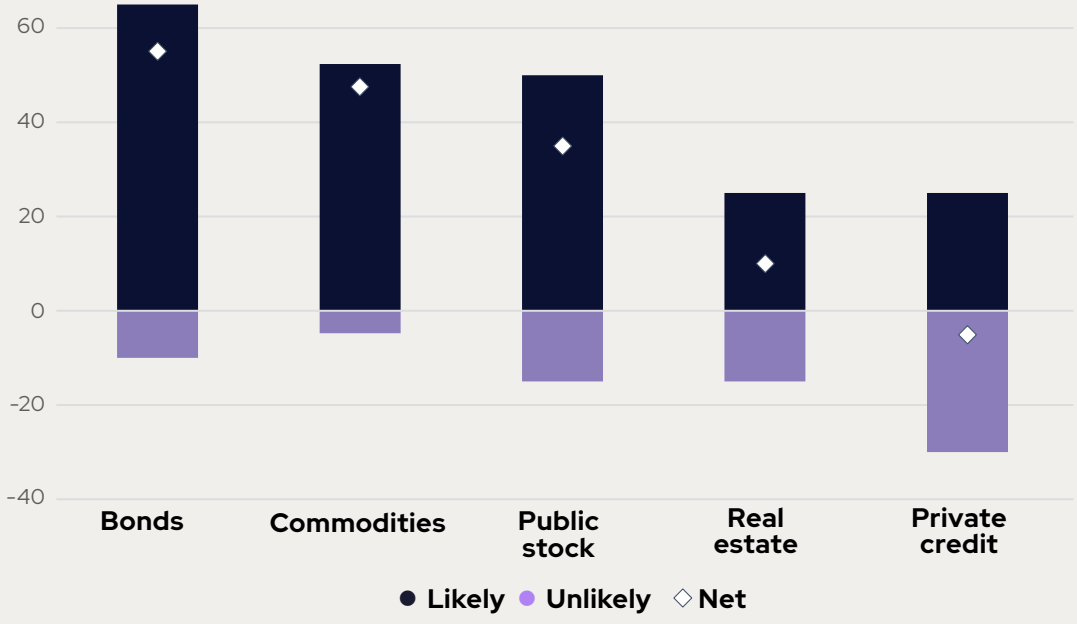
Even in the cryptoasset market, where the phrase 'not your keys, not your crypto' became a popular mantra for the virtues of self-custody as opposed to intermediated custody, intermediaries are still common. Coinbase, the US's largest cryptocurrency exchange, gives its clients intermediated custody.

Regulators will need to mandate and audit strict technical and prudential standards for digital asset custodians and will need to become familiar with security protocols, both from a prudential perspective – hosting a certain proportion of DLT assets in cold storage – and an operational perspective – covering concepts like multi-party computation, air-gapping and more.

'Adoption will need to be near-universal in order to avoid compromising the liquidity of an asset.'

Figure 4.3. Bonds lead, but equities and commodities may follow

Which asset classes are most likely to be tokenised? Share of respondents, %



Source: OMFIF Digital assets and market infrastructure survey 2024

Stellar

THE POWER OF PUBLIC BLOCKCHAINS

Public blockchains represent the next era of public financial infrastructure, write Marcelo Prates (left), policy director, and Alex Wu (right), policy and government relations manager, Stellar Development Foundation.

IF digital payments and financial transactions are the vehicles that help move the modern economy forward, the roads they run on are as important as the vehicles themselves. These roads must offer the stability, security and resilience required for all vehicles to reach their destination smoothly and on time.

National payments systems controlled by public or private actors like T2 in Europe and CHAPS in the UK are traditional examples of such roads. More recently, public blockchains have appeared as a robust alternative for the financial transit of the digital world. And they do so in a decentralised manner, which should be seen not as a drawback but as a desired feature.

Decentralisation, rather than denoting a total absence of control, really means that no single party has control over the network. The development, maintenance and use of a public blockchain are spread across multiple parties and follow internal rules embedded in its protocol that are automatically applied and enforced. No stakeholder can unilaterally change the rules or arbitrarily decide who can build upon or use a public blockchain.

'Decentralisation, rather than denoting a total absence of control, really means that no single party has control over the network.'

Public blockchains don't have an identifiable legal entity behind them. But they're supported by communities of developers working collaboratively to identify and solve problems and contribute to code changes and updates, ensuring timely improvements to the blockchain's protocol. Many decisions about changes and updates are made through discussions among these community members rather than simply relying on the routine execution of digital contracts.

While these arrangements may not follow traditional accountability structures, public blockchains introduce new ways to achieve the safety and vitality that are expected from any financial infrastructure. And public blockchains have built an impressive track record to support that claim.

In almost 15 years of continued operation, the bitcoin network has gone down twice – in 2010 and 2013 for a total of 15 hours. To date, the network has an uptime percentage of 99.99%. Similarly, the Stellar blockchain has faced 67 minutes of total downtime in its 10 years of 24/7 operations. In 2021, Stellar continued to operate as designed even when many of its validator nodes went offline.

Ensuring that market infrastructures operate smoothly can be challenging. European payments system T2 (then TARGET2) suffered a 10-hour outage on 23 October 2020. A 6-hour failure also hit the UK's CHAPS payments system on 14 August 2023. The downtime of payment systems operated by centralised organisations demonstrates that centralisation and traditional legal entities don't guarantee a flawless performance.

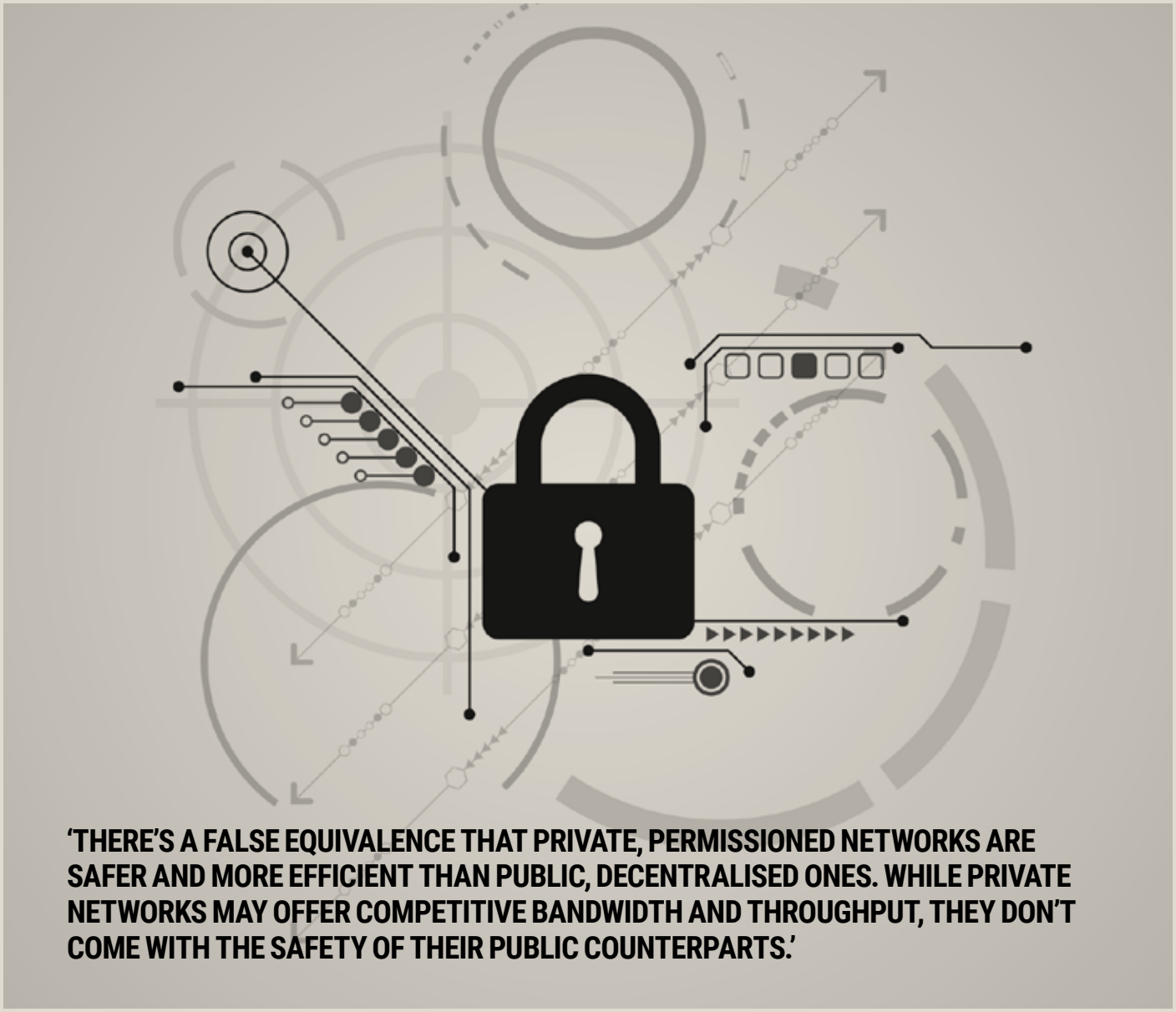
Private versus public blockchains

There's a false equivalence that private, permissioned networks are safer and more efficient than public, decentralised ones. While private networks may offer competitive bandwidth and throughput, they don't come with the safety of their public counterparts. Private blockchains are likely to have fewer developers, nodes and data storage facilities supporting their operations. Private networks therefore have fewer sets of eyes ensuring their safety and resiliency.

Public blockchains, on the other hand, have hundreds if not thousands of parties running full nodes that maintain these networks. Some of them validate and confirm transactions according to the related consensus mechanism – from bitcoin's proof of work, based on the nodes' investment of computational power and energy, to Stellar's proof of agreement, based on the reputation of the entities running validator nodes.

Public blockchains also host a wide array of developers and users who benefit from network improvements. Unlike traditional financial infrastructures or private blockchains, network updates aren't decided unilaterally. Developers and users alike can propose software changes that must be approved by a majority of nodes – only then can a change be implemented and executed.

This governance arrangement allows for a comprehensive risk management of public blockchains, with developers, nodes and validators depending on each other. All the parties benefit from knowing that the network will work according to its programmatic protocol rules and that changes will be implemented only after proper vetting and if incentives are aligned.



‘THERE’S A FALSE EQUIVALENCE THAT PRIVATE, PERMISSIONED NETWORKS ARE SAFER AND MORE EFFICIENT THAN PUBLIC, DECENTRALISED ONES. WHILE PRIVATE NETWORKS MAY OFFER COMPETITIVE BANDWIDTH AND THROUGHPUT, THEY DON’T COME WITH THE SAFETY OF THEIR PUBLIC COUNTERPARTS.’

This process gives public blockchains strong operational resilience as it eliminates single points of failure or attack. As no single party controls the network, no one can disrupt its functioning or shut down operations, either willingly or accidentally. No individual breakdown or outage at the developer, node or validator levels is enough to affect the operation of a public blockchain.

Ensuring control over assets

It’s also important to distinguish between the decentralised nature of public blockchains, the roads upon which digital assets run, and the assets themselves. The assets are generally issued by a centralised entity and can be configured to comply with applicable regulatory requirements. While blockchains may be public, the issuers of assets deployed on many of those blockchains can choose the degree of control they want to have over their assets, especially when they need to comply with existing regulations.

For example, many public blockchains offer optional features that issuers can easily add to new assets, like the possibility of clawing back or freezing tokens. Issuers can choose the degree of control they want or need over each issued asset, from no control at all (for unregulated assets like non-fungible tokens) to more stringent controls (for regulated assets like tokenised securities).

On Stellar, these control features are native to the platform and can be implemented directly without additional programming or smart contracts. In fact, the Stellar network has intuitive ‘asset flags’ that can be used to turn on control features at the time of asset issuance.

Issuers can fully customise and control their assets according to compliance needs and regulatory requirements. And this is all transparent to users, who can view the profile of each asset and decide which ones they are willing to hold or use.

Public blockchains represent the next era of public financial infrastructure, providing an open and neutral platform for everyone to securely interact, innovate and exchange ideas and value online. They are ready to pave the way for the payments and financial vehicles of the 21st century.

OVERHAULING MARKET STRUCTURES

Could distributed ledger technology one day replace central securities depositories, making processes faster and more efficient?

KEY FINDINGS

1. A single master blockchain is implausible, but the proliferation of private platforms may result in market fragmentation. Interoperability solutions can help but may add complexity.

2. Though distributed ledger technology threatens to disrupt their models, central securities depositories might co-opt the technology and leverage their regulated position to establish market standards.

3. Shared infrastructure will be vital to the proliferation of blockchain technology in markets.

‘[CSDs] WILL REMAIN AN IMPORTANT INTERMEDIARY, BUT WITH DIFFERENT OPERATING MODELS.’

A survey respondent

THE TECHNOLOGY known as blockchain is around 15 years old. People have been seriously attempting to apply it to capital markets for perhaps 10 years. But our image of exactly what a capital markets infrastructure powered by distributed ledger technology would look like has changed much during that time.

The original vision of blockchain was that it would enable secure peer-to-peer transfer of value without having to rely on intermediaries or third parties, which have to be trusted and can extract rents. The world of finance, however, is built on trust and regulated intermediaries. Many of them have roles that are deeply entrenched both in regulation and in the operating models of market participants.

Early attempts at tokenisation of debt securities aimed to directly connect borrowers with investors, disintermediating banks. For most market participants, however, banks provide important services: advising on and structuring the deal, as well as locating investors and making markets. More recent efforts have looked at the settlement process – particularly the roles of central securities depositories – and considered whether DLT infrastructure could replace these intermediaries, streamlining the process, making it faster and more efficient.

Regulators, particularly in the UK and Europe, are permitting the market to conduct experiments within their sandbox and pilot regimes. It is hoped that this will demonstrate the extent to which DLT can substitute the institutional role of financial market infrastructure components like CSDs.

The development trajectory of blockchain

One early vision of how blockchain-powered capital markets would operate was that they would be built on a single ‘master’ chain. All assets and forms of money would be tokenised on one chain, on which every participant would be represented directly, allowing them to freely and securely exchange them with ease.

Nothing of the sort is emerging. Instead, individual institutions are standing up blockchains for their own use and for that of their customers. This is understandable. It is much easier to stand up a protocol for internal use than to create a widely adopted market utility.

In some cases, such networks have already begun generating value. HQLAX is a start-up that uses DLT to improve the efficiency of collateral management, creating impressive savings for banks and asset managers that are active in repurchase markets. Individual platforms like these can begin to deliver valuable innovations and change how the business of capital markets is conducted, but they are unlikely to lead to the large-scale transformative revolution in capital markets infrastructure that DLT promised.

The present model – where each institution establishes its own platform with its own private chain and its own standards for smart contracts – may, if improperly designed, replicate siloes. If customers are obliged to open wallets on each chain in order to interact with the security tokens it hosts. This can lead to a a fragmentation of liquidity. Perhaps even more challenging than the simple exchange of assets between chains is the governance and oversight of smart contracts. Integrating smart contracts with security tokens is an important step to delivering the promised efficiency savings and streamlining security life cycle events.

At a fundamental level, many blockchain protocols use different languages and execution environments for smart contracts so, for interoperability between chains to be achieved, standards must be set. Even beyond standardising the language, it is important to have a robust mechanism for checking the integrity of smart contracts. Smart contracts, like interoperability bridges, have often been the source of security vulnerabilities that have resulted in the theft or loss of tokens.

Making both assets and smart contracts interoperable between chains is a complex challenge. Interoperability bridges and cross-chain solutions of the sort that Swift is pioneering can lead to solutions that allow assets to be exchanged onto new chains and access new investors. Early examples, pioneered in the cryptoassets market, have often proved vulnerable to cyberattack and resulted in the loss of assets. However, this might prove to have been a teething trouble and, with refinement, the technology may demonstrate its reliability.

Some see interoperability solutions as added frictions, re-adding layers of complexity to address fragmentation that the implementation of DLT was meant to remove. While a single master blockchain is not a viable goal, sharing infrastructure between different market participants will be vital to the widespread adoption of DLT systems.

‘A number of platforms are emerging,’ said Philippe van Hecke, head of product management,

'What we need is some form of consolidation or "co-opetition" between the platforms: a basic layer of shared technical infrastructure to reduce the number of chains that need to be interconnected.'

Philippe van Hecke, head of product management, Luxembourg Stock Exchange

Luxembourg Stock Exchange. 'Often, these have their own operating model, their own chains, their own smart contract rules and audits, and customers need to open a wallet in their infrastructure to hold tokens they host. What we need is some form of consolidation or "co-opetition" between the platforms: a basic layer of shared technical infrastructure to reduce the number of chains that need to be interconnected. Connecting every individual platform's private chain will add complexity and reduce efficiency.'

A basic layer of technical infrastructure – a chain on which multiple assets are issued and a protocol determining smart contract standards – will improve efficiency in market operations without compromising competition. In the same way that banks are able to compete for business while sharing the infrastructure provided by Euroclear and Clearstream, platforms would still be able to compete while sharing DLT infrastructure.

This consolidation will not be universal. Several chains, rather than a single master, are likely to persist. It is not yet clear on what basis the consolidation might occur. We might see a number of major institutions adopting a shared infrastructure for all their transactions. This could be based on matching preference for technical features of a given protocol, business alignment geographical proximity. We might also see an asset class adopt a single protocol, bringing all the market participants onto the shared infrastructure.

Do CSDs have a future?

The European Union's DLT pilot regime and the UK's Digital Securities Sandbox are initiatives that aim to test whether DLT infrastructure can effectively replace traditional CSDs. DLT infrastructure proponents promise near real-time settlement, reducing counterparty risk and improving transparency and traceability.

OMFIF's Digital assets and market infrastructure survey asked market participants how they anticipate tokenisation would change the role of market participants, particularly CSDs. Responses included: 'It will reduce their importance and monopoly' and 'Blockchain will allow for bypassing these market participants. We expect pressure on these business models for widely distributed, retail-focused financial instruments.'

Others, however, felt that CSDs would adapt, saying: 'Tokenisation will transform the roles of CSDs. CSDs will oversee the issuance and registration of tokenised securities, integrating blockchain technology to manage token life cycle events and shift from maintaining centralised ledgers to interfacing with decentralised ledgers to ensure accurate and up-to-date ownership records.' Another said: 'They will remain an important intermediary, but with different operating models.'

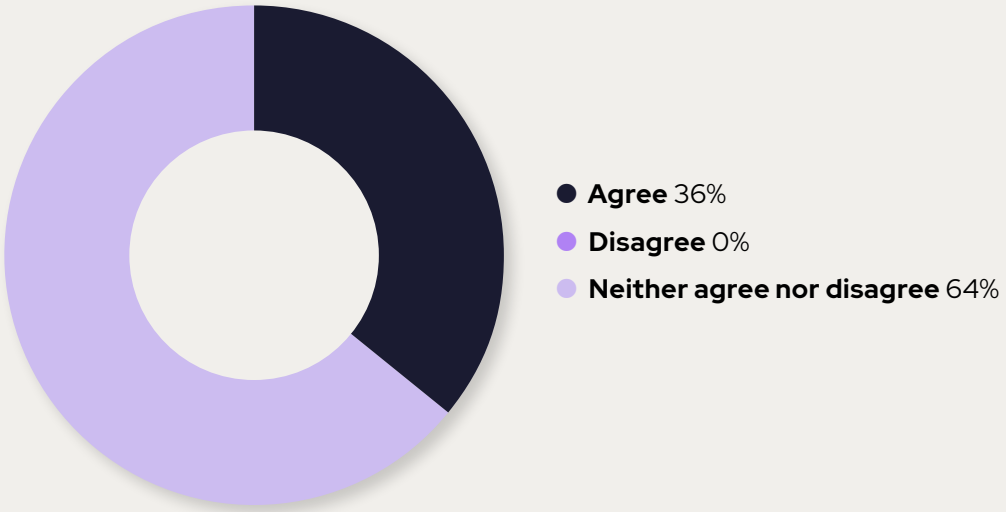
Figure X.1 shows that, while many remain unsure, a net 36% of survey respondents believe that the sandbox and pilot regime will show that DLT can perform the functions of a CSD.

The EU's DLT pilot regime, operational since March 2023, introduced the concept of DLT market infrastructures. These can function as DLT trading and settlement systems or DLT settlement systems. DLT TSS combine the functions of multilateral trading facilities and securities settlement systems, while DLT SS focus solely on settlement operations. The UK's Digital Securities Sandbox is expected to launch in autumn 2024.

A crucial aspect of both programmes is that they disapply certain requirements for CSD registration,

Figure 5.1. DLT is capable of performing the functions of a CSD

Will initiatives like the digital securities sandbox and blockchain pilot regime show that DLT can perform the functions of a CSD? Share of respondents, %



Source: OMFIF Digital assets and market infrastructure survey 2024

allowing for more flexible testing of DLT-based alternatives. By doing this, the programmes directly challenge the traditional role of CSDs by allowing for integrated or standalone DLT-based settlement solutions.

As yet, no institutions have registered as SS or TSS under the DLT pilot regime. The construction of the regime may be to blame here, rather than a lack of interest in the promise of the technology. The total market value of DLT transferrable securities recorded by a DLT MI must not exceed €6bn. This, combined with the fact that the regime is scheduled to end on 23 March 2026, has discouraged many potential entrants. This lessens the value of the regime as an experiment in determining the value of traditional CSD intermediaries.

Many institutions have said that they are ready to collaborate with DLT MIs, should they emerge. 'We have confirmed with our regulator that securities issued via duly licenced DLT MIs (typically (I)CSDs under CSDR or SS/TSS under the DLT pilot regime) could be listed on our current multilateral trading facility,' said van Hecke, LuxSE. 'Of course, we would need to do our due diligence on the entity running it but, in principle, the form factor would not prevent us listing such a security.'

Amélie Frémy, innovation chief operating officer for global markets at BNP Paribas, agreed: 'We are open to the possibility of making use of the EU blockchain pilot regime, but at present there are no registered or licenced trading or settlement systems. Until those licences are granted, we can't experiment in that area, but it's something we're interested in exploring.'

It is important to ask the question: do we want to disintermediate CSDs? CSDs have operated for many years within well-established legal frameworks. Changing these might introduce instability. The present arrangement gives CSDs responsibility for providing regulatory certainty, compliance reporting, asset servicing, default management procedures and well-established links to corresponding institutions in other jurisdictions. They protect investors via segregated accounts, maintain strict confidentiality and are effectively integrated with the systems of a critical mass of market participants. Their throughput is also enormous. DTCC handled transactions worth over $3 quadrillion in 2023.

Replacing these qualities with DLT MIs may prove challenging. For one market participant to ensure market-wide interoperability or attract a critical mass of participants to the market will be enormously difficult. Building up gradually is not necessarily an option, since any security issued to a smaller community will be less liquid and may therefore trade cheaper than an equivalent security issued in the conventional ecosystem.

'The future is not a binary choice between the replacement of CSDs by DLT infrastructure and the continuation of the status quo. CSDs are also working hard on the adoption of the technology some think will disintermediate them.'

Co-opting the disruptor

The future is not a binary choice between the replacement of CSDs by DLT infrastructure and the continuation of the status quo. CSDs are also working hard on the adoption of the technology some think will disintermediate them.

'When it comes to listed securities, CSDs and/or ICSDs need to be involved,' said van Hecke, LuxSE. 'Their basic role is likely to remain the same (preserving the integrity of the issue and providing settlement services), but they might achieve it differently, not necessarily by providing and controlling the entire infrastructure, but by controlling the smart contracts of the securities and guaranteeing their integrity. Other parties involved in the administration of the security, like paying agents, can be part of the network, paying investors directly on the blockchain into wallets provided by their custodians.'

The clearest example of this is the Digital Financial Market Infrastructure project at Euroclear. The platform was inaugurated in October 2023 with a €100m World Bank blockchain bond or 'digitally native note'.

D-FMI is a DLT environment hosted by Euroclear. Investors create wallets on the platform, in which they can hold DNN securities. It is unlike some other visions of DLT market infrastructure in that the security tokens are mobilised in the Euroclear wallet, but the distribution of the assets is done in the core system using traditional accounts. This makes it conveniently easy to adopt but does not offer the same level of flexibility as a market infrastructure in which investors or their custodians directly hold security tokens.

Because of their central position as a market utility, CSDs have the opportunity to shape the trajectory of market developments. They can make use of DLT to deliver the sorts of innovations promised by those looking to disrupt their business models, within the mainstream regulated perimeter, without relying on a sandbox or temporary pilot regime with caps and limitations.

CSD DLT infrastructure projects have another advantage. For many DLT infrastructure providers, the challenge will be to ensure that a critical mass of market participants adopt the platform and have the capacity to trade assets issued on it. Without this, the liquidity and the value of assets on the platform will be compromised. CSDs already have all the relevant market participants onboarded within their systems and have enabled clients to trade digital assets just as they would trade conventional ones.

DTCC, Clearstream and Euroclear have laid out the Digital Asset Securities Control Principles – a framework intended to identify risks specific to digital securities and provide measures to mitigate them. It should also provide the basis for standardisation, establishing common ground on which other market players developing platforms and systems can base their efforts in order to enable seamless interoperability.

It is important to note that these control principles entrench the roles of CSDs, which the Digital Securities Sandbox and the blockchain pilot regime are evaluating.

A NETWORK OF NETWORKS

To fully realise the benefits of blockchain innovation, an ecosystem of networks will be required, writes Kate Karimson, chief commercial officer at R3.

WHILE the institutional adoption of blockchain technology has proceeded more slowly than many predicted a decade ago, the market continues to evolve in exciting and unexpected ways.

When we began our journey at R3, we believed that the path to institutional adoption of distributed ledger technology would involve a single, global network. This network would follow the Ethereum model, but would also be specifically designed for regulated financial markets, providing a platform for the issuance and exchange of all types of tokenised assets, enabling faster settlement and the automation of business processes. We believed that such a network would remove the complexity and friction that had developed out of financial markets' reliance on outdated legacy systems.

As we began to work with capital markets participants, solving for their business use cases, our vision for the market changed. We came to understand that a single-network solution would not be able to address the regulatory requirements of global capital markets, nor would it provide the level of sovereignty that central banks, financial service firms and other market participants must demonstrate in order to comply with them.

'With assets and currencies coexisting on multiple different networks, solutions that enable cross-ledger transactions are essential to realising the opportunities of digital finance and the full utility of this technology.'

We now firmly believe that, rather than a single network or unified ledger solution, the digital markets of the future will require a heterogeneous ecosystem, or a 'network of networks'. Competition and collaboration have always been key to building more efficient markets, and we believe these two forces will continue to drive innovation in this space.

No one-size-fits-all model

Discussions surrounding public versus private and open versus permissioned networks, while important, have acted as somewhat of a red herring in the industry. The question is not so much which model of DLT is best overall for financial markets, but rather which model best addresses the requirements of specific use cases.

We see many potential uses and benefits of public permissionless networks in financial markets, such as in the distribution of tokenised funds and other assets, but they also have limitations. This is because they are, by their very nature, both transparent and censorship-resistant. Anyone with an internet connection is theoretically able to connect to and transact on them, typically pseudonymously. While this poses a challenge to institutions that must comply with know your customer and anti-money laundering requirements, there have been successful use cases, such as ABN AMRO's use of a permissionless network to issue tokenised corporate bonds.

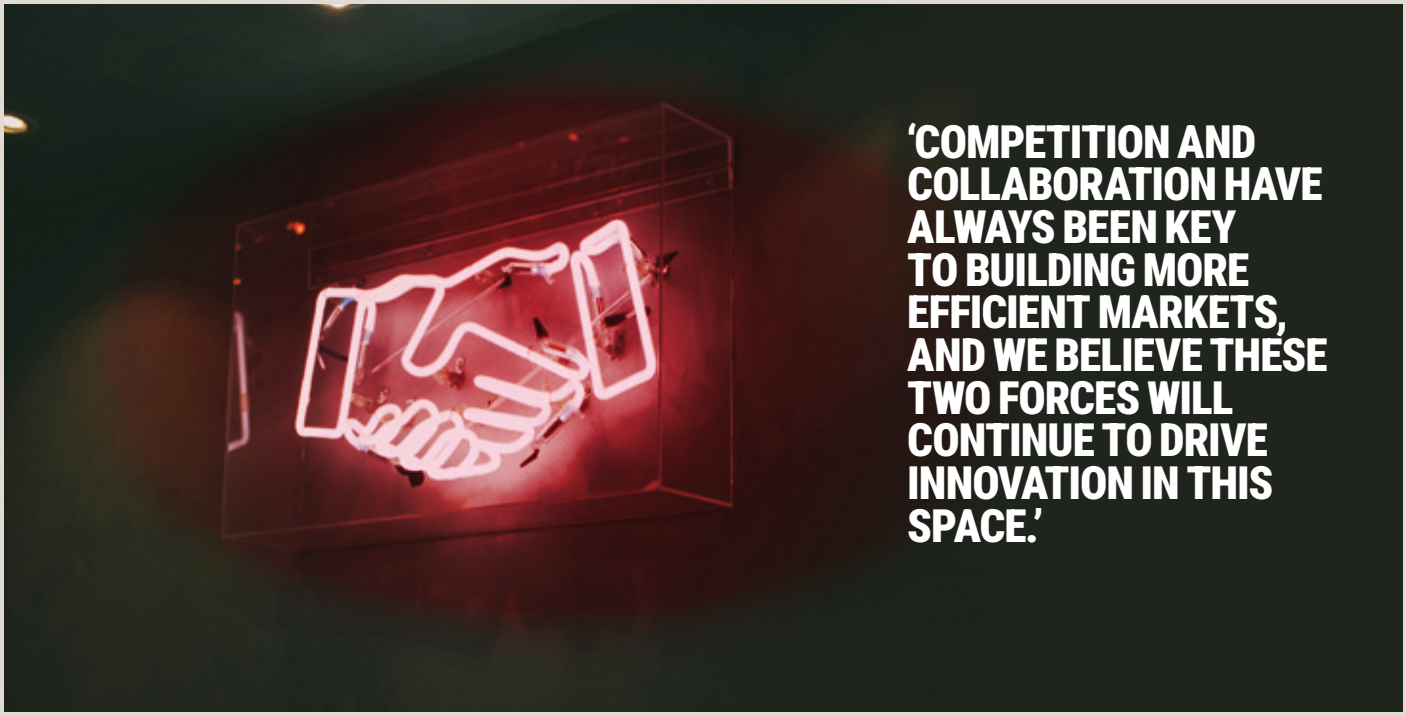
In contrast, permissioned ledgers – whether public or private – are managed by designated entities, providing a level of control over who can access them and what requirements they must meet. What these networks give up in decentralisation, they make up for in enhanced privacy, scalability and data control. Our substantial experience serving regulated financial market participants has taught us that most firms want a significant degree of control over their technology stack, including over who can access the network and which data are available to which participants. While providing this level of control typically requires a permissioned model, that does not mean that is all the ecosystem has room for. This is where the crucial topic of interoperability arises.

Interoperability

Take for example a regulated financial institution that wants to build a solution for a tokenised money market fund. This firm may find that, while a permissioned network is necessary for regulatory compliance, its clients would like to be able to purchase shares using a digital currency issued on a public blockchain, such as a stablecoin. As such, their permissioned network must be able to transact with the public blockchains that house clients' digital currencies. This is not only necessary to prevent the siloing of assets, but also to bolster liquidity on these new platforms.

Similarly, because these DLT networks will coexist and be used alongside traditional infrastructure for some time yet, emerging DLT infrastructure will need to interoperate with firms' existing non-DLT systems and current books and records applications. As such, R3's interoperability effort is focused on ensuring that our networks can interoperate with whichever networks our clients require.

Our work with SIX Digital Exchange has illustrated the versatility of DLT and the successful coexistence of permissionless and permissioned networks. SDX is the world's first fully regulated



‘COMPETITION AND COLLABORATION HAVE ALWAYS BEEN KEY TO BUILDING MORE EFFICIENT MARKETS, AND WE BELIEVE THESE TWO FORCES WILL CONTINUE TO DRIVE INNOVATION IN THIS SPACE.’

digital exchange and central securities depository, enabling traders, broker-dealers, custodian and other banks to access digital assets. SDX’s CSD provides secure custody and eliminates the need for institutions to manage their private keys for ledger-based securities. These digital assets can be custodied alongside traditional assets, such as listed shares, exchange-traded funds and structured products, allowing investors to use their existing bank security deposit accounts. Additionally, issuers can benefit by attracting investors who do not wish to maintain public blockchain custody solutions for their private securities.

In January 2023, SDX released the first native digital bond by the city of Lugano, Switzerland to be admitted in the central bank's eligible collateral basket. In partnership with Aktionariat, they went on to demonstrate that shares issued on the Ethereum blockchain could be transformed from public ledger-based securities into intermediated, bankable securities on a regulated, permissioned platform. Collaborations like this underscore the pivotal role blockchain interoperability plays in setting a new standard for innovation in regulated markets, by facilitating custody and improving the transferability of digital securities for private company investors.

In another great example of the value of interoperability, June 2024 saw the completion of the first end-to-end test of a cross-chain repurchase trade settlement by Fnality and HQLAX. The two parties completed a fully automated, successful atomic settlement via smart contract across the Ethereum-based Fnality Payment System and the Corda-based HQLAX Digital Collateral Registry.

These use cases illustrate that the blockchains firms choose to invest in and build on now do not need to be treated as risky bets on the type of network that will win out in the long run. Market participants should choose the right tool for their problem today, and the providers of DLT technology should remain committed to developing interoperability solutions that preserve the ability of these networks to connect to and interact with one another in the future.

The path forward

When DLT first emerged as a solution for financial market infrastructure, there was a fear that this model would disintermediate incumbent FMIs. Instead, incumbents like SIX Group, and the many Tier 1institutions that have supported R3 throughout our journey, have become pioneers in this space. Rather than disintermediating FMIs, DLT has become a tool through which they are improving their own operations and capabilities in order to meet the needs of an evolving market and better serve their clients now and in the future.

Encouraging more participants to join industry initiatives will be crucial to realising the full utility of this technology and to accelerating industry adoption. While greater regulatory clarity will be needed before traditional institutions are fully comfortable integrating DLT systems into their everyday workflows, collaborations between industry groups and regulators are underway globally.

R3 believes that a heterogeneous DLT landscape is the future of digital capital markets. Achieving this vision will require interoperability between an ecosystem of diverse DLTs that have a range of characteristics, applications and participants. With assets and currencies coexisting on multiple different networks, solutions that enable cross-ledger transactions are essential to realising the opportunities of digital finance and the full utility of this technology.

OMFIF DIGITAL MONEY SUMMIT 2025

THE NEXT CHAPTER IN PAYMENTS AND DIGITAL ASSETS

This exclusive in-person summit delves into critical issues surrounding central bank digital currencies, stablecoins and tokenised deposits, global crypto asset regulation, innovation in capital markets and the future of cross-border payments.

The event will convene a global audience of approximately 200+ in-person representatives, including central bankers, regulators, technologists, banks and digital currency specialists.

Through keynotes, panel discussions, presentations and roundtables, we explore how the roles of the public and private sector are adapting to the new payments landscape and how they can collaborate on practical solutions to foster an inclusive, secure and regulated digital transition.

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Shape the agenda
Shape the agenda on CBDCs, digital assets, cross-border payments, AI and other emerging technologies.

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Showcase your leadership and expertise in conversations with influential leaders.

Executive connections
Network with industry peers, partners and influential stakeholders.

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Grow your brand and reputation, aligning your firm with finance's most authoritative leaders.

AUDIENCE

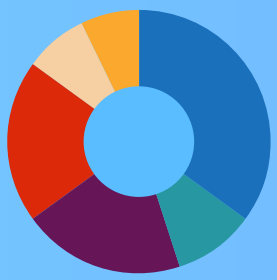
The Digital money summit convenes key players across banking, finance and technology – an influential audience eager for insights to accelerate innovation.

Dominant attendees include decision-makers from pioneering central banks leading monetary policy and C-suite strategists from top commercial banks seeking opportunities in digital disruption. We'll also connect with fintech pioneers, policy-makers charting regulatory evolution, investors spotting early signals and professional services shaping the foundations of the digital economy.

This convergence of financial leaders allows a front row view into the commerce and banking future, with a mandate to enable change through bold ideas and action. The summit offers a platform to directly inspire those authoring the next chapter in financial history.

AUDIENCE BREAKDOWN

- 35% **Central banks**
- 10% **Policy-makers, regulators and government officials**
- 20% **Commercial banks**
- 20% **Fintechs**
- 8% **Investors**
- 7% **Professional services**



'I thought it was an exceptionally well-run event, with extremely interesting discussions and networking.'
Leading professional services network

'It was a pleasure taking part in the event. The very rich panel of speakers shared insights about key trends and emerging issues in the digital payments space. It was a wonderful event! I look forward to attending more OMFIF summits in future.'
Bank of Uganda

'Worldline was very pleased to be able to participate in such a great event. Panels were of high quality with very knowledgeable participants demonstrating a will to collaborate all together on such an important topic. The networking moments were very valuable. Thanks!'
Worldline

'The summit provides a tremendous platform and opportunity for everyone to connect, discuss and exchange views and insights regarding the latest development and innovation of digital assets and money. Looking forward to the next one in 2025!'
Hong Kong Monetary Authority

'It was a pleasure to participate and hear the insights from a great set of panellists.'
Swift

'Great event, we had lots of interesting interactions with the CBDC community. Insightful talks and panel discussion. Very well organised with the right mixture of attendants from the public sector and private companies.'
Giesecke+Devrient

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