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CBDcs: IT'S TIME FOR ACTION

**Why central banks should
take the next step**

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TIME FOR THE DECISIVE STEP: A CALL FOR ACTION!



CBDCs can foster a more inclusive, resilient and accessible financial system. By Wolfram Seidemann, chief executive officer of Giesecke+Devrient Currency Technology.

'Retail CBDCs present a promising solution to the major challenges the financial system is currently facing, which have become increasingly apparent with digitalisation'.

THE pace of technical innovation is rapidly advancing, and its impact can be felt by all of us in our daily lives. So much so that we wonder how we ever managed without the internet, smartphones or ChatGPT. I am convinced that in a few years, we will be asking ourselves the same question regarding central bank digital currencies.

There is a simple reason for this: retail CBDCs present a promising solution to the major challenges the financial system is currently facing, which have become increasingly apparent with digitalisation. These challenges include the fact that not everyone has yet been reached by financial inclusion initiatives, which are vital for economic and social development.

Additionally, the shift towards digital payments can lead to public money losing its role as monetary anchor and it has created dependencies on a few private players. Last year we experienced one of the biggest global technology outages and a significant number of natural disasters – events with a substantial impact on the digital economy and the ability to pay digitally.

Today's payment systems are often burdened by costly friction, high fees and insufficient automation. By addressing these challenges, CBDCs with offline capabilities can deliver real value to society by fostering a more inclusive, resilient and accessible financial system that

lays the groundwork for economic and social advancements.

The objective of this report is to provide insights into the state of CBDC development, identify the factors that are impeding the launch of CBDCs, propose solutions to overcome them and highlight the opportunities that could emerge from a rapid yet cautious implementation.

Although the European Central Bank has made strides in the digital euro project, we are still eagerly awaiting a widespread launch of a CBDC.

To ensure continued trust and economic stability, the evolution of public currency is crucial to maintain its relevance in the digital age. CBDCs hold significant potential for advancing the digital economy. By laying the foundation in the form of public infrastructure and issuing an innovative digital token that represents public money, CBDCs enable private sector innovation and serve as the basis for various new products and services. In fact, the success of CBDCs will depend on a thriving ecosystem and close collaboration between the public and private sectors.

At G+D, we take pride in our contribution to this report as it underscores the need for the issuance of a retail CBDC to strengthen central banks' monetary sovereignty and economic growth in the digital age. Let's not wait any longer, but take the decisive step now.

WHY CENTRAL BANKS SHOULD TAKE THE NEXT STEP

Hesitancy over issuing a CBDC could delay important innovations.

Perhaps the most striking element of good news from the survey is that technical challenges are no longer a serious obstacle for the vast majority of central banks.

THE world's central banks are exploring the benefits and costs of issuing retail central bank digital currencies. Although few have gone ahead and issued, progress has nevertheless been made. In this year's report, we shed light on the remaining challenges and benefits that a CBDC can offer. Some of these are part of central banks' strategies and others are less frequently touted but may prove comparably important.

Our survey of central banks indicates that CBDC issuance is getting closer, albeit gradually. The road to issuance is far from smooth, however. Though the majority of central banks still intend to go ahead with their plans, almost a third have been forced to delay their issuance timeline and the proportion of central banks that say they are less inclined to issue than last year has risen to 15% from zero in 2022.

Perhaps the most striking element of good news from the survey is that technical challenges are no longer a serious obstacle for the vast majority of central banks. In previous years, OMFIF's survey revealed that central banks were wrestling with delivering technical features like offline payments, privacy and interoperability with existing payments systems.

This year's survey indicates that central banks are vastly more satisfied with their progress on almost every key technical issue than they were last year. Although offline payments was still selected as the most challenging feature to deliver, the proportion was smaller than last year and satisfaction with progress had climbed substantially, reflecting a number of successful pilots in offline payments.

The exception to the general improvement is on user experience, where a much higher proportion than in previous years rated this as the most challenging feature of a CBDC to design. However, OMFIF believes that this reflects technical progress on the more existential challenges of delivering a CBDC. Without improving satisfaction on major technical topics like privacy and interoperability, it is unlikely that central banks would have advanced to the stage of focusing on designing user experience.

We delve deeper into the rationale underpinning the issuance of CBDCs. The first of these is the most important factor for emerging market central banks: promoting financial inclusion. We discuss the policy mix necessary to promote not just financial inclusion but also financial health. Offline payments are a particularly important consideration since they help to make a CBDC accessible in remote areas without or with only intermittent access to internet connectivity.

Finally, we examine the ways in which the payments system is already undergoing dramatic changes from innovation in the private sector. While this innovation is welcome, for the digital payments world to operate entirely on private forms of money, including new forms from beyond the banking sector, it would compromise the important role of central bank money as monetary anchor.

By developing a CBDC, central banks can maintain their mandate as issuers of sovereign money and provide a secure digital infrastructure on which service providers can innovate and offer new financial products and services.

Key numbers

50%

of developed market central banks are pursuing a CBDC to preserve monetary sovereignty

48%

of respondents expect to issue a CBDC in five years, up from 32% in 2023

31%

said that they have delayed their issuance timeline

20%

report improved satisfaction with offline payments functionality, up from 0% in 2023

27%

identified user experience as the most challenging feature of a CBDC, up from 10% in 2023

Key quotes

‘The important thing is not only the technical feasibility but also the use case and its extent to provide benefits to businesses and individual citizens.’

Wijitleka Marome, London Chief Representative, Bank of Thailand

‘The central bank would not have access to user data. We have no interest in it and would not use it for commercial purposes.’

Alexandra Hachmeister, Director General of the Digital Euro, Deutsche Bundesbank

‘Low adoption as a problem is even more concerning, that is why we’re engaging the market from the beginning to help mature the platform.’

Fabio Araujo, Senior Adviser, Banco Central do Brasil

‘The technology for offline payments has been around since the 1990s, but the challenge was to ensure that the requirement of frequent reconnection and re-syncing was not obstructive.’

Kwame Oppong, Head of Fintech and Innovation, Bank of Ghana

APPETITE FOR CBDC ISSUANCE IS EVOLVING

Many central banks expect to issue a CBDC within the next five years, but some are delaying their timelines.

KEY FINDINGS:

1. Three-quarters of central bank survey respondents expect to issue a CBDC. Where 34% expect to issue one in 3-5 years, 91% have done or will conduct feasibility studies.
2. One-third of central banks have delayed their issuance timelines. This is for a variety of reasons, including economic situations and political will.
3. Financial inclusion and preserving central bank monetary sovereignty are the leading motivations for emerging market central banks (44%) and developed market central banks (50%), respectively.

THE issuance of a central bank digital currency is gradually coming closer to being a reality. OMFIF's 2024 survey of central banks found that the share of respondents that expect to issue a CBDC (72%) has remained relatively steady since 2023 (74%). However, the share of respondents expecting to issue a CBDC within five years or sooner has increased, while those expecting to launch one in six years or more has declined.

In the near term, the difference is modest: the proportion that expects to issue a CBDC within the next 1-2 years has doubled to 12% from 6%. But the proportion expecting to issue in the next 3-5 years has grown to 34% from 26% in 2023 (Figure 1.1). While many central banks are cautious about CBDC issuance, they remain positive on implementing it within five years.

Emerging market respondents expect to issue their CBDCs a little earlier than developed markets. Though a similar proportion expect to issue at some point within the next five years, 19% of emerging market participants expect to issue in the next 1-2 years, while no developed market participants anticipate issuing before 3-5 years (Figure 1.2).

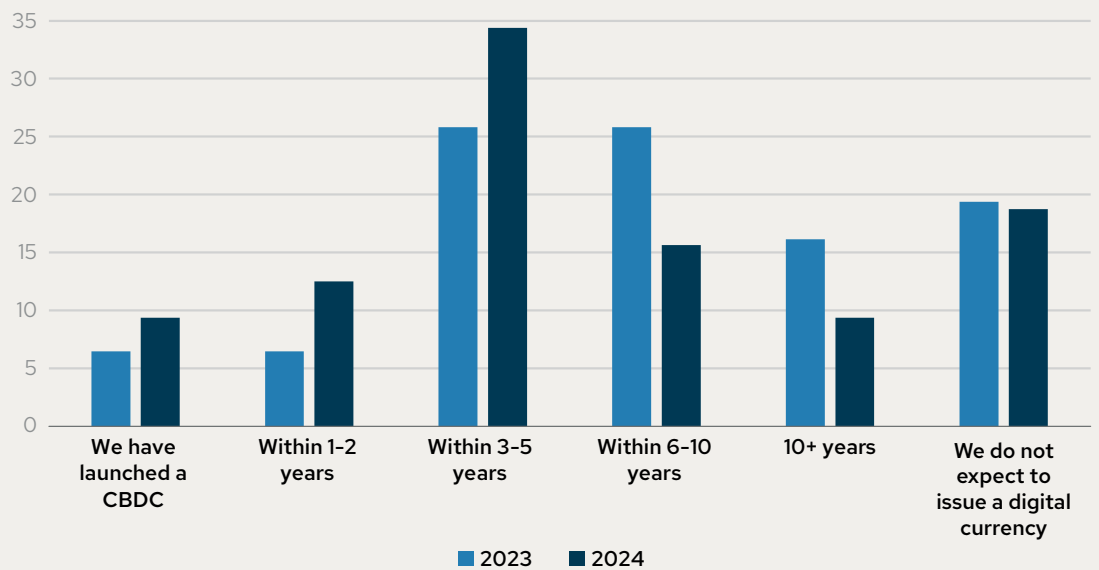
Notably, the share of respondents that do not plan to issue a CBDC has remained the same at 19%. This may imply that most central banks have made their decision on whether they will launch a CBDC.

However, one respondent said that their stance is 'subject to change'. Another said: 'we continue to

The proportion of respondents expecting to issue a CBDC in the next 3-5 years has grown to 34% from 26% in 2023.

1.1. Most central banks expect to issue a CBDC

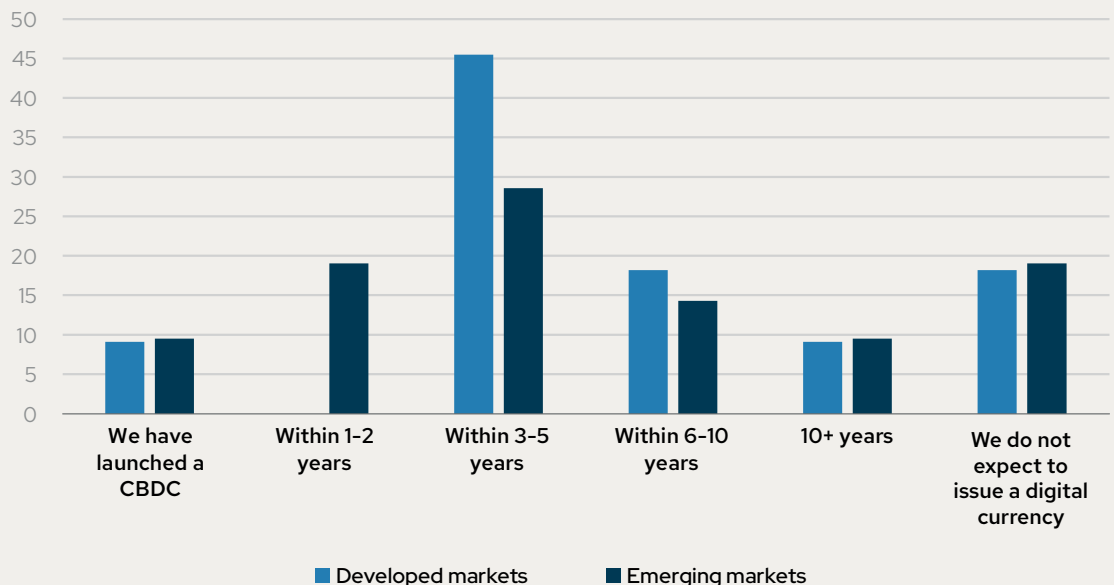
When do you expect to issue a central bank digital currency? Share of respondents, %



Source: OMFIF 2023-24 survey of central banks. Note: Survey question considers retail, wholesale, domestic or cross-border CBDCs.

1.2. Developed market central banks taking a longer view

When do you expect to issue a central bank digital currency? Share of respondents, %



Source: OMFIF 2024 survey of central banks

67%

of central banks have not changed their thinking on CBDCs in the last year.

build our capacity in this area and explore possible use cases for CBDC issuance'. Decisions from major central banks such as the European Central Bank may spur more decisions to issue a CBDC. One respondent explained: 'our position has not changed, but we are attentive of developments around the digital euro.'

Feasibility studies help central banks decide whether issuing a CBDC would be appropriate for their contexts, what the best use cases could be and how soon the CBDC can launch. Wijitlekha Marome, London chief representative from the Bank of Thailand, explained, 'the important thing is not only the technical feasibility but also the use case and its extent to provide benefits to businesses and individual citizens'.

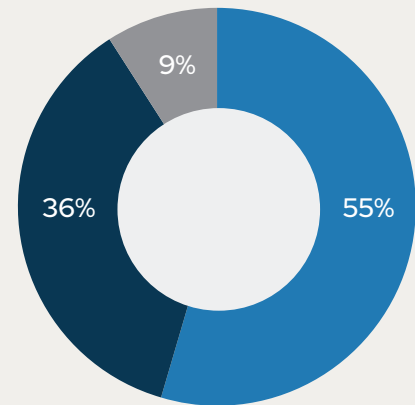
Central banks are working on determining feasibility – 91% of respondents have conducted feasibility studies or intend to (Figure 1.3). These may include user and merchant consultations, focus groups, white papers or technical research.

Are central banks cooling on CBDCs?

Most central banks have maintained their stance on CBDC issuance: 67% of respondents have not changed their thinking on CBDCs in the past year (Figure 1.4). But the share of central banks who are inclined to issue a CBDC has declined steadily – only 18% say they are more inclined to issue a CBDC than the previous year, compared to 38% in 2022. This is mirrored by an increase in those who are less inclined to issue to 15%, up from 0% in 2022.

1.3. Most central banks have done or will conduct feasibility studies

Have you conducted feasibility studies for a CBDC? Share of respondents, %

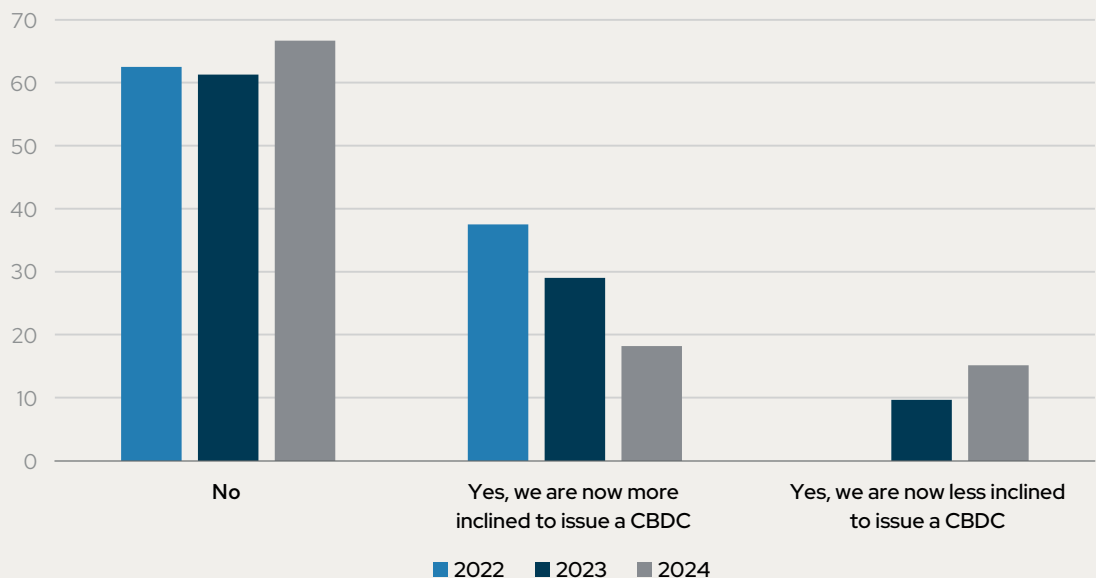


■ Yes
■ No, but we intend to
■ No, and we don't intend to

Source: OMFIF 2024 survey of central banks

1.4. Central banks maintaining their stance on CBDCs

Has your thinking on CBDCs changed in the last year? Share of respondents, %



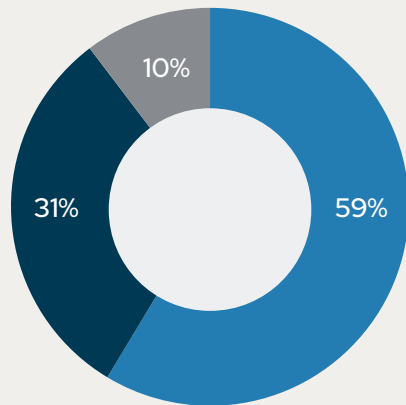
Source: OMFIF 2022-24 survey of central banks

59%

of respondents expect to keep the same issuance timeline, but 31% have delayed it.

1.5. One-third of central banks have delayed issuance timeline

Has your timeline for issuing a CBDC changed in the last two years? Share of respondents, %



- No, we expect to issue on the same timeline
- Yes, we have delayed our issuance timeline
- Yes, we have accelerated our issuance timeline

Source: OMFIF 2024 survey of central banks

One survey respondent announced that they will be reducing their efforts on CBDC research to 'focus on other payment issues', while another explained that, 'we concluded that we need to make more progress in terms of regulations and market developments for payments first'.

Although central banks are gradually advancing with their plans to issue CBDCs, this topic has been on their agenda for several years and very few have so far taken the decision to issue, despite a great deal of exploratory work. There is a clear hesitancy around the subject. When respondents were asked whether they have changed their CBDC issuance timelines, 59% expected to keep the same timeline, but 31% have delayed it (Figure 1.5).

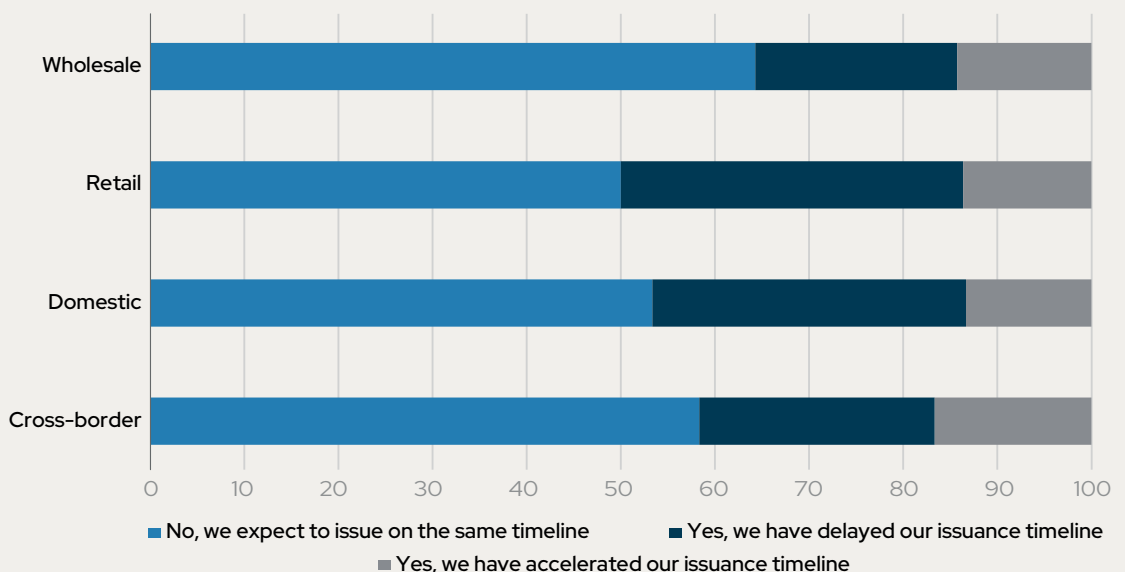
Among the 34% of central banks who anticipate issuing a CBDC within 3-5 years, 45% stated that they are delaying their issuance timeline. Only 25% of respondents who intend to issue a CBDC within 6-10 years have delayed their timeline. When broken down by type, it seems that central banks who are pursuing retail CBDCs are more likely to delay their issuance timelines (Figure 1.6). Some 36% of respondents pursuing a retail CBDC have delayed. By contrast, only 21% of those pursuing wholesale CBDC are delaying their timeline.

Causes for delay

The two notable reasons for central banks delaying their issuance timelines are legislation and exploration of a wider range of solutions. Some respondents have concerns with regulatory and

1.6. Retail CBDC projects are more likely to be delayed

Has your timeline for issuing a CBDC changed in the last two years? Share of respondents, %



Source: OMFIF 2024 survey of central banks

55% of emerging market survey respondents plan to dedicate more internal resources to their CBDC work.

governance frameworks. Establishing legislation is also partially dependent on political will, rather than the central bank’s technical capacity or decision on policy.

Willingness of a government to issue a CBDC may ensure that the central bank can work with legislature to iron out CBDC regulation. Kwame Oppong, head of fintech and innovation at the Bank of Ghana, highlighted the bank’s confidence in addressing the potential technical challenges in issuing a CBDC. He envisions issuance occurring sooner rather than later.

Another reason for delay among respondents is unforeseen economic challenges taking priority over CBDC work. One respondent cited an ‘inflation spike and debt distress’ behind the reason why the central bank has delayed its issuance timeline.

Only one central bank cited technical challenges as a reason for delay, highlighting that this pertained to privacy (see Chapter 2). Privacy is becoming an increasingly contentious issue due to the vast amounts of personal data being collected, stored and analysed.

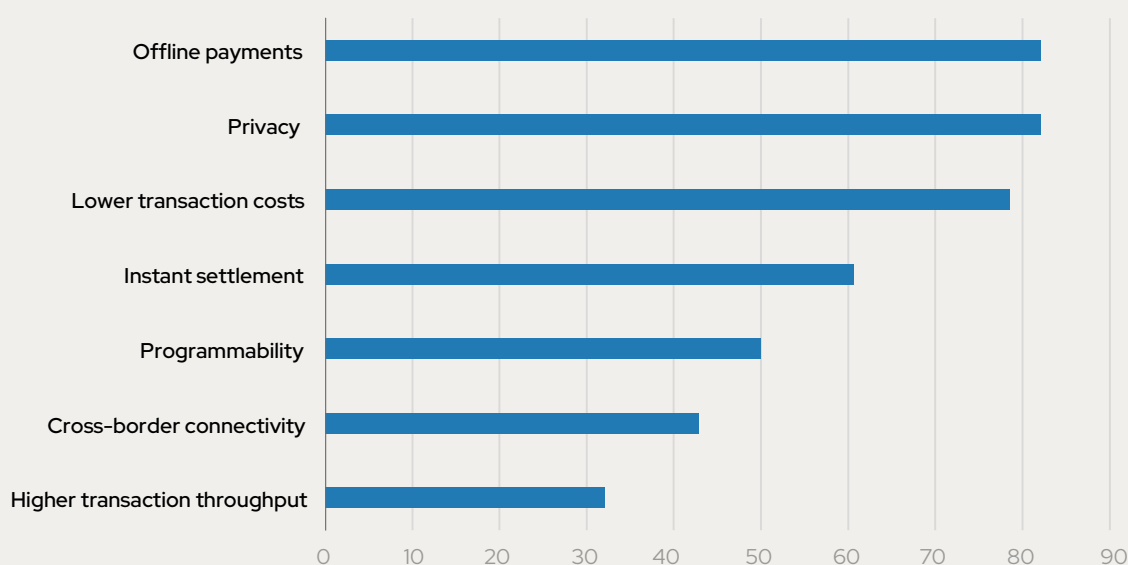
Financial data provide insights into spending patterns, locations, social connections and even political inclinations, which can be highly sensitive. Data collection and monitoring therefore raises concerns about privacy being compromised for purposes such as targeted advertising, credit scoring or surveillance.

Alexandra Hachmeister, director general of the digital euro at Deutsche Bundesbank, emphasised that, ‘the central bank would not have access to user data. We have no interest in it and would not use it for commercial purposes. It’s a two-tier system, where central banks build the rails and the private sector sits on top of it.’ But she recognises that it will be a ‘huge and difficult communication task’ to address public misconceptions around privacy in CBDCs. Central banks will need to effectively address concerns about privacy and communicate to the public how CBDCs can uphold it. According to OMFIF’s survey, 82% of respondents recognise the importance of privacy in CBDCs (Figure 1.7).

Resource allocation for the research and implementation of a CBDC may depend on

1.7. Offline payments and privacy most important features for central banks

What features are most important for your CBDC? Share of respondents, %



Source: OMFIF 2024 survey of central banks



Alexandra Hachmeister, director general of the digital euro at Deutsche Bundesbank, recognises that it will be a **'huge and difficult communication task'** to address public misconceptions around privacy in CBDCs.

external factors that require central banks to divert their resources to more pressing issues, or on the capacity and availability of relevant experts.

Among survey respondents, 55% of emerging market and 50% of developed market respondents plan to dedicate more internal resources to their CBDC work (Figure 1.8). However, 35% of emerging market respondents remain unsure on whether they intend to increase resourcing for CBDC projects. Developed market respondents, on the other hand, seem to have mostly decided how much they intend to put into their CBDC projects.

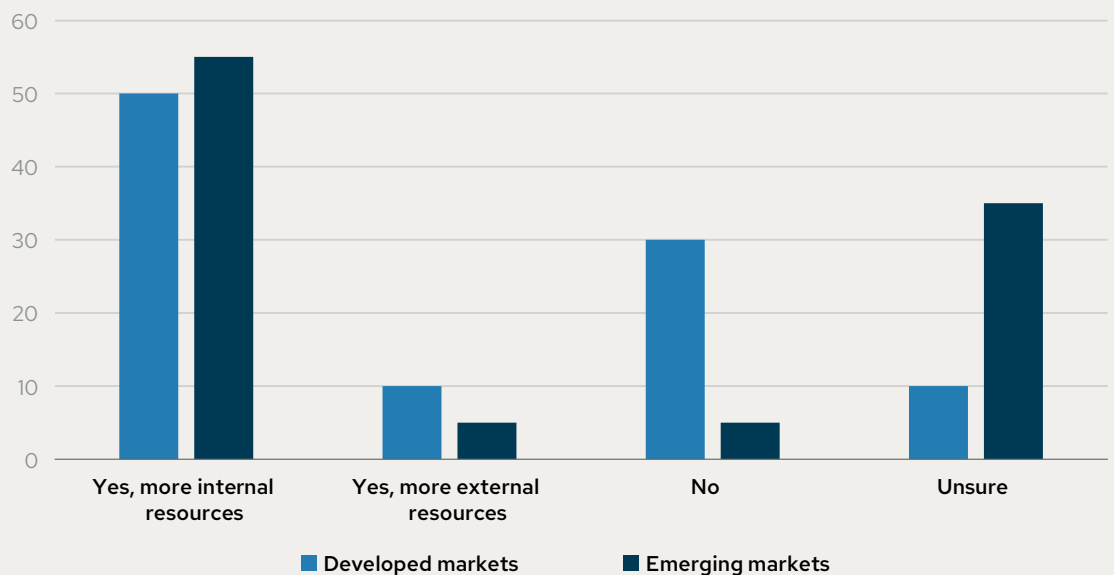
Central bank motivations

Marome from the Bank of Thailand highlighted the importance of deciding on the appropriate use case of a CBDC and its benefits to the ecosystem. The use case is informed by central banks' motivations for issuance. In this year's survey, much like last year's, financial inclusion and preserving central bank monetary sovereignty are the top two motivations for respondents to issue a CBDC.

However, within this group, there is a clear

1.8. More than half of central banks plan to increase internal resourcing

Do you plan to increase the resources dedicated to the exploration and/or implementation of your CBDC project? Share of respondents, %



Source: OMFIF 2024 survey of central banks



One emerging market respondent said they were pursuing a CBDC **'with a focus on the underbanked population'** and to **'democratise access to financial services'**.

difference in motivation between emerging market and developed market respondents (Figure 1.9). While 44% of emerging market participants chose financial inclusion, it was chosen by 0% of developed markets. In contrast, 50% of respondents from developed markets chose preserving central bank monetary sovereignty as opposed to just 17% of emerging markets.

Increasing financial inclusion is a pressing need for emerging market respondents. Many view retail CBDCs as an important tool to address this, particularly when combined with features such as offline payments, which can bring digital payments to citizens in remote areas. One emerging market respondent said they were pursuing a CBDC 'with a focus on the underbanked population' and to 'democratise access to financial services'.

By creating a government-backed, digital form of legal tender accessible through digital devices, central banks can ensure that CBDCs capitalise on the growing availability of digital technology to close the financial access gap. As financial inclusion improves, the focus will start shifting towards financial health. CBDCs have the potential to support this shift by promoting better financial management through programmable payments, automated savings mechanisms and improved transparency.

Preserving monetary sovereignty via CBDCs is more of a priority for developed market

respondents. In an environment where the private sector has dominated the provision of payment services, issuing a CBDC can preserve the central bank's control over the financial system, promote confidence in a nation's currency and reduce reliance on external actors.

The Bundesbank's Hachmeister elaborated on this motivation, explaining that, 'Cash remains the only means of payment that can be used across the euro area'. The digital euro could be a way to address the fragmentation among euro area countries and provide users with a 'safe means of payment' as digitalisation increases.

Alternatively, a CBDC could be a catalyst for further innovation. Andrew Bailey, governor of the Bank of England, explained in a speech the importance of continuing 'to prepare for retail CBDC' to provide payments innovation, particularly if legacy infrastructures and technologies may hinder it. To keep pace with the needs of the users, central banks may need to closely monitor the payments landscape and be prepared to continue innovating in the retail payments space.

Low adoption is a big concern

Low adoption is the leading concern among survey respondents, as it has been for the last two years (Figure 1.10). This year, 56% of emerging market survey participants are concerned about low adoption of CBDCs by users.

56%

of emerging market survey participants are concerned about low adoption of CBDCs by users.

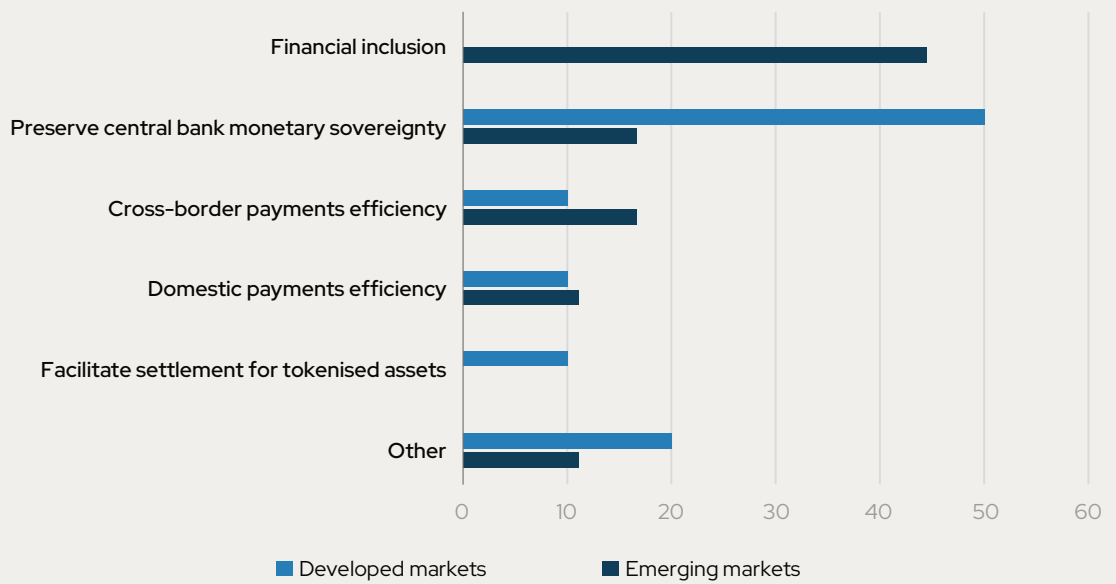
Central banks from emerging markets are working to avoid this. Fabio Araujo, senior adviser at Banco Central do Brasil, stated that ‘low adoption as a problem is even more concerning, that is why we’re engaging the market from the beginning to help mature the platform’. Marome from Bank of Thailand, said, ‘the major part for us is to be

prepared and to understand the adoption and associated risks to our economy’.

Despite concerns from central banks around low adoption, it is clear that many anticipate CBDC issuance to occur sooner rather than later. They seem willing to forge ahead with their plans while carefully addressing their concerns and challenges.

1.9. Split motivations for emerging and developed markets

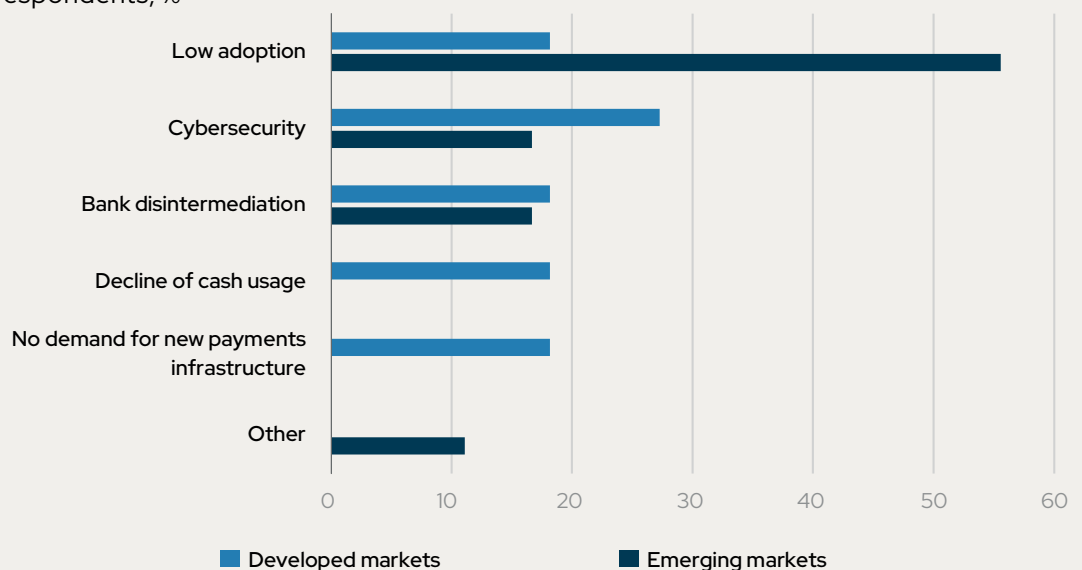
What is your main motivation for pursuing a CBDC? Share of respondents, %



Source: OMFIF 2024 survey of central banks

1.10. Low adoption still leading concern

What is your main concern over deploying a central bank digital currency? Share of respondents, %



Source: OMFIF 2024 survey of central banks

OVERCOMING TECHNICAL CHALLENGES

Central banks have been grappling with the technical realities of CBDC issuance for many years, but progress is being made.

KEY FINDINGS:

1. Central banks have made remarkable progress in addressing the major technical requirements of issuing a CBDC. The biggest jumps have been in interoperability, cybersecurity and offline payments.
2. Previously ranked as the most challenging feature to deliver, 20% of surveyed central banks report improved satisfaction with progress in offline payments, up from 0% in 2023.
3. As central banks advance on features like offline payments and cybersecurity, their focus is turning to optimising user experience. The share of respondents that identified it as the most challenging area more than doubled to 27%.

CENTRAL banks must answer a variety of questions when they are looking to issue a CBDC, but perhaps the most fundamental of them is ‘can we?’ When the motivation for CBDC issuance is determined, and the policy choices about its design have been made, the technical reality of the exercise must be addressed.

Creating a payments instrument of systemic importance demands the highest possible standard of operational resilience. Can central banks design and maintain a system with world-class disaster recovery and redundancy, keeping downtime negligible? Can they ensure that their systems will resist cyberattacks and can they convince the public that using CBDCs will not compromise their privacy?

A CBDC will not operate in a vacuum, but as part of a complex landscape of overlapping payments systems. Will central banks be able to ensure that CBDCs will be interoperable with major payments platforms? Can they design CBDCs to both serve domestic needs and facilitate cross-border interlinkage? Are central banks capable of delivering this without compromising the integrity of the currency? Given that few central banks have experience in developing systems for retail use, will they be able to master user experience design to ensure adoption? Can central banks deliver an instrument that can scale to handle economies’ peak load of transactions?

If the answer to any of the above is no, then can central banks procure the necessary expertise in the private sector without compromising strategic autonomy, risking vendor lock-in or introducing additional risks?

Without improving satisfaction on major technical topics, it is unlikely that central banks would have advanced to the stage of focusing on designing user experience.

Despite this daunting range of technical challenges, central banks and the third parties assisting them are showing clear signs of progress in overcoming it. Our survey suggests that central banks' confidence in their ability to achieve the technical requirements is growing steadily.

Progress in almost every area

With few CBDCs making it to the issuance stage as yet, it might be tempting to conclude that progress has stagnated. But our survey shows that central banks do not feel this is the case. Year on year, central banks' satisfaction with the progress they have made has climbed in many of the key areas of CBDC development.

The biggest jumps come in the areas of interoperability, cybersecurity and, last year's most challenging feature, offline payments (Figure 2.1). These were chosen by 38%, 35% and 20% of respondents, respectively. Central banks also say they are more satisfied than last year with their progress on privacy (38%) and cross-border connectivity (19%). The two areas where

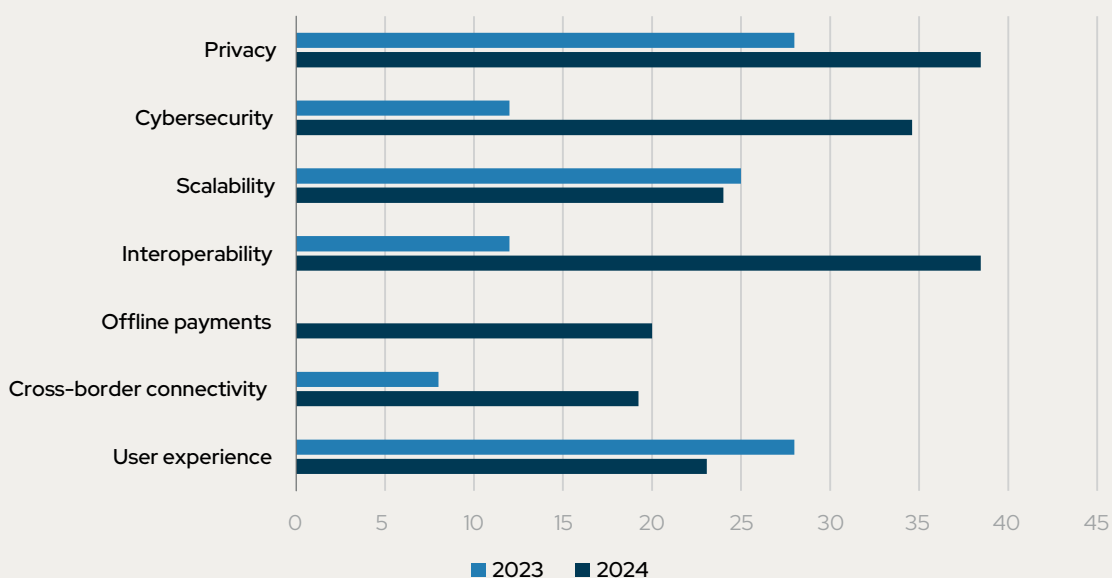
satisfaction has declined are scalability, where the change is a negligible 1%, and user experience, where the change is slightly more substantial, though still only 5%.

'There's no reason to think that issuing a CBDC is not feasible. But if you want your CBDC to have unique capabilities and support advanced use cases, then some features are more challenging than others,' said Yoav Soffer, CBDC project manager at the Bank of Israel. 'The challenge is primarily to achieve the right balance of ambition. If it's just another way of moving money it won't get adopted. We need to provide new functionalities to ensure the CBDC is adopted both by users and by companies for building innovative features. That means we have to deliver new features, some of which can be technically challenging.'

This chimes with the year-on-year changes in what central banks view as the most challenging features of designing a CBDC. Here, progress is likely to be less linear, since central banks are not assessing how challenging each feature is but selecting which features they find most

2.1. Satisfaction with progress climbs in key areas

In which areas of CBDC design are you most satisfied with the progress made? Share of respondents, %



Source: OMFIF 2023-24 survey of central banks

27%

the share of respondents that identified user experience as the most challenging area more than doubled to 27% from 10% in 2023.

challenging.

The most dramatic change is that central banks are finding user experience a much more challenging feature – the share of respondents that selected it more than doubled to 27% from 10% in 2023 (Figure 2.2). Offline payments (36%), cybersecurity (9%), privacy (9%) and cross-border connectivity (5%) are seen as slightly less challenging, while scalability (5%) and interoperability (9%) have increased slightly.

The challenge of user experience design has not become more difficult over the past year. Rather, it seems that this is now occupying more of the resources and attention of central banks than in the past. This suggests that central banks are closer to issuance than in previous years. Since central banks will not compromise on achieving the required standards of scalability, cybersecurity and privacy, they are unlikely to begin focusing on topics like user experience unless they believe they will be able to deliver on the essential technical features.

This is supported by the improvement in satisfaction across the majority of key technical areas. Without improving satisfaction on major technical topics, it is unlikely that central banks would have advanced to the stage of focusing on designing user experience.

Offline payments

Delivering offline capacity has dominated conversations in the payments space over the last year. One of the central challenges is the

prevention of ‘double-spending’ – spending units without debiting the paying account, allowing the same tokens to be spent again. While the conversation began as one centred on a possible feature of CBDCs, the benefits of operational resilience and improved accessibility that offline payments offer mean the feature has become a key part of discussions about national payments systems and digital public infrastructure.

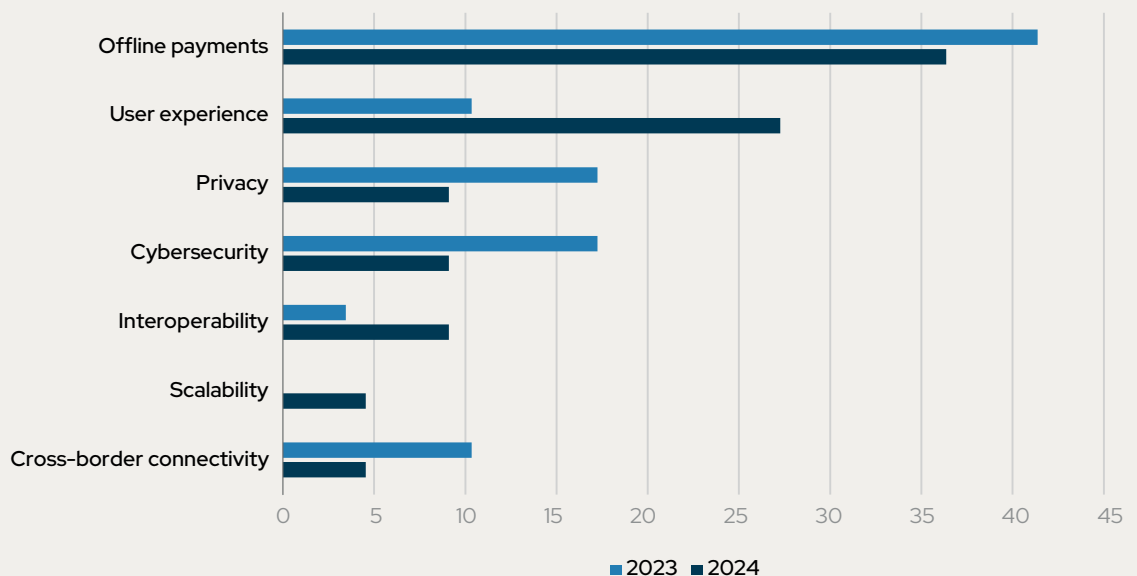
Creating a payments system capable of secure operation is therefore a challenge that has moved beyond the preserve of CBDC teams at central banks and become something for a much wider base of stakeholders to address.

With a broader community working to address the challenge, central banks seem more confident that progress will be made in delivering this feature. Some have already solved the problem to their satisfaction. Several central banks have published reports on pilot projects with offline payments. Accordingly, the central banking community is growing more comfortable with the foundational technology. This has allowed discussions to advance from the question of ‘can offline payments functionality be delivered?’ to ‘how can offline payments be integrated into our existing payments landscape?’

A key example of this is the European Central Bank’s commitment to ensuring the digital euro works with existing point-of-sale terminals. This is likely to prove a challenging commitment, given research conducted by the Bank of England found that while existing terminals (using current

2.2. Focus is shifting to user experience design

What are the most challenging features of designing a CBDC? Share of respondents, %



Source: OMFIF 2023-24 survey of central banks



The Bank of Ghana expects to launch its retail CBDC in 2025 (contingent on an act of parliament) and Kwame Opong, head of fintech and innovation, says that offline payments is a function the bank is confident in delivering.

industry standards) could, in principle, be used for online digital pound payments, they would require modifications to facilitate offline payments. Yet, adding new payment methods has happened before and the payments industry has ample experience with a changing landscape.

The Bank of Ghana made offline functionality a priority because of its importance in serving remote and traditionally excluded communities. The Bank of Ghana expects to launch its retail CBDC in 2025 (contingent on an act of parliament) and Kwame Opong, head of fintech and innovation, says that offline payments is a function the bank is confident in delivering.

'It was an important feature for us to deliver because, at present, there is no commercial solution that allows for digital money to function in an offline environment,' said Opong. 'Technically, it's no longer a challenge. The technology for offline payments has been around since the 1990s, but the challenge was to ensure that the requirement of frequent reconnection and re-syncing was not obstructive. That means the experience is not truly like offline payments. We wanted to create an instrument that allows people to live off-grid and use it as they would use cash.'

Ghana is ready to integrate a CBDC with point-of-sale technology, making use of near-field communication and existing secure elements to deliver efficient and robust in-person payments with or without internet connectivity. Opong added that users will be able to make use of this

Case study: Ghana

The Bank of Ghana published a report describing the setup and outcomes of its CBDC pilot project. Using G+D's Filia technology, the pilot explored a variety of payments scenarios such as online and offline payments, person-to-person and merchants with point-of-sale terminals, and integration of financial intermediaries.



Building a sufficiently robust perimeter around this infrastructure will be an enormous initial hurdle but, because of the evolving threats, delivering cybersecurity is a continuous challenge.

feature with entry-level phones. This reliance on the secure elements already existing within many technological devices like phones is becoming a standard part of the approach for central bank designers. It is a key part of the solution to the double-spend problem.

As well as the technical element, it is worth considering the appropriate design choices to best combat this threat, particularly when it comes to token versus account design. In account-based systems, a private key is used to create signatures and authorise transactions. If counterfeit payment units were created, accounts could use these to pay and the integrity of the system would be compromised.

In a token-based architecture, the payment instrument has its own key. With each transaction, fresh tokens are created. This means that each token can be used only once. The central bank must maintain a ledger as a final authority, ensuring that it can verify every token.

Cybersecurity: a continuous challenge

For many of the technical features of a CBDC, solving and building them is something done only once. Cybersecurity is different. The threats posed to the operators of CBDCs are changing rapidly as the tools available to bad actors evolve.

A CBDC will present a major new piece of digital infrastructure for cyberattackers to target. Building a sufficiently robust perimeter around this infrastructure will be an enormous initial hurdle

but, because of the evolving threats, delivering cybersecurity is a continuous challenge. Oppong said: 'It will be an ongoing concern. In addition to preventing intrusion at the system level, we also have to ensure a basic level of security education for users.'

The potential advent of cyberthreats from quantum computers will be a particularly challenging threat to which CBDC issuers will most likely be forced to adapt. Fortunately, as with offline payments, the move to post-quantum cryptography will involve a much broader range of stakeholders than CBDC issuers, since the problem will threaten all types of digital systems.

Complying with the National Institute of Standards and Technology standards on this topic is a key step in delivering continuous cybersecurity. An important feature will be 'crypto agility'. This means that wallets should be designed to update their cryptography without disrupting their service. Without the ability to upgrade in the field, it will be difficult to design a CBDC to be effectively 'future-proof'.

Ensuring interoperability

CBDCs will not deploy into a vacuum. If they are to be successfully adopted, they will have to operate seamlessly with existing payments platforms. That means interacting with bank accounts, card systems and wallet providers, as well as achieving near universal compatibility with the systems in use at point of sale.

A conceptual model for point-of-sale payment with retail CBDC

At point of sale, CBDCs will become one of many different payment options. This paper analyses the technical background of CBDC wallets and proposes a conceptual model of how to introduce CBDC payments to consumers.



How does post-quantum cryptography affect central bank digital currency?

This study explores the impact of post-quantum cryptography on CBDCs. It delves into how digital assets, including CBDCs, can be secured in the era of quantum computing.



From a technological perspective, a CBDC can be designed in such a way as to protect user privacy while simultaneously addressing regulatory requirements through a true separation of concerns for operational, transactional and governance processes.

Central banks will face radically different challenges in this area. The Reserve Bank of India has deployed the Unified Payments Interface, and this has rapidly achieved wide adoption. Accordingly, the RBI's digital rupee pilot will be compatible with this platform. The ECB, by contrast, will have to make its digital euro compatible with a broad range of bank architecture, including payments systems and ATMs, as well as a new generation of wallets. The variety of systems could mean a more challenging battle to achieve interoperability.

Many of the challenges in the present payments environment stem from the need to exchange different forms of private money, each of which carries counterparty risk. This results in complications, which may require systems operators to hold liquidity to mitigate the risk. So, while introducing a CBDC adds a new element or medium to the payments environment, since it is not a private liability, it may be able to act as a bridge, improving interoperability between private forms of money.

If central banks wish to maximise this benefit, then they should expand the types of institutions that are able to access and provide CBDC services beyond the bank community to include e-money businesses, payment services providers and mobile money operators. If institutions like these were able to provide CBDC wallets for customers, the interoperability between different types of private money would be improved.

Regarding cross-border payments, interoperability will almost certainly prove challenging. Although there is some international collaboration on development and research, as

yet, there is no clear set of messaging standards or formats central banks should make use of in their CBDC design.

Privacy

When asked about the reasons for delays to CBDC issuance timeline, only one response alluded to unforeseen technical challenges, highlighting that the specific challenge that led to the delay was around ensuring they could deliver transaction privacy. While privacy is important, it needs to be balanced with regulatory requirements. Anti-money laundering and countering the financing of terrorism regulations may require the storing of specific user data for a certain period to enable authorities to trace and investigate financial activity.

These safeguards are essential to protect the integrity and stability of the financial system, but they naturally come at the expense of privacy. However, this level of oversight is already a standard feature in financial services, and users seem largely accepting of the privacy trade-offs involved in participating in the digital financial ecosystem.

Technology offers a means of mitigating this trade-off by allowing data to be collected and stored in a manner that respects privacy as much as possible. G+D's CBDC solution Filia, for example, protects privacy through a true separation of concerns for operational, transactional and governance processes. Privacy-enhancing technologies like pseudonymisation, zero-knowledge proofs and multi-party computation can all help to ensure that CBDCs actually improve the privacy of digital payments.

TIMELY ACTION IS KEY

Financial inclusion and monetary sovereignty are at the heart of many central banks' motivations for developing a CBDC.

KEY FINDINGS:

1. Central banks are shifting focus from exploration of the reality of CBDCs to targeted designs that address financial inclusion, efficiency and policy alignment.
2. Offline CBDC capabilities offer resilient alternatives during network disruptions, ensuring continuity and cash-like privacy.
3. CBDCs offer greater depth than IPS by serving as a platform for innovation and addressing a broader spectrum of use cases.

CENTRAL banks are reaching a peak in their exploration of CBDCs. Many are now transitioning from broad experimentation to more focused, strategic decisions about the role and design of CBDCs to ensure their effectiveness within the future global financial system. Given this shift, it is increasingly clear that for many the conversation is no longer centred on whether CBDCs will become a reality or not, but on the timing of their introduction and the specific objectives they should serve.

OMFIF's survey of central banks examines the rationale for CBDC issuance, finding that central banks are focused on aligning CBDC design with their broader policy goals. While the reasons for introducing a CBDC may vary across countries, particularly between developed and emerging markets, several overarching themes emerge.

Inclusive and reliable finance

CBDCs have an opportunity to gain widespread acceptance by replicating the desirable features of cash, acting as a gateway to financial inclusion with the potential to deliver value beyond that of physical currency. CBDCs can also act as a bridge within the payments ecosystem by serving as public money in digital format. Unlike private liabilities, CBDCs carry no counterparty risk and can improve interoperability between different forms of private money, streamlining transactions and enhancing efficiency.

It is possible to design CBDCs that can be used without a bank account. This is a key advantage in promoting financial inclusion since opening a bank account can pose a significant barrier – particularly for the 850m people worldwide who lack formal identification, according to the World Bank.

While the question of formal identification in CBDC or wallet design remains a political topic, exploring solutions that balance accessibility with regulatory requirements could still be worthwhile, especially in regions where similar systems, like mobile money, have proven effective despite ID requirements. When integrated with national digital identification systems, CBDCs can offer a trusted

and efficient means of identity verification without requiring physical documents. This integration streamlines customer due diligence, enabling underserved populations to access financial services while ensuring anti-money laundering and countering the financing of terrorism compliance.

Similar to cash, CBDCs can support small-scale, low-cost transactions, which could have less stringent identification requirements. In addition, CBDCs offer the potential for immediate settlement of funds, just like cash transactions. Unlike traditional bank transfers or card payments, which often require processing time, offline CBDC transactions are instantaneous and final, reducing friction and enhancing accessibility.

Yoav Soffer, CBDC project manager at the Bank of Israel, designates offline payments as a stand-out use case for CBDCs. He contends that this is the one area where a public solution decisively trumps private alternatives.

Offline transactions require a secure liability, issued by an entity that all participants in the payments chain are willing to trust – similar to the role that cash fulfils today. CBDCs therefore address this need by offering a central bank-issued digital liability that ensures trust and interoperability across the financial ecosystem.

Expanding reach and resilience

Since CBDCs are digital by definition, their design is inherently tied to connectivity. But central banks are aiming to create a payments system for in-person use as well. Since many central banks wish to use CBDCs to improve financial inclusion, offline functionality has become key as it allows individuals in remote or underserved areas to use CBDCs

without a steady internet connection or need for a smartphone.

In introducing a CBDC, a central bank can make policy and design choices that commercial banking providers may not consider worthwhile, improving access to historically underserved communities. Serving these communities also often entails substantial investment that private companies might not deem commercially viable.

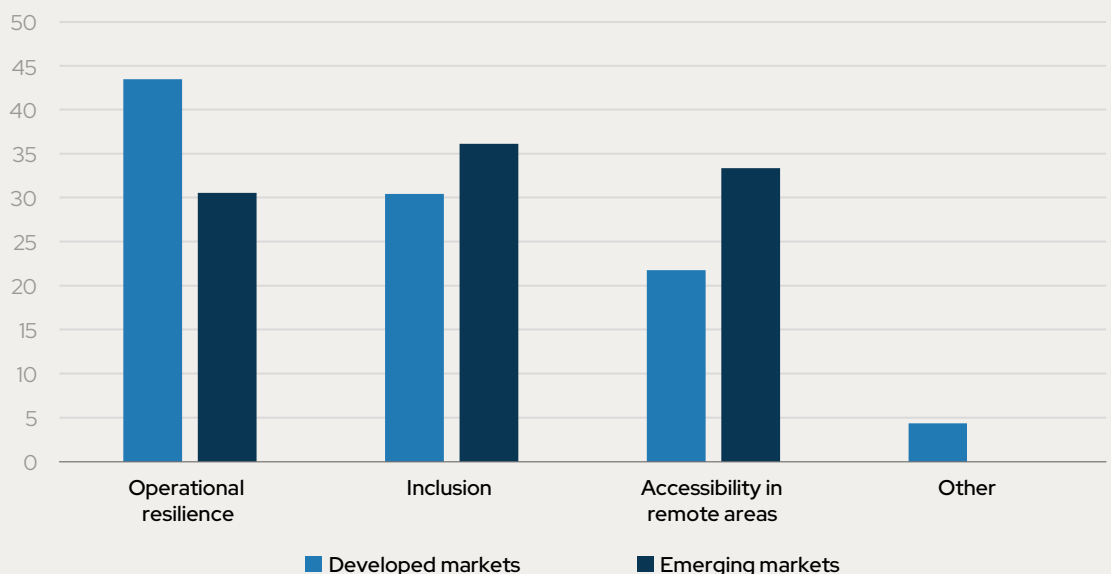
Accessibility in remote areas is a key consideration for 33% of respondents in emerging markets, as this is closely tied to the goal of fostering financial inclusion (Figure 3.1). For 43% of developed market respondents, the primary purpose of offline CBDCs is to support operational resilience, ensuring the reliability of a CBDC under diverse conditions.

Offline CBDCs should offer a fail-safe mechanism that guarantees continuity in payments and access to funds, even during internet outages, power failures or natural disasters. This resilience means CBDCs can play a role in maintaining economic stability and ensuring access to particular financial or payment services in ways physical cash and online-only digital payments may not fully cover.

The banking industry, which is among the most heavily impacted sectors during IT outages, highlights the critical dependence on uninterrupted digital infrastructure to maintain transaction flows, payment processing and financial stability. The ability to operate independently of connectivity offers a distinct advantage by ensuring continuous access to central bank money even when banking systems or private digital payments are disrupted. This resilience fosters trust, supports adoption and strengthens system stability by providing confidence that the currency will remain available

3.1. Offline functionality tied to financial inclusion goals

If you are pursuing offline functionality, why do you consider it to be important? Share of respondents, %



Source: OMFIF 2024 survey of central banks

The introduction of CBDCs... provides an opportunity to embed robust safeguards that meet users' expectations of privacy as well as regulatory requirements.

and functional at all times.

Offline functionality is a particularly important point for central banks evaluating whether to issue a CBDC or deploy an instant payments system. While IPS offer many advantages versus the status quo, they do not offer offline functionality, which compromises their ability to provide an inclusive service.

Developing some of these tools for IPS is likely to be a complex and challenging process. For some central banks, moving to CBDCs may therefore be preferable. Kwame Opong, head of fintech and innovation at the Bank of Ghana, said: 'Yes, IPS do offer advantages, but when you consider how payments are developing, we believe that those who move to an IPS now will end up moving to a CBDC later in any case, so we might as well go straight there.'

In addition, depending on its design, offline functionality can support higher levels of privacy, a feature that users universally value and which is lacking in most digital payment options. Up to certain amounts set by the central bank, offline CBDC transactions could mimic the privacy of conducting a transaction in cash by ensuring that only the amount and time are recorded, without tracking specific use or purpose. For smaller transactions, this design could allow payments to leave no record, offering a level of anonymity similar to cash withdrawals and in-person payments.

The privacy-centric design of a CBDC contrasts sharply with IPS and private payments systems, where user data is often a critical component of a business model. While regulation could improve privacy standards in existing systems, such changes would not only be complex, but they would inherently conflict with their data-driven revenue models.

Bank of Israel's Soffer pointed out that the development of a new system for CBDCs offers the chance to embed privacy protections by design, while maintaining regulatory compliance.

Information sharing in the digital economy

Most users are willing to share personal information with PSPs and accept certain data storage requirements in exchange for convenience and efficiency in digital transactions. Data-sharing leads to improvements in user experience and increases the quality of digital financial services.

Information sharing extends beyond the relationship between users and their financial service providers. Financial institutions and PSPs already engage with the public sector and share information, whether as part of legal obligations tied to know your customer and AML/CFT or for broader purposes, such as trend analysis, market stability assessments and risk management.

These established data-sharing practices suggest that users are either not necessarily opposed to certain privacy concessions, at least when they perceive tangible benefits in return,

or they might not even be aware of the extent of information sharing in the financial system. It therefore stands to reason that the fear about CBDCs being used as a tool for state surveillance is overstated.

Propelled by some news outlets and critics, this notion has prompted people to question how their data might be used or monitored by governments and central banks. Such apprehensions also reflect existing practices within the traditional banking system, where governments – in line with prevalent legal frameworks – can request account or customer data from financial institutions if an entity is flagged as suspicious.

Against this backdrop, it is important to emphasise that the introduction of CBDCs does not inherently create a new surveillance mechanism but instead provides an opportunity to embed robust safeguards that meet users' expectations of privacy as well as regulatory requirements.

CBDCs as a platform for innovation

The private sector should continue innovating and creating advanced payment solutions that cater to user needs, but in a regulated and interoperable framework that promotes fair access and inclusivity. Integrating private sector innovation with central bank oversight eliminates inefficiencies from overlapping or duplicate systems, reducing redundancies while enhancing the performance of the domestic payments ecosystem.

This should drive adoption and improve usability by allowing users to continue relying on familiar solutions while benefitting from the advantages of a modernised system. The objective is to encourage widespread use of a CBDC, which promotes network effects that amplify the efficiency of the payments system.

The Bank of Israel emphasised that the success of the digital shekel fundamentally builds upon private sector involvement and the development of innovative use cases. A CBDC framework must ensure interoperability between solutions and prevent the formation of closed ecosystems.

By creating a common infrastructure, central banks provide a foundation that all participants – central banks, financial institutions, PSPs from big tech to fintech, and end-users – can build upon. This platform model fosters collaboration and innovation while distributing benefits more equitably.

IPS are unlikely to offer the same depth as CBDCs when it comes to providing a platform for innovation, since they essentially offer a new means of settling traditional forms of money, rather than creating a new form factor.

Network effects further reduce costs by scaling infrastructure, standardising transactions and encouraging private sector advancements. This leads to faster, cheaper and more efficient transactions, creating a self-reinforcing cycle of improvement and utility.

Brazil is fostering a vibrant fintech and innovation ecosystem through initiatives that go beyond

Financial inclusion across borders with retail CBDC

Cross-border payments suffer from a long list of inefficiencies and come with high fees. This report examines how cross-border retail CBDCs could positively impact this situation, making the process for sending money quicker, cheaper and more secure.



Brazil's Pix showcases how IPS can deliver immediate, inclusive payment solutions, while its CBDC efforts aim to address broader strategic objectives, such as monetary sovereignty and cross-border use cases.

regulation, including innovation platforms, start-up mentorship and collaborations with universities. According to Fabio Araujo, senior adviser at Banco Central do Brasil, the aim is to nurture market-ready solutions, build industry skills and ensure sustainable growth within a dynamic regulatory framework for CBDCs and other asset classes.

The Brazilian case demonstrates that IPS and CBDCs are not mutually exclusive solutions, but rather complementary components of a holistic financial strategy. Brazil's Pix showcases how IPS can deliver immediate, inclusive payment solutions, while its CBDC efforts aim to address broader strategic objectives, such as monetary sovereignty and cross-border use cases.

Similarly, India's Unified Payments Interface, integrated within its broader digital public infrastructure, highlights how IPS can coexist and synergise with potential CBDC deployment to promote financial inclusion, drive innovation and enhance payments resilience. By integrating IPS and CBDCs, like Brazil and India, central banks can address both domestic and international payments challenges, fostering a robust digital economy as well as a cohesive and interoperable global financial ecosystem.

Fragmented frontiers in cross-border transactions

Domestic payments systems are often not interoperable across countries due to differences

in legal frameworks, technological standards, infrastructure and economic objectives. These disparities hinder seamless interaction between systems, leading to longer processing times, higher transaction fees and increased compliance risks and costs.

Remittances are a striking example of the inefficiencies in cross-border transactions. The issue is particularly pronounced in emerging markets where remittance fees are notoriously high. The United Nations estimates costs as high as 20% in some African countries, including Angola, Botswana and Namibia. Extensive processing times further add to the complexities, as these particularly affect vulnerable groups such as migrant workers who rely on remittances to support families in their home countries.

Emerging markets are therefore disproportionately affected by the inefficiencies and high costs of cross-border transactions. They often rely heavily on foreign currencies – particularly the dollar – to maintain their connection to the global economy. This reliance deepens economic vulnerabilities and increases exposure of these nations to external shocks and the policies of dominant economies.

Inefficiencies and lack of interoperability in cross-border payments highlight the urgent need for accessible, affordable and globally integrated financial services. Private alternatives like cryptoassets will continue to pose risks such as volatility and security concerns without stronger regulation and oversight.

If private interests dictate the terms for investment in cross-border payments, the primary focus is often on maximising returns over critical aspects such as ensuring accessibility, affordability and security of payments. With public intervention, this investment can drive a broader agenda, helping to serve a wider range of historically marginalised people and businesses.

Central banks are therefore increasingly looking beyond their own borders to address these challenges and considering CBDCs as a potential solution. The goal is to establish a globally interconnected payments network that reduces costs and increases efficiency.

CBDCs in the global financial landscape

CBDCs enabling interoperability between disparate systems could create a safe, regulated framework for cross-border transactions. Unlike the current fragmented and costly system, a CBDC network would provide the foundation for security and ensure oversight in international payments.

Cross-border transactions rely on digital infrastructures, making CBDCs well-positioned to revolutionise the role of public money in global trade by enabling its direct use in cross-border transactions.

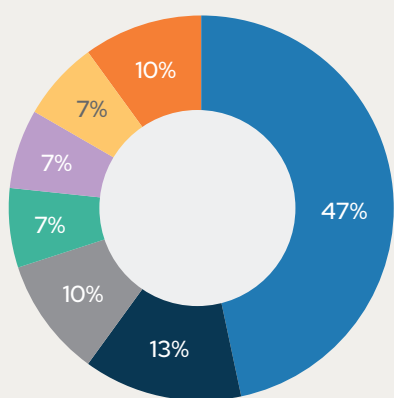
At present, cross-border payments rely on correspondent banking networks using commercial bank money. Central bank money is limited to

47%

of central bank survey respondents selected interlinking IPS as the most promising avenue for the improvement of cross-border payments.

3.2. Interlinking IPS most promising avenue

What do you think is the most promising avenue to improve cross-border payments? Share of respondents, %



- Interlinking instant payments systems
- Interlinking RTGS systems
- Aligning regulatory frameworks
- Stablecoins
- Connecting CBDCs
- Harmonising formats like ISO 20022
- DLT/shared ledger infrastructure

Source: OMFIF 2024 survey of central banks

settling balances between banks, often through intermediaries that obscure fund flows. The cross-border functionality of CBDCs could reduce dependence on correspondent banks and improve transparency in transactions. Central banks could directly steer global money flows and address inefficiencies that have long plagued the global financial system.

If CBDCs are to achieve these objectives, they must be developed as sustainable and scalable solutions for international payments. This demands coordinated international efforts to ensure interoperability, establish standardised protocols and optimise system efficiency.

Project Icebreaker demonstrates how domestic retail CBDCs can be used for cross-border payments. The Bank for International Settlements and the central banks of Norway, Sweden and Israel explored the possibility of linking domestic CBDC systems through the Icebreaker hub.

Based on a hub-and-spoke model, each domestic CBDC system only needs to connect to the central hub, rather than with each individual CBDC. This enables participation in the system without creating additional complexities in its design. OMFIF's survey of central bank found a growing preference for hub-and-spoke solutions for connecting CBDCs, as it

should offer greater sovereign control by reducing the risks of integration and offering incremental scalability.

Other central banks are contemplating the creation of a single technical infrastructure that integrates multiple CBDCs onto a shared platform, enabling direct interoperability across borders without a central hub.

Project Dunbar, a collaboration led by the BIS with Singapore, Australia, Malaysia and South Africa, explored how such a multi-CBDC platform could improve cross-border payments. While Dunbar focuses primarily on wholesale payments, the underlying infrastructure could similarly facilitate retail use cases. The multi-CBDC platform should bring efficiency gains by consolidating common processes, such as in relation to compliance, and through process automation enabled through programmability features and smart contracts.

Project mBridge similarly tests the utility of a multi-CBDC platform, leveraging distributed ledger technology to enable instant, cheap and universally accessible cross-border payments between Thailand, Hong Kong, China, the UAE and Saudi Arabia. This initiative showcases how multilaterality, delivered via blockchain-based infrastructure like the mBridge ledger, can address inefficiencies in international payments while fostering interoperability, financial inclusion and innovation.

Central banks are considering the compatibility of CBDC systems through common standards. This entails the standardisation of messaging formats between CBDC systems, such as by aligning with ISO 20022 standards, ensuring safe and consistent methods for encryption and transaction validation across borders and establishing protocols for data management. This approach can complement both hub-and-spoke and single system models, ensuring that, independent of the chosen infrastructure, transactions can occur seamlessly and securely.

CBDCs as value-add beyond existing structures

It is important to acknowledge that, at present, for cross-border payments, CBDCs are far from the only option. Interlinking instant payments systems is, according to 47% of central bank survey respondents, the most promising avenue for the improvement of cross-border payments (Figure 3.2).

The BIS's Project Nexus has achieved some early success in this regard, creating a framework for the interconnection of IPS in southeast Asia. This initiative has garnered attention from central banks globally, assessing its potential for broader adoption. Such efforts highlight the immediate viability of IPS integration for enhancing payments efficiency.

However, while IPS excel in domestic payments, their scalability and effectiveness in cross-border contexts are constrained by inherent limitations.

IPS participation typically requires entities to hold full banking licences, which restricts access

Beyond regulating financial systems, central banks must act as facilitators of innovation, striking a balance between maintaining financial stability and monetary policy mandates while responsibly embracing new technologies.

for non-bank participants such as fintechs or other cross-border PSPs. Furthermore, IPS often depend on pre-funded accounts, which can restrict liquidity and increase transaction costs, particularly in illiquid currency pairs. Linking IPS across borders also requires significant harmonisation of messaging formats, regulatory frameworks and settlement mechanisms, adding complexity when scaling these systems for cross-border use.

CBDCs offer an opportunity to address these challenges. While IPS provides immediate improvements to payments efficiency, CBDCs expand participation, resolve liquidity challenges and introduce advanced functionalities. By leveraging their complementary strengths, they can create a more inclusive, efficient and resilient global payments landscape.

Strategic imperatives for CBDC implementation

With payment systems like Thailand's PromptPay, India's UPI or Brazil's Pix already in place, questions arise about the value CBDCs can add to the retail payments landscape.

Wijitlekha Marome, director of the Bank of Thailand, acknowledged that the efficiency and pervasiveness of Thailand's domestic IPS may reduce immediate pressure for a digital baht. Notwithstanding, Marome emphasised that central banks need to evolve with digitalisation to remain relevant and ensure that they can address emerging challenges and opportunities in the dynamic financial landscape.

This highlights the strategic imperative for the timely implementation of CBDCs. Beyond regulating financial systems, central banks must act as facilitators of innovation, striking a balance between maintaining financial stability and monetary policy mandates while responsibly embracing new technologies.

The Bank of Thailand highlights the potential of CBDCs to fuel innovation through common functionality features such as programmability. By leveraging these features, financial institutions operating retail payments systems can develop and deploy innovative use cases that are interoperable across institutions. This approach would minimise the cost and effort required to adapt in-house legacy systems, fostering long-term efficiency and broader adoption of advanced financial solutions.

The Bank of Ghana supports such a forward-looking perspective. Oppong argued that traditional systems, particularly in emerging markets, are rooted in legacy technologies. For such markets, the strategic question is whether to invest in developing IPS now, or leapfrog directly into future-ready technology with CBDCs.

Oppong views CBDCs as an opportunity to bypass the limitations of legacy systems and align with modern technological advancements. Ghana has decided not to use DLT for the eCedi, instead opting for a more centralised model. That does not mean that interoperability with DLT is impossible: Oppong highlighted that the eCedi retains the

flexibility to leverage DLT in the future.

This approach allows the central bank to integrate the CBDC with DLTs later if needed, potentially integrating it into a broader blockchain ecosystem. Rather than fully committing to blockchain or DLT from the outset, Ghana is seeking to design a framework that is capable of interacting seamlessly with both traditional systems and emerging digital infrastructures.

Ghana's strategic approach highlights the critical importance of interoperability. It ensures that the CBDC can function across different payment networks and integrate with private sector innovations. This framework avoids fragmentation while still capitalising on the benefits of tokenised ecosystems when appropriate. Importantly, the potential integration with DLT systems could facilitate tokenised asset settlement. This is a capability that Marome, Oppong and Araujo all highlighted as a critical opportunity for enhancing financial market efficiency and liquidity.

Towards a tokenised future: unlocking new opportunities with CBDCs

CBDCs offer an opportunity for central banks to be at the vanguard of technological innovation, acting both as stabilisers and enablers of financial modernisation. In particular, tokenisation streamlines financial processes by automating transactions, enabling real-time settlement and reducing operational complexities, improving liquidity and efficiency. Programmability in tokenised assets allows for automated compliance procedures, tax collection or conditional payments, aligning well with central banks' goals for more efficient and precise monetary operations.

CBDCs could play a transformative role in government-to-consumer payments, such as targeted stimulus transfers, social benefits or emergency aid. CBDCs enabling programmable payments would ensure funds are distributed quickly and transparently. By applying predefined conditions, they can guarantee their intended use, enhancing fiscal management and policy effectiveness.

It is crucial to distinguish between programmable payments and programmable money. With programmable payments, conditions for payments execution are set at the transaction level; programmable money embeds conditions directly into the monetary instrument itself. The former aligns with CBDC design principles by maintaining flexibility and avoiding restrictions that could undermine trust or limit broader usability.

By enhancing interoperability and integration across digital assets – including stablecoins, tokenised deposits and other financial instruments – CBDCs can support the development of a unified and efficient financial ecosystem. This integration reduces costs, simplifies processes and improves transaction efficiency, positioning CBDCs as a foundation for financial innovation and fiscal modernisation in the digital age.

TRUST IN THE FINANCIAL SYSTEM

CBDC design enables a balanced partnership between the public and private sector, ensuring regulatory oversight and stability while encouraging technological advancement and innovation.

KEY FINDINGS:

1. Central bank money serves as a trust anchor, counterbalancing volatility and risks in private digital currencies. CBDCs, as the digital version of central bank money, should reinforce this stabilising role and safeguard monetary sovereignty.
2. CBDCs can harmonise fragmented payments systems, fostering competition and innovation across private and public financial networks.
3. With strong regulatory oversight, CBDCs can enable secure, privacy-focused digital transactions while addressing systemic risks in private payment ecosystems.

INNOVATION in payments is inevitable. But leaving it entirely to the private sector brings risks for the economy. The central bank has an important role to play in anchoring trust and security in the financial system. Fulfilling this role requires it to maintain its presence in new payments media.

The private sector has a track record of innovation, offering faster, more convenient payment solutions and continuously improving its services. People have grown accustomed to those benefits, such as instant payments or responsive customer support. The relationship between consumers and their service providers is well-established, providing a sense of trust in private actors.

However, in most jurisdictions, the public sector enjoys a long-standing history of reliability in the realm of money. The role of a central bank is to function as the guardian of economic stability, issuing and maintaining the value of currency.

Central banks are public institutions, but they operate independently from the state. This ensures that monetary policy decisions are insulated from political influence and instead focus on long-term economic objectives such as price stability and financial system integrity. The private sector also relies on public infrastructures. In the context of retail payments, private payment services providers and financial institutions require access to state-managed systems to facilitate everyday financial activities. This includes real-time payment platforms or interbank settlement systems that are managed by central banks and public authorities.

The public sector therefore already plays a vital role in overseeing and maintaining the stability of the financial ecosystem and private actors do not function in isolation. Any perceived autonomy from government control, based on mere reliance

on private companies and entrusting them with personal and financial data, is therefore just that – a perception, not reality.

The case for public intervention

Private payments networks often operate within closed ecosystems, which essentially limits accessibility and creates barriers to financial inclusion. These closed systems create difficulties for participants who wish to exit the system or use their funds outside the network, hindering user choice and impeding interoperability across the broader financial landscape.

In addition, in these walled gardens, data are only shared to the minimum extent necessary. This leads to the creation of data silos that restrict the flow of information across platforms, resulting in the concentration of data in the hands of a few dominant players.

In the race for profit, user data becomes a valuable asset, incentivising companies to maximise data collection and retention. When there is limited competition in a concentrated market, there is less pressure on powerful actors to prioritise consumer privacy or enhance data protection measures.

The dominance of the private sector is a result of consumer preferences and trust in convenient, technology-driven solutions and the lack of any public alternative in digital payments. Central bank money for retail use only exists in the form of cash, which cannot be used online. Private money has therefore taken over the digital payments space, despite the possibility of abuse or commercial exploitation.

In line with the Bank of Israel's vision for the digital shekel, CBDCs could also lower barriers to entry for new players in the payments sector. In traditional systems, service providers need to maintain significant liquidity and capital reserves to handle financial exposure. In contrast, PSPs in a CBDC framework could operate solely as facilitators or intermediaries, handling the technical and operational aspects of payments without directly holding reserves or managing liquidity.

According to Yoav Soffer, CBDC project manager at the Bank of Israel, decoupling payments services from banking systems could enable new participants to enter the market with fewer regulatory hurdles. This would diversify the financial landscape and transform existing market structures by breaking down concentrated systems. Such an approach aligns with the potential of CBDCs to foster innovation, competition and inclusivity in the



According to Yoav Soffer, CBDC project manager at the Bank of Israel, decoupling payments services from banking systems could enable new participants to enter the market with fewer regulatory hurdles.

financial ecosystem.

CBDCs can also fill the gaps left by private systems by facilitating the integration of disparate networks. The integration of different networks could streamline transactions across various financial services offerings, improving efficiency, increasing consumer choice and fostering competition. It also enables the creation of a system in which data flow freely and securely between platforms, which could facilitate regulatory oversight. In this context, central banks are ideally positioned to facilitate co-operation between financial institutions, PSPs and regulatory bodies, and establish specific guidelines for the handling of user data.

Furthermore, consent-based data-sharing in a CBDC system could empower users to control their personal financial information. While this advantage is not exclusive to CBDCs, a CBDC system could set a public sector standard for secure and selective sharing of personal financial information.

Central bank money in payments

Central bank money, whether in the form of cash or a CBDC, provides stability, trust and universal acceptance. Its resilience in crisis scenarios makes it a reliable refuge, free from institutional bankruptcy risks that can affect commercial bank deposits. For instance, despite cash usage having significantly

Cryptoassets are exposed to market forces, but even stablecoins pegged to sovereign currencies like the dollar and backed by reserves occasionally trade at a discount to face value because of concerns around the issuer.



declined in Sweden, authorities have advised residents to keep one week's worth of cash at home, highlighting the enduring role of state-backed money as a trusted safeguard in emergencies.

While a sovereign currency's value can fluctuate against other currencies – no matter whether it is in the form of a CBDC, cash or deposits – its stability is anchored by state backing, which is mostly widely trusted to uphold its value even under extreme economic conditions. This trust is reinforced by the underlying strength of the domestic economy, as economic performance supports confidence in the value of a currency.

This distinguishes sovereign currency from new forms of private money, such as stablecoins and other digital assets. Cryptoassets are exposed to market forces, but even stablecoins pegged to sovereign currencies like the dollar and backed by reserves occasionally trade at a discount to face value because of concerns around the issuer.

While these forms of private money may serve specific needs, they cannot offer the same level of security as central bank money. In some emerging markets, where economic instability, high inflation or limited access to traditional financial services undermine trust in domestic currencies, cryptocurrencies have gained traction.

Especially as private innovations expand, regulatory efforts are essential to integrate digital assets into the financial ecosystem. However, central bank money remains the most reliable safeguard for economic activity, offering resilience through its secure design and trusted role as a stable medium of exchange.

Safeguarding payments for the public good

Central bank money lies at the heart of a sound monetary system, serving as the anchor that underpins the value of all other forms of money, such as commercial bank money and emerging digital assets. Its stability ensures the uniformity

and substitutability of money, fostering trust and reducing the risk of economic fragmentation.

However, the steady decline in cash usage is diminishing the visibility and relevance of central bank money, threatening its ability to maintain cohesion within the monetary system. Without central bank money designed for compatibility with existing digital ecosystems – the epitome of what a CBDC is – the public sector risks ceding control over payments to private actors. This could lead to monetary system fragmentation, reduced stability and risks to users, including higher fees, financial exclusion and misuse of personal data, as private entities prioritise profit over the public interest.

Preserving the singleness of money is crucial to ensuring the seamless exchangeability and trust that form the basis of economic stability. CBDCs should therefore help safeguard the integrity of the financial system in the face of growing private sector dominance.

While wholesale central bank money in the form of reserves held by authorised financial institutions remains the foundation of monetary stability, a retail CBDC could play a complementary role by providing the public with direct access to secure, central bank-backed money in an increasingly digital economy. By doing so, central banks can retain control over their currency, financial system and economic policies, mitigating the risk of monetary authority shifting to private or foreign actors and reinforcing public trust.

Although monetary policy effectiveness does not inherently depend on the balance between public and private money, central bank engagement in digital payments remains critical. A well-designed CBDC, even if primarily a payment instrument, can strengthen monetary policy tools by enhancing transmission channels, improving liquidity management and ensuring widespread access to central bank money.

By bridging the gap between traditional public money and the digital economy, a CBDC can

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ensure that payments remain a public good: secure, universally accessible and transparent. It would safeguard the monetary anchor, promote financial inclusion and uphold economic oversight, aligning the monetary system with the demands of modern economic activity while preserving the public interest.

Counteracting foreign dependencies

Central banks are increasingly concerned about maintaining monetary sovereignty as private digital currencies and even foreign CBDCs gain traction. OMFIF's survey of central banks confirms that the development of CBDCs has become a strategic priority for many countries.

Fintechs and other private sector payments providers are increasingly dominating the digital payments landscape, offering more convenient, efficient and cost-effective alternatives to traditional banks. In a scenario in which multiple, diverse actors offer payment services, the resulting competitive dynamics would benefit consumers and the market. Competition would fuel innovation, improve services and lower costs.

However, in reality, the market is governed by a payments duopoly, whereby Visa and Mastercard control the majority of global payments outside of China. While their networks have enabled seamless, reliable and global payment solutions, this dominance also creates dependencies for merchants, banks and consumers. It limits alternatives and poses challenges to fostering greater innovation and competition in the payments market.

This means that the global market is heavily dependent on these US payments giants. For countries and consumers outside the US this means entrusting critical financial infrastructure to foreign entities, which may not align with their local economic priorities, regulatory frameworks or geopolitical interests. This raises concerns about fairness, accessibility and system resilience. It undermines the ability of a country to independently manage its financial systems, leaving the economy at the mercy of externalities with potentially conflicting interests.

Central banks are therefore highlighting strategic autonomy in their CBDC initiatives. The Eurosystem has declared this a distinct objective for the digital euro. Alexandra Hachmeister, director general for the digital euro at Deutsche Bundesbank, emphasises that the cost of relying on foreign providers has become particularly burdensome for European merchants and businesses; card schemes have significant negotiating power, allowing them to charge high fees in absence of any viable alternative.

Big tech companies like Apple, Google or Facebook have also entered the playing field, leveraging their vast user bases and advanced technological infrastructures. The integration of payments platforms and financial services into their ecosystems has introduced greater convenience and expanded access to financial tools for many users. However, their scale and influence bring concerns about market concentration, data privacy

and the potential erosion of central bank authority.

By accumulating payments data and influencing consumer behaviour, these companies hold significant power to shape the payments market, potentially excluding smaller providers and altering competitive dynamics. Their rapid pace of innovation risks outpacing local providers and traditional banks, posing further challenges to ensuring a level playing field.

The capacity of big tech companies to successfully innovate has produced positive outcomes, but it remains important that they operate within an environment that prevents any single entity securing dominant market share to the detriment of consumers. By providing a level playing field, a CBDC can promote a healthy and competitive ecosystem.

The balance between public and private currency

Private payment platforms, such as those offered by big tech, but also by traditional PSPs and other providers, increasingly facilitate the use of digital currencies like cryptocurrencies or stablecoins. These currencies are becoming more integrated into mainstream digital payment solutions, despite the lack of regulatory clarity in some jurisdictions.

The proliferation of private digital currencies challenges the very nature of central bank money, threatening to sever the ties between money and sovereignty. Unbacked cryptoassets are prone to volatility. Stablecoins, while backed by low-volatility assets like deposits or government bonds, remain subject to the actions of their issuers, which can impact their stability.

Despite their growing popularity and increasingly thorough regulatory scrutiny, these instruments have not yet gained traction in mainstream use cases. However, absent a stable, public alternative that can be used in the digital space, this might change.

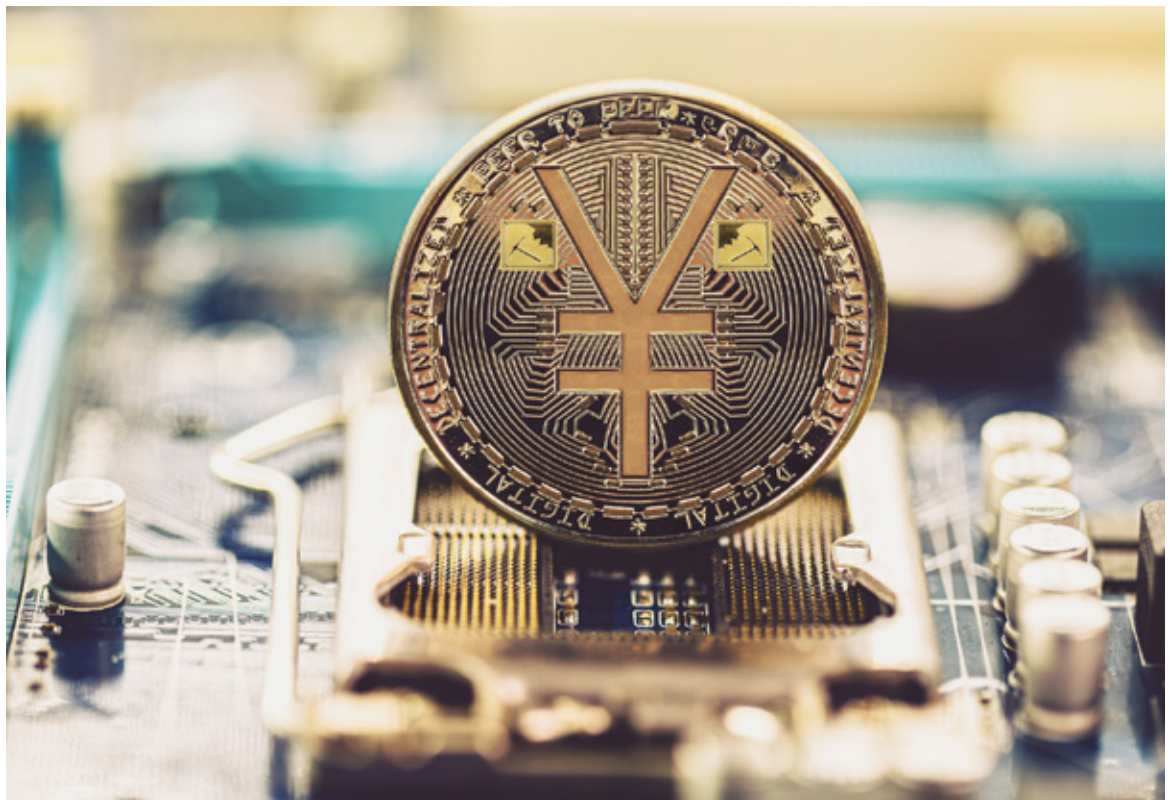
Though not yet widely adopted for everyday use, stablecoins are rapidly gaining ground, particularly in facilitating convertibility from crypto to sovereign money. This growing adoption could reshape the payments landscape, posing risks to currency stability and the broader economy.

If a domestic market is dominated by private solutions, such as MoMo in Vietnam or Alipay and WeChat Pay in China, these high levels of market concentration reduce competitive pressures. Consequently, private actors may be less motivated to innovate, since monopolistic conditions create higher opportunity costs and reduce incentives for change.

Against this backdrop, CBDCs could act as a catalyst for competition and innovation. As a public alternative, a CBDC can challenge existing market dynamics, enhancing competition policy and stimulating private actors to continue improving their offerings.

The disruptive forces of private actors, foreign or not, as well as private currency alternatives have sent shockwaves through the central banking community. Driven by digitalisation and

CBDCs offer an opportunity to reinforce structural foundations, regardless of regional economic context or the level of existing payments infrastructure. Countries like China and India already have advanced digital payments systems that surpass those of some more developed nations.



globalisation, the money and payments environment continues to change – and central banks need to be part of that change.

Public currency, specifically CBDCs, offers a critical counterbalance to the proliferation of private digital money. By providing a secure, inclusive and interoperable digital payments solution that also aligns with regulatory frameworks, CBDCs can seamlessly integrate into the digital economy.

Monetary sovereignty as overall goal

Monetary sovereignty in the context of CBDCs refers to the central bank's ability to exert control over its currency and monetary policy, ensuring that public money remains the cornerstone of the financial system. In developed markets, which tend to display more complex and mature financial systems than emerging markets, central banks face the challenge of regulating the financial system in an environment shaped by powerful private sector forces.

Rather than dampening market innovation, CBDCs aim to complement these private initiatives while safeguarding the central bank's role in anchoring the financial system. For example, the Eurosystem has explicitly identified strategic autonomy and monetary sovereignty as key objectives of the digital euro. This underscores the commitment to ensuring that Europe retains control over its monetary infrastructure and remains resilient to external pressures.

For some emerging markets, monetary sovereignty takes on a different dimension. In many cases, these economies have less established financial structures, and they rely more on informal

or cash-based systems. The introduction of CBDCs should therefore most importantly offer a pathway to greater financial inclusion and economic growth, while reducing reliance on foreign currencies or private digital money systems. By strengthening domestic monetary systems, emerging markets can bolster economic resilience and enhance trust in their national currencies.

CBDCs offer an opportunity to reinforce structural foundations, regardless of regional economic context or the level of existing payments infrastructure. Countries like China and India already have advanced digital payments systems that surpass those of some more developed nations. Importantly therefore, CBDCs advance monetary sovereignty as an overarching goal, ensuring resilience, stability and inclusivity tailored to diverse economic needs.

Many central banks have already taken the decision that issuing a CBDC is a necessary response to the evolution of the payments landscape that they supervise. The private sector is making rapid and important innovation in delivering payments services and, unless central banks take action, their role as the anchor of stability may be eroded.

While some feel that other public solutions will meet their needs effectively, CBDCs offer a vital means for central banks to protect their role in the flourishing digital age, especially as technical barriers become less of an issue. CBDCs help maintain the singleness of money by ensuring that both public and private forms of money remain interchangeable at par, underpinned by the reinforced trust and stability of central bank money.



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