

White paper

Worldline Central Bank Digital Currency

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Introduction to CBDCs

The count is almost complete. A total of 130 countries, representing 98% of the global economy, are now exploring digital versions of their currencies. Almost half of these are in advanced development, pilot phase, or imminent launch, according to a study by the American think tank Atlantic Council.

CBDCs have the potential to significantly redefine our monetary system. As we navigate this time of rapid technological change, it is important to explore the revolutionary possibilities of CBDCs and consider the questions that arise.

This white paper discusses the opportunities created by CBDCs and highlights the exciting possibilities of a new monetary era. CBDCs offer advantages such as quicker transactions, improved transparency, greater financial inclusion, and enhanced innovation, which appear limitless. Nevertheless, we must also reflect on the implications of this change.

What are the reasons behind the focus and extensive research being conducted on CBDC?

“It is a paradigm shift. A technological one. Just as Voice over IP turned the telecom world upside down, the arrival of Blockchain technology – powering cryptocurrencies and stablecoins – has enabled non-financial entities to enter the payment business.

In other words, the barrier to entry suddenly dropped, revealing a risk of new entrants with different goals and different business models joining the competition.

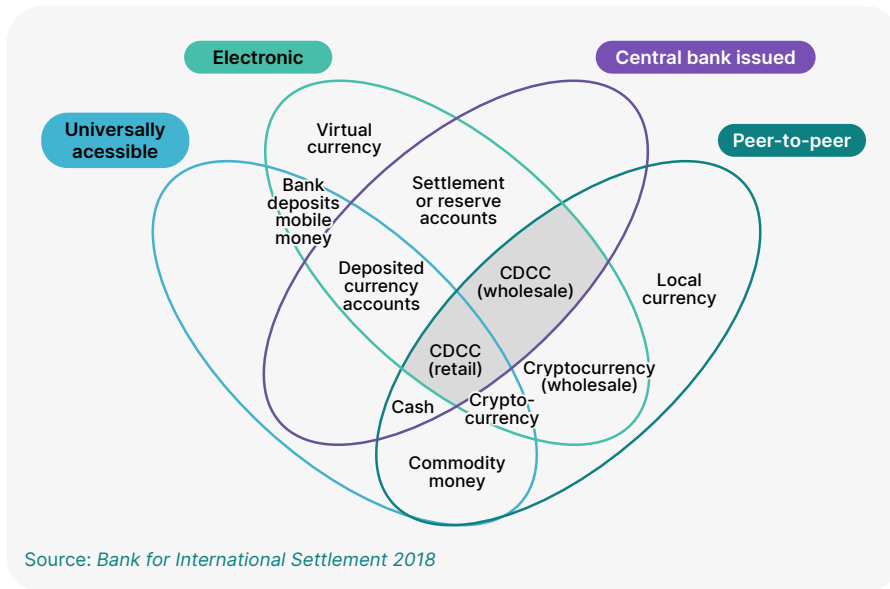
That touches the “sovereignty” of States, not directly, but indirectly by weakening their financial institutions. CBDCs are a way to bring the payment business into the 21st century.

It is not easy, but central banks are showing the way, and that’s clearly to their credit...”



Nicolas Kozakiewicz
Innovation Executive Advisor.

What is a CBDC?



A new instrument of sovereignty for a jurisdiction’s currency is emerging under the name of Central Bank Digital Currency or CBDC. Unlike typical e-money, it is a direct liability from the central bank and constitutes part of its monetary base. Currently, the public holds central bank money physically through coins and banknotes issued by the central bank, while financial institutions also have reserves in the form of digital accounts with the central bank. CBDCs are issued and managed by a country’s Central Bank, serving as a modern tool for both individuals and businesses to conduct retail transactions, akin to using cash, but in a digital format. Additionally, CBDCs will find utility in the interbank market, facilitating streamlined wholesale settlements.

Retail CBDC

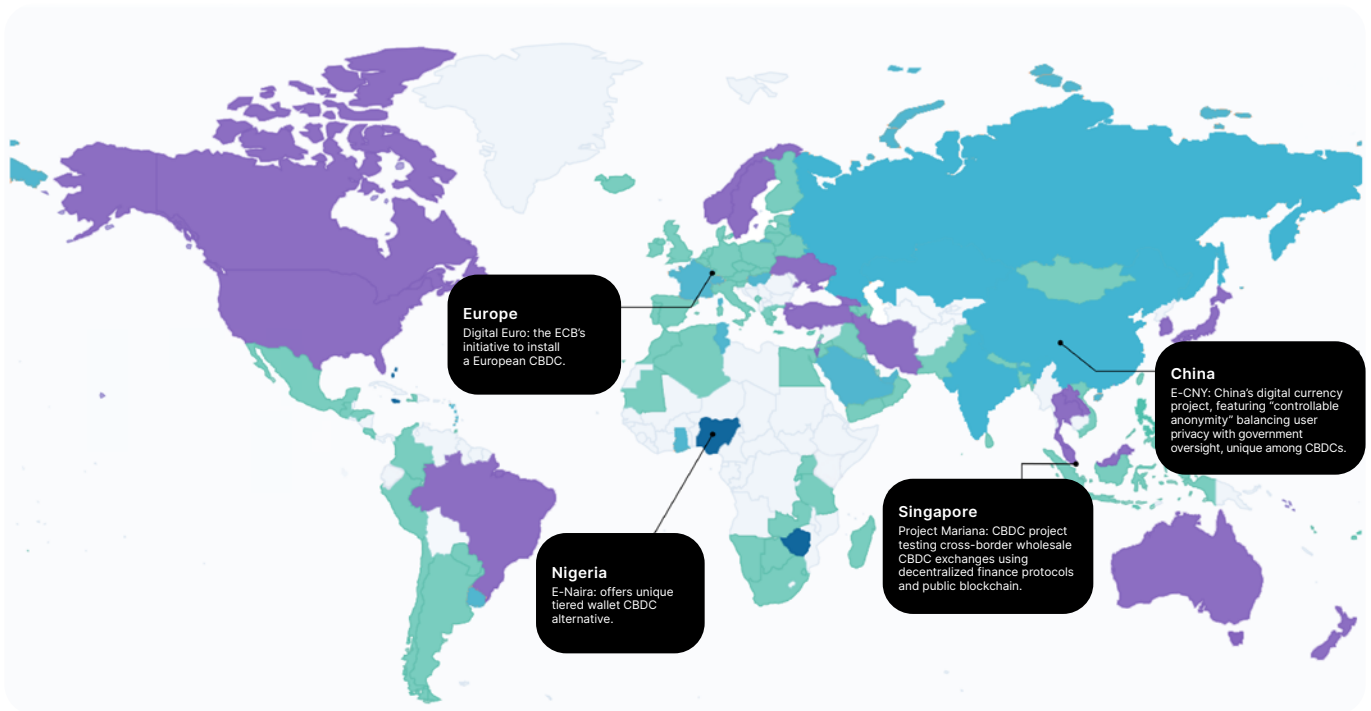
The idea behind the development of Retail CBDC is to provide universal access to a digitalised liability from the central bank. The creation of such would enable any entity, any person or business to free hold and transfer public money in a digital form.

Wholesale CBDC

A wholesale CBDC serves as a means for interbank settlements, aiming to accelerate transaction speed, reduce cost and improve security for international transfers. This concept enables financial institutions to facilitate their current transaction processes.

The rise in popularity of CBDCs

■ Research ■ Proof of concept ■ Pilot ■ Launched



www.atlanticcouncil.org/cbdctracker/

Since the initial emergence of positive discourse around CBDCs, what may appear as a subtle shift has garnered significant attention from central banks and leading financial institutions globally. These entities are actively exploring various development options, focusing on both wholesale and retail CBDCs. As it stands, fourteen distinct CBDCs have progressed to the pilot stage. Although the majority of these projects are still limited in scale, three have transitioned to a fully launched status : Bahamas, Nigeria, Jamaica. Meanwhile, large-scale developments are to come with the E-CNY in China, and Digital Euro in Euro Zone. The driving force behind their evolution is a combination of innovative technology and careful consideration of population feedback, ensuring that these digital currencies are effectively tailored to meet user needs and preferences.

Each of these digital currencies offers a secure, user-friendly, and swift transaction mechanism for goods and services within their territories. Their performances are under scrutiny, with multiple global financial institutions keenly observing their operations and results to adapt their own CBDC to these standards.

Although the development of CBDCs is a complex and challenging process, it is gaining momentum worldwide. As more countries explore the potential benefits of CBDCs, we can expect to see further progress in the coming years. According to Juniper Research, the transaction volume is projected to reach \$100 million by 2023 and \$213 billion by 2030¹. This represents a significant growth of over 260,000%, reflecting the early stage of the sector.



01 — www.juniperresearch.com/press/cbdc-transactions-to-exceed-213-bn-by-2030/

Usage of CBDC

When did Worldline started to invest in CBDC?

“Worldline has been at the forefront of digital currencies exploration. Following the emergence of digital assets such as Bitcoin, Worldline had invested in R&D to anticipate the technology shift around blockchain. In the meantime, we started to support our first clients in their strategy with digital currency, developing innovative products for them. But the momentum truly accelerated in 2019 with Facebook’s unveiling of the Libra/Diem project, a stablecoin issued by a private corporate, backed by multiple currencies. This has forced the market and central banks, especially in Europe, to recognize the urgent need for innovation in payment systems. Since then, hundreds of CBDC exploration have been led by central banks, and Worldline has been continuously investing to support our clients and public institutions in this revolution.”



Clément Jozwiak
Chief Product Officer
Financial Services.

Overall, the introduction of CBDCs would stimulate competition and innovation and improve the efficiency of payments. We could benefit from streamlined settlement procedures, faster processing times and automated compliance workflows.

Driving forces behind CBDC

The rise of cryptocurrencies and the growing demand for digital payments are among the reasons that have prompted central banks to consider developing and issuing their own digital currencies. However, there are other driving forces behind the development of CBDCs that go beyond the desire for digital payment alternatives and aim to improve the monetary system.

Improving the availability and usability of central bank money:



Availability

The use of cash is declining in many economies, potentially restricting access to public money. Central banks are considering issuing retail CBDCs to provide a secure and widely available form of money in the digital age.



Upgrade in payments

CBDCs could reduce operational costs and risks such as counterfeiting and theft. They could also facilitate faster and more efficient payment processes, potentially reducing corruption and fraudulent activity.



Monetary sovereignty

Private digital currencies are on the rise, which could concentrate economic power in the hands of tech giants. Central banks are considering CBDCs to maintain their role and guarantee public access to safe and reliable money.



Financial inclusion

Digital payments could extend access to financial services, particularly among those without banking infrastructure. CBDCs offer a more accessible alternative to traditional banking channels and could help drive national advancement.

Efficiency of CBDC through use cases

Generic use cases

Distribution

Instant disbursement at a low cost.

Maintenance

The system can be updated through software updates, lowering operational costs.

Monitoring

Real-time monitoring, helping in policy implementations and regulatory compliances.

Retail CBDC

P2P Payments

Facilitating efficient digital transfers between individuals.

Merchant Payments

Enabling efficient low-cost transactions between consumers and merchants.

Offline Payments

Ensuring financial access in areas with limited access through offline digital transactions.

Wholesale CBDC

Cross-Border Transactions

Streamlining international transfers reducing fees and transaction times and fostering global economic integration.

Wholesale settlement

Using CBDC as a settlement asset in central bank money to enhance transaction efficiency.

With endless possibilities to modernise current-day finance, CBDCs have several ways to facilitate and enhance the current experience for end-users and financial institutions. Here are a few examples of applicable use cases which can either accelerate the process in modern-day finance or supplement it by lowering costs, increasing security, facilitating payments, and more.





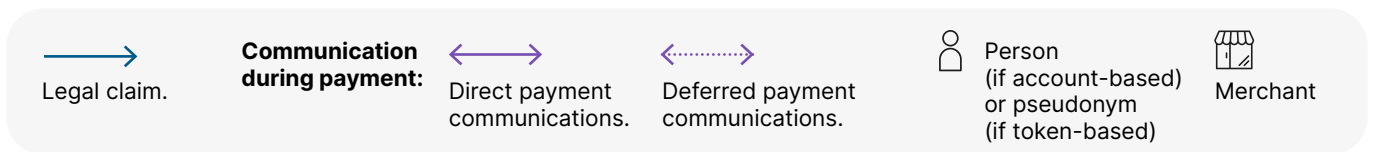
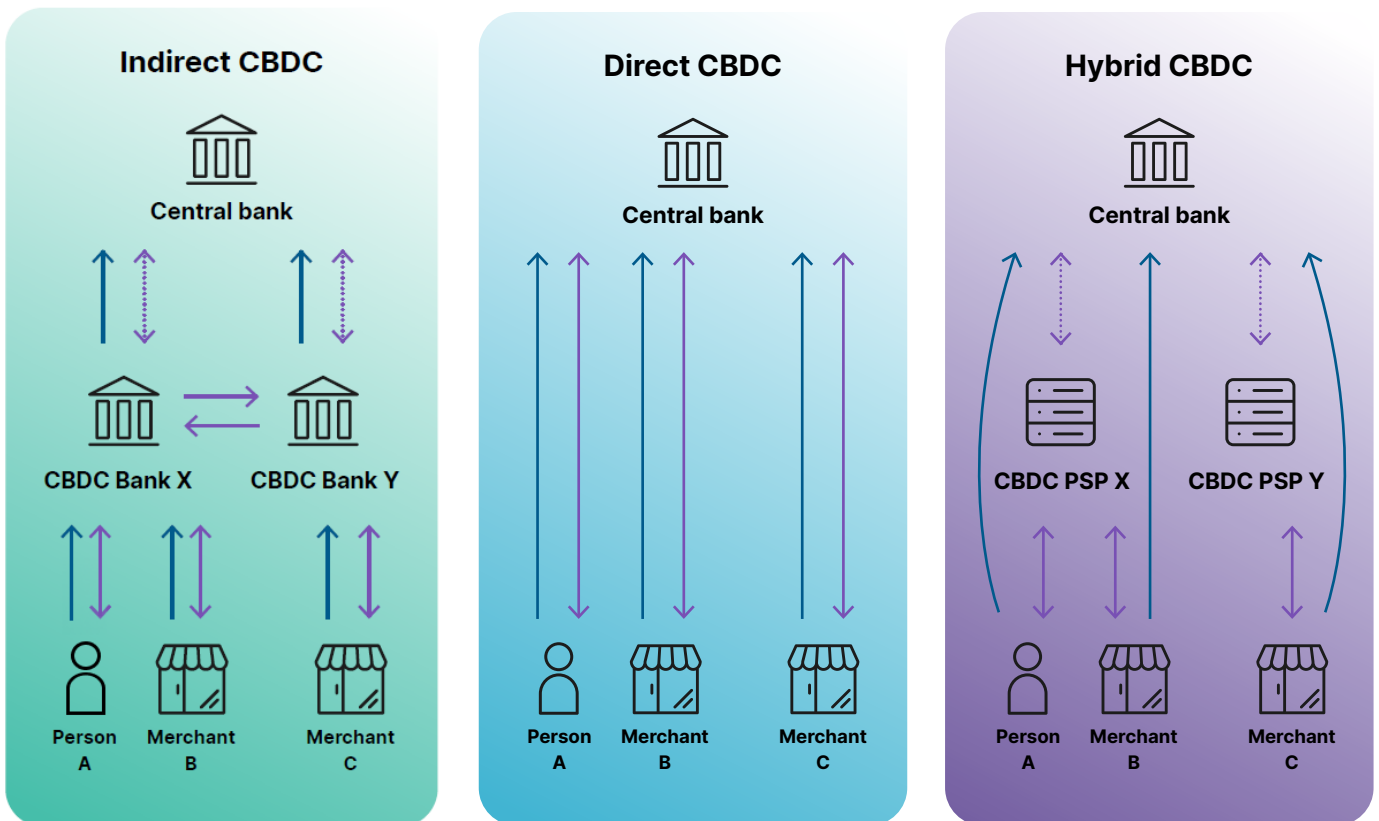
The creation of digital money public or private?

Around two-thirds of central banks are considering issuing a retail CBDC in the short or medium term, according to current trends. There are multiple reasons for this, including making domestic payments more efficient, ensuring secure transactions, and addressing concerns about financial stability. Developing countries are also considering financial inclusion.

Three potential infrastructures can be considered to meet the expectations of central banks and the public concerning the creation CBDC money.

A study conducted by the BIS found that most central banks are exploring a retail CBDC hybrid architecture that involves collaboration with the private sector.

The research suggest that hybrid CBDC is the preferable system. The Central Bank is responsible for the ledger (with anonymized or pseudonymized informations), but collaborate with the private sector for the distribution, and onboarding of the users.



Indirect CBDC involves regulated financial institutions distributing CBDC, preserving the role of commercial banks but raises concerns about potential migrations of bank balances

Direct CBDC enables direct deposits with the central banks but raises concerns about bank runs and operational challenges for the central bank.

Hybrid CBDC the hybrid approach presents a two-tier system, with PSPs responsible for distribution, onboarding, KYC, etc., but the accounts remain in the Central Bank ledger.

Developing a CBDC

Key design considerations

The design of a central bank digital currency (CBDC) must consider several factors, including the desired level of access, privacy, transferability, and custody. This involves making decisions about whether to replicate the properties of cash in a digital currency.

The distribution of a CBDC is widely agreed to be based on a two-tiers system. However, there are questions surrounding access.

Could you elaborate on the key characteristics that a CBDC system should take into consideration to create benefits to the financial ecosystem?

"To design a successful CBDC system, central bank policies should balance regulatory needs and user requirements for access, convenience and privacy. These shall define a viable value proposition for users, maximising consumer adoption and therefore stimulating private sector adoption and investment. The roles of both public and private entities should be preserved, but efforts should be made to maximise automation to help transition to a digital economy. Innovation should also be stimulated while cross-border transactions ought to be supported. On the other side, the commercial sector should have carte blanche on deposits, payment transaction processing and any other commercially viable service. Finally, CBDCs policies should fulfil all compliance requirements such as Know Your Customer, money

laundering and anti-terrorism financing regulations without introducing additional burdens for PSPs. The design of the system must also consider supportive policies and tools for financially excluded or underserved / commercially unviable segments to adopt the CBDC. This might include deploying pre-funded cards, or providing access to mobile devices to these groups if mobile wallets are the only transaction tool but also a mechanism for delivering helicopter money at scale in case of a financial crisis.

Lastly, the technical stack and supplier selection must meet requirements for availability, reliability, capacity and scalability, security, and continuity in addition to the above policies."



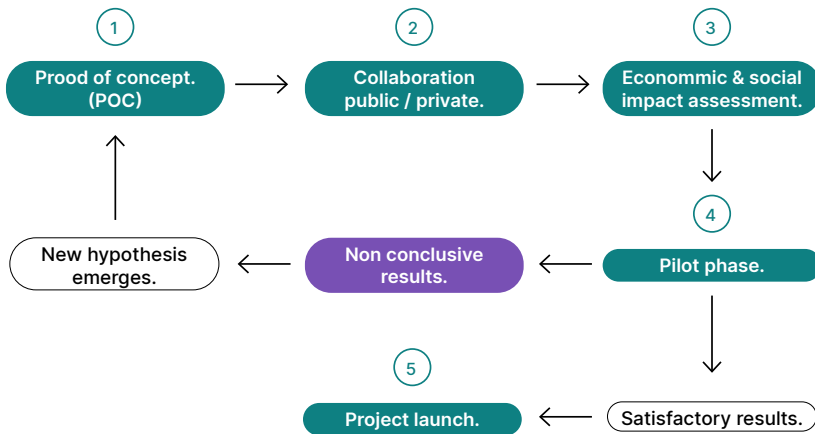
Sabrina Rochemont
CBDC Expert.

The infrastructure of the CBDC must be designed to scale seamlessly as adoption grows, with a focus on maintaining performance and security at larger scales. Exploring solutions for enabling cross-border transactions and ensuring interoperability with other digital currencies, means of payment and payment systems is crucial to unlock global scalability. Moreover, implementing a framework for regular technology upgrades is necessary to keep pace with evolving technology advancements, ensuring the CBDC remains robust and relevant in a rapidly evolving digital financial landscape. Finally, it is also important to open new gateways to the private sector to keep the competition fierce and motivate innovation to create a more qualitative global experience, which could even be personalised and unique.



CBDC deployment

The process of implementation is currently a game of try and repeat with multiple projects developing a proof of concept and testing it.



- 1 The CBDC model needs clear objectives to evaluate its feasibility, efficiency, and effectiveness. Gathering honest observations and user experience data can provide valuable information for the project's growth and development.
- 2 Private sector involvement and open system architecture are key to the CBDCs growth and sustainability. Regulations that encourage competition and compliance, as well as engagement with Fintech companies, can promote innovation and technology development.
- 3 Conducting comprehensive analyses on both high-level and operational-level hierarchies is important to evaluate the CBDCs impact on financial inclusion, monetary policies, and economic growth. This analysis can lead to a clear assessment of the potential value of the CBDC.
- 4 A controlled rollout of the CBDC in selected regions or sectors, followed by continuous monitoring of its performance, can provide valuable feedback to refine the design. This approach allows for refinement of the CBDC to address any identified issues before deploying it more broadly.
- 5 Launch of a full-scale CBDC following conclusive pilots, to replace the local currency and boost the economy of the government implementing it.

How should a central bank approach the integration on CBDC in the existing system?

“Despite its intrinsic value, individual and business users will only actively embrace a new digital currency if it is convenient and easy to use. Merchants should be able to initiate transactions to conclude sale in a generic way without the extra hassle of selecting a payment method. Individuals don’t want to actively charge and manage a separate balance alongside their current account systems.

To accelerate adoption, leverage the reach of established service providers, and be sufficiently open for new or existing market driven front-end innovations and integration standards. This is where transparency and added value innovation can be found to entice individuals and merchants.”



Johan Maes
Head of Worldline Labs.

Key success Factors for a CBDC



Data governance

- The collection of payment data in a CBDC system raises concerns about privacy and security. Central banks must therefore ensure that user and payment data are protected.
- CBDC should be designed to protect privacy and give the users control over their data, while complying with AML and CFT regulation. Some models allow for a greater privacy by keeping the data only at the Financial Intermediary level.



Interoperability

- CBDCs must coexist or integrate with existing financial infrastructure and payment systems such as ACH, SWIFT, or RTGS, to be widely adopted.
- CBDCs compatibility with various payment instruments like digital wallets, mobile payment apps, and traditional bank cards will make it easy for users to access and use it.
- Interoperability across systems and devices is crucial for inclusivity and user-friendliness as it allows for seamless transactions across different technologies and ecosystems.
- CBDCs should allow flexibility in conversion, enabling users to convert their holdings into other forms of money, including physical cash or commercial bank money, as needed.

How can merchants be part of the network effect of CBDC?

“Today’s merchants have to deal with a multitude of different payment instruments – ranging from credit and debit cards to alternative payment methods, account to account payments and various European- and international wallets. Worldline’s goal is to ensure that the acceptance of CBDC follows our philosophy of simplifying life for our customers. Instead of fragmenting or bifurcating the acceptance or payment flows, we aim to deal with that complexity behind the scene, so that our customers can focus on what do they best: serving their customers and facilitating commerce.”



Urs Gubser
Head Innovation Merchant Services.



Opportunities of a CBDC

Accessibility and added value

CBDCs provide an opportunity to introduce innovative value-added services by offering a secure and efficient payment solution. Commercial banks will play a crucial role in the successful implementation of CBDCs, as they will be entrusted with the services required to support CBDC transactions. By closely collaborating with central banks, commercial banks can ensure widespread adoption of CBDCs and take advantage of their potential to create additional value-added services. Streams of businesses such as digital wallets or mobile payments could further magnify and develop the accessibility to this brand-new technology.



Mobile payments

CBDCs can be used for direct transfers between peers, and retail banks can offer mobile payment services by integrating CBDCs into their mobile banking apps or developing dedicated CBDC payment apps, providing customers with a convenient and secure way to make mobile payments using public money.



New financial products

CBDCs offer opportunities to increase the efficiency, transparency and accessibility of the financial market. The introduction of digital bonds and loans through CBDCs could meet the evolving needs of investors and borrowers by enabling broader participation in bond markets and facilitating access to loans.



How do you believe CBDCs can complement or compete with existing digital payment systems, such as cryptocurrencies and other private payment platforms?

"I believe that CBDCs (Central Bank Digital Currencies) will both complement current systems by filling gaps in accessibility to the digital economy and strengthen competition, particularly in terms of robustness and reliability. Indeed, CBDCs will reinforce financial inclusion by providing equitable and universal access to digital money, especially for those without traditional banking services. At the same time, backed by the credibility and stability of central banks, CBDCs could offer a more reliable digital payment option, fostering trust among users concerned about the volatility inherent in cryptocurrencies and the regulatory uncertainties surrounding private platforms."



Maelle Lafont De Sentenac
Group Head of Strategy.

Cross-Border Transactions

Cross-border transaction occur when persons or businesses in one jurisdiction send or receive money from other persons or businesses in another. Usually it relies on correspondent banking network. New players such as Financial technologies companies are entering the market, especially with peer-to-peer payments, through the use of digital wallet.

CBDC could also simplify cross-border transaction by reducing the number of intermediaries.

Multi-CBDC platforms are emerging as a viable solution to facilitate cross-border transactions. These platforms allow financial institutions to transact directly with each other using digital currencies issued by participating central banks without the need for intermediaries, thereby reducing the time and cost of transactions.

Cross-border payments remain slow and expensive, especially in emerging market economies. Multi-CBDC could offer a solution by enhancing efficiency and reducing the cost of these international transactions, thereby making financial services more accessible and affordable in these regions.

The full report on project Mariana in 2023¹, a collaborative effort among financial entities of different countries such as Singapore, Switzerland, Malaysia, and France on CBDC initiatives in September, concluded that the project was a tremendous success. It reinforced the technology and enabled significant progress in facilitating cross-border payments and advancing CBDCs as a whole. However, the report emphasised that further experimentation was needed and collaboration among stakeholders would be crucial to continue progressing.

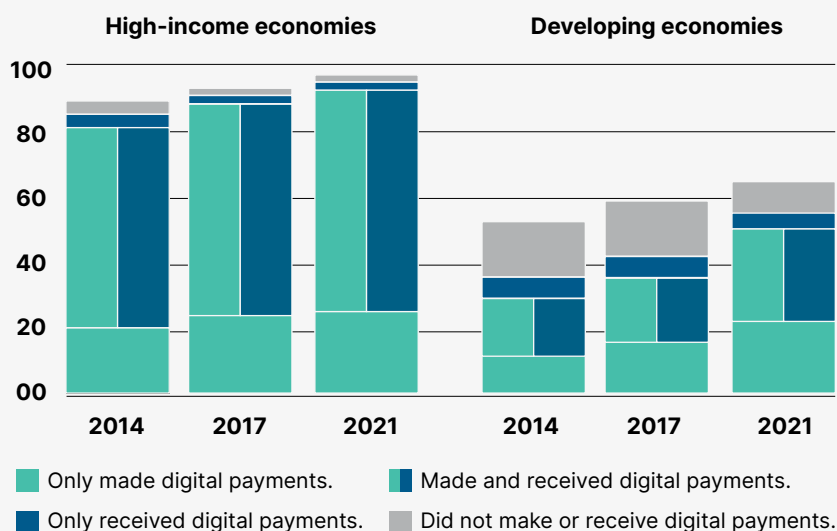


Financial Inclusion

The gradual decline of cash payments and the increasing popularity of card and digital payments are paving the way for CBDC and financial inclusion. This transition is driven by several factors including technological advancements, changing consumer behaviours and the global response to the COVID-19 pandemic, which accelerated the adoption of digital payment instruments over physical instruments (checks, cash, ...).

The reliance on cash is gradually diminishing and the majority is shifting towards online and digital payments. CBDCs, in their design, can significantly impact financial inclusion and the broader payment systems. They have the potential to facilitate the integration of unbanked individuals into the financial system. The IMF notes that CBDCs could offer a risk-free and widely acceptable form of digital money, which is available for offline payments, potentially lowering costs and offering greater accessibility, thereby promoting financial inclusion.

The largest share of digital payment users both made and received payments (versus only made or only received). Adults with an account (%). 2014-2021¹



Both emerging and developed markets have economic incentives to explore CBDCs. Emerging markets often grapple with inadequate financial infrastructure, and CBDCs can provide a secure, fast, cheap, and reliant means of payment. On the other hand, developed countries are seeking faster and cheaper payment methods, preserving monetary sovereignty.

How can CBDCs be designed to promote financial inclusion and ensure accessibility for all, including unbanked and underbanked populations?

“When considering inclusivity, it is crucial to address both financial inclusion and accessibility for individuals with disabilities, or non-digital natives. CBDC should be universally accessible, offering a reliable means of payment. In the envisaged System, the responsibility for onboarding users and distribution of CBDC wallet would fall to Payment Service Provider (PSPs). By extending distribution beyond commercial bank, unbanked people could have a reliable mean of payment in a digital economy. Additionally, implementing a tiered-wallet system, would permit users to sign-up with minimal information. This approach is exemplified by the E-Naira in Nigeria,

which let individuals to onboard with only a phone number, and imposes lower limits on holding. Offline functionality is also critical, enabling transactions for those who can't access the internet, and providing cash-like features. Secondly, the interface should apply the latest accessibility standards: high-contrast colours, voice guidance, compatibility with screen readers, etc... Overall user experience will be key to encourage adoption, especially among those who are non-digital natives. All of this is essential to ensure that CBDCs are usable for everyone regardless of their condition or aptitude. “



Thibault Pelé
Product Manager CBDC.



Offline Payments

Reasons for offline payment

Implementing an offline payment system is a way for a CBDC project to create a cash resemblance. Offering a dematerialised currency to central banks seeks to provide a seamless and familiar user experience, akin to physical banknotes, while also ensuring pseudonymity and resilience in times of crisis. By replicating the ease of use and convenience of cash, individuals and businesses can easily transition to the new digital payment system.

Overall, offering a dematerialised currency to central banks addresses the challenges of crises and enhances the accessibility and reliability of the digital currency.

What main technical challenges will central banks face when deploying a scalable offline solution, and how can surpassing these challenges contribute to the democratization of CBDCs?

“When talking about the adoption of offline solutions, we’re really talking about trust. Unlike online transactions, no third party is involved to establish that both transacting parties are trustworthy.

Similar to traditional fiat banknotes, embedding physical measures to detect counterfeit, offline digital currency must provide guarantees to ensure legitimate transactions for end users. The use of smart chip banking cards over the past few decades has demonstrated that hardware security has the potential to provide this trust.

Also, for such a solution to be widely adopted, it must be convenient for end users. The smartphone ecosystem is evolving and can be one answer to both requirements.

Worldline has the expertise to take advantage of hardware security using the increasing availability of embedded secure elements in today’s smartphones.”

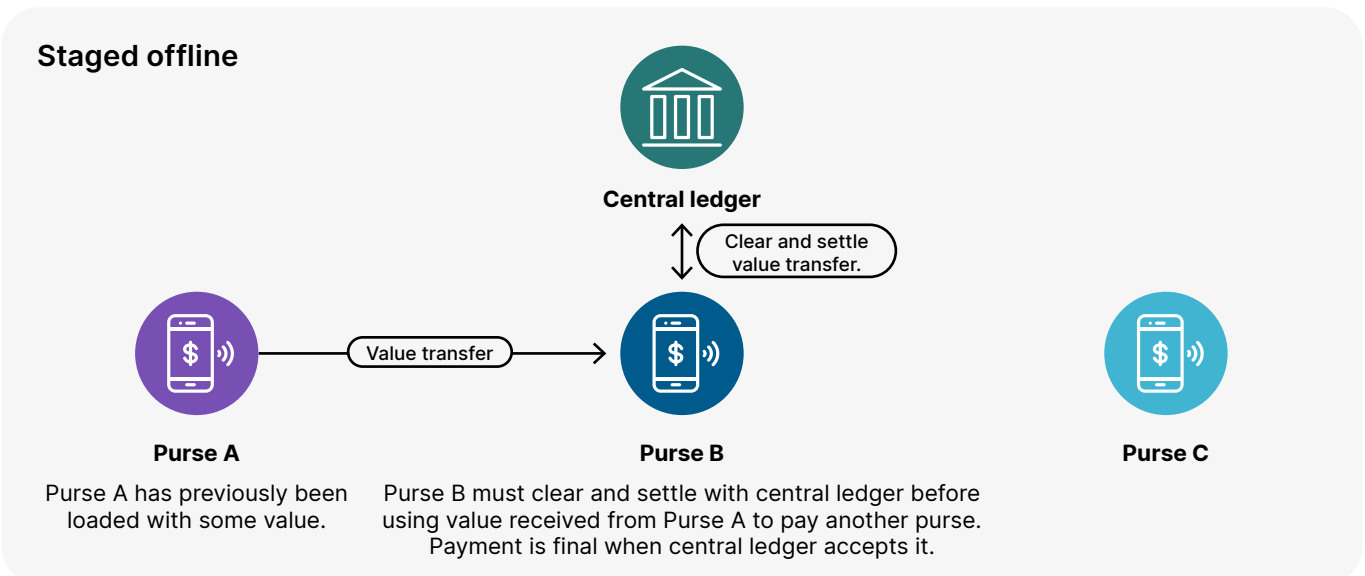
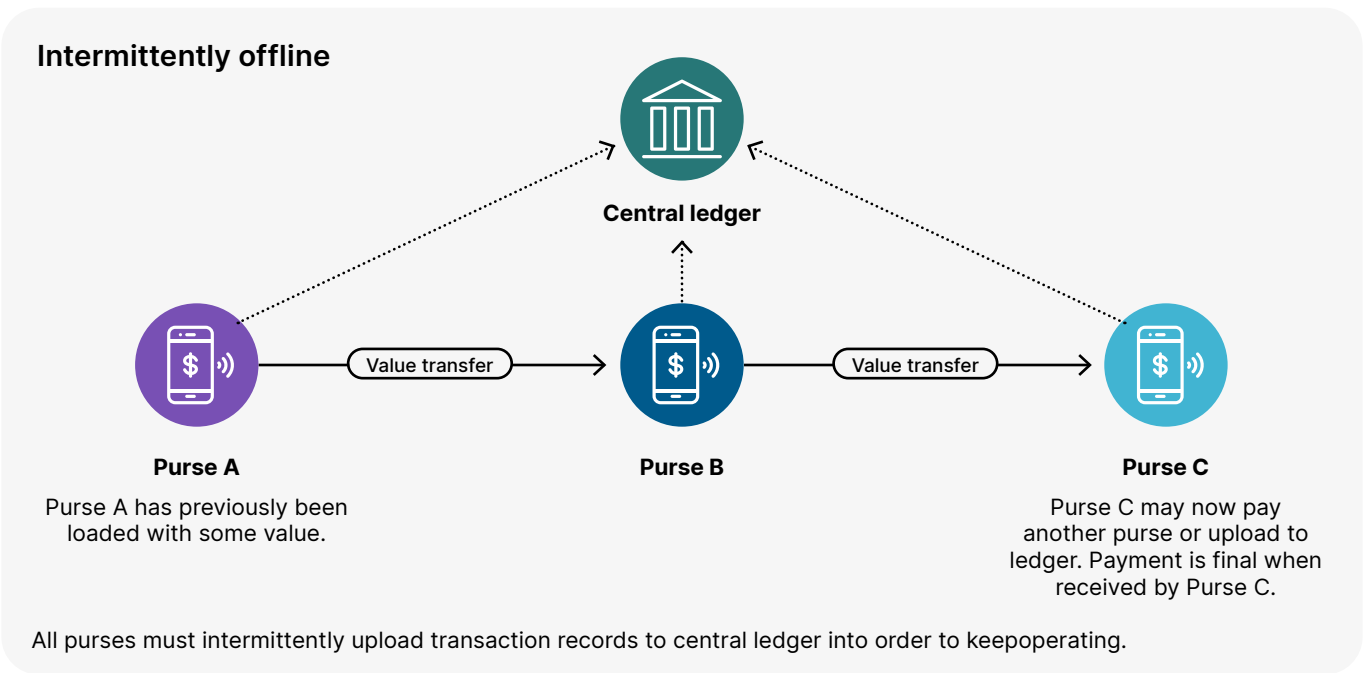
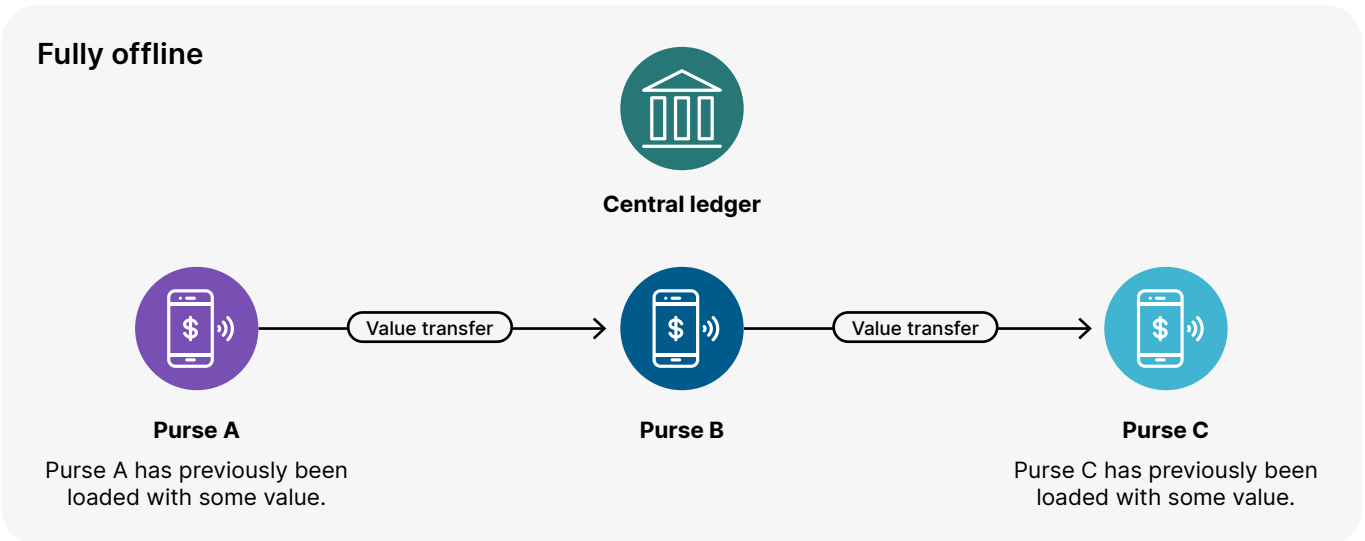


Ramuntcho Goyenette
Offline Architect - ECB D€ Prototype

In the event of a global or regional crisis, hack, or emergency, which could jeopardize and potentially shut down the CBDC network, having an offline payment system can support the continued functioning of the economy and its surrounding ecosystem. Overall, offline payments bolster the resilience and sustainability of the CBDC initiative. Furthermore, the ability to pay in any situation (online or offline), fosters trust for the user, giving the impression of using a reliable and available service.

Offline payment structure

Intermittent offline can manifest in two forms: “short” intermittency, beneficial for partial loss of connection like when entering a parking lot, and “long” intermittency, where users experience a longer loss of connection (days or even weeks).



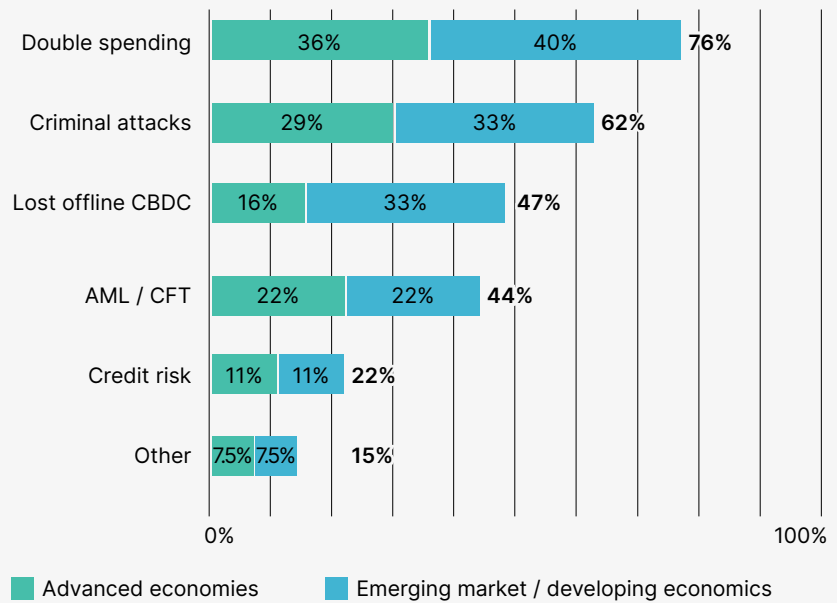
Risks of offline payments

While offline payment is a great initiative and unlocks many features which benefit the project as a whole, it would still be subject to certain risks. These risks can be classified into three different categories:

- **Technological:** any risks that may disrupt the functionalities of the CBDC due to technological failures.
- **Operational:** any risks in relation to internal operations.
- **Reputational:** any risks that may impact the image and reputation of the CBDC project, potentially leading to negative repercussions.

Risks such as counterfeit or double spending, where a currency can be used twice, or more, are prominent when considering the array of risks involved.

What are the greatest risks with offline payments with CBDC?



Survey respondents could select more than one option, so the total does not up to 100%. Source: BIS IH central bank survey on offline payments with CBDC.

It will therefore be more than necessary to approach risk management with extreme caution and not underestimate the risks of failure as some of them carry immense consequences. Ensuring the security levels of a CBDC must be robust, and the introduction of offline payment functionality presents additional security challenges. Development efforts must focus on addressing concerns such as double spending and the potential loss of devices that could result in a loss of funds for the user.



Conclusion

CBDCs: reshaping the future of money?

While the development of CBDCs is still in its early stages, the numerous pilots and initiatives by different financial institutions hold great promise for the evolution and sustainability of digital finance. The decisions and actions we take in the coming years in response to this emerging technology will be pivotal for our economy.

Worldline's stance on CBDCs

As a leading global FinTech company, we fully embrace this evolution and are enthusiastic about advancing not only our brand but also our partnerships. The potential introduction of a retail CBDC could cause confusion for merchants and small businesses worldwide, which is why we seek to act as intermediaries, facilitating the development of practical solutions while also sharing insights into the many benefits inherent to this revolutionary form of currency. By fostering support for the CBDC ecosystem, we are creating a solid foundation for the technology to prosper and endure over time.

Furthermore, as the commercial banking industry undergoes a monumental shift, its very essence will be redefined. At Worldline, we recognise the significance of this change, and we are committed to providing guidance and support to financial institutions as they navigate this transformative period. Our goal is to facilitate a smooth transition and enable these banks to thrive in the new era of banking.

Worldline's projects

European Central Bank

In 2022, Worldline embarked on its journey in the CBDC sector by being selected by the ECB to develop a prototype of mobile wallet for offline payment leveraging hardware secure element. In 2023, we conducted extensive market research, providing valuable support to the ECB in designing 12 CBDC components.

Bank for International Settlement

Worldline's commitment to the CBDC sector was further evidenced in March 2023 when we were selected to develop a CBDC use case for the BIS TechSprint. This project involved integrating Rosalind APIs with our Wallet and POS to demonstrate a streamlined end-to-end payment journey for customers and merchants.

Subsequently, in May 2023, Worldline had the privilege to present our innovative offline solution to BIS Nordics, as part of BIS's project Polaris.

Reserve Bank of Australia

As part of the exploration of the RBA, ANZ collaborated with Worldline on an offline usecase to demonstrate how an organisation could step in during an emergency to provide immediate financial support through the distribution of a CBDC.

These collaborative efforts underscore Worldline's proactive and influential role in shaping the future developments within the CBDC sector.

[Learn more](#)



Why is Worldline supportive of central banks in their CBDC development?

"At Worldline we are in discussions with many central banks around the globe about the benefits of CBDCs and how a central bank could implement CBDCs. CBDCs offer enhanced monetary policy tools, enabling direct control over money supply, facilitating financial inclusion by reaching unbanked populations and increasing transparency in financial transactions. Additionally, CBDCs can counter the rise of cryptocurrencies and stablecoins, providing a regulated alternative that maintains monetary sovereignty. They also offer a chance to innovate payment systems, promoting efficiency and security while potentially combating illegal transactions. For central banks, CBDCs represent a modernised approach to finance, fostering economic stability and adaptability in an increasingly digital financial landscape."



Sheri Brandon
Chief Market Officer at Worldline
Financial Services.

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About Worldline

Worldline [Euronext: WLN] helps businesses of all shapes and sizes to accelerate their growth journey – quickly, simply, and securely. With advanced payments technology, local expertise and solutions customised for hundreds of markets and industries, Worldline powers the growth of over one million businesses around the world. Worldline generated a 4.6 billion euros revenue in 2023.

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