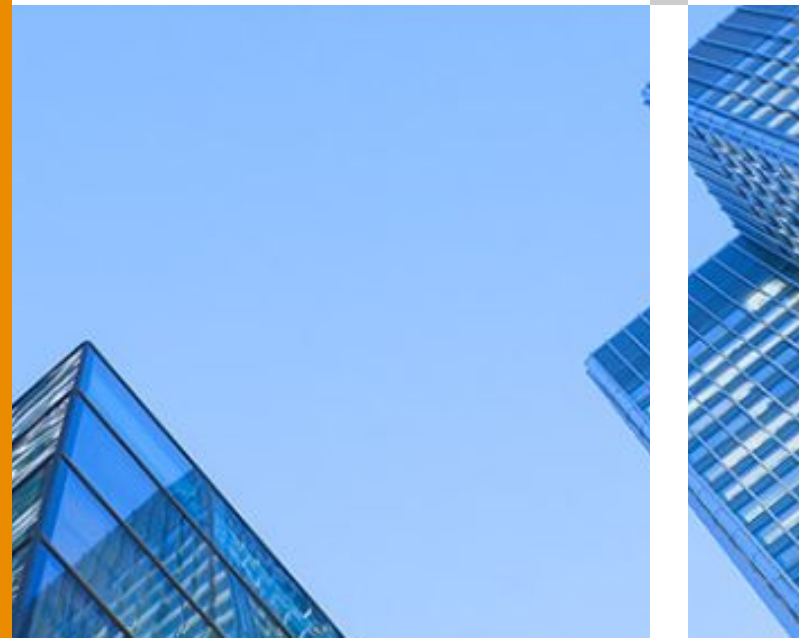


PwC CBDC Global Index

1st Edition

April 2021



PwC Global CBDC Index 2021

Dear Clients and Friends,

We are proud to launch the 1st edition of the **PwC Global CBDC Index**. We hope the analysis and insights from this report will provide useful data points. We aim to publish this report annually to enable you to monitor the ongoing transformation triggered by Central Bank Digital Currencies (CBDCs) globally.

The **PwC Global CBDC Index** is designed to measure a central bank's level of maturity in deploying their own digital currency. It provides a synthetic index, capturing the central banks' progress, stance on CBDC development and public interest in two distinct use cases:

- Retail CBDC which are held directly by citizens and corporates;
- Interbank, or Wholesale CBDC which are restricted to Financial Institutions, principally for interbank payments and financial settlement processes.

We believe CBDCs will contribute significantly to the modernization of the international monetary landscape, hand-in-hand with reconfiguration in both payment and financial infrastructure. They will generate numerous opportunities for further digitization in both corporates and financial institutions, as their integration in payment and financial infrastructure progresses.

Seizing these exciting opportunities will require operational, legal and regulatory process upgrades as well as an alignment of accounting and internal control measures. PwC has developed a “one-stop-shop” offering which includes strategy, legal, regulatory, accounting, tax, governance, risk assurance, audit, cybersecurity as well as transaction advisory.



The general public will be one of the biggest beneficiaries of CBDCs as it will give them access for the first time to a digital form of central bank money. And that is a big milestone in the evolution of money.



Henri Arslanian
Partner and Global Crypto Leader
PwC

Three trends to watch out for in 2021

CBDC projects are gaining traction

More than 60 Central Banks have been exploring CBDCs since 2014.

Progress has been **accelerating** with some CBDC projects now entering implementation phases.

Institutional involvement in CBDC continues to strengthen the ecosystem at large, with public stakeholders such as the Bank for International Settlements, the World Bank, the International Monetary Fund or the World Economic Forum, active on the topic.

CBDCs are now live Transactional volumes should be interesting to monitor

Central Banks are working on two main CBDC operational designs:

- **Retail** applications, where CBDCs can be directly held by citizens and corporates as a form of digital cash.
- **Interbank or wholesale** applications, where CBDC use is restricted to financial institutions, namely for interbank transactions and financial settlement.

Retail CBDC projects appear to be more advanced in emerging economies with **financial inclusion** stated as an expected outcome. Wholesale efforts are mostly conducted in more advanced economies, with more developed **interbank systems and capital markets**.

Looking at the most advanced projects globally, retail efforts have already produced **two live projects** in the Bahamas and Cambodia. No interbank/wholesale CBDC projects have reached this maturity level yet. However, nearly 70% of declared wholesale projects are already running pilots, while only 23% of retail projects reached this implementation stage.

Blockchain is the technology of choice

More than 88% of CBDC projects, at pilot or production phase, use blockchain as the underlying technology.

Whilst a blockchain is not always necessary to create digital tokens, blockchain technology brings several benefits to CBDC developments. Namely:

- Integrated platforms built by design to share value and **transfer ownership in a secure way**, which is key to supporting digital money;
- Smart contract **programmability**, supporting CBDC as a new form of programmable monetary instrument that could trigger automatic payments based on pre-programmed conditions;
- Transparent **audit trails**;
- Configurable **confidentiality** features;
- Increasing **interoperability** with other digital assets through atomic swaps.



A low-angle, upward-looking photograph of several modern skyscrapers with glass facades, set against a clear, light blue sky. The buildings are positioned around the perimeter of the slide, creating a sense of height and urban density. A large orange rectangular area is overlaid on the left side of the image, containing the main text.

PwC Global CBDC Index - Top 10

A quick snapshot of CBDC maturity globally.



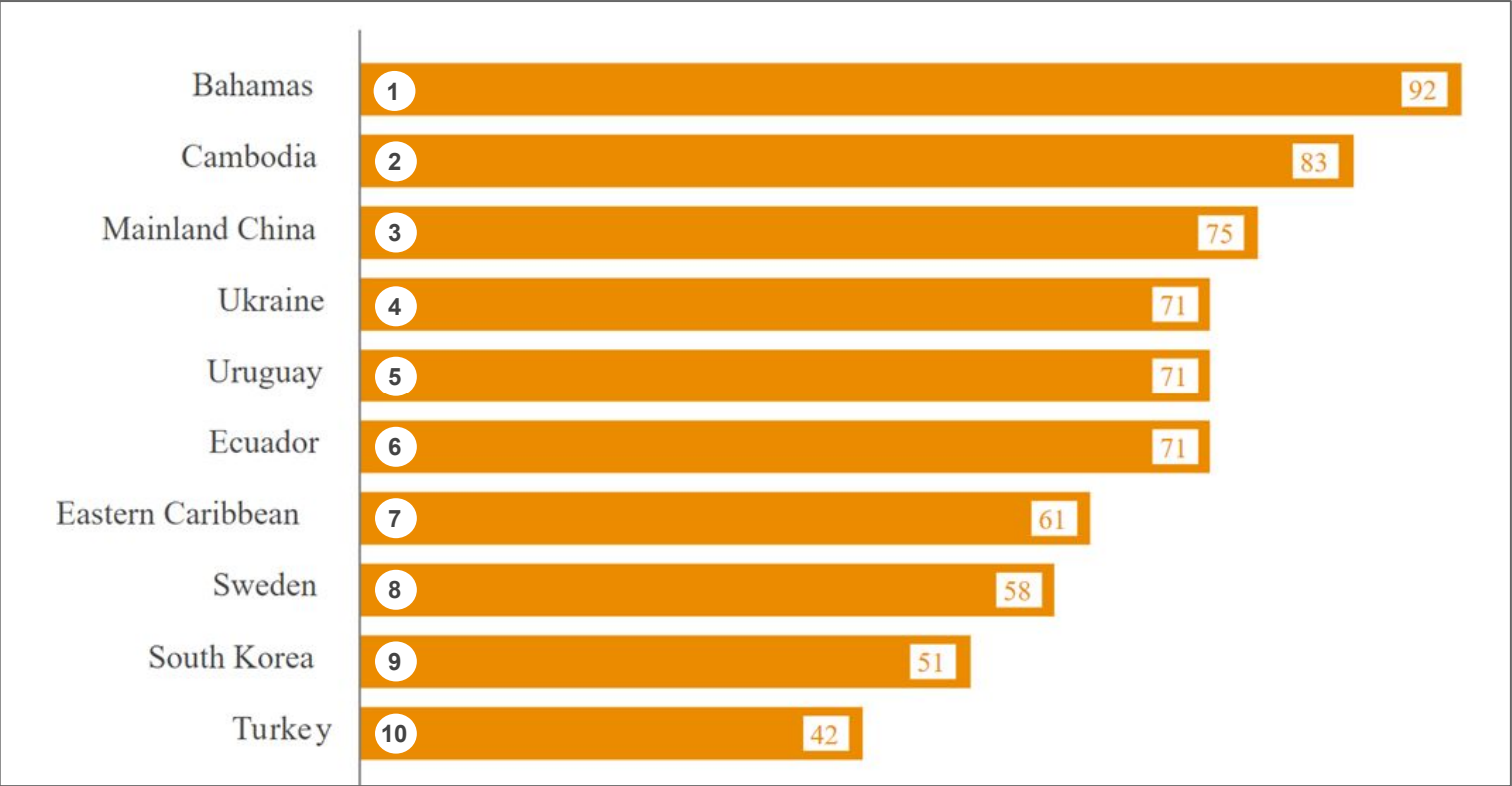
More than 60 central banks have already entered the central bank digital currency race. CBDCs will be a game-changer, providing access to alternative payment solutions for citizens and corporates, as well as reinventing financial market settlement and interbank monetary transactions.



Benoît Sureau
Partner Financial Services Risk and Blockchain
PwC France & Maghreb

Project Maturity - Retail CBDC development

Top 10 - Retail CBDC projects



Source: BIS Working paper No 880, December 2020 update and PwC analysis. Rebased against an index of 100, and is dependent on the availability of data.

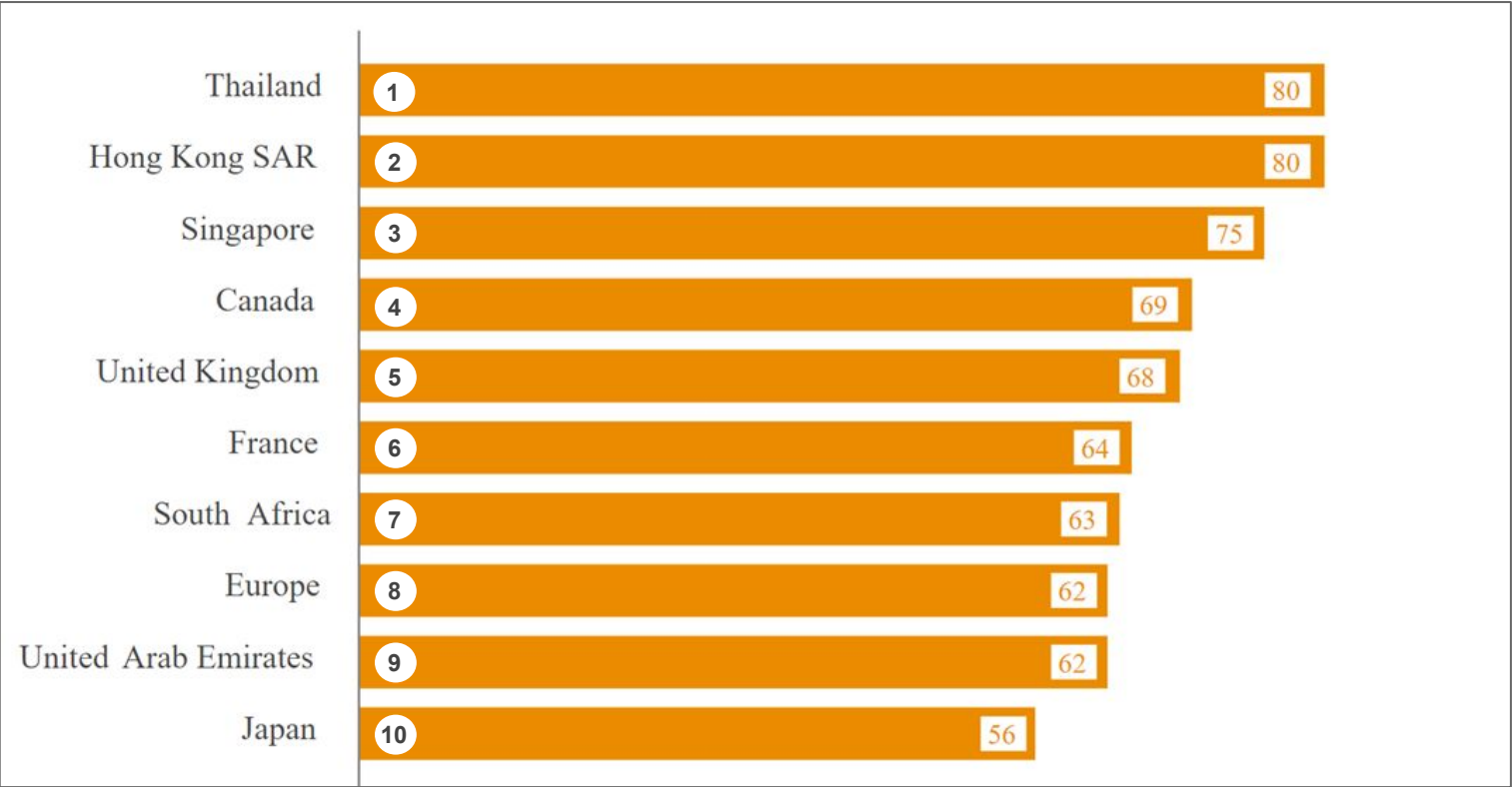


Key insights

- Retail CBDC initiatives are particularly strong in **emerging economies**, where financial inclusion and digitization appear as key drivers.
- Two projects are now **live**; the **Bahamas with the Sand Dollar** and **Cambodia, with project Bakong**. It is still too early to capture uptake data on CBDC usage but 2021 should produce further interesting insights.
- The **Digital Yuan project in Mainland China** has already reached an advanced level of trialling, with more than 2 billion yuan (~\$300m) in transactions and is reportedly preparing for broader usage at the Beijing 2022 Winter Olympics.

Project Maturity - Interbank CBDC development

Top 10 - Interbank or Wholesale CBDC projects



Source: BIS Working paper No 880, December 2020 update and PwC analysis. Rebased against an index of 100, and is dependent on the availability of data.



Key insights

- Advanced Interbank/Wholesale CBDC projects have on average **shorter research stages** than retail programmes but **longer pilot stages**. There are no live projects as yet but there are **very advanced pilot initiatives**.
- Cross-border** projects make up the majority of the most advanced initiatives, allowing Central Banks to test cross-border connectivity and project **interoperability**, examples include Hong Kong SAR-Thailand, Singapore-Canada, Europe-Japan, United Arab Emirates-Saudi Arabia.
- Most advanced interbank/wholesale projects are **expanding their scope** to test **interconnectivity** with other interbank projects or the potential of **linking with retail** projects.

Research methodology

Data source

BIS*, Central Bank websites, Atlantic Council, Press, Central Banks, Google Trends, Baidu Index and PwC Analysis

Index composition

The objective of this index is to provide an overview of the development of CBDC globally.

The primary variable is the CBDC project status, indicating the current stage of project development. Two other variables capture the stance of the central bank based on published speeches, and a public interest proxy (Google Trends or Baidu Index).

This index is technology agnostic: each countries' design choices (infrastructure, technologies, etc.) has no index impact.

Composition rationale

We analysed the following aspects of the three indicators introduced by BIS, based on the BIS data update release in December 2020:

CBDC projects' status tracks three stages of development - namely, research, pilot and production. Given the trend that more and more CBDC projects entered into pilot phases, we introduced more detailed development stages in the pilot phase (i.e. proof-of-concept, development, implementation and completion). The more advanced a CBDC project is, the higher score it receives. In addition, bonus points are allocated, based on the duration of the corresponding pilot projects, to simulate the project progress. For example, we expect on average a retail CBDC pilot project would complete its conceptual stage within one year from the start of their pilot project (or we expect that a retail pilot project takes three years to reach a conclusion and six years for a wholesale project.)

CB speech stance measures the recent average opinion expressed by Central Bankers captured within the BIS central bankers' speeches databases. This indicator aims to provide information about the future of the project status and legal aspects.

Public interest proxy is the average score of Google Trends (for projects outside Mainland China) and Baidu Index (for Mainland China only) during the recent periods. It represents recent trends of general public interest. It suggests potential collaborative interest from private sectors, who could support future project advancement.

Quality review

We made an extensive use of the BIS data, and subjected the analysis to several rounds of review prior to publication. Furthermore, a quality review is performed on index distribution and ranking changes to evaluate data robustness.

An expert judgement is undertaken on scores allocated to each qualitative indicator, i.e. *CBDC projects'* advancement status, CB speech stance before each publication.

* 'Rise of the central bank digital currencies: drivers, approaches and technologies', BIS working paper, No 880, August 2020 (updated December 2020) by Auer, R, G Cornelli and J Frost.

Retail CBDC Index of the Top 10 Central Banks

Discover in depth the most mature retail CBDC projects globally.

What is retail CBDC?

Retail CBDC can be directly held by citizens and corporates as a digital form of cash as a complement to paper money. As the digital equivalent of banknotes and coins, it offers a new platform for holding and exchanging money.





Central Bank Digital Currencies are direct alternative solutions to further financial inclusion efforts by public authorities. As sovereign digital cash, they can contribute to modernize the current monetary system but also help to bridge the gap with the unbanked.



Pauline Adam-Kalfon
Partner, Financial Services and Blockchain Leader
PwC France & Maghreb

Global ranking



1st

Index value



92

Retail index

Region



Americas

1st in Americas

Project name:
Sand Dollar

Top 10 - Retail projects

Focus on Bahamas

- The launch of the pilot phase in December 2019 marked the start of the Sand Dollar project by the Central Bank of The Bahamas. The Sand Dollar, i.e. a digital version of Bahamian Dollar, was officially launched in October 2020, issued through authorised financial institutions (AFIs). All residents can access the digital wallet through the mobile application or a physical payment card. The records collected during daily operations, such as income and spending information, can support applications for micro-loans.
- With the launch of Sand Dollar, the Central Bank wants to establish its leading position in the financial services sector with a modern payment system. In order to make that happen, the central bank set the following objectives:
 - Establish a more efficient Bahamian payments systems with more secure transactions and shorter settlement times;
 - Enhance financial inclusion, reduce costs, and promote access to financial services across The Bahamas;
 - Provide access to payment systems to citizens of all ages and status;
 - Strengthen controls around Anti-Money Laundering (AML), anti-counterfeiting, and other illicit activities associated with cash usage.

Link to Central Bank Project:

<https://www.sanddollar.bs/>

Global ranking



2nd

Index value



83

Retail index

Region



Asia

1st in Asia

Project name:
Bakong Project

Top 10 - Retail projects

Focus on Cambodia

- The National Bank of Cambodia (NBC) started exploring digital currencies in June 2018.
- Project Bakong, a DLT-based interbank payment system, was tested in July 2019 and officially launched in October 2020: it currently links 11 domestic commercial banks and payment processors. Since October 2019, the NBC has also started experimenting with digital wallets for cross border transactions with Maybank, a Malaysian-based bank, allowing the possibility of Cambodian citizens working in Malaysia, to transfer funds to Cambodia with much lower costs than before.
- Bakong aims to increase financial inclusion, in a country where most citizens are not accustomed to using bank accounts but mobile phone utilisation is high. It also allows interbank, real time electronic transactions and promotes transactions in Cambodian riels, compared with today where the bulk of transactions are in US Dollars.
- Bakong will support rural financial sector development, easing access to credit for SMEs and will provide targeted lending products for micro enterprises.

Link to Central Bank Project:

<https://bakong.nbc.org.kh/>

Global ranking



3rd

Index value



75

Retail index

Region



Asia

2nd in Asia

Project name:
DC/EP

Top 10 - Retail projects

Focus on Mainland China

- Mainland China began the development of a retail CBDC in 2014. In April 2020, Mainland China became the world's first major economy to pilot a digital currency. The pilot programs, conducted in its four major cities, (most notably Shenzhen in October 2020), have shown that the digital yuan works when paying for goods.
- The aim of DC/EP (Digital Currency/Electronic Payment) is to improve the convenience, the efficiency and the resilience of the retail payment system, which could further strengthen the yuan's monetary sovereignty and internationalisation. Its design features offer the potential to replace M1 (cash currency in circulation, such as coins and banknotes) and it could be functional both online and offline. The regulator does not expect it to replace long-term deposits in bank accounts.
- Mainland China adopts a hybrid approach for its technical design, with the People's Bank of China (PBoC) issuing DC/EP to commercial banks who then distribute it to the public. This offers the possibility of recording the flow of the digital currency between users, providing the PBoC with greater visibility on the use of money.
- The Digital Yuan project has already reached an advanced level of trialling, with more than 2 billion yuan (~\$300m) having been issued. Despite the fact that some crucial aspects like an estimated launch timeline remain undisclosed, Mainland China is currently believed to be preparing for widespread domestic use of DC/EP during the Beijing 2022 Winter Olympics.

Link to Central Bank Project:

No official website

Global ranking



4th

Joint

Index value



71

Retail index

Region



Europe

1st in Europe

Project name:
E-hryvnia

Top 10 - Retail projects

Focus on Ukraine

- In September 2018, the National Bank of Ukraine (NBU) launched its pilot project to explore the potential of launching an innovative, low-cost, secure and operational payment and transaction platform for retail use. The pilot project was completed in December 2018.
- During the pilot project, the NBU issued 5,443 E-hryvnia and tested the launch and the operation of a central bank digital currency (CBDC). The project included a test on distributed ledgers, formulating a provisional framework and regulations, establishing a temporary accounting model, and the study of various aspects from the impact on macroeconomic stability to the legal position of CBDC issuance and circulation. In areas such as monitoring and technical support, it was clearly demonstrated that the technology could support the issuance and circulation of the currency.
- According to the speech given by Yakiv Smolii, former governor of the National Bank of Ukraine, in February 2020, NBU was still evaluating the possibility of CBDC issuance after the pilot project had been completed. The premise is that a E-hryvnia should be technically feasible, and it will not disrupt price and financial stability.

Link to Central Bank Project:

https://bank.gov.ua/admin_uploads/article/Analytical%20Report%20on%20E-hryvnia.pdf?v=4

<https://bank.gov.ua/en/news/all/vitalna-promova-golovi-natsionalnogo-banku-yakova-smoliya-na-mijnarodniy-konferentsiyi-tsifrovi-valyuti-tsentralnih-bankiv-novi-mojlivosti-dlya-platejiv>

Global ranking



4th

Joint

Index value



71

Retail index

Region



Americas

2nd in Americas

Project name:
e-peso

Top 10 - Retail projects

Focus on Uruguay

- Uruguay took the initiative to launch its CBDC pilot project in November 2017, the e-peso. The project was used to test the technical aspects of the currency and lasted for 6 months (November 2017 - April 2018), with a limited level of issuance: \$20 million for 10,000 mobile users, capped at \$30,000 per wallet and \$200,000 for registered businesses.
- During the pilot phase, e-peso was mainly used for payment transactions in registered stores and businesses, and peer-to-peer transfers. The system employed instantaneous settlement without an internet connection. E-peso was designed to be anonymous but traceable, which could prevent double spending and falsification. No technical incidents were reported. Since the pilot, the central bank, Banco Central del Uruguay (BCU), has reported no further investment associated with the project. In terms of direct impact, given the banks were not involved in the pilot, it is difficult to assess the results of the initiative.
- Another feature of this pilot program is that BCU explored the possibility of outsourcing CBDC development, under close supervision, working with the Roberto Giori Company to develop digital notes, IN Switch Solutions for wallets, and Redpagos for point of sale operations.
- At the end of the pilot project, all the e-pesos produced were cashed-out and destroyed. The BCU are still considering full scale public e-peso issuance.

Link to Central Bank Project:

https://www.bis.org/events/eopix_1810/licandro_pres.pdf

<https://www.imf.org/~media/Files/Publications/CR/2019/1URYEA2019001.ashx>

Global ranking



4th

Joint

Index value



71

Retail index

Region



Americas

2nd in Americas

Project name:
dinero electrónico

Top 10 - Retail projects

Focus on Ecuador

- Ecuador was the first country to start CBDC trials. In 2014 the country announced the issuance of dinero electrónico, (DE), by Ecuadorian Central Bank (BCE). One year after launch, the BCE made it possible for users to open their accounts and to transfer funds with a mobile application. This mobile app was operated by CNT, a state-owned enterprise mobile telco operator. The objective of this project was to decrease both poverty levels and various expenses for the government, as the country was spending more than \$3m in exchanging old notes for new dollars annually.
- Ecuador dollarized its monetary system in 2000 and the DE was intended to be a claim against the government's U.S. dollar reserves. However, given the government defaulted on sovereign dollar-denominated bonds in 2008, citizens did not perceive the DE to be as safe as deposits held in commercial banks. Further, the DE was widely viewed as a way for the government to gain a monopoly and so profit from the project, as only a state-owned company could provide mobile payments services.
- In 2016, the value of all DE in circulation was less than \$800,000 (0.003% of the monetary liabilities of the Ecuadorian financial system) with 1,100 transactions per day. In December 2017, Ecuador's National Assembly passed legislation to abolish the central bank electronic money system and outsource e-payments to private banks. In March 2018, the system was fully deactivated and all accounts closed, having spent more than \$7m on the project.
- More recently, Bimo, a digital payment app, was launched in 2019 by the Ecuadorian interbank network highlighting the country's reaffirmed stance towards digitization, and opening the potential that another CBDC project may be launched someday.

Link to Central Bank Project:

No official website

Global ranking



7th

Index value



61

Retail index

Region



Americas

4th in Americas

Project name:
DXCD

Top 10 - Retail projects

Focus on Eastern Caribbean

- In 2019, the Eastern Caribbean Central Bank (ECCB) contracted with fintech company Bitt to launch a pilot project to mint a digital version of the Eastern Caribbean Dollar (DXCD or DCash) as legal tender. Not designed to replace cash, DCash is planned to circulate alongside physical notes and coins. The ECCB will issue DCash to banks and approved non-bank financial institutions on a private permissioned blockchain network.
- The ECCB launched the pilot to reduce transaction costs and banking services fees, support customers needs with banking services, and provide a more efficient form of payment than cheques, which slow the speed of commerce. The overall goal is to help build resilience into the financial system and promote financial inclusion for citizens in the Eastern Caribbean Currency Union.
- During the pilot program, the ECCB and Bitt will be conducting a number of tests, including:
 - An acceptance test to evaluate the compliance of DXCD system with future business needs;
 - A security audit on the adequateness of the current strategy underpinning DXCD's security;
 - A readiness assessment on the identification of potential challenges, new procedures, frameworks and processes.
- Phase 1 (Development and Testing) commenced in mid-March 2019. Phase 2 (Rollout and Implementation) commenced in Antigua & Barbuda, Grenada, and Saint Lucia and St. Kitts & Nevis in 2020.

Link to Central Bank Project:

<https://www.eccb-centralbank.org/p/about-the-project>

Global ranking



8th

Index value



58

Retail index

Region



Europe

2nd in Europe

Project name:
E-krona

Top 10 - Retail projects

Focus on Sweden

- Sweden is seeking to implement a retail digital currency to replace Swish, a digital payment app developed by 6 Swedish banks. After 3 years of research, in December 2019 the Riksbank tested e-wallets, distributed ledger technology, and levels of interoperability across participant banks. Following this, the Riksbank proposed that the Riksdag, the Swedish parliament, review the concept of legal tender to grant the central bank more control over money.
- In April 2019, the Riksbank announced they were studying the introduction of a central bank digital currency, i.e. e-krona, to which the general public has access, driven by the decreasing use of cash. Indeed, according to the Riksbank, Sweden's central bank, less than 10% of all payments are made with cash in Sweden. The goal of e-krona would be to increase safety and efficiency of electronic transactions.
- Following the initial pilot in December 2020, the Riksbank launched a review into the feasibility of having Sweden move to a digital currency. The review is expected to be completed by the end of November in 2022. To date, Sweden has provided the highest level of technical insight into its digital currency project.

Link to Central Bank Project:

<https://www.riksbank.se/en-gb/payments--cash/e-krona/>

Global ranking



9th

Index value



51

Retail index

Region



Asia

3rd in Asia

Project name:
E-won

Top 10 - Retail projects

Focus on Korea

- The Bank of Korea (BOK) launched its 22-month pilot trial in March 2020 to explore the potential use of a digital currency. According to the BOK's published plan, the pilot projects involves three stages.
- The first stage, completed in July 2020, was to identify the design and technical requirements, including determining the technology to be used, such as blockchain. The second stage, scheduled from September 2020 to December 2020, was designed to analyze operational procedures for a CBDC rollout with external partnerships. The third stage, which would be a 12-month testing and implementation period, is to launch the pilot system in a limited and virtual environment and to run tests on the functionality and security of the platform.
- On February 8th 2021, BOK published a report in which they reviewed the CBDC-related legal issues and presented possible revisions on related laws, especially the Bank of Korea Act. The report re-confirmed the timelines of the project phases detailed above.

Link to Central Bank Project:

<http://www.bok.or.kr/portal/bbs/P0000559/view.do?nttId=10057475&menuNo=200690>

<https://www.bok.or.kr/portal/bbs/B0000232/view.do?nttId=10062867&menuNo=200725>

Global ranking



10^t
h

Index value



42
Retail index

Region



Asia
4th in Asia

Project name:
Digital Lira

Top 10 - Retail projects

Focus on Turkey

- The former president of the Turkish Central Bank, Naci Agbal, announced on Dec 25, 2020 that the central bank had completed the proof-of-concept of a digital lira and that pilot tests were expected to begin in H1 2021.
- According to the latest updates, Turkey's central bank digital currency project will be operated by the Turkish Central Bank and the Scientific and Technological Research Council of Turkey.
- The name of the digital currency has not yet been announced and there are no officially published documents describing the CBDC project.

Link to new article from the state-owned media:

<https://www.trthaber.com/haber/ekonomi/merkez-bankasi-kendi-dijital-parasini-uretiyor-555201.html>

Interbank or wholesale CBDC Index of the Top 10 Central Banks

Discover in detail the most mature interbank CBDC projects globally.

What is interbank/wholesale CBDC?

Interbank/Wholesale CBDC is restricted to use by Financial Institutions alone for interbank payments and financial settlement processes.



Central Bank Digital Currencies will provide financial market infrastructure with the missing links to enable participants to fully benefit from tokenization opportunities, so accelerating distributed ledger technology integration and simplifying settlement.



Klara Sok,
Senior Manager, Blockchain Lab
PwC France & Maghreb

Global ranking



1st

Joint

Index value



80

Wholesale index

Region



Asia

1st in Asia

**Project name:
Inthanon-LionRock**

Top 10 - Interbank/Wholesale projects

Focus on Hong Kong SAR and Thailand

- The Hong Kong Monetary Authority (HKMA) commenced Project LionRock in 2017. Initial research findings highlighted the huge potential of CBDC adoption for wholesale and cross-border payments.
- In 2019, to test the application of CBDC in cross-border payments, the HKMA and the Bank of Thailand (BOT) initiated Project Inthanon-LionRock. The joint study entered Phase 2 this year, with the purpose of developing a software prototype to enable cross-border settlement in CBDC and to explore a range of different use cases.
- The joint study is also seeking to evolve from bilateral cross-border use cases to ones involving multiple jurisdictions and multiple currencies. It was announced at the Asian Financial Forum in early January 2021 that the UAE and Mainland China are also joining the initiative.
- Of note, the Hong Kong SAR CBDC study is also combining wholesale with retail use cases. Moreover, the HKMA is closely coordinating with The People's Bank of China (PBOC) to explore the possibility of mutual connectivity with Mainland China's DC/EP for cross-border payments to enhance Hong Kong SAR's position as a global hub for offshore Renminbi (RMB) business.

Link to Central Bank Project:

<https://www.hkma.gov.hk/eng/news-and-media/press-releases/2020/01/20200122-4/>

Global ranking



3rd

Index value



75

Wholesale index

Region



Asia

2nd in Asia

Project name:
Ubin

Top 10 - Interbank/Wholesale projects

Focus on Singapore

- 13 July 2020 marked the completion of Project Ubin's final, and the fifth phase of Singapore's exploratory project in CBDC. In this last phase, the Monetary Authority of Singapore, (MAS), announced the completion of a range of tests of blockchain-based payments solutions supporting various currencies. This last phase included development of the interfaces to establish connections to other blockchain networks. These interfaces can support various use-cases such as delivery-versus-payment with private exchanges, conditional payments, trade escrow, and trade finance payment commitments.
- Moving forward, MAS is encouraging further collaboration with other central banks and has publicly announced its intention to cooperate with the People's Bank of China. Following Project Ubin, to improve the efficiency of wholesale payments, several institutions, namely DBS, J.P. Morgan and Temasek, are developing a blockchain-based clearing and settlement network. The network is seeking to use Singapore as a base and expand from there to other jurisdictions.

Link to Central Bank Project:

<https://www.mas.gov.sg/schemes-and-initiatives/project-ubin>

Global ranking



4th

Index value



69

Wholesale index

Region



Americas

1st in Americas

Project name:
Jasper-Ubin

Top 10 - Interbank/Wholesale projects

Focus on Canada

- **Project Jasper** covered a range of research initiatives which were initiated in 2017 by Payments Canada. The scope of work included improvements to the platform to explore the efficiency of blockchain technology when applied to high-value interbank payments clearing and settlement processes. Latter findings established the potential advantages of integrating this cash-on-ledger with other assets, for example, foreign exchange and securities, ultimately leading to the creation of the wholesale focussed Jasper-Ubin project.
- **Project Jasper-Ubin** concluded in May 2019 which was a collaborative research programme undertaken between Singapore and Canada, supported by the Canadian private sector, and Payments Canada. The collaboration was designed to extend the understanding of how DLT could lead to more cost-effective, safer and more efficient cross-border and cross-currency payments with the adoption of different types of DLT platform. After publication of the report, subsequent research was conducted by a consortium that included the Bank of England and HSBC.

Link to Central Bank Project:

<https://www.bankofcanada.ca/research/digital-currencies-and-fintech/projects/>

Global ranking



5th

Index value



68

Wholesale index

Region



Europe

1st in Europe

Project name:
TBC

Top 10 - Interbank/Wholesale projects

Focus on United Kingdom of Great Britain and Northern Ireland

- The Bank of England (BoE) published its discussion paper, Central Bank Digital Currency: Opportunities, Challenges and Design on 12 March 2020. Its guiding principles were to understand the benefits, risks and practicalities of introducing a wholesale CBDC alone.
- A platform model is initially proposed by the BoE that would sit alongside the Bank's existing RTGS platform. Payment interface providers can connect to provide customer-facing CBDC services. It also outlined three design principles which must be met: 1) Reliable and resilient; 2) Fast and efficient and 3) Innovative and open to competition.
- Acknowledging a perfect outcome for each principle is, in practice, impossible, and the BoE presented views on which principles to prioritise and those where trade-offs may be required.
- The introduction of a CBDC will require approval from the Government, Parliament and relevant regulators. The Bank has yet to decide on whether to introduce a CBDC or not.

Link to Central Bank Project:

<https://www.bankofengland.co.uk/paper/2020/central-bank-digital-currency-opportunities-challenges-and-design-discussion-paper>

Global ranking



6th

Index value



64

Wholesale index

Region



Europe

2nd in Europe

**Project name:
CBDC Experiments**

Top 10 - Interbank/Wholesale projects

Focus on France

- In March 2020, Banque de France issued a public tender designed to initiate the exploration of projects integrating central bank digital currencies with the settlement of tokenized assets. The objective was to assess the benefits such innovation could offer, in order to contribute to the wider discussions and development of a central bank digital currency led by the European Central Bank's Eurosystem. The scope of the tender featured three main CBDC settlement categories:
 - Listed or unlisted, tokenized financial asset CBDCs;
 - Cross CBDC payments between two different central banks;
 - Non-financial, crypto-asset CBDCs.
- As a result of the public tender, Banque de France selected a consortia of 8 members in order to explore the benefits of CBDC. As requested by the public tender, each participant had to include a TARGET2 or TARGET2-Securities licensed member, i.e. an entity with an account at a Real Time Gross Settlement (RTGS) system owned and operated by Eurosystem, processing central bank money settlements.
- The experiment has already demonstrated several successful use cases, for example the settlement of a tokenized bond via CBDC in May 2020, and the settlement of money market funds via CBDC announced in January 2021. We anticipate further developments over the coming months.

Link to Central Bank Project:

https://www.banque-france.fr/sites/default/files/media/2020/03/30/fact_sheet_-_central_bank_digital_currency_30_march_2020.pdf

Global ranking



7th

Index value



63

Wholesale index

Region



Africa

1st in Africa

Project name:
Khokha

Top 10 - Interbank/Wholesale projects

Focus on South Africa

- **Project Khokha (Phase 1):** The project commenced in the latter part of 2017 with a team consisting of seven banking industry participants, a technical service provider (ConsenSys), and PricewaterhouseCoopers Inc.
- The project delivered a realistic test of a DLT-based wholesale payments system, built on Quorum and was the first time that a novel consensus and encryption mechanism, (Istanbul Byzantine Fault Tolerance and Pedersen commitments for confidentiality) had been used with Quorum.
 - The results showed that the typical daily volume of the South African payments system could be processed in less than two hours with full confidentiality of transactions and settlement finality.
- **Project Khokha 2 (Phase 2):** This is the latest phase, commencing in 2021 and will issue, clear and settle debentures on DLT using tokenized money built as a minimum viable product to further explore policy and regulatory considerations.
- Key considerations that need to be addressed going forward include the evaluation of supporting frameworks and other systems that integrate with the wholesale system, as well as legal, regulatory and compliance factors. The South African financial sector regulators, working as the Intergovernmental Fintech Working Group (IFWG), have stated:
 - “Industry participants will be able to purchase the debentures with a wholesale central bank-issued digital currency (wCBDC) and a wholesale digital settlement token (wToken). The wToken can be seen as a privately issued stable coin used for interbank settlement.”

Link to Phase 1 project report :

https://www.ifwg.co.za/wp-content/uploads/2020/03/SARB_ProjectKhokha_20180605.pdf

Global ranking



8th

Index value



62

Wholesale index

Region



Europe

3rd in Europe

Project name:
Stella

Top 10 - Wholesale projects

Focus on the Euro Area

- **Project Stella:** 12 February 2020 marked the completion of Stella phase 4. In this last phase, the project analyzed how to balance confidentiality and auditability in a distributed ledger environment. Through theoretical studies and practical tests, it explored how privacy-enhancing technologies and techniques, (PETs), would ensure confidentiality, whilst supporting transaction audit in DLT-based financial market infrastructures (FMI). The approach allowed the fundamental features of transaction confidentiality to be defined, whilst assessing the effectiveness of the audit on the premise that confidentiality is assured. The results represent a start point for choosing PETs and designing auditing processes for transactions.
- Since its inception in December 2016, Project Stella, which is a joint research project of the European Central Bank (ECB) and the Bank of Japan (BOJ) has contributed to the ongoing debate covering the opportunities and obstacles of DLT for FMI. This work has resulted in three reports:
 - Phase 1, published in September 2017, analysed large-value payments operations using DLT;
 - Phase 2, published in March 2018, studied securities delivery-versus-payment using DLT;
 - Phase 3, published in June 2019, discussed the possibility of enhancing cross border payments,, by using DLT-related technologies.

Link to Central Bank Project:

https://www.ecb.europa.eu/paym/intro/publications/pdf/ecb.miptopical200212_01.en.pdf?4362b9bc33cd54ed51c86825b16ad457

Global ranking



9th

Index value



62

Wholesale index

Region



Middle East

1st in Middle East

Project name:
Aber

Top 10 - Wholesale projects

Focus on the United Arab Emirates

Project Aber

- Project Aber is a joint project undertaken by the central banks of UAE (CBUAE) and Saudi Arabia (SAMA). The project commenced in 2019 and was tasked with exploring the feasibility of a dual-issued digital currency that could be used in cross-border payments across the commercial banks of these two countries.
- The project designed, developed, tested and deployed the full lifecycle of a digital currency, using a DLT platform/protocol, chosen to support technology requirements based on specific criteria namely decentralization, privacy, scalability, solution complexity, security, readiness, and long term viability. Hyperledger Fabric (HLF) was eventually selected for the purpose, and a protocol has been designed specifically for Aber requirements.
- Three use cases have been explored: 1) cross-border settlement between the two central banks; 2) domestic settlement across three commercial banks in each country; 3) cross-border transactions between the commercial banks using the digital currency.
- In country banks have been active participants in the project operating local nodes on the network, and real money has been used to explore interactions with existing payments systems such as RTGS platforms.
- The project confirmed the technical viability of a cross-border, dual issued currency and further options are under consideration including the possibility of studying the role of the central bank versus commercial banks and to trial a retail CBDC.

Other Projects

- The Central Bank of UAE is exploring opportunities to leverage DLT technology in a number of projects which includes a partnership with Emcredit to release a stable digital currency called “emcash”, linked to the UAE dirham (AED). Development has yet to be completed, but given that Emcredit is a subsidiary of the Department of Economic Development, its use as a CBDC is very much a possibility.

Link to Central Bank Project:

<https://www.centralbank.ae/en/node/2382>

Global ranking



10^t
h

Index value



56
Wholesale index

Region



Asia
4th in Asia

Project name:
Stella

Top 10 - Interbank/Wholesale projects

Focus on Japan

- The Bank of Japan (BOJ) has been engaged in a joint research project - Project Stella - with the ECB since December 2016. To date, Phases 1 to 4 have been completed, with details previously provided as part of this analysis. Whilst the BOJ does not have immediate plans to issue a CBDC, it has emphasised the importance of preparatory work, driven by the following:
 - Given the rapid rate of technology innovation and advancement, public interest for CBDC may increase tremendously;
 - BOJ should ensure a stable and efficient payment and settlement system.
- To complement the wholesale project, BOJ will work towards a retail proof of concept the objective of which is to study the technical functionality of the key features. The BOJ may launch a pilot program that will include payment service providers (PSPs) and end users, if needed. There will be two phases of the proof of concept:
 - Phase 1, commencing 2Q 202, will focus on the development of a test environment and trialing of core functions;
 - Phase 2, will address the implementation of additional functions in the test environment alongside a feasibility test.
- More broadly, the BOJ continues to explore institutional set up and close coordination with a range of stakeholders.

Link to Central Bank Project:

<https://www.boj.or.jp/en/paym/digital/index.htm/>



Focus on other CBDC projects

Notably absent from the Retail and Interbank/Wholesale Top 10 Index.

This section highlights CBDC projects yet to join the PwC Global CBDC Index Top 10, whether retail or interbank/wholesale, but are otherwise advanced in digital finance and cryptocurrency development.



A digital currency, backed by an asset held on a central bank balance sheet, allows for money to be fully integrated into the emerging digital ecosystems of the future that will support supply chains, securities settlement and even social media platforms.



Haydn Jones
Director, UK Blockchain & Crypto Leader
PwC UK

Global ranking



11th

Retail ranking

Index value



42

Retail index

Region



Europe

6th in Europe

Project name:
Retail digital euro

Focus on other territories

Focus on the Euro Area

- In January 2020, the ECB initiated a high-level task force to further its work on retail CBDC across the Euro area. In October 2020, a report was released describing a digital euro and launched a public consultation for citizens, businesses and market players. In parallel, different European Financial Institutions have been invited to join a research project, to be completed by March 2021, focused on analyzing key concepts of the digital euro such as infrastructure scalability, transaction privacy, offline transaction, user usability, etc.
- The aspiration is to launch the digital euro project by mid-2021, commencing with an exploratory phase and the release of a minimum viable product (MVP). To achieve this goal, it is expected that the first trials of the digital euro will be based on centralized technology with an account-based model leveraging TIPS infrastructure to guarantee speed of execution and reliability. At the same time, research projects will be undertaken to study improvements in the MVP, building towards the final implementation. R&D projects are underway to understand how a DLT-based digital euro can address areas such as financial inclusion and cash type features through a token-based model.

Link to Central Bank Project:

<https://www.ecb.europa.eu/euro/html/digitaleuro.en.html>

Global ranking



11th

Retail ranking

12th

Wholesale ranking

Index value



42

Retail index

Region



Europe

4th in Europe

Project name:
E-Franc / BIS innovation
Hub centre

Focus on other territories

Focus on Switzerland

- In December 2020, it was announced that a project entitled Project Helvetia had been undertaken between the Bank of International Settlements Innovation Hub Swiss Center, the Swiss National Bank and the financial market infrastructure operator, SIX. As part of this project, two proof of concepts were assessed to determine the technical and legal feasibility of integrating tokenized assets and central bank money in a simulated environment.
- The first proof of concept focused on the issuance and redemption of a wholesale CBDC, using the CBDC to settle transactions with tokenized assets on a distributed ledger at a digital exchange implemented by the SIX Digital Exchange, SDX. The second proof of concept focused on linking the existing payment system to a distributed ledger without the issuance of a CBDC.
- At this stage, no further information has been published as to the results of these proof of concepts, or broader plans on the part of the Swiss National Bank to issue a wholesale CBDC.

Link to Central Bank Project:

<https://www.bis.org/publ/othp35.htm>

<https://www.bis.org/press/p201203.htm>

Global ranking



16th

Retail

Index value



38

Retail index

Region



Europe

6th in Europe

Project name:
Digital euro research and
prototypes

Focus on other territories

Focus on Italy

- In December 2020, 18 banks, and the Italian Banking Association (ABI), commenced trials given the progress made with the digital euro. The initiative aims to actively contribute to the public debate and to support banks operating in Italy in preparing for potential future scenarios.
- The project is aimed at enhancing the role of banks in supporting a digital euro, whilst demonstrating the technical feasibility of a distributed ledger technology implementation, alongside exploring value-added services, enabled by the inherent programmability of the currency.
- The project consists of two parts:
 - The infrastructure and distribution model focused on technical feasibility;
 - Programmability, to test use cases that can distinguish a digital euro from current electronic payments.
 - The first part will be conducted in collaboration with Sia, in synergy with the ABILab Chain banking infrastructure, which has distributed 100 active nodes in Italy. The second part will be divided into different workstreams, working in collaboration with banks and consulting firms amongst which **PwC** is participating.



The potential of a Central Bank Digital Currency to digitize cash, accelerate payments and provide a more efficient way to distribute economic stimulus is gathering pace around the world. In the US, the digital dollar has been described by the Federal Reserve Bank as a “high priority project” with research focused on understanding the potential impact use, benefits, risks and design.



Paul Chew
Principal, Financial Services Technology
PwC US

Global ranking



18th

Retail

Index value



37

Retail index

Region



Americas

6th in Americas

Project name :
Digital Dollar

Focus on other territories

Focus on the United States of America

Research is underway, but proceeding iteratively

- The Federal Reserve Bank (“FRB”) has been researching Digital Currencies for several years and continues to experiment through partnerships with leading universities such as MIT and collaborations with other central banks across the globe.
- Given the dollar’s role in the global economy, the FRB has acknowledged the importance of staying at the forefront of CBDC research but is taking a measured “more important to get it right than be to be first” approach to understanding the potential impact, use, risks, trade-offs and design before publicly announcing a path forward.
- We believe that the issuance of a USD CBDC may be several years away, given the 2022 timing of a new US cryptography standard (quantum resistant) and the need for the highest levels of security to protect against sophisticated attack by organized crime and nation states.
- While the innovation for USD backed stablecoins has been largely driven by the private sector, the USD is the currency of choice for many of the regulated, privately-issued, asset-backed stablecoins, and US regulators have been engaged in providing feedback throughout the process.

Link to Central Bank Project:

<https://www.federalreserve.gov/newsevents/speech/brainard20200813a.htm>

<https://www.bis.org/publ/othp33.pdf>

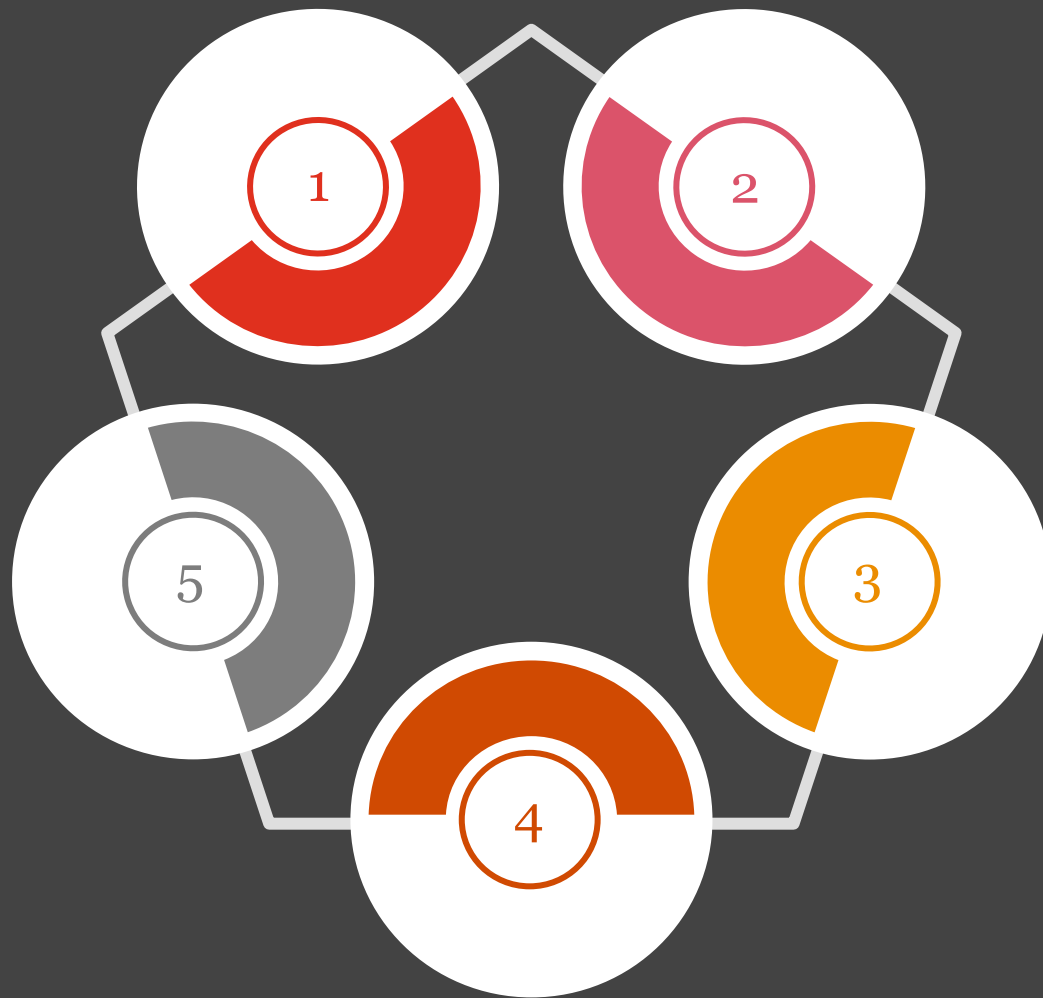
[US National Institute of Standards and Technology \(NIST\) is planning to release an initial new cryptography standard \(quantum-resistant\) in 2022 =](#)

<https://www.nist.gov/news-events/news/2020/07/nists-post-quantum-cryptography-program-enters-selection-round>

<https://www.reuters.com/article/us-usa-fed-powell-digitalcurrency/feds-powell-more-important-for-u-s-to-get-digital-currency-right-than-be-first-idUSKBN27410I>

How can PwC help?

PwC has been working on CBDC projects since 2016 and our teams can help our clients to better understand their deployment:



- 1 Understanding**
A 360 degree view of Central Bank Digital Currencies
- 2 Knowing when to move**
Regulatory and Competitive Environment
- 3 CBDC Driven Financial Products and Services of the Future**
e.g. Trade Finance, Debt, Equity, Asset Management etc.
- 4 Positioning CBDC's Potential**
What's in it for Financial Services?
- 5 The Impact of Central Bank Digital Currencies**
In a Retail and Commercial Context

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