

Casting Light on Central Bank Digital Currency

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A Survey of Research on Retail Central Bank Digital Currency



FINTECH

NOTES

Behind the Scenes of Central Bank Digital Currency
Emerging Trends, Insights, and Policy Lessons

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Retail Central Bank Digital Currency

Current Landscape

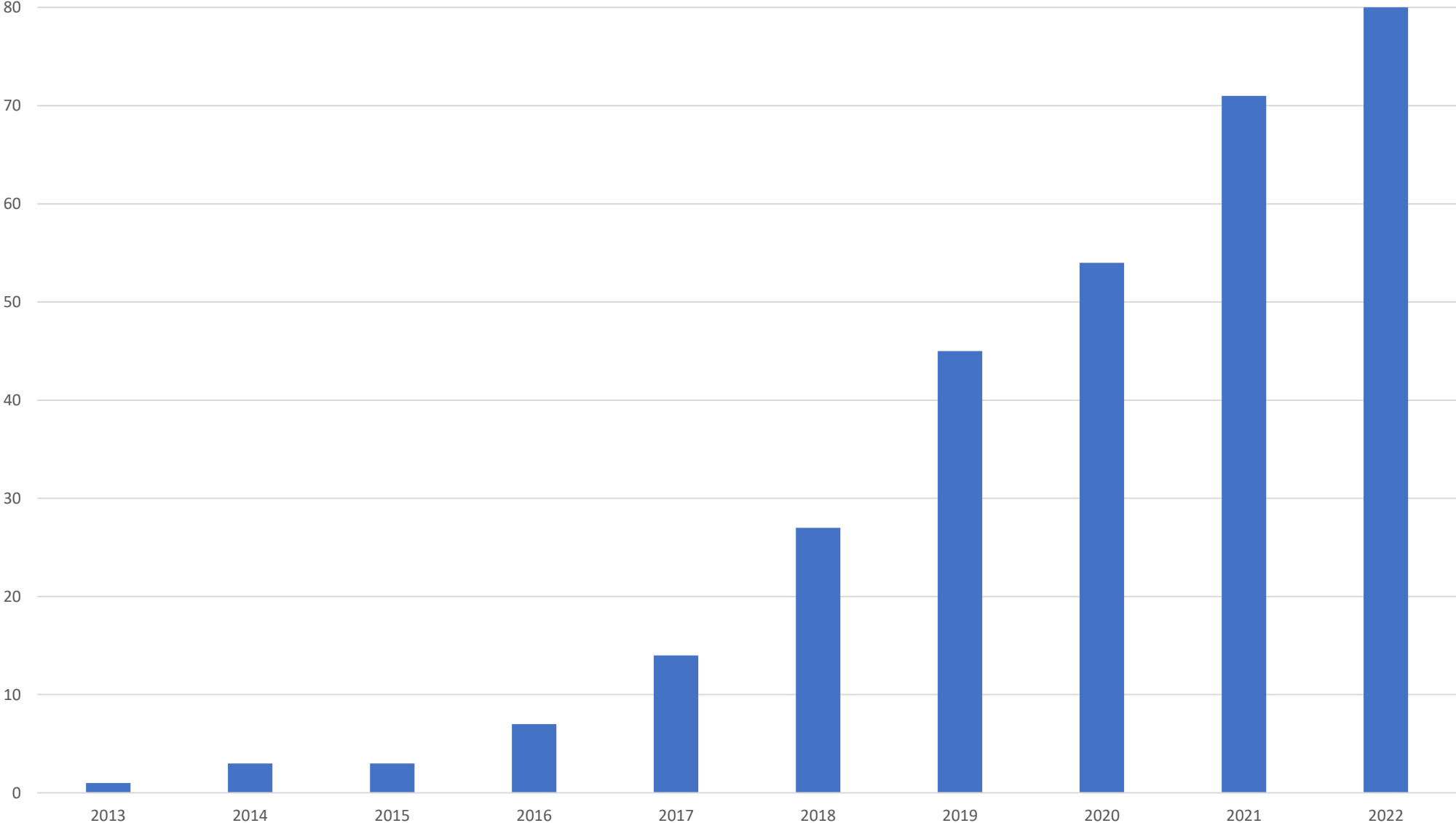
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Central Bank Retail CBDC Experimentation by Launch Year
(based on publicly-available information)



What is Central Bank Digital Currency (CBDC)?

Key retail CBDC Criteria	Cash	Retail CBDC	Wholesale CBDC	GovCoin	Synthetic CBDC	B- and E-Money	Asset-Backed Stablecoins	Crypto-Assets
Denominated in jurisdiction's unit of account	✓	✓	✓	✓	✓	✓	✓	
Backed by jurisdiction's monetary authority	✓	✓	✓	Government	✓	?		
Issued by and direct liability of jurisdiction's monetary authority	✓	✓	✓	Government				
Broadly accessible to the public for general-purpose usage	✓	✓	B2B	?	?	?	?	?
May be used in peer-to-peer (P2P) transactions	✓	✓	B2B	?	?	?	?	?
Available 24/7 for instant settlement	✓	✓	✓	?	?	?	?	✓
Divisible and interchangeable (fungible)	✓	✓	✓	?	?	?	?	?
Subject to same rules and regulations as the jurisdiction's other units of account	✓	✓	✓	?	?			
Legal tender status?	✗	?	?	?	?	?	?	?
Runs on Distributed Ledger Technology	n/a	?	✓	?	?	?	✓	✓

Who's Doing What and Why?

Jurisdictions Where Retail CBDC Is Being Explored (78+2)

Where central banks (CBs) have launched or piloted (or soon will)

Bahamas (launched)	Eastern Caribbean (pilot launched)	Nigeria (pilot launched)	Uruguay (pilot completed)
China (pilot launched)	Jamaica (pilot complete; launch soon)	Russia (pilot launched)	

Where CBs have done proofs of concepts (PoCs)(or soon will)

Bahrain (2021)(completed; 2022)	Ghana (update)(started)	Korea (2022)(started)	Turkey (2021)(started)
Bhutan (planned)	Hungary (2021)(completed)	New Zealand (2022)	Ukraine (completed; 2019)
Euro Area	Iran (2021)(completed; 2022)	Sweden (started)	United States (2022)
Japan (started)	Kazakhstan (2021)(completed; 2021)	Thailand (2021)(started)	

Where CBs are in advanced stages of research and development

Canada (update)	Mauritius (update)	Norway	United Kingdom
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Where CBs have explored or are exploring (with year of CB's last update)

Australia (2021)	Hong Kong SAR (2021)	Morocco (2019)(update; 2022)	South Africa (2021)
Brazil (2021)(update, 2021)	Iceland (2018)	Nepal (2021)(update; 2022)	Sudan (2022)
Chile (2021)	India (2021)(update; 2022)	Oman (2022)	Switzerland (2019)
Curaçao en Sint Maarten (2019)	Indonesia (2020)(update; 2021)	Palestine (2021)(update; 2022)	Taiwan (2020)
Czech Republic (2021)	Iraq (2022)	Pakistan (2021)	Trinidad and Tobago (2021)(update; 2022)
Denmark (2017)	Israel (2021)(update; 2021)	Peru (2019)(update; 2021)	Tunisia (2018)(update; 2022)
Egypt (2022)	Kenya (2022)	Philippines (2020)	Vietnam (2021)
Eswatini (2020)	Kuwait (2019)(update; 2022)	Poland (2021)	Yemen (2022)
Georgia (2021)(update; 2021)	Lebanon (2020)(update; 2022)	Qatar (2022)	Zimbabwe (2022)
Haiti (Bitkòb) (2021)	Madagascar (2021)	Saudi Arabia (2022)	
Honduras (2021)	Malaysia (2021)	Singapore (2021)	

Where CBs have explored or are exploring (according to reputable news sources)

Guatemala (2021)	Macau (2021)	Tanzania (2021)	Zambia (2022)
Jordan (2022)	Mexico (2021)	Uganda (2022)	
Laos (2021)	Rwanda (2021)	United Arab Emirates (2021)	

Where CBs have launched and discontinued

Ecuador (2014-2018)	Finland (1992-2006)		
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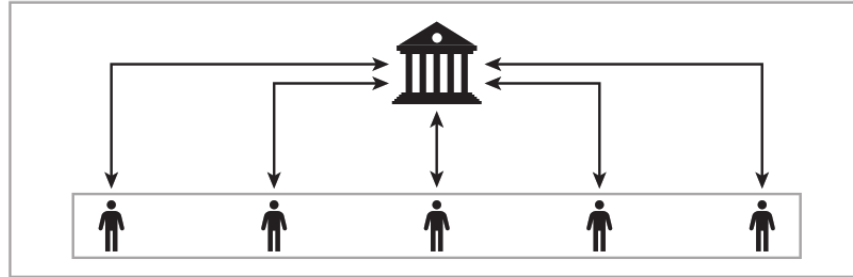
Central Banks' Stated CBDC Policy Goals

	Financial Inclusion	Efficiency	Resilience	CB Money Access	Monetary Sovereignty	Countering Monopoly Distortions	Illicit Financial Activity	Cross Border Payments	G2P Payments	Monetary Policy
Bahamas	√	√	√	√			√			
ECCB	√	√	√							
Jamaica	√	√	√							
Nigeria	√	√	√		√		√	√	√	
Uruguay	√	√								
Canada			√	√	√	√				
China	√	√	√	√	√	√				
ECB		√	√	√	√					
Sweden		√	√	√		√				
USA	√	√		√				√	√	

Note: ECCB = Eastern Caribbean Central Bank; ECB = European Central Bank

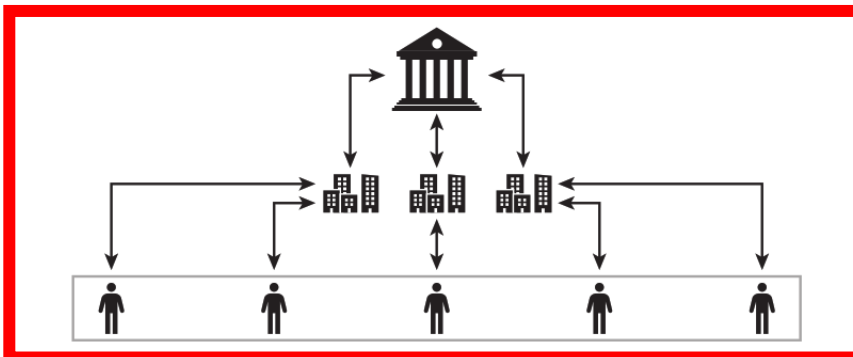
Design Considerations and Outcomes

All Are Outsourcing User-Facing Activity



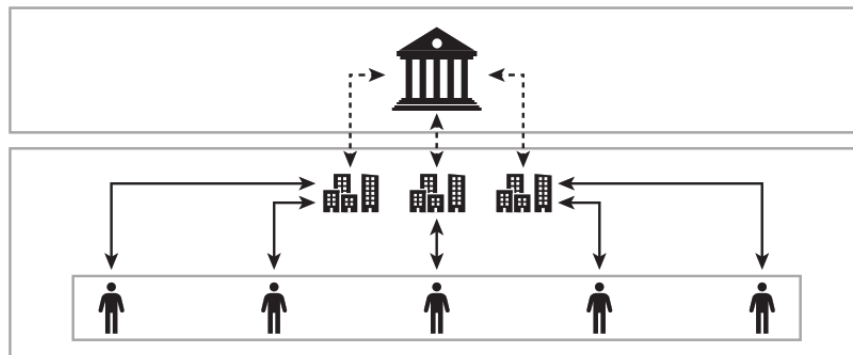
Unilateral CBDC

Central bank issues money and performs all functions, including direct interaction with end users



Intermediated CBDC

Central bank issues money, but delegates functions to non-central bank intermediaries who interact with end users



Synthetic CBDC

Non-central bank actors issue money that is backed by central bank assets that they acquire from the central bank (dashed line)

Distribution of functions between central bank and intermediaries

	Minting		Issuance		Distribution		Validation		Ledger Updates		KYC/AML/CFT		User Interface		User Data		Customer Service		
	Owner	Executor	Owner	Executor	Owner	Executor	Owner	Executor	Owner	Executor	Owner	Executor	Owner	Executor	Owner	Executor	Owner	Executor	
Bahamas		?																	
China		?																	
ECCB		?																	
Jamaica																			
Nigeria	?																		
Uruguay																			
Canada	n/a																		
Sweden		?																	
Eurozone	n/a																		

Color scheme: yellow = central bank; blue = intermediaries; purple = shared; gray = not available or still exploring

Based on: Soderberg, Bechara, Bossu, Che, Davidovic, Kiff, Lukonga, Mancini-Griffoli, Sun and Yoshinaga. 2020. "[Behind the Scenes of Central Bank Digital Currency](#)," IMF FinTech Note No 2022/004.

Transaction Fees and Remuneration

- None of the launched or piloted CBDCs charge transaction fees, but some central banks may to compensate intermediaries.
- None are remunerating, but paying interest could enhance CBDC attractiveness, and provide a way too modulate demand. Plus:
 - Could enhance monetary policy transmission , by increasing the economy's response to changes in the policy rate.
 - Could enable breaking the “zero lower bound” on policy rates to the extent cash were made costly. (Bordo and Levin, 2018)
 - But remuneration could increase disintermediation and run risk.

Disintermediation and Run Risk Mitigation

- **Disintermediation or Deposit Substitution Risk:** Banks losing deposits to CBDC, with negative impact on lending activities and the economy (“deposit substitution” or “disintermediation”). Mitigation:
 - No remuneration and **holding/transaction limits**, plus requiring bank accounts to which excess holdings are auto-transferred.
- **Run Risk:** CBDC providing a convenient “flight-to-safety” vehicle for retail depositors. Mitigation:
 - **Holding/transaction limits**, especially if there is no credible deposit insurance, or there are frictions to inter-bank transfers.

Compliance with AML/CFT/CPF Standards: Principles

- CBDCs must comply with AML/CFT/CPF regulations and requirements, and international standards established by the FATF. (G7, 2021)
- May require information on users/transactions to be collected and, on a when-necessary basis, made available to competent authorities.
- Central bank (CB) could delegate account/identity management to payment service providers, so the CB sees only pseudo-anonymous public keys, unless suspicious activity is observed.
- Some proportionality could be applied to reduce data requirements on low value transactions – i.e., tiered holding/transaction limits.

Key Design Features of Launched/Piloted Retail CBDCs

	Central Bank of the Bahamas Sand Dollar	Eastern Caribbean Central Bank DCash	Central Bank of Uruguay e-Peso	Central Bank of Nigeria eNaira	People's Bank of China eCNY	Bank of Jamaica Jam-Dex
Launch Dates	Pilot started Dec. 2019; launched Oct. 2020	Pilot started March 2021, still ongoing	Pilot started Nov. 2017; ended April 2018	Pilot started Oct. 2021; still ongoing	Pilots started April 2020; still ongoing	Pilot to start in Q1 2022
Transaction fees?	No, but maybe yes later	None during pilot	None during pilot	None during first 90 days	None during pilot	None
Interest bearing?	No	No	No	No	No	No
Access	Smartphones and smart cards	Smartphones only?	Smart- and feature-phones	Smart- and feature-phones	Broad array of devices	Smart-, feature-phones and smart cards.
Offline?	Limited value payments when network down. Wallets update when network is back up	Sender must be online. If the receiver is offline the payment will process when back online.	No but can use a USSD mobile network for settlement without an "internet" connection.	Sender must be online. If the receiver is offline the payment will process when back online.	The PBOC is piloting offline universal access devices	CBDC can be transferred in various offline media as a bearer instrument.
User holding/ transaction limits	Physical/email address, phone number and photo for low-limit access (B\$500 holding and B\$1,500/month transaction). Plus, government-issued photo ID for higher limits (B\$8,000 holding and B\$10,000/month).	Physical/email address, phone number, photo and birth date/place for low limit access (EC\$1,000 to EC\$2,700/month transaction depending on risk profile). Plus, full name and bank account for higher limits (EC\$3,000 to EC\$20,000/day).	Physical/email address, SIM card and national ID for low limit access (UYU30,000).	Physical/email address, phone number, passport photo and birth date/place for low limit access (N120,000 holding; N20,000/day). National ID Number and bank account for higher limits (N300,000 – N5,000,000 holding; N50,000 – N1,000,000/day;).	SIM card for low limit access (¥10,000 holding; ¥2,000/transaction; ¥5,000/day). Plus, full name, address, phone number and bank account for higher limits (¥500,000 holding; ¥50,000/transaction and ¥100,000/day).	CBDC transactions subject to the existing risk-based AML/CFT PSP framework, including collecting know-your-customer (KYC) information on all holders.
Central bank (CB) and payment service provider (PSP) data access	CB sees pseudonymous transactions data to monitor for suspicious activity and stop accounts if necessary.	CB sees anonymous holdings and transactions data. PSPs can see the identity of payers and payees and the purpose of transactions.	CB sees anonymous holdings and transaction data, which can be decrypted under very restrictive legal conditions- e.g., with a court order.	Unclear based on available information	Controllable anonymity: The CB can see all holdings and transaction data, but users can control what information they expose to counterparties	The CB does not see holdings or transactions data. PSPs maintain the IDs of their respective users and transactions in line with KYC regulations.
Programmable?	No, but smart contracts could be used for point-of-sale tax payments, integration with physical devices or IoT applications, or automate distribution of economic relief based on specific demographic or other characteristics.					At the wallet and service provider level.
Cross-border?	Not directly	No	No	Unclear based on available information	No	No
Platform Vendor and Type	NZIA Limited (DLT private permissioned)	Bitt (Hyperledger Fabric DLT private permissioned)	Roberto Giori Company (Centralized ledger)	Bitt (Hyperledger Fabric DLT private permissioned)	No known platform vendor (hybrid platform type)	eCurrency (DSC3 Digital Bearer Instrument)

Whither cross-border CBDC?

- Existing launched/ piloted CBDCs are not for cross-border use but interest among central banks for this option is growing
- But there are many design and technical challenges to achieve the required level of interoperability
- Not just harmonizing technical design, standards and interfaces, but harmonizing different AML/CFT/CPF, legal, regulatory/supervisory frameworks and data services (e.g., digital identity repositories)
- The [G7 encourages](#) monetary authorities to engage with [work of the CPMI, BIS Innovation Hub, FSB , IMF and World Bank](#) on enhancing cross-border payments, and factor this work into domestic CBDC explorations and design.

Technology Platforms Used in Launches and Pilots

Digital Currency	Partner Firm	Platform Technology	Platform Type
Bahamas Sand Dollar	NZIA	NZIA Cortex DLT	DLT private permissioned
China e-CNY	n/a	n/a	Centralized ledger
ECCB DCash and Nigeria eNaira	Bitt	Hyperledger Fabric	DLT private permissioned
Ecuador dinero electrónico	n/a	Mobile money	Centralized ledger
Ghana	G+D	Filia	?
Jamaica	eCurrency	DSC ³	Digital bearer instrument
Sweden e-Krona	Accenture	R3 Corda	DLT private permissioned
Ukraine E-Hryvnia	Stellar	Stellar	DLT private permissioned
Uruguay e-Peso	Roberto Giori	GSMT	Centralized ledger

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Discussion and Questions?

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