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Beyond technology: Considerations for retail central bank digital currency adoption in Asia-Pacific

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ABSTRACT

While central banks' objectives for issuing central bank digital currencies (CBDCs) are increasingly clear, many observers continue to raise

questions regarding the usefulness of CBDCs for the broader population. This question is particularly relevant for Asia-Pacific economies where the payment infrastructure is generally both efficient and resilient, and digital payments have been widely adopted. As this paper will argue, ensuring the adoption of CBDCs in Asia-Pacific requires a 'future-proof' solution that is sufficiently flexible to adapt to advances in payments technology. In addition, any solution will have to replicate the underlying benefits of physical cash, such as offline availability, while addressing concerns around transaction privacy.

Keywords: retail payment systems, CBDCs, Asia-Pacific

INTRODUCTION

Central bank engagement in retail central bank digital currencies (CBDCs) has increased considerably. Globally, 130 countries — representing over 98 per cent of global gross domestic product (GDP) — are currently exploring CBDCs.¹ The Asia-Pacific region is no exception. Most economies in the region are engaged in some form of CBDC project, whether research, proof of concept or pilot. There is, however, a question that is surfacing with increasing frequency: what is the incentive for end users and private

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businesses to use retail CBDCs? Relatedly, how can central banks boost adoption?

This paper considers the challenges associated with achieving a viable level of retail CBDC adoption. Specifically, Asia-Pacific is a region with advanced digital and payment infrastructures, where e-commerce has been widely adopted, and, for many economies in region, there exists already a vast network of digital payments. What value CBDCs add to such networks is, therefore, a key consideration.

To answer this question, we gauge user preference for different payment systems. We find that despite advanced digital and payment infrastructures, Asia-Pacific is also a place where cash holds broad and enduring appeal. Against this backdrop, we offer suggestions on CBDC design considerations that can support adoption. Specifically, CBDCs will have to match the technical innovations that have revolutionised the payment landscape and usage patterns. At the same time, they must also incorporate features that mimic the functionality of physical cash.

This paper contributes to two strands of literature. First, we relate to the broad discussions on payment systems and their challenges, including an overview on retail payments in Latin America and the Caribbean.² We help broaden the understanding of existing global payments by presenting a landscape of the payment industry in the Asia-Pacific region, underscoring the enduring appeal of cash and card payments, alongside the rise in digital payments. Second, we contribute to the literature discussing the added value of CBDCs, including the reduction of payment costs and financial inclusion.³ The paper also offers suggestions for design features.

ADOPTION FOR VIABILITY: THE LESSONS OF DINERO ELECTRÓNICO

One way to unpack the challenges associated with boosting CBDC adoption is by addressing the target market's incentives for

using such a currency. From a customer's perspective, uptake of CBDCs hinges on low cost, ease of use, and often, preservation of privacy. From the perspective of banks and payment service providers (PSPs), the considerations often centre on competitive concerns over potential disintermediation: banks' revenues, including payment service fee income, which could come under pressure from CBDC issuance. The experience of Ecuador's *Dinero Electrónico* is illustrative of some key lessons for broadening the adoption of CBDCs.

Dinero Electrónico was a mobile payment system developed by Banco Central del Ecuador that supported the person-to-person transfer of money in real time. The system was launched in 2014; its primary goal was to boost financial inclusion and be a mechanism for citizens to transact directly among themselves. Sign-up was easy — users did not need internet access, initial deposits or applications; they could sign up by using a dial-in protocol, registering their national ID and answering a few security questions. Transaction fees were lower than those charged by PSPs and transactions were settled in real time. Take-up was swift: the number of accounts increased seven times between January 2016 to December 2017.⁴ At its peak, *Dinero Electrónico* had 500,000 users (roughly 3 per cent of Ecuador's population). However, it faced stiff opposition from incumbent banks, which perceived threats to their payments processing income as well as possible loss of customers. In August 2017, the new national government declared that *Dinero Electrónico* would no longer be administered by the Banco Central del Ecuador, but by a consortium of private banks instead. By the end of March 2018, *Dinero Electrónico* ceased to exist.

There are several lessons from the *Dinero Electrónico* experience: user preference is foundational to CBDC design and, the support of the private sector is critical for success. *Dinero Electrónico's* take-up

among end users was immediate and sizable as it was easy to sign up; no application or initial deposits were needed. It was also easy to use; internet access was not required while transfers between accounts were in real time, seamless and cost little. But support from private sector was lacking, despite Dinero Electrónico's technological superiority. Dinero Electrónico needed a critical degree of engagement — from users, businesses, as well as intermediaries — to allow it to actualise its benefits. Without private sector participation, it was unable to achieve sufficient deployment scale for permanence.

HOW DO ASIA-PACIFIC ECONOMIES USE RETAIL PAYMENT SYSTEMS?

That CBDC projects falling the way of Ecuador's Dinero Electronico is plausible: evidence from real-world CBDC pilots suggests boosting adoption has indeed been challenging. In China, for example, the adoption rate for e-CNY has been low thus far, although it has been increasing and the scheme is still at the pilot stage. The People's Bank of China estimated that as a part of

currency circulation, e-CNY represented roughly 0.13 per cent of the 10.47tn yuan (US\$1.54tn) cash in circulation at the end of 2022.⁵ Meanwhile, in Nigeria, where the eNaira was introduced in October 2021, the take-up of the eNaira had been slow;⁶ less than 1 per cent of bank accounts in the country had eNaira wallets, despite more than 50 per cent of the population having already used cryptocurrencies as of July 2022.⁷

To tackle low adoption rates, CBDCs must satisfy the target market's payment system usage preferences. To gauge these preferences, we review the payment system landscape in Asia for insights on the usage pattern in the region. We find that the payments landscape in Asia-Pacific is diverse, marked by the dominance of big-techs and efficient payments technologies, but also considerable informality and a continued reliance on cash. As shown in Table 1, several key features characterise the retail payment landscape in the region.

The enduring appeal of cash

During the last decade, the use of cash has grown in the region. Notably, in some

Table 1: Payment system usage

<i>Country</i>	<i>Cash in circulation (% of GDP)</i>	<i>Cashless payments (% of GDP)</i>	<i>POS terminals per inhabitant</i>	<i>Use of top payment apps (% of population)</i>
Australia	4.9%	749.2%	0.037	6.3%
China	8.4%	3,806%	0.028	5.3%
Hong Kong SAR	21.1%			14.3%
Japan	23.5%	603%		20.4%
Indonesia	5.7%	300%	0.006	4.5%
India	13.2%	209%	0.004	18.0%
South Korea	8.1%	1,772%		10.0%
Malaysia	9.7%			15.7%
Philippines	11.2%			11.6%
Singapore	11.3%	252%	0.061	10.8%
Thailand	14.3%			12.5%
Vietnam	18.1%			

Note: Data as of end 2021 or latest available as of end 2022.
Sources: CPPI Redbook statistics; Sensor Tower

advanced economies, cash in circulation as a share of GDP surpassed emerging market economies (Figure 1, first panel) while cashless transactions also remained relatively high (second panel). In addition to Japan, Hong Kong SAR and Singapore also saw sizable increases in cash in circulation.

These increases in cash transactions concurrent with the proliferation of new payment technologies underscore the enduring appeal of cash in the region. For instance, a survey

on individuals' retail payment habits conducted by the Reserve Bank of India (RBI) showed that cash remains the preferred mode of payment, particularly for small-value transactions, despite the existence of an efficient payments system and recent innovations.⁸ Relatedly, in Japan, a highly digitised economy, cash remains the most-used payment method. In 2018, roughly 82 per cent of all transactions in Japan still involved some form of cash, making Japan

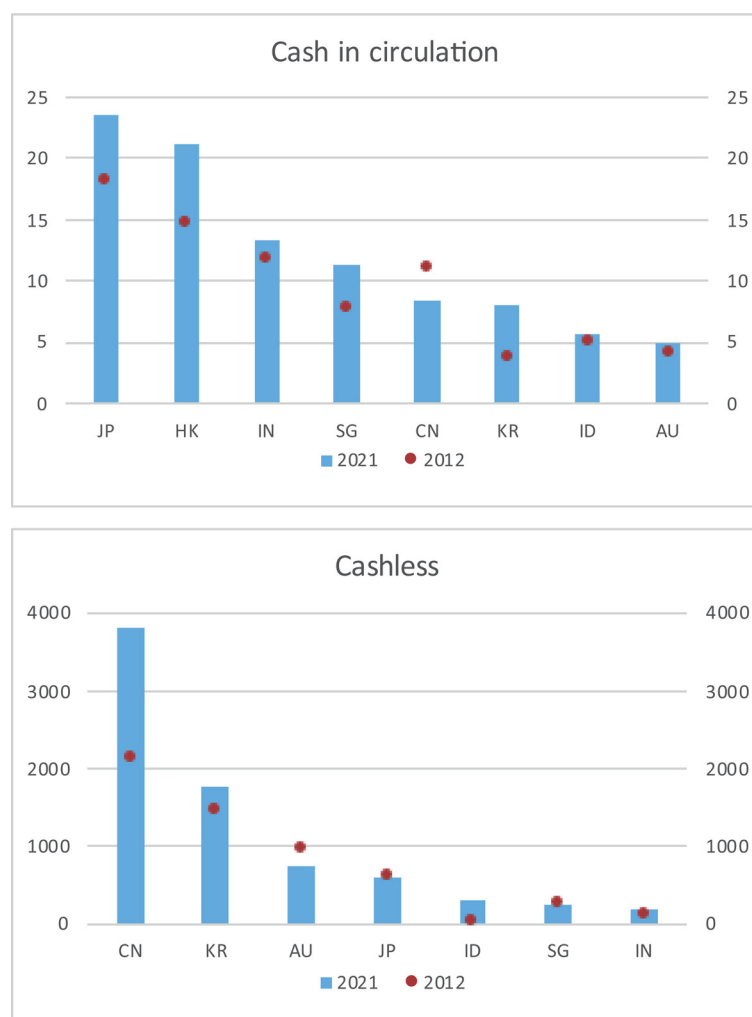


Figure 1: Both (a) cash in circulation and (b) cashless payments continue to grow as a percentage of GDP

Note: For cash in circulation, year-end stock is shown; for cashless payments, total value during a calendar year is shown.

Sources: CPMI Redbook statistics; authors' calculations.

one of the most cash-dependent economies globally.⁹ In fact, Japan's payment system has been constructed around a strong preference for cash. Although electronic payment systems have been in place as early as the 1970s, ATM penetration is also high in Japan due to the aggressive rollout that banks have conducted since the mid-1970s, and inter-bank alliances for cash card transactions have been in place since 1990 to facilitate cash usage.

Rise of electronic and digital payments

A second notable feature of payment systems in Asia-Pacific is the substantial growth of digitisation in the payments industry. This growth has been driven by contributions from both the public and private sectors, such as card payments and infrastructures developed by big techs.

In the public domain, fast payment systems have helped develop a public platform to facilitate digital payments. Almost all Asian jurisdictions now have fast payment systems (see Appendix Table A1). Compared with cash and card payments, fast payment systems have several benefits. These systems offer 'instant' settlement with less (or even no) cost to users. They are also interoperable. For instance, India's Unified Payment Interface (UPI) was integrated with Singapore's PayNow on 21st February, 2023, facilitating remittances between the two countries. In some Asian economies, central banks provide a public digital platform via fast payment systems to avoid market monopoly. In Singapore, for example, digital payments supported by a consortium of banks under PayNow — its fast payment system — more than doubled in 2021, compared with a year earlier. Fast payment systems could also help broaden financial inclusion. For example, in Thailand, PromptPay provides users with a credit history, which could support credit applications including qualifying for loans, and accessing insurance products. During

the pandemic, PromptPay also helped with cash handouts.

Meanwhile, big tech companies, as key players in the payment industry, have also stimulated the digital payment service by capitalising on their ecosystem and technological advancements. In Indonesia, the aggregate value of e-money transactions has risen exponentially since 2010, reaching around IDR 205tn in 2020 (or 1.3 per cent of GDP). A few domestic nonbank players dominate Indonesia's digital payment market, including Gopay, OVO, DANA and LinkAja. In South Korea, the market share of big techs (eg Naver, Kakao and Toss) in its 'easy payment' market increased from 56 per cent in 2019 to 65 per cent in 2020.¹⁰ In China, Alipay (launched in 2004) and WeChat Pay (launched in 2011) together account for 94 per cent of mobile payments.¹¹ In India, PhonePe and Google Pay — two private payment solutions built on the Unified Payment Interface (UPI) — have rapidly gained prominence. Meanwhile, Japan's Rakuten, China's Alibaba Group and Indonesia's GoTo Group are major players in e-commerce, with revenues that rival those of Amazon and Walmart in the USA.¹²

At the same time, card payments have also increased in the region. Over the last decade, card payments (defined as e-payments made with a plastic card at a point-of-sale (PoS) terminal) have become more popular. However, there is sizable heterogeneity. The value of card payments relative to GDP is only around 14 per cent in Japan in 2020, where cash is widely used, whereas in South Korea, where cashless transactions have risen sharply, it is around 47 per cent.¹³ Infrastructure development is one of the factors that has supported greater card usage. The average number of terminals per resident in Asia increased from 0.016 in 2012 to 0.026 in 2020.¹⁴ This is likely due to the emergence of mobile terminals (such as lower-cost smartphone or tablet-based PoS terminals).

IMPLICATIONS FOR CBDC DESIGN TO ENCOURAGE ADOPTION

Current payment system usage patterns in Asia-Pacific, including the enduring appeal of cash, combined with rapid and broad-based adoption of digital payment technologies underscore three core CBDC design principles that can help bolster its adoption and viability.

Future-proofing

The design of any CBDC must be ‘future-proof’. Digital and payment infrastructures are evolving rapidly in the region. At the same time, users’ preferences are also changing quickly, marked by the widespread use of e-commerce and FinTech. To remain attractive, CBDCs must meet the evolving needs of an increasingly sophisticated user base. To

do so, CBDCs must be designed in a way that can adapt to technological changes. This calls for a design that is flexible and modular, one that allows for new functionalities to be added over time. At the same time, CBDCs would need to have compelling use cases, especially those functionalities that are not offered by existing solutions.

Reflecting this perception that CBDCs can more easily incorporate new features, several countries see CBDCs as a means for introducing add-on features such as offline functionality and interoperability with cash-in and cash-out networks, electronic know-your-customer (KYC) screening, programmability, micro-loans, and better integration of the payment ecosystem with the wider economy (eg utility billing system; Figure 2). In China, for example, the digital yuan offers smart

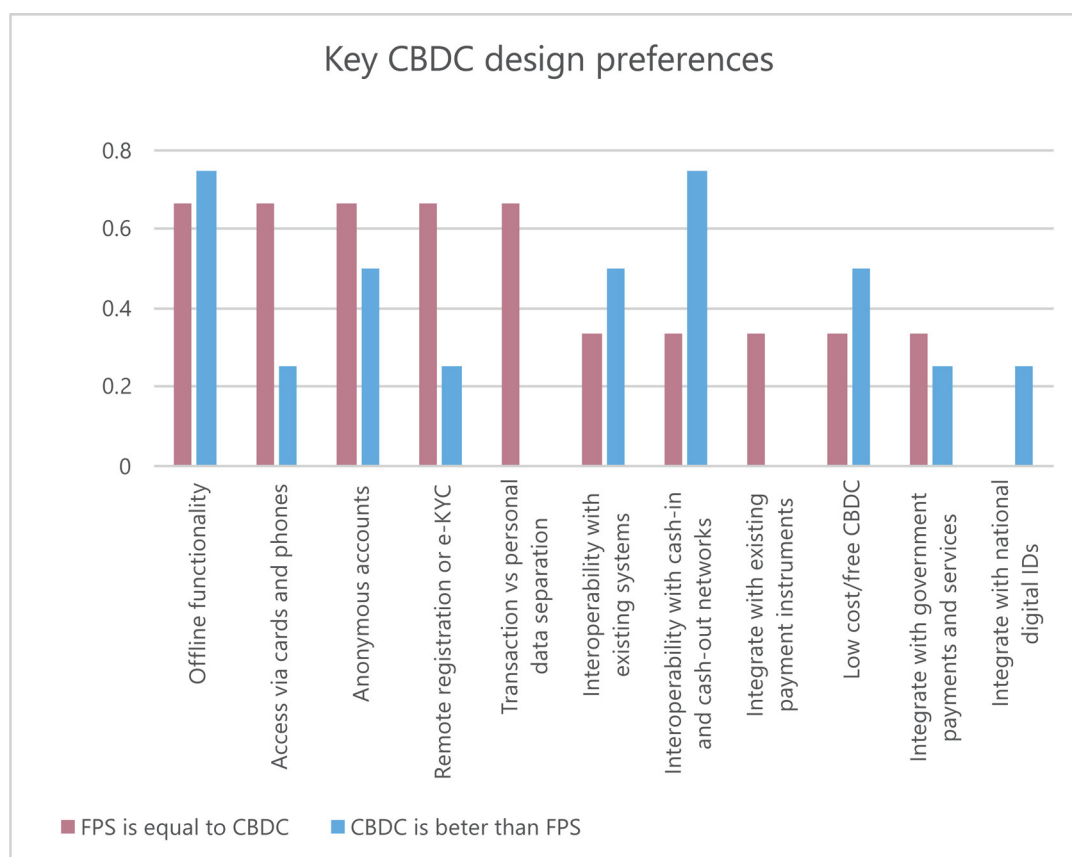


Figure 2: Key CBDC design preferences — Share of central bank respondents

Source: BIS Survey 2022

contract functionality in addition to use cases such as securities purchases and offline access. Going forward, the eCNY is exploring voice-authenticated payments (see case study below for more details) while India's eRupee is exploring programmable retail payments, and Project Rosalind of the BIS Innovation Hub London Centre is investigating cognitive accessibility for financial inclusion.

Mimicking the appeal of physical cash

Secondly, the enduring appeal of cash, even in Asia-Pacific economies with a high level of digitisation, suggests that digital cash would need to mimic the core features of physical cash. This includes, in particular, offline access and the preservation of privacy.

At the current juncture, CBDCs are able to replicate some features of physical cash. As is the case with cash, CBDCs carry the status of a legal tender. They offer instant settlement, are meant to be relatively inexpensive to use, be interoperable across payment systems, and provide a store of value, although with limited amounts. CBDCs could also offer some degree of anonymity and offline functionality, similar to cash. For example, the Bank of Japan's digital yen pilot includes universal access, instant payment capability and interoperability.¹⁵

Meanwhile, a growing awareness for data protection has focused the need for data privacy in CBDC design (as noted by the RBI). Although it is difficult for CBDCs to be fully anonymous, a fair degree of data privacy can still be achieved. For instance, China's e-CNY follows the principle of 'anonymity for small value transactions and traceability for large value transactions'.¹⁶ Moreover, CBDCs could improve users' data governance experiences. In most jurisdictions, users of financial services are often unclear about how their data are handled and used. CBDCs can embrace existing governance standards more effectively or trigger the establishment of such standards. (That said, admittedly, the design of data

governance standards does not necessarily depend on the design of CBDCs; nevertheless, CBDC can play a pivotal role in establishing or implementing effective data governance standards.) Concretely, central banks could be clearer in letting users know who manages their data and who can use their data generated as part of the CBDC system. In India, the Data Empowerment Protection Architecture (DEPA), launched in September 2021, allows users — both consumers and businesses — to control aspects of the data they generate, such as whom to share with and for how long.¹⁷

The degree to which a CBDC can achieve its policy goals depends largely on design, but central banks must contend with trade-offs. For example, the degree of privacy a CBDC affords will affect the authority's ability to pursue its obligations with regard to combating money laundering and the financing of terrorism. Programmable money and targeted fiscal support could reduce anonymity. Enabling cross-border interoperability with payment systems or CBDCs from other economies requires international coordination; for economies with lower technological capacities, such coordination might require deference to economies with established technology.

Several projects exploring the (technical and policy) feasibility of such features are underway. For example, Project Tourbillion from the BIS Innovation Hub Swiss Centre is studying the use of 'blind signatures'. These allow central banks to issue retail CBDCs without knowing the identity of the holder. Furthermore, the project uses 'mixed networks' that prevent the traceability of communications between customers, banks and central banks. China's eCNY is also considering a number of features that help preserve user privacy.

For many central banks (eg Bank of Japan), CBDCs are not seen as a substitute for physical cash. Rather, CBDC is seen as a payment instrument to complement cash,

similar to the RBI's approach to its CBDC. A CBDC would therefore have to coexist alongside cash rather than substitute for it.

Active private sector participation

Finally, it is essential to ensure active private sector participation in the CBDC ecosystem. For example, in Brazil, participation from large banks in PIX is mandatory. By contrast, in India and China, bank participation in the respective CBDC projects is voluntary. Despite operational differences, most economies are adopting a two-tier system, which highlights the common understanding that the success of CBDCs depend in large part on private bank participation. Indeed, recognising the need for private sector buy-in is necessary for the success of any CBDC engagement. Such an approach would help preserve the two-tier financial system. At the same time, it is crucial to ensure that it is financially viable for the private sector to participate in the CBDC ecosystem, such as by giving CBDC wallet providers the flexibility to charge fees competitively based on any add-on features they provide.

In addition to the three core design principles, additional measures may be needed to boost CBDC adoption. For example, some jurisdictions are using incentives to boost CBDC usage, including seeding digital accounts with initial grants. Some are also actively communicating with the public via different channels to ensure that there is awareness about the CBDC initiative and its specific advantages.

CASE STUDY: ADOPTION AND PRIVACY CONSIDERATIONS FOR THE E-CNY

The People's Bank of China (PBC) initiated the study of CBDC in 2014. In 2019, with high-level design, function development, and system testing largely completed, the PBC initiated trial CBDC programmes in select regions.

Challenges: Adoption and data privacy concerns

The adoption rate for e-CNY adoption has thus far been low but is growing with the introduction of new features. Wallet balance for e-CNY totalled US\$203m as of December 2021, accounted for 0.02 per cent of M0. As a part of currency circulation, e-CNY represented roughly 0.13 per cent at the end of 2022.¹⁸

To boost adoption, the PBC is working to improve user experience. New features have been introduced continuously. Some recently introduced features include a payroll function in eCNY wallets (ie the ability of employers depositing monthly paycheques directly to employees in their e-wallets), linking e-CNY wallets to bank accounts for automatic top-ups, public utility payments, and catering payments. Some cities have also unfurled features unique to their region, including carbon trading and smart contracts for insurance. One new feature being developed is the merging of all QR code payment systems by unifying the technical standards behind payment platforms. Doing this would enable e-CNY wallet users to use different platforms as one. Another new feature being developed is one that can support payments even when a phone is out of battery or has no internet connection. The PBC is targeting having e-CNY as a universal service provider rather than just a wallet. With new user features, adoption rate is expected to accelerate in the second half of 2023.

The second challenge is to resolve public concerns on privacy protection — a concern also echoed by many other economies.¹⁹ However, full anonymity is not possible given considerations relating to combating money laundering and the financing of terrorism. The design of e-CNY thus addresses privacy concerns on several fronts:

- Different categorisations of wallet to help maintain privacy. For KYC, e-CNY

- wallets can be classified into four categories with different balances and transaction caps. Users can open the least privileged category of wallet (category four) using only a mobile phone number; PBC has no visibility to the data behind the wallet;
- The confidentiality of daily small-value payment transactions is preserved. e-CNY follows the principle of ‘anonymity for small amounts, traceability for large amounts in accordance with the law’;
 - The e-CNY app collects information based on user consent and follows the rules of autonomy, transparency and data minimisation. There are clear rules in place limiting data access. Users have the right to withdraw their permissions and therefore revoke access to data at any time. The e-CNY app will immediately stop any information collection and processing;
 - The e-CNY adopts a ‘two-tier’ operating system. The PBC only processes inter-institutional transaction information and does not hold personal information. ID anonymisation technology is used between e-CNY wallets and the personal information exchanged between all wallets is anonymous to counterparties and other commercial institutions;

Payment-system related motivations

The introduction of e-CNY is a part of the digital payment revolution in China. With retail payment already highly digitised, the PBC sees e-CNY offering added value to the existing payment system on several fronts.

First, e-CNY helps improve the efficiency of the central bank payment system. e-CNY is built through a collaborative effort involving a broad set of private sector participants including commercial banks, financial market institutions, payment service providers, FinTech companies and telecommunication operators. e-CNY provides broad access, offering 24/7/365 services to

the general public. In addition, e-CNY offers instant payment settlement. It also enhances the performance of the central bank payment system with a capability of 10,000 transactions per second.

Second, e-CNY provides a backup for the retail payment system. For instance, given the limited options for traditional electronic payments at the 2022 Beijing Winter Olympics (due to Visa’s exclusive arrangement), people could still use e-CNY for payments. As a new form of legal tender, e-CNY could build upon the latest innovations and technologies in the payment sector.

Third, e-CNY reduces retail payment costs. It is a legal tender, and thus the PBC does not charge authorised operators for exchange and circulation services, and operators do not charge individual clients for the exchange of e-CNY. e-CNY also supports offline functions through technologies such as near-field communication and cryptography; therefore, it could be accessed with no network connections or weak connections such as during extreme weather events.

CBDC issuance motivations beyond payments

A goal of issuing e-CNY is to boost financial inclusion by enhancing the accessibility of payment services and the formal financial system. Despite rapid and sizable digitisation, pockets of China’s population have limited or no easy access to the formal financial system. e-CNY is loosely linked to bank accounts, so a digital wallet could be delivered to end users, even those without traditional bank accounts. e-CNY has features that are designed for easy access, including hardware wallets, wearable products such as e-ink cards and smart watches, speech recognition to reduce the need to read small print and prompts in multiple languages. Senior citizens, people with disabilities, foreign visitors and non-residents

can thus easily access formal financial services in China.

e-CNY could also bolster market innovation and level the playing field. e-CNY offers a platform for the country's payment systems to be interoperable with each other, thus opening up the market to greater competition by reducing the costs for new market entrants. Also, by deploying smart contracts, e-CNY could offer programmability, which would enable self-executing payments according to predefined conditions or terms agreed between two concerned parties.

Overall, PBC sees e-CNY as offering an opportunity to improve the payment system in China, including enhancing competition and boosting financial inclusion.

CONCLUSION

The proliferation of CBDC initiatives has raised questions about the value that CBDCs offer to end users, private banks and payment service providers. Indeed, while central banks have clear policy objectives for CBDC issuance, the use case is far less clear for many end users and businesses. Nevertheless, the viability of CBDC initiatives depend on adoption, without which the policy objectives for CBDC issuance cannot be met and the anticipated benefits will not materialise. Meeting user preferences and addressing businesses' concerns are thus prerequisites for ensuring CBDC adoption.

For economies in Asia-Pacific — a region characterised by both enduring preference for cash as well as a high degree of digitisation — CBDC designs must incorporate two key considerations to boost adoption. One is to incorporate the usability of cash into the design while addressing the privacy concerns of end users. The second is to future-proof the design, to ensure it keeps pace with the rapidly evolving digital payments landscape.

Past experiences with payment innovations suggest that securing the success of

CBDCs requires a broad and long horizon. Studies on scientific progress and technical change show that many benefits come not simply from adopting the technology, but from *adapting to* these new technologies. History has shown that the full benefits of technical disruptions cannot be fully utilised without wide adoption, and that benefits tend to be materialised much later. For example, electricity generation and its targeted delivery depended on wide adoption. Likewise, James Watts' engine design was published in 1774, yet the first commercially successful steam locomotive did not appear until 38 years later in 1812.²⁰ There is little doubt that the full benefits of CBDCs will only become clear years from now. Indeed, for many central banks, the potential and promises of CBDCs, as a part of their broader payment system upgrade and technical innovation, are still only starting to come into view.

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APPENDIX

Table A1: Chronology of fast payment systems

<i>Year</i>	<i>Country/region</i>	<i>System name</i>
2001	South Korea	Electronic Banking System (EBS)
2003	Chinese Taipei Iceland	ATM, FXML and FEDI systems CBI Retail Netting System (JK)
2006	Malaysia South Africa	Instant Interbank Fund Transfer Real-Time Clearing (RTC)
2007	Korea	CD/ATM system
2008	Chile UK	Transferencias en línea (TEF) Faster Payments Service (FPS)
2010	China India	Internet Banking Payment System (IBPS) Immediate Payment Service (IMPS)
2011	Argentina Costa Rica Nigeria	Immediate Transfer (IT) Transferencias de Fondos a Terceros del SINPE NIBSS Instant Payments
2012	Ecuador Poland Sweden	Pago Directo Express ELIXIR BiR
2014	Denmark Singapore	Nets Real-time 24/7 Fast and Secure Transfers (FAST)
2015	Bahrain Mexico Sri Lanka	Fawri+ SPEI LankaPay CEFTS
2016	Belize Ghana India Euro area (ES)	Automated Payment and Securities Settlement System (APSSS) GhIPSS Instant Pay (GIP) Unified Payments Interface (UPI) SNCE
2017	Bhutan Euro area Euro area (FI) Euro area (IT) Kenya Euro area (LV) Switzerland Thailand USA	Immediate Payment Service RT1 Siirto BI-COMP PesaLink Zibmaksajums Twint PromptPay RTP®
2018	Australia Czech Republic Euro area Euro area (FR) Hong Kong SAR Japan Euro area (LT) Malaysia Philippines Euro area (PT) Serbia	New Payments Platform (NPP) RTPE TIPS SEPA EU Faster Payment System (FPS) Zengin System CENTROlink RPP InstaPay Sistema de Compensação Interbancária Instant Payments Serbia

<i>Year</i>	<i>Country/region</i>	<i>System name</i>
2019	Aruba	Instant Payments Clearing and Settlement Mechanism
	Euro area (BE)	CEC.IP
	Bulgaria	SCT Inst for local currency
	Croatia	SCT Inst for local currency
	Mexico	Cobro Digital (CoDi)
	Euro area (NL)	equensWorldline Instant Payment CSM
	Euro area (SI)	Bankart
	Norway	Straksbetalinger
	Romania	Plăți Instant
	Russia	Faster Payment System (FPS)
2020	Southern African Development Community	Transactions Cleared on an Immediate Basis (TCIB) [cross-border payment system]
	Brazil	Pix/Sistema de Pagamentos Instantâneos (SPI)
2021	Pakistan	RAAST
	Saudi Arabia	sarie
	Türkiye	Instrant and Continuous Transfer of Funds (FAST)
	Indonesia	BI-FAST
Planned	Azerbaijan	Instant Payment System (IPS)
	Canada	Real-Time Rail (RTR)
	Colombia	CENIT
	Czech Republic	CERTIS
	Hungary	Instant Payments
	Maldives	The Maldives Payment System Development (MPSD)
	Peru	<i>To be determined</i>
	Sweden	RIX-INST
	Switzerland	SIC IP
	The Nordics	P27
USA	FedNow SM Service	

Table A2: Landscape of payment systems and CBDC design considerations (end 2021 or latest available)

Country	Landscape				Top motivations for issuance*			Payment systems comparison	Monetary system impact	Retail CBDC development	Status	
	Cash in circulation (% of GDP)	Cashless to GDP	POS terminal per inhabitant (% of population)	Use of top payment apps	Digital cash	Financial inclusion	Increase competition	FPS equal to CBDC	CBDC better than FPS	CBDC improvement policy implem.		Name
AE	7.3	NA	NA	NA	✓	✓		✓		Somewhat	Digital dirham	Research
AU†	4.9	7,549	3.7	6.3	NA	NA	NA	NA	NA	NA	eAUD	Research
CN	8.4	3,806	2.8	5.3	✓	✓	✓			Somewhat	e-CNY	Pilot
HK	21.1	NA	NA	14.3	✓		✓			*	e-HKD	Research
JP†	23.5	612	NA	20.4	NA	NA	NA	NA	NA	NA	Digital yen	POC
ID	5.7	300	0.6	4.5	✓	✓	✓			Slightly	Digital rupiah	Research
IN	13.2	209	0.4	18.0	✓	✓				Somewhat	eRupee-R	Pilot
KR	8.1	1,772	NA	10.0	✓		✓	✓		Somewhat	Digital won	POC
MY	9.7	NA	NA	15.7		✓		✓		Somewhat	e-Ringgit	POC
PH	11.2	NA	NA	11.6	✓	✓			Slightly		CBDCPh	Research
SG	11.3	252	6.1	10.8	✓		✓		Slightly	*	Project Orchid	Research
TH	14.3	NA	NA	12.5	✓		✓	✓		Significantly	Digital baht	Pilot
VN	18.1	NA	NA	NA		✓		✓		Somewhat	Digital dong	Research

POC, proof of concept; AE, United Arab Emirates; AU, Australia; CN, China; HK, Hong Kong SAR; JP, Japan; ID, Indonesia; IN, India; KR, South Korea; MY, Malaysia; PH, Philippines; SG, Singapore; TH, Thailand; VN, Vietnam.

*Only the top three motivations from all respondents are listed; †country was not part of the survey or data unavailable

Sources: BIS CBDC survey (2021); CBDCtracker.org; central bank websites; Committee on Payments and Market Infrastructures (CPMI) Redbook statistics, Sensor Tower, authors' calculations.

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