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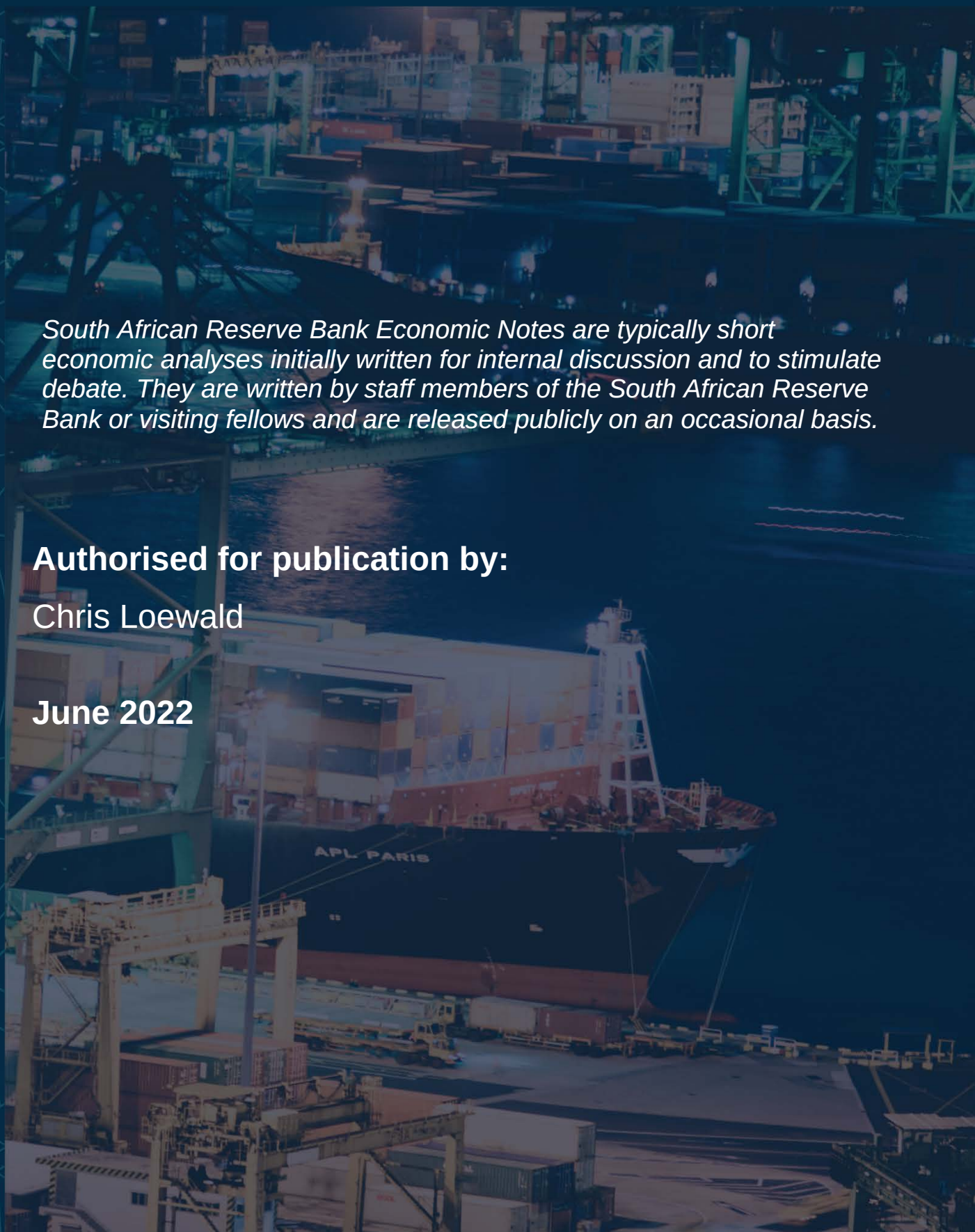
SOUTH AFRICAN RESERVE BANK



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Authorised for publication by:

Chris Loewald

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Enquiries
Head: Research Department
South African Reserve Bank
P O Box 427
Pretoria 0001

Tel. no.: +27 12 313-3911
0861 12 SARB (0861 12 7272)

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Policy lessons from global retail CBDC projects

Nic Spearman

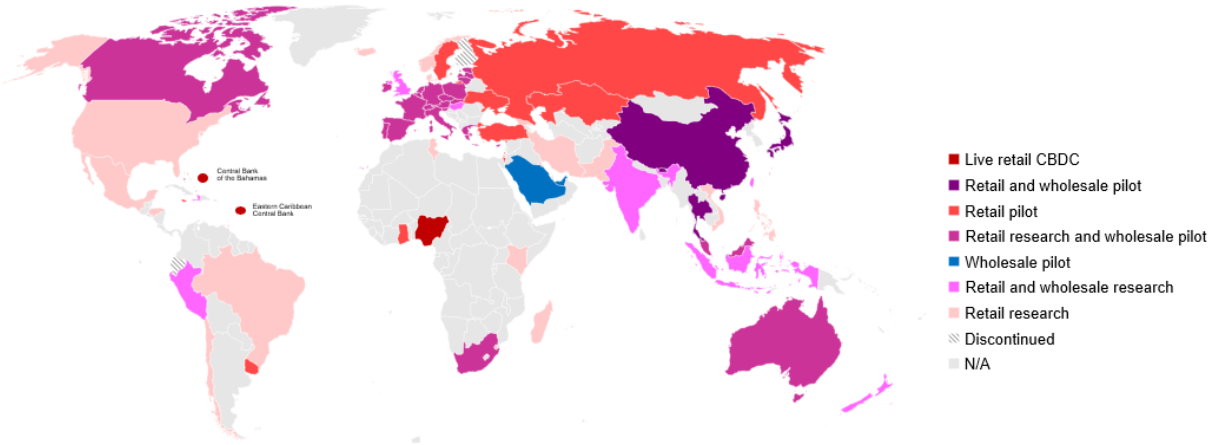
Abstract

Central banks world-wide are working to future-proof their role in a rapidly changing digital world. In this context, retail central bank digital currency (rCBDC) presents a potential tool for addressing key policy challenges going forward. These include monetary policy transmission, financial stability, payment system inefficiencies, and financial market failures. Addressing these challenges as well as improving integration with global payment systems are central to the SARB's strategic focus areas. Various rCBDC projects are in experimental stage working to assess policy uses and potential designs. These provide useful case studies for the SARB to understand the need for rCBDC and its potential policy spill-over effects. Understanding these impacts is important for ensuring the SARB's capacity to respond timeously and appropriately to the rapidly changing digital payment environment. For policy makers concerned by the prospect of currency substitution, a key economic lesson is that issuing rCBDC will not arrest currency substitution as it does not address the underlying economic factors that drive substitution.

1. Introduction

Interest in central bank digital currency (CBDC) is a global phenomenon as illustrated in Figure 1.[1]

Figure 1: Global CBDC projects



Sources: Auer, et al. (2020); BIS; SARB

[1] Figure 1 illustrates the status and scope of CBDC projects as at February 2022. We only include projects with sufficient information released officially to classify the status and scope of the projects. Additional projects had been announced but without sufficient information to indicate status and scope. These projects are therefore not included.

In this note, we review 57 global rCBDC[2] projects to identify and learn from the underlying policy issues motivating central bank interest in rCBDC. We find that the policy case motivating rCBDC projects differs depending on country-specific economic circumstances and the efficiency of respective national payments systems. We find that 22 central banks are developing rCBDC to achieve clear and specific policy objectives that fall within three broadly differentiated categories:

i. modernising the role of central banks in an increasingly digital economy;
ii. improving payment system efficiency and capability; and
iii. addressing domestic financial sector market failure and regulatory concerns.

We find that an additional 30 rCBDC projects are not targeting specific policy objectives but are exploring rCBDC as a general policy tool with central banks working to better understand the broad policy impacts and spill-over effects of CBDC. We find that a further three central banks have considered the case for rCBDC and concluded that there are currently no policy imperatives for developing rCBDC. Finally, we find two examples where rCBDC was implemented but later discontinued. These findings are summarised in Table 1.

[2] There are two types of domestically issued CBDC: wholesale and retail. Wholesale CBDC (wCBDC) is conceptually like reserve deposits but differs primarily in the technology underlying the system. Retail CBDC (rCBDC) refers to a central bank liability like wCBDC but made available to the public.

Table 1: Policy objectives motivating global rCBDC projects (February 2022)

Country	Modernising the role of central banks for the digital economy: Maintain monetary sovereignty and policy control	Modernising the role of central banks for the digital economy: Maintain public access to central bank liabilities	Improving retail payment efficiency and capability: Reduce the operational cost / complexity of issuing cash	Improving retail payment efficiency and capability: Facilitate cross-border remittances	Improving retail payment efficiency and capability: Promote regional payment integration	Improving retail payment efficiency and capability: Promote digital services innovation / interoperability	Improving retail payment efficiency and capability: Develop a new centralised government payment platform	Financial sector market failure and regulation: Foster financial inclusion	Financial sector market failure and regulation: Improve transparency / AML	General interest: Tool for mitigating general policy inefficacies	No compelling policy case: NA	Discontinued: NA
Australia[1]											x	
Bahamas[2]			x					x	x			
Bahrain[3]										x		
Bhutan[4]		x				x						
Brazil[5]										x		
Canada[6]	x	x										
Chile[7]										x		
China[8]	x						x					
Curaçao en Sint Maarten[9]			x		x			x	x			
Czech Republic[10]										x		
Denmark[11]											x	
Eastern Caribbean[12]						x		x				
Ecuador[13]												x
Eswatini[14]								x				
Eurozone[15]		x			x							
Finland[16]												x
Ghana[17]						x		x				
Georgia[18]								x		x		
Haiti[19]			x					x				
Honduras[20]										x		
Hong Kong[21]										x		
Hungary[22]										x		
Iceland[23]										x		
India[24]										x		
Indonesia[25]										x		
Iran[26]										x		
Israel[27]										x		
Jamaica[28]			x			x		x				
Japan[29]		x	x			x						
Kazakhstan[30]										x		
Kenya[31]					x	x						
Kuwait[32]										x		
Madagascar[33]										x		
Malaysia[34]										x		
Mauritius[35]										x		
Mexico[36]								x				
New Zealand[37]										x		
Nigeria[38]			x	x		x		x	x			
Norway[39]		x										
Pakistan[40]										x		
Peru[41]										x		
Philippines[42]						x		x				
Russia[43]				x		x		x				
Singapore[44]										x		
South Africa[45]										x		
South Korea[46]										x		
Sweden[47]												
Switzerland[48]											x	
Thailand[49]										x		
Trinidad and Tobago[50]										x		
Tunisia[51]										x		
Turkey[52]										x		
Ukraine[53]								x				
United Kingdom[54]										x		
United States[55]										x		
Uruguay[56]			x					x				
Vietnam[57]							x					

Notes:
[1] Australia: Reserve Bank of Australia (2019)
[2] Bahamas: Central Bank of the Bahamas (2019)
[3] Bahrain: Central Bank of Bahrain (2021)
[4] Bhutan: Royal Monetary Authority of Bhutan (2021)
[5] Brazil: Burgos & Batavia (2018)
[6] Canada: Bank of Canada (2020)
[7] Chile: Banco Central Chile (2021)
[8] China: People's Bank of China (2021)
[9] Curaçao en Sint Maarten: Centrale Bank van Curaçao en Sint Maarten (2018)
[10] Czech Republic: Czech National Bank (2020)
[11] Denmark: Danmarks Nationalbank (2017)
[12] Eastern Caribbean: Eastern Caribbean Central Bank (2021)
[13] Ecuador: White (2018)
[14]: Eswatini: Central Bank of Eswatini (2020)
[15] Eurozone: European Central Bank (2020); Brunnermeier & Landau (2022)
[16] Finland: Grym (2020)
[17] Ghana: Addison (2019)
[18] Georgia: National Bank of Georgia (2021)
[19] Haiti: Bank of the Republic of Haiti (2020)
[20] Honduras: Banco Central de Honduras (2021)
[21] Hong Kong: Hong Kong Monetary Authority (2021)
[22] Hungary: Magyar Nemzeti Bank (2021)
[23] Iceland: Central Bank of Iceland (2018)
[24] India: Reserve Bank of India (2021)
[25] Indonesia: Harahap, et al. (2017); Reuters (2021)
[26] Iran: Reuters (2018)
[27] Israel: Bank of Israel (2021)
[28] Jamaica: Haynes (2020)
[29] Japan: Bank of Japan (2020)
[30] Kazakhstan: National Bank of the Republic of Kazakhstan (2021)
[31] Kenya: Central Bank of Kenya (2022)
[32] Kuwait: Central Bank of Kuwait (2019)
[33] Madagascar: Central Bank of Madagascar (2020)
[34] Malaysia: Central Bank of Malaysia (2020)
[35] Mauritius: Googoolye (2019)
[36] Mexico: O'Boyle (2021)
[37] New Zealand: Wadsworth (2018)
[38] Nigeria: Central Bank of Nigeria (2021)
[39] Norway: Norges Bank (2019)
[40] Pakistan: Baqir (2022)
[41] Peru: Montoros, et al. (2019)
[42] Philippines: Bangko Sentral ng Pilipinas (2020)
[43] Russia: Bank of Russia (2021)
[44] Singapore: Monetary Authority of Singapore (2021)
[45] South Africa: South African Reserve Bank (2021)
[46] South Korea: Bank of Korea (2020)
[47] Sweden: Sveriges Riksbank (2021)
[48] Switzerland: Swiss Federal Council (2019)
[49] Thailand: Bank of Thailand (2021)
[50] Trinidad and Tobago: Central Bank of Trinidad and Tobago (2018)
[51] Tunisia: Central Bank of Tunisia (2019)
[52] Turkey: Türkiye Cumhuriyet Merkez Bankası (2021)
[53] Ukraine: National Bank of Ukraine (2019)
[54] United Kingdom: Bank of England (2020)
[55] United States: Federal Reserve Board (2022)
[56] Uruguay: Central Bank of Uruguay (2017); Barontini & Holden (2019)
[57] Vietnam: Socialist Republic of Vietnam (2021)

Source: SARB

2. The role of central banks in the digital economy

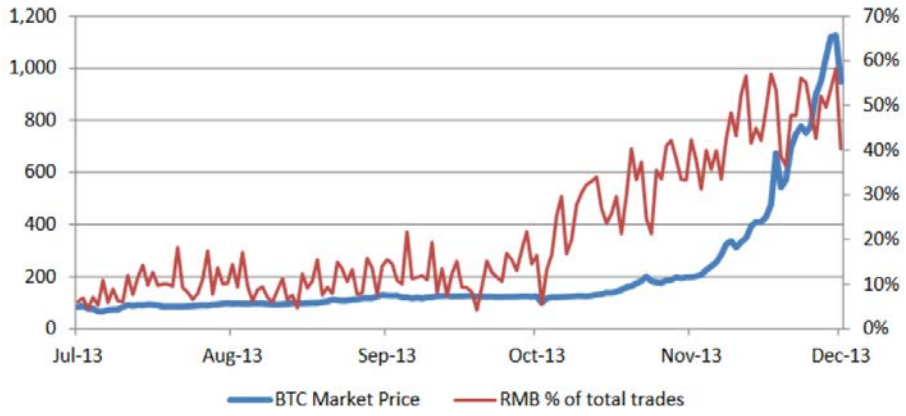
Concern about modernising the role of central banks in a rapidly changing digital world is one of the key policy factors motivating CBDC research especially among early CBDC projects. There are two key policy issues. First, is the potential for privately issued digital currencies to displace control of policy. This could occur through currency substitution. Second, is the potential for citizens to lose access to physical notes and coins as a payment medium. Here the impact is uncertain, but a key policy concern is that this loss of access could undermine the resilience of the payment system if payments become highly concentrated among a few dominant private digital operators.

Three seminal examples illustrate how central banks are thinking about rCBDC as a solution to these concerns and highlight the forward-looking approach of CBDC projects aimed at future-proofing central bank operations in an evolving digital economy.

Maintaining monetary sovereignty and policy control

Significant growth in renminbi financed Bitcoin trading activity in China (Figure 2), raised concern that private digital currencies could be used to displace the renminbi as a medium of exchange and undermine domestic policy control (BBC, 2013; Gloudeman, 2014). In response, the People's Bank of China (PBoC) launched the e-CNY rCBDC project in 2014 and prohibited financial institutions from dealing in Bitcoin to "protect the status of the renminbi as the statutory currency, prevent risks of money laundering, and protect financial stability" (Gloudeman, 2014). Various central banks have subsequently restricted cryptocurrency use.[3]

Figure 2: Bitcoin market price vs proportion of trading conducted in RMB



Source: Gloudeman (2014)

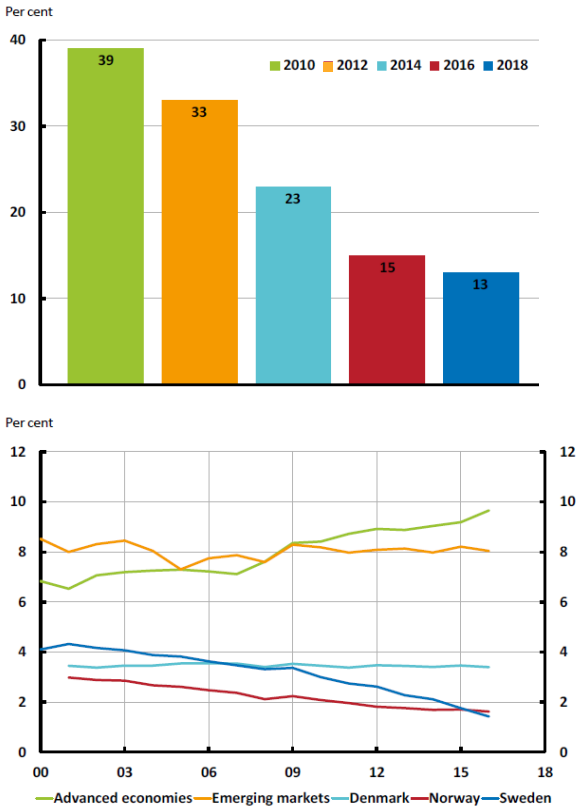
Maintaining public access to central bank liabilities

The PBoC has since indicated that "China's e-CNY system aims to create a new form of RMB that meets the public's demand for cash in the era of digital economy" (People's Bank of China, 2021). Likewise, the Sveriges Riksbank's e-Krona CBDC project, launched in 2017, was prompted by a declining proportion of cash payments in the retail sector in Sweden (Figure 3).

[3] See Orji (2022).

This raised concern that if digital payments came to be dominated by a few private operators, this could undermine competition and resilience in the financial sector (Sveriges Riksbank, 2017; 2021). In response, the e-krona project seeks to provide a digital currency and payment infrastructure that can function independently but along-side private owned infrastructure to enhance resilience and competition (Sveriges Riksbank, 2017; 2021).

Figure 3: Cash purchases in Sweden and comparative economies



(a) Percentage paying for their most recent purchase in cash in Sweden

(b) Cash as a percentage of GDP

Source: Sveriges Riskbank (2018)

Future-proofing the central bank's policy efficacy

Although declining cash use is not currently a general problem (Figure 3b), nor is currency substitution to privately issued digital currencies, many central banks list these as potential *future* concerns. For example, the Bank of Canada (BoC) lists both as the key policy issues motivating their rCBDC research program. But critically, while the BoC does not see these as *current* issues; the BoC's goal is to have a rCBDC ready for deployment as a *contingency technology* in preparation for change (Bank of Canada, 2020). This is an example of the forward-looking approach of many rCBDC projects.

3. Payment efficiency and capability

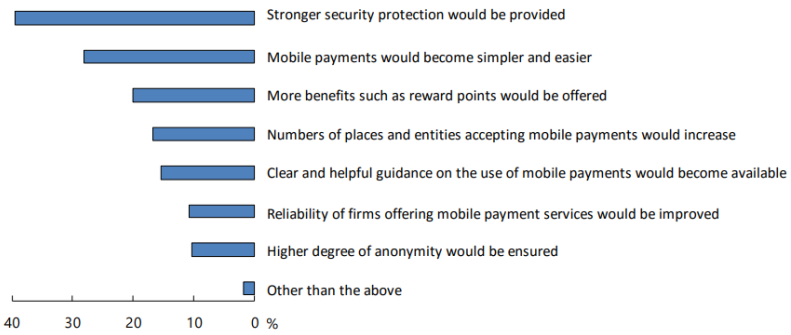
An increasingly important policy motivation for rCBDC projects is the opportunity for payment system modernisation. Related policy objectives include reducing the cost and complexity of

maintaining physical cash as a medium-of-exchange by providing a digital substitute to issuing physical cash; promoting regional payment integration by collaborating to redesign cross-border payment systems architecture; facilitating cross-border remittances by providing lower cost infrastructure; providing a catalyst for digital payment and financial services innovation by providing a blockchain enabled central bank-backed digital payment instrument; and even building new payment systems entirely.

Issuing a CBDC is not critical to achieving payment system modernisation objectives – CBDC is just one potential technology solution. However, central banks are well positioned to implement economy-wide payment infrastructure that can meet new and changing social needs making CBDC an important discussion point.

For example, changing demographics and migration into urban areas has reduced general cash circulation in Japan and put upward pressure on overall cash distribution costs especially to rural areas (Bank of Japan, 2020). However, cash remains a popular payment medium because privately issued digital money does not provide the same level of confidence as cash. An opinion survey by the BoJ highlights that a key factor discouraging digital payments in Japan is security concerns (Figure 4). The BoJ therefore sees a potential future need to issue CBDC to provide a more cost-effective digital alternative to cash as a payment medium, especially in remote areas of Japan (Bank of Japan, 2020).

Figure 4: Factors that would encourage more use of mobile payments in Japan



Source: Bank of Japan (2020)

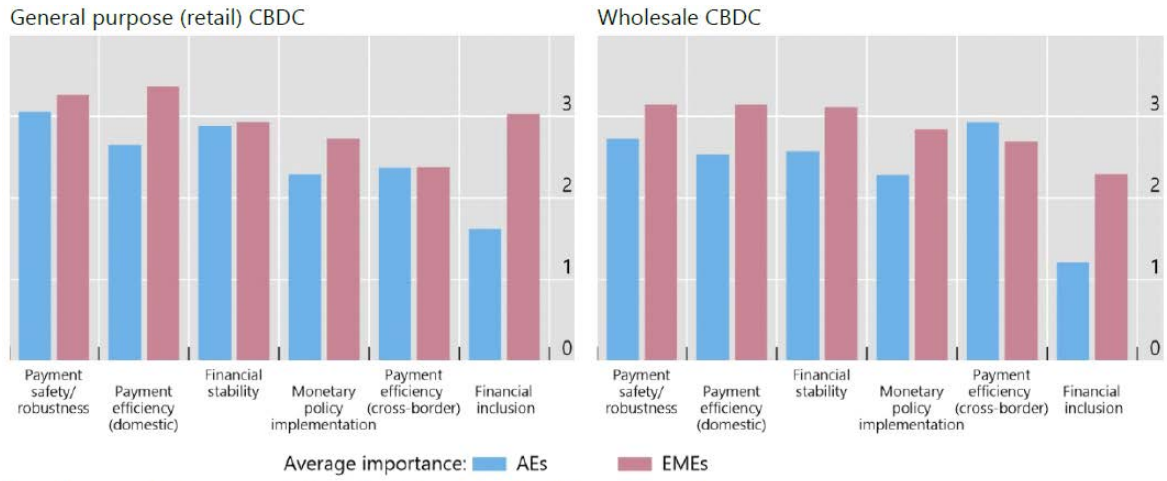
4. Domestic financial sector policy issues

A third broad category of policy objectives relates to domestic financial sector policy issues. These include promoting financial inclusion and improved anti-money laundering capabilities. The BIS's 2019 CBDC survey highlights that promoting financial inclusion is of more importance for emerging market economies than advanced economies (Figure 5). In this third category, policy objectives are not aimed at efficiency and capability, but instead at addressing specific local regulatory and market failure concerns.

Once again, these objectives do not specifically require a CBDC, but the need for market wide intervention places a central bank driven solution in an optimal position. The key questions for policy makers in these instances are, what is driving these regulatory and market failure concerns, and whether CBDC is an optimal policy tool for addressing them?

An illustrative example is the Sand Dollar, a CBDC version of the Bahamian dollar launched by the Central Bank of the Bahamas' (CBoB). An acute problem faced by the CBoB is that the rising cost of delivering financial services across the archipelago has led to a scaling back of private bank branch networks. This has exacerbated disparities in access to basic financial services due to infrastructure challenges, unstable communication and power, and a year-round risk of natural disasters. The result is that pockets of Bahamian society rely solely on cash as a means of transacting (Central Bank of the Bahamas, 2019). The Sand Dollar project aims to address this market failure by providing universal access to digital payments infrastructure and related services that the private sector is not adequately providing (Central Bank of the Bahamas, 2019).

Figure 5: Motivations for issuing CBDC



1 = not so important; 2 = somewhat important; 3 = important; and 4 = very important.

Source: Auer, et al. (2020)

5. A solution in search of a problem?

In many cases the motivation for rCBDC research is to better understand broad policy impacts and spill-over effects of CBDC, rather than addressing specific policy objectives. Potential spill-overs include monetary policy and financial stability impacts.

For example, the Bank of England (BoE) notes that issuing rCBDC could enable changes to the policy rate being passed on faster and more fully. But the BoE notes that issuing rCBDC could also disintermediate commercial banks raising financial stability concerns and disrupting the transmission of monetary policy (Bank of England, 2020). Similarly, the US Federal Reserve Board notes that the introduction of rCBDC could affect monetary policy implementation and interest rate control by altering the supply of reserves in the banking system, but the magnitude of the impact is uncertain (Federal Reserve Board, 2022). More research is therefore required to understand these impacts. However, at least one Fed Governor has expressed doubt that rCBDC would solve "any major problem confronting the U.S. payment system" suggesting that rCBDC is more like "a solution in search of a problem" (Waller, 2021). The UK House of Lords has expressed the same sentiment (House of Lords Economic Affairs Committee, 2022).

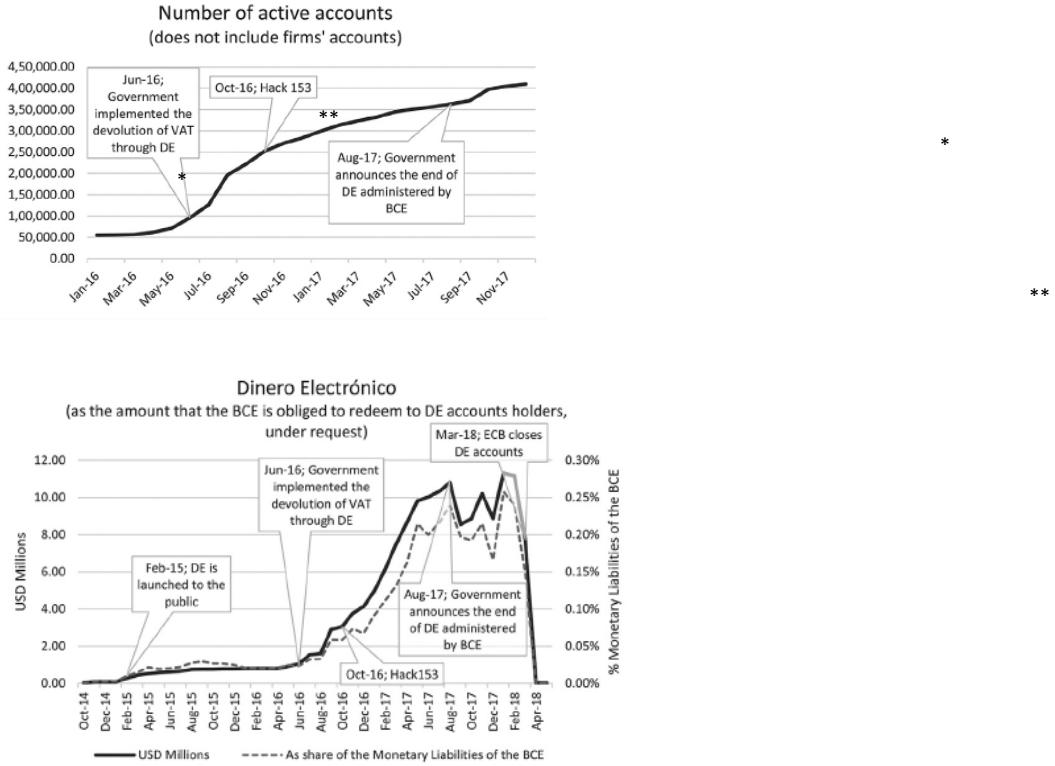
Further to this point, three central banks have researched the domestic policy case for rCDBC and concluded there is no policy case for developing a rCBDC at present. The Reserve Bank of Australia (2019; 2021) has indicated that it is "not yet convinced that a strong policy case has emerged" for a rCBDC in Australia finding that Australia is already well served by a wide range of safe, convenient, low-cost and efficient real-time retail payment methods, and that "much (if not all) of the innovation and new functionality that could potentially be enabled by a CBDC could in principle also be enabled by innovation based around commercial bank deposit accounts, e-money or stablecoins". The Swiss Federal Council (2019) has likewise indicated that rCBDC would not currently bring "additional benefits" to Switzerland. Similarly, the Danmarks Nationalbank (2017) has expressed concern that a CBDC would bring additional risk without additional benefits that are not "already covered by the current payment solutions".

6. Lessons from projects implemented but discontinued

Two case studies focusing on discontinued projects highlight that, apart from the importance of identifying clear policy (supply side) objectives for issuing a digital central bank digital currency, a valued consumer (demand side) use case is also important.

The first case study highlights the importance of an underlying consumer use case for ensuring viability when weighed against the costs of maintaining the system. In 1992, the Bank of Finland (BoF) launched the Avant smart card system. Avant smart cards issued by the BoF could be preloaded with digital currency using a network of authorised loading points. The Avant smart card was positioned as a low-value payment card intended to pre-emptively avoid fragmentation of the payment market leading to over-investment and a lack of standards (Grym, 2020). Using the Avant card was initially cost-free, but fees were later added to cover the costs of operating the system. At the same time, the cost of using debit cards was decreasing. Ultimately, the Avant card system did not offer a compelling cost-effective consumer use case and debit cards gained wider acceptance leading to the discontinuation of Avant cards in 2006 (Grym, 2020).

Figure 6: Diner Electrónico (DE) accounts



(a) Number of DE accounts (b) Value of DE held

Notes:
* The Ecuadorian government launched a program whereby DE users received a rebate of 2 percentage points off VAT paid.
** The Ecuadorian government, NGOs, and private firms organized the Hackathon HACK153 to develop solutions using DE.

Source: Arauz, et al. (2021)

The second case study highlights that issuing rCBDC will not arrest currency substitution without addressing the underlying economic factors that drive substitution.[4] In 2015 the Central Bank of Ecuador (CBoE) began issuing digital US dollar backed digital currency accounts but discontinued in 2018 following low adoption (Figure 6).[5] Ecuador's dollarised financial system had brought financial stability and low inflation, but had constrained domestic policy. In this context, White (2018) argues that dollars on deposit at private commercial banks were regarded as less risky than CBDC dollars on deposit at the central bank. This is because private banks had commercial incentives to behave prudently whereas legislation specified no limit on the volume of CBDC dollars the CBoE could create, and no prudential requirement that the central bank hold adequate assets to redeem them (White, 2018). The CBoE's CBDC therefore did not provide a credible substitute to US dollars.

4 Melvin (1988) and Reinhart, et al. (2003) find that substitution is primarily driven by macro instability. With regards to issuing rCBDC as a strategy to discourage substitution towards decentralised payment systems such as Bitcoin, this strategy overlooks the fact that decentralised systems are specifically designed to provide users with an alternative to centralised systems like a CBDC.

5 Despite the CBoE's expectation that 500,000 people would sign up in 2015, less than 50,000 were opened in 2015, and holdings accounted for less than 0.05% of Ecuador's monetary liabilities (White, 2018; Arauz, et al., 2021).

7. Key take aways for the SARB

Central banks world-wide are working to future-proof their role in a rapidly changing digital world. In this context, rCBDC presents a potential tool for addressing key policy challenges going forward. These challenges include policy transmission, financial stability, payment system inefficiencies, and financial market failures. Addressing these challenges as well as improving integration with global payment systems are central to the SARB's strategic focus areas and the National Payment System Framework and Strategy (South African Reserve Bank, 2018). It is therefore important that the SARB continue engaging with and learning from international rCBDC experiences to further assess rCBDC as a policy tool.

Apart from considering rCBDC as a solution to supply-side policy challenges, it is also important for policy makers to understand the demand-side consumer use case. It is not enough for policy makers to issue CBDC for policy purposes; consumers must want and value it too. This need is important for assessing the viability of a rCBDC when weighed against the costs of maintaining the system. This is also an important consideration for policy makers concerned by the prospect of currency substitution towards private or externally issued digital currencies. Unless rCBDC directly addresses the underlying demand for substitution, issuing rCBDC is unlikely to mitigate substitution. This is worth emphasising as few documents reviewed provided demand-side evaluation or discussion.

rCBDC therefore presents a potential policy tool, but it is not yet clear that it provides an optimal tool for achieving specific policy objectives. We recommended that the SARB continue engaging with global CBDC research as well as key stakeholders to understand the need for rCBDC in South Africa and abroad and its potential policy spill-over effects. This will be important for ensuring the SARB's capacity to respond timeously and appropriately to the rapidly changing digital payment environment.

8. References

Addison, E., 2019. *23rd Annual Banking Conference Chartered Institute of Bankers, Ghana,* Accra: Bank of Ghana.

Arauz, A., Garratt, R. & Ramos, D. F., 2021. Dinero Electrónico: The rise and fall of Ecuador's central bank digital currency. *Latin American Journal of Central Banking,* Issue 100030.

Auer, R., Cornelli, G. & Frost , J., 2020. Rise of the central bank digital currencies: Drivers, approaches and technologies. *BIS Working Papers No. 880.*

Banco Central Chile, 2021. *Nota de prensa: Banco Central presenta agenda sobre medios de pago digitales del Instituto Emisor,* Santiago: Banco Central Chile.

Banco Central de Honduras, 2021. *Comunicado,* Tegucigalpa: Banco Central de Honduras.

Bangko Sentral ng Pilipinas, 2020. *BSP Digital Payments Transformation Roadmap 2020-2023 ,* Manila: Bangko Sentral ng Pilipinas.

Bank of Canada, 2020. *Contingency Planning for a Central Bank Digital Currency,* Ottawa: Bank of Canada.

Bank of England, 2020. *Discussion Paper: Central Bank Digital Currency: Opportunities, challenges and design,* London: Bank of England.

Bank of Israel, 2021. *A Bank of Israel Digital Shekel: Potential Benefits, Draft Model, and Issues to Examine,* Jerusalem: Bank of Israel.

Bank of Japan, 2020. *The Bank of Japan's Approach to Central Bank Digital Currency,* Tokyo: Bank of Japan.

Bank of Korea, 2020. *Bank of Korea launches central bank digital currency (CBDC) pilot test,* Seoul: Bank of Korea.

Bank of Russia, 2021. *Digital Ruble Concept,* Moscow: Bank of Russia.

Bank of Thailand, 2021. *The Way Forward for Retail Central Bank Digital Currency in Thailand,* Bangkok City: Bank of Thailand.

Bank of the Republic of Haiti, 2020. *Press release: Closing speech delivered by Mr. Jeudy on the occasion of the launch of the competition on the Digital Gourde.* [Online] Available at: https://www.brh.ht/discours-de-cloture-prononce-par-m-jeudy-a-loccasion-du-lancement-du-concours-sur-la-gourde-digitale/
[Accessed 12 December 2022].

Baqir, R., 2022. *The Rise of Digital Currencies and the Road Ahead,* Karachi: State Bank of Pakistan.

Barontini, C. & Holden, H., 2019. Proceeding with caution – a survey on central bank digital currency. *BIS Papers No 101.*

BBC, 2013. *China bans banks from handling Bitcoin trade.* [Online] [Accessed 9 December 2021].

Brunnermeier, M. K. & Landau, J., 2022. *The digital euro: policy implications and perspectives,* Luxembourg: Publication for the committee on Economic and Monetary Affairs, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.

Burgos, A. & Batavia, B., 2018. *Currency in the digital era,* Brasilia: Banco Central do Brasil.

Central Bank of Bahrain, 2021. *Press release.* [Online] Available at: https://www.cbb.gov.bh/ar/media-center/مصرف-البحرين-المركزي-يترتكز-على-5-أولويات-طموحة-وحزمة-متنوعة-م/ [Accessed 13 February 2021].

Central Bank of Eswatini, 2020. *Eswatini CBDC Diagnostic Study,* Mbabane: Central Bank of Eswatini.

Central Bank of Iceland, 2018. Rafkróna? Central bank digital currency: Interim report. *Central Bank of Iceland Special Publication,* Issue 12.

Central Bank of Kenya, 2022. *Discussion Paper on Central Bank Digital Currency,* Nairobi: Central Bank of Kenya.

Central Bank of Kuwait, 2019. *Kuwait Banking Report 2019,* Kuwait City: Central Bank of Kuwait.

Central Bank of Madagascar, 2020. *The e-Ariary Project In A Few Lines,* Antananarivo: Central Bank of Madagascar.

Central Bank of Malaysia, 2020. *Annual report 2020,* Kuala Lumpur: Central Bank of Malaysia.

Central Bank of Nigeria, 2021. *Design paper for the eNaira,* Abuja: Central Bank of Nigeria.

Central Bank of the Bahamas, 2019. *Project Sand Dollar: A Bahamas Payments System Modernisatoin Initiative,* Nassau: Central Bank of the Bahamas.

Central Bank of Trinidad and Tobago, 2018. *Central Bank of Trinidad and Tobago Statement on Financial Technology and Virtual Currencies,* Port of Spain: Central Bank of Trinidad and Tobago.

Central Bank of Tunisia , 2019. *Press release Clarification,* Tunis: Central Bank of Tunisia .

Central Bank of Uruguay, 2017. *The BCU presented a pilot plan for the issuance of digital banknotes.* [Online] Available at: https://www.bcu.gub.uy/Comunicaciones/Paginas/Billete_Digital_Piloto.aspx [Accessed 14 December 2021].

Centrale Bank van Curaçao en Sint Maarten, 2018. *Press release 2018-033: CBCS and Bitt Inc. sign Memorandum of Understanding,* Willemstad: Centrale Bank van Curaçao en Sint Maarten.

Czech National Bank, 2020. Central Bank Digital Currencies (CBDCs). *Central Bank Monitoring,* Volume IV, pp. 8-11.

Danmarks Nationalbank, 2017. Central bank digital currency in Denmark?. *Analysis - Danmarks Nationalbank,* Issue 28.

Eastern Caribbean Central Bank, 2021. *Public Roll-out of the Eastern Caribbean Central Bank's Digital Currency – DCash!.* [Online] Available at: https://www.eccb-centralbank.org/news/view/public-roll-out-of-the-eastern-caribbean-central-bankas-digital-currency-a-dcash [Accessed 5 February 2022].

European Central Bank, 2020. *Report on a digital euro,* Frankfurt am Main: European Central Bank.

Federal Reserve Board, 2022. *Money and Payments: The U.S. Dollar in the Age of Digital Transformation,* Washington, DC: Federal Reserve Board.

Gloudeman, L., 2014. Bitcoin's Uncertain Future in China. *USCC Economic Issue Brief,* Issue 4, pp. 1-21.

Googoolye, Y., 2019. *Annual Dinner for Major Economic Stakeholders Speech: Shaping the New Banking Landscape: Defining the priorities and leveraging new technology to propel the Mauritian financial system forward.* Flic en Flac: Bank of Mauritius.

Grym, A., 2020. Lessons learned from the world's first CBDC. *BoF Economics Review,* 2020(8).

Harahap, B. A., Idham, P. B., Kusuma, A. C. M. & Rakhman, R. N., 2017. Perkembangan Financial Technology terkait Perkembangan Financial Technology terkait terhadap Transmisi Kebijakan Moneter dan Makroekonomi. *Bank Sentral Republik Indonesia WP/2/2017.*

Haynes, N., 2020. *A Primer on BOJ's Central Bank Digital Currency.* [Online] Available at: https://boj.org.jm/a-primer-on-bojs-central-bank-digital-currency/ [Accessed 16 January 2022].

Hong Kong Monetary Authority, 2021. *Press release: The HKMA Unveils "Fintech 2025" Strategy,* Hong Kong: Hong Kong Monetary Authority.

House of Lords Economic Affairs Committee, 2022. *Central bank digital currencies: a solution in search of a problem?,* London: House of Lords.

Magyar Nemzeti Bank, 2021. *At the dawn of a new age - Money in the 21st century,* Budapest: Magyar Nemzeti Bank.

Melvin, M., 1988. The Dollarization of Latin America as a Market-Enforced Monetary Reform: Evidence and Implications. *Economic Development and Cultural Change,* 36(3), pp. 543-558.

Monetary Authority of Singapore, 2021. *A Retail Central Bank Digital Currency: Economic Considerations in the Singapore Context,* Singapore: Monetary Authority of Singapore.

Montoros, C., Perez, F. & Moran, Y. M., 2019. Monedas Digitales de Bancos Centrales. *Moneda,* Issue 178, pp. 4-9.

National Bank of Georgia, 2021. *The National Bank of Georgia invites fintech companies to cooperate on digital gel project,* Tbilisi: National Bank of Georgia.

National Bank of the Republic of Kazakhstan, 2021. *Digital Tenge Report for Public Discussion May 2021,* Almaty Qalasy: National Bank of the Republic of Kazakhstan.

National Bank of Ukraine, 2019. *Analytical Report on the E-hryvnia Pilot Project,* Kyiv: National Bank of Ukraine.

Norges Bank, 2019. *Central bank digital currencies: Second report of working group ,* Oslo: Norges Bank.

O'Boyle, M., 2021. *Mexico's Central Bank Will Launch Digital Currency by 2024.* [Online] Available at: https://www.bloomberg.com/news/articles/2021-12-30/mexico-s-central-bank-will-launch-its-digital-currency-by-2024#:~:text=Mexico%E2%80%99s%20central%20bank%20will%20have%20its%20own%20digital,on%20its%20Twitter%20account%2C%20confirming%20the%20bank%E2%80 [Accessed 20 January 2022].

Orji , C., 2022. *Bitcoin ban: These are the countries where crypto is restricted or illegal.* [Online] Available at: https://www.euronews.com/next/2022/01/11/bitcoin-ban-these-are-the-countries-where-crypto-is-restricted-or-illegal2 [Accessed 20 February 2022].

People's Bank of China, 2021. Progress of Research & Development of E-CNY in China. *Working Group on E-CNY Research and Development of the People's Bank of China.*

Reinhart, C. M., Rogoff, K. S. & Savastano, M. A., 2003. Addicted to dollars. *NBER Working Paper 10015.*

Reserve Bank of Australia, 2019. *Submission to the Senate Select Committee on Financial Technology and Regulatory Technology,* Sydney: Reserve Bank of Australia.

Reserve Bank of Australia, 2021. *The Future of Payments: Cryptocurrencies, Stablecoins or Central Bank Digital Currencies?,* Sydney: Reserve Bank of Australia.

Reserve Bank of India, 2021. *Report on Currency and Finance 2020-21,* Mumbai: Reserve Bank of India.

Reuters, 2018. *Iran cryptocurrency project on track despite cenbank ban, minister says.* [Online] Available at: https://www.reuters.com/article/uk-crypto-currency-iran-idUSKBN1HZ0O6 [Accessed 27 January 2022].

Reuters, 2021. *Bank Indonesia joins global c.bank push for digital currencies.* [Online] Available at: https://www.reuters.com/article/indonesia-cenbank-cryptocurrency-idUSL2N2NC0NX [Accessed 2 February 2022].

Reuters, 2022. *Swiss National Bank against issuing retail central bank digital currency.* [Online]
Available at: https://www.reuters.com/article/swiss-snb-maechler-idUKKBN2JS18T [Accessed 10 February 2022].

Royal Monetary Authority of Bhutan, 2021. *Press Release: Pilot Project on Central Bank Digital Currency,* Thimphu: Royal Monetary Authority of Bhutan.

Socialist Republic of Vietnam, 2021. *Approving strategy for development of e-government towards digital government for 2021 - 2025 with orientations towards 2030,* Hanoi: Socialist Republic of Vietnam.

South African Reserve Bank, 2018. *The National Payment System Framework and Strategy: Vision 2025,* Pretoria: South African Reserve Bank.

South African Reserve Bank, 2021. *Press release: SARB commences feasibility study for a general-purpose retail central bank ,* Pretoria: South African Reserve Bank.

Sveriges Riksbank, 2017. *The Riksbank's e-krona project: Report 1,* Stockholm: Sveriges Riksbank.

Sveriges Riksbank, 2021. *E-krona pilot: Phase 1,* Stockholm: Sveriges Riksbank.

Swiss Federal Council, 2019. *Central bank digital currency,* Bern: Swiss Federal Council.

Türkiye Cumhuriyet Merkez Bankası, 2021. *Press Release on Central Bank Digital Turkish Lira R&D Project,* Ankara: Türkiye Cumhuriyet Merkez Bankası.

Wadsworth, A., 2018. The pros and cons of issuing a central bank digital currency. *Reserve Bank of New Zealand Bulletin,* 81(7).

Waller, C. J., 2021. *CBDC: A Solution in Search of a Problem? Speech at the American Enterprise Institute, Washington, D.C. (via webcast),* Washington, DC: Federal Reserve Board.

White, L., 2018. *The World's First Central Bank Electronic Money Has Come – And Gone: Ecuador, 2014-2018.* [Online] Available at: https://www.alt-m.org/2018/03/29/the-worlds-first-central-bank-electronic-money-has-come-and-gone-ecuador-2014-2018/ [Accessed 16 January 2022].