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Abstract

We review arguments for CBDC issuance in India. These include facilitating payments, enhancing financial inclusion, enabling the central bank and government to retain control of the payments system, facilitating cross-border payments, reducing dependence on the dollar-dominated global payments system, providing an encompassing platform for digital financial innovation. We then compare progress in India with other countries. In setting an end 2022 target date for issuance, India is in line with the other BRICS, but not with other countries with comparable levels of per capita GDP, which have been more reluctant to commit to a date. Nor is it in line with other countries with comparably independent central banks, which have been more cautious about setting a deadline. Finally, we sketch a roadmap and timeline for India's CBDC project going forward.

Keywords: Central Bank, Digital Currency, India, Monetary Systems, Payment Systems
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1. Introduction

In her Budget Speech on February 1, 2022, Finance Minister Nirmala Sitharaman announced the Indian government's commitment to issuing a digital rupee. The relevant text was short and sweet, running three sentences in its entirety. "Introduction of Central Bank Digital Currency" (CBDC) will give a big boost to digital economy. Digital currency will also lead to a more efficient and cheaper currency management system. It is, therefore, proposed to introduce Digital Rupee, using blockchain and other technologies, to be issued by the Reserve Bank of India starting in 2022-23."

With this proposal, India joined a long list of countries actively contemplating issuance of a CBDC.[1] But in setting a firm deadline, the government is also joining a more select subset. As we will see, a majority of countries with which India might be compared have not set a target date.

Moreover, the minister's statement raised as many questions as it answered. How will issuance and circulation of the digital rupee be organized? What is the content of the passage reading "blockchain and other technologies?" Will the currency run on a public blockchain, where validation is decentralized; a permissioned or private blockchain, where only authorized nodes can validate transactions; or no blockchain, with encryption and security provided in other ways? Will the Reserve Bank operate a wholesale CBDC, in which the central bank provides digital currency to authorized banks which then provide it to their customers, or a wholesale CBDC that is used strictly for interbank settlements?[2] Will a retail CBDC eventually follow?[3] In what ways will a CBDC boost the digital economy? Isn't there a danger, instead, that a central-bank-backed unit will crowd out private initiatives designed to facilitate more efficient payments? How does issuance of a CBDC square with the government's parallel efforts to clamp down on cryptocurrency markets, on the grounds that these raise macroeconomic and financial stability concerns as well as scope for money laundering and tax evasion? In what sense would a CBDC lead to a more efficient and cheaper currency management system? Does this simply refer to eliminating, or at least limiting, the need to print and manage the supply of physical bank notes or to something more?

No less an authority than the Reserve Bank of India has expressed similar concerns. Earlier this year, RBI Governor Shaktikanta Das pointed to risks related to cybersecurity and counterfeiting. No doubt, a CBDC would offer a rich target to hackers and cyber terrorists. The Reserve Bank's report on "Trend and Progress of Banking in India," issued at the end of 2021, voiced additional concerns, namely that issuance of a CBDC might have unintended (and

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[1] A 2021 survey by the Bank for International Settlements found that 86 percent of central banks were researching issues around CBDCs, that 60 percent were experimenting with the technology, and that 14 percent were in the process of deploying pilot projects.

[2] As the BIS (2021) writes, "Wholesale CBDCs are intended for the settlement of interbank transfers and related wholesale transactions, for example to settle payments between financial institutions."

[3] At a post Monetary Policy Committee press conference on 8 April 2022, Deputy Governor T. Rabi Sankar indicated that the RBI will debut a wholesale CBDC, possibly to be followed by a retail version.

unspecified) consequences for the conduct of monetary policy, financial stability, and operation of the banking system.[4] The report flagged the nagging question of whether the RBI should issue a retail or wholesale CBDC, but without providing further clarity on the answer.

These are among the issues taken up in this paper. Its second section reviews the arguments that have been advanced for CBDC issuance. These include facilitating payments, enhancing financial inclusion, enabling the central bank and government to retain control of the payments system in the presence of incursions from stablecoins and other digital payments rails, facilitating cross-border payments, reducing dependence on the dollar-dominated global payments system, providing an encompassing platform for digital financial innovation. In addition, it has been argued that first movers in issuing CBDC will be able to set global standards for CBDC design and tailor those standards to their national advantage and to the advantage of the domestic high-tech sector.

The paper provides a somewhat skeptical perspective on these arguments. We argue that many of these arguments for CBDCs have been advanced uncritically. Their proponents fail to acknowledge that some of these goals can be advanced at lower cost and at less risk through alternative means. This point is true generally and, in some cases, especially of India, with its already-existing universal payments system and ongoing financial inclusion efforts. Other arguments in favor of CBDCs, in some cases, are logically or practically flawed. Very few entertain the real downside risks associated with CBDC development, including hazards to institutional actor, end-users of retail CBDCs, and the reputation of the central bank.

The third section then compares the state of debate and progress in India with obvious comparator countries. We show that in setting an end 2022 target date for completion of its pilot project and for issuance, India is in line with the other BRICS, but not with other countries with comparable levels of per capita GDP (which have been more reluctant to commit to a date) or with other countries with comparably independent central banks (which have been cautious about setting a deadline, especially one in the near future).

The final section offers some tentative conclusions and a roadmap for India going forward.

2. The Cases For and Against

The first and perhaps most obvious argument for a CBDC is to facilitate payments. Consumers use a variety of different means of payment: cash and coin for hand-to-hand transactions, debit and credit cards for online and point-of-sale transactions, and bank debits and deposits for paying bills and receiving salaries. A CBDC could conceivably substitute for these other means. A CBDC would be

[4] Financial stability might be placed at risk if bank depositors, at the first sign of trouble, find it easy to run on their bank by shifting their deposits to the central bank. If such shifts are permanent or ongoing, the commercial banking system may be disintermediated. Insofar as currency substitution is facilitated by CBDCs that circulate outside the issuing country, room for independent monetary policies may be reduced. These are important issues, but they are beyond the scope of this short paper.

safe and easy to use for transactions at a distance, unlike cash (no small consideration in an age of pandemics). It would be universally accepted for transactions within the country, in contrast to credit and debit cards, which require the merchant to have an electronic connection to the bank or other issuer. In the case of a retail CBDC, the balance would be transferred between two agents' electronic wallets, or between their individual accounts at the central bank, instantaneously and with finality.[5] In the case of a wholesale CBDC, the balance would be transferred between their CBDC accounts at their respective commercial banks, which would run on a closed circuit or blockchain. The transaction would cost less than payment by credit or debit card, the argument goes, because the bank, when issuing and transferring CBDC balances to consumers, would not also be providing and charging for other services, such a fraud protection, overdraft protection, and a credit line that generally come packaged together with such cards. It would cost less than a bank deposit or debit because the transaction would not go through the interbank payment system, which is costly to operate; rather, it would go through a dedicated circuit where transfers were limited to fully funded, final payments.

In the case of India, however, these savings of convenience and cost may be subject to exaggeration. Electronic payments are already ubiquitous in India. Modalities include prepaid payment instruments (prepaid smart cards, etc.), mobile banking, and use of credit and debit cards at point of sale. Figure 1 shows that the value and volume of such electronic payments has been growing strongly. To be sure, that growth is somewhat less impressive when scaled by GDP or by a measure of the size of the financial system, such as M3 (see Figure 2).

Moreover, India already possesses a relatively efficient, encompassing low-cost electronic payments infrastructure, the Unified Payments Interface (UPI). UPI is a real-time payments system developed and operated by the National Payments Corporation of India (NPCI), a nonprofit operating under the umbrella of the Reserve Bank and the Indian Banks' Association. UPI instantly transfers funds between retail bank accounts on a mobile platform (e.g. a smartphone) at negligible cost. UPI runs on both Android (version 4.2.2 and above) and iOS (version 8.1 and above). Multiple banks and third-party e-money companies have introduced UPI-enabled mobile payment apps allowing users to send and receive money between UPI-linked bank accounts. It can also interface with Pre-Paid Instruments (PPIs), smart cards, magnetic stripe cards and the like on which balances can be pre-loaded. As of early 2022, some 300 banks participated in the system. In its history to date, UPI has hosted some 70 billion transactions, some as small as one rupee, making it the world's largest real-time payment system by transactions. The National Payments Corporation of India is testing a voice-based version for smartphone users that will work without an internet connection (using over-the-air programming).[6]

[5] Compliance with know-your-customer rules would mean that the central bank would have to require identifying information (the People's Bank of China requires customers downloading its digital wallet to provide a registered phone number) and/or mean that the size of transactions and balances would be limited.

[6] It might be argued that moving these retail transactions onto a blockchain with CBDC would reduce costs for the NPCI, increase speed of transactions and eliminate disputes. We have yet to see

A retail CBDC would effectively extend these services to the unbanked. CBDC balances could be loaded to the digital wallet on their smartphones or could conceivably loaded onto a smartcard (the CBDC equivalent of a bank credit card), and transferred to the wallet or smartcard of another individual or merchant without the two parties having to possess bank accounts. But it would not obviously add value for individuals already possessing a bank account, given the ubiquity and very low cost of UPI. And if the CBDC is issued on a wholesale basis, via banks, as officials have suggested will be the case at least initially, then it will not in fact be available to the unbanked.

This brings us to a second argument for CBDC issuance, on grounds of financial inclusion. Governments seeking to make income-support payments to low-income individuals during the pandemic were sometimes stymied by the absence of a bank account to which to transfer the payment. But if every individual had an electronic wallet into which CBDC could be transferred, such financial transfers would become easier to undertake. More generally, a CBDC wallet available to all, regardless of employment and credit history, would make it easier for the un- and underbanked to complete financial transactions. This is why CBDCs have particular appeal to developing countries and emerging markets, where financial inclusion is a first-order issue.

But the problem of inadequate financial inclusion can also be addressed in ways that don't involve a CBDC. Since 2010, the Reserve Bank has required banks to formulate and implement policies with the goal of enhancing financial inclusion. These may entail establishing traditional brick and mortar bank branches in rural areas or providing banking services through nonbank partners and agents. Table 1 shows how the number of commercial bank branches (per 100,000 adults) has been growing. This number still lags behind some other comparator countries (Brazil, Morocco, Russia) but exceeds others (notably China). The number of ATMs has also been growing, although this number per 100,000 adults still lags far behind its analog in comparator countries (Figure 3). The government has also launched a mobile app *Jan Dhan Darshak* (JDD) to enable smartphone users to locate bank branches, ATM, post office banking facilities etc. Data from this app show that the number of villages not having such a banking touch point within five kilometers had declined to low levels by 2021 (see Figure 4).

Financial inclusion plans have also extended to the creation of Basic Savings Bank Deposit Accounts (BSBDAs), no-frills accounts that do not require the maintenance of a minimum balance. Table 2 shows that these have been growing strongly. The holder obtains an ATM/debit card and passport services free of charge. The bank then allows a certain number of deposits and withdrawals per month free of cost.[7] Banks generally pay the same rate of interest as on regular accounts.

In addition, *Pradhan Mantri Jan Dhan Yojana* (the Prime Minister's People's Wealth Scheme), established in 2014, charges public sector banks (including the State Bank of India, the Reserve Bank, Canara Bank and Bank of

evidence.

[7] Some banks also provide other services, such as a checkbook, email statements and demand drafts.

Baroda, along with regional rural banks owned and operated by the government) with offering zero balance, low-cost bank accounts to underbanked rural residents. As of 2021, more than 400 million such accounts had been opened, although some 15 percent of these were inactive, and some were opened as second accounts by individuals already possessing a bank account.[8] (For details see Table 3 and Figure 4.) Usage of many of these accounts was sparing initially, though the frequency of transactions appears to have been rising with time, as account holders gain experience and familiarity with banking services.

But whereas "only" some 20 percent of India's population is unbanked, half of all Indians do not own a smartphone capable of downloading a central bank app and digital wallet and transacting over a 3G network (minimal conditions for making internet-enabled payments using a CBDC).[9] (See Figure 5.) The Reserve Bank of India has recognized this constraint; in March of 2020 it launched an initiative to make UPI available not just to smartphone users but also to feature phone users, feature phones having limited processing and storage capacity and being unable to access the internet (RBI 2022). One can imagine that capacity to transact using CBDC through feature phones may follow. Adequate 3G coverage may also be lacking in some of the relevant (relatively remote) areas. The same problem extends to internet connectivity more generally (see Table 4). Some projects have focused on addressing these issues in CBDC design – as with exploring offline CBDC payments functionality, for example.[10] But any improvement in financial inclusion arising from a CBDC would require concurrent efforts to address the ancillary causes of exclusion. For the moment at least, it would appear that there are more direct ways of effectively fostering financial inclusion.

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[8] An account is treated as inactive in these data if there were no transactions in the preceding two years.

[9] The penetration of basic mobile phone is, of course, much higher. On the other hand, not a few Indians own multiple smartphones, meaning that the number of individuals who can utilize a CBDC wallet may be lower than the raw ratio.

[10] Thus, Bank of Ghana (2021, p.27) writes "From a perspective of technology, it is feasible to implement an offline eCedi [Ghana's prospective CBDC] with a smartcard (potentially – with a smartphone) using standard interfaces like NFC or Bluetooth. Transactions for offline payments are therefore instantly settled without accessing a backend system." How this would work in practice is still being explored by computer scientists and hardware designers. Preloading CBDC with a unique digital signature onto a smartcard inserted into a smartphone eliminates the danger that the same CBDC will be used for multiple offline payments. Two smartphone users could in principle then transfer funds between their respective smartphones using Bluetooth or near-field communication (NFC). Or merchants might have a smart "point of contact" or other piece of hardware that could communicate by Bluetooth or touch with the retail customer's smartphone. The payment is peer-to-peer without any intermediary and clears instantaneously. The accounting system is then updated when reconnection to the network happens. A paper from Visa (Christodorescu et al. 2020) explains how this might work. But not only are the required software and hardware still largely hypothetical at this stage, but users will require a smartphone, which is a constraint in countries such as India, as just noted. One can also imagine CBDC being loaded onto smartphone alternatives (keyfobs, wristbands) that could then be plugged into a desktop, laptop or similar device and updated when reconnected to a network, but how much these devices would cost and how they would work are unknown at this stage. This approach might also heighten risk of loss (since keyfobs are easy to misplace), and the size of offline transactions would have to be limited to conform to anti-money-laundering and know-your-customer rules.

A third rationale sometimes heard for CBDC issuance is to enable the central bank and the government to retain control of the payments system in the face of stablecoins and other private payment rails. This is a way of understanding how Facebook's announcement of its prospective stablecoin, initially dubbed Libra, galvanized so many central banks to begin thinking about a CBDC.[11] Ensuring the stability and soundness of this essential public utility is a key aspect of the central bank's mandate. The fear is that, if payments migrate away from UPI and toward a private-label stablecoin, the central bank will then have limited insight into the operation of the payments system and limited ability to ensure its integrity. A related danger is that payments will migrate to a single large private provider with market power over both payments and related services. Another related argument is that the central bank's oversight of the payments system provides it with valuable real-time information on the state of the economy, and that there would be costs of losing this were payments to migrate to a private system.

If the concern is the concentration of payments in a single or small set of private hands, then the obvious solution is to strengthen regulation of those private providers. This is the approach taken, for better or worse, by the Chinese authorities when cracking down on Alipay and WeChat Pay. These providers were required to share more information with the authorities and to build firewalls between their payments data and other operations. Similarly, and less aggressively, other countries have been moving quickly to regulate the private digital currency market in order to ensure safe operations, protect consumers from harm, and to mitigate systemic risk to the financial system.

But these efforts do not require the issuance of a CBDC. Instead, they can be informed by decades of financial markets regulation precedent. In the case of India, similarly, opinion and policy seem to have shifted away from earlier discussions of possibly banning crypto assets that may be used for digital payments toward adopting appropriate regulation. In particular, if private nonbanks take on more payments responsibilities of the sort traditionally executed by banks, then they can be regulated like banks. Stablecoins are beginning to be used for payments, mainly in the cryptosphere but possibly, in the not-too-distant future, more widely. Governments are responding, appropriately, by asking whether stablecoin issuers should be required to take out bank charters and otherwise be regulated like banks. This would seem to be a more appropriate response to concerns about losing control of the payments system than issuing a CBDC.

As for the real time information about the economy, there exist myriad other sources of real-time information: financial market data, cellphone location data, web traffic data, etc.

Yet another argument is that a CBDC could facilitate cross-border transactions, making life easier for Indian exporters and importers. A digital rupee that could be seamlessly exchanged for, say a digital dollar or a digital euro would eliminate the need for an India firm seeking, for example, to import machinery from the United States to have to instruct its bank to contact a correspondent bank in the United States via SWIFT, transfer funds there, and then instruct the correspondent to credit the bank where the exporter maintains an account. Both

[11] As of 2022, Libra nee Diem is no more, but this doesn't change the fundamental point.

time and expense would be saved, particularly on small purchases and transfers, where the share of the principal dissipated in bank fees can be considerable.

But this argument overlooks two points. First, there already exist alternative nonbank mechanisms for making small purchases and sales abroad. The most ubiquitous of these is the credit card. In addition, Paypal, while no longer providing domestic payments services in India (due, presumably, to the ubiquity and low cost of UPI), continues to process international sales for Indian merchants (in 2020, $1.4 US billion worth of sales by some 360,000 merchants). Google Pay can be used both for domestic payments and to send money from the United States to India, Google having partnered with Western Union and Wise (formerly TransferWise).[12]

It may be that officials are uncomfortable using international as opposed to home-grown platforms for these transfers. This may be a matter of national pride (a noneconomic argument that, as economists, we are not qualified to comment on here). Or it may be regarded as a national security matter: recall how PayPal and Google Pay suspended their operations in Russia in March in response to that country's war on Ukraine. Officials may also be concerned about data privacy and the uses to which these commercial payments platforms put their customers' transactions data. In principle, however, this issue can be addressed through regulation and legal action rather than by creating a central-bank-based alternative. Thus in 2020 the Delhi High Court issued a notice in response to a complaint that Google Pay was illegally sharing sensitive personal user data. In 2021, in response, Google updated its policy to allow users to delete sensitive data from the company's internal network.

Second, it is not clear that CBDCs can in fact be used to seamlessly complete cross-border transactions. Cross-border transfers of digital rupees will be subject to all the same capital account restrictions as existing rupee-denominated transfers, the only difference being that the RBI will be directly responsible for monitoring and enforcing compliance in the case of a retail CBDC (commercial banks and other authorized intermediaries remaining responsible in the case of a wholesale CBDC). If that U.S. exporter is able and willing to accept digital rupees in payment (itself a dubious proposition), he or she will then face the challenge and cost of converting these into (nondigital or perhaps digital) dollars. The Federal Reserve System in conjunction with the Reserve Bank of India could conceivably provide this service. The two central banks could establish a special platform (or "corridor") where authorized dealers (designated banks from the two countries) can convert the national CBDC into a depository receipt, at which point the CBDC is burned (extinguished) and then convert that depository receipt into the other CBDC, at which point additional CBDC is minted. The Bank of Thailand and Hong Kong Monetary Authority have been jointly exploring the possible operation of such a corridor. Alternatively, two and more national CBDCs could circulate on the same blockchain, allowing them to be automatically exchanged for one another at a rate determined by supply and demand.

[12] Note, however, that the Google Pay app can be used for transfers between individuals but not merchants.

The technical obstacles to CBDC interoperability are surmountable, which is why various central banks and the Bank for International Settlements' Innovation Hubs have been exploring them. The mCBDC is one key example of international cooperation that seeks to overcome this technical hurdle in concurrent development with state-level CBDC projects. But the governance obstacles to this arrangement are formidable. The participating central banks would have to agree on an architecture for their corridor. They would have to jointly govern its operation. They would have to license and regulate dealers holding inventories of currencies and depository receipts to ensure that the exchange rate inside the corridor doesn't diverge significantly from that outside. They would have to agree on who provides emergency liquidity, against what collateral, in the event of a major order imbalance. None of these traditional governance issues are inherently solved by the technical features of a CBDC, and few gains from CBDC cross-border payments can be realized without this type of governance coordination.

In a world of 180 currencies, moreover, arrangements of this type would require scores of bilateral agreements. We have already seen the resulting proliferation of agreements in the fast-payments domain (fast payments systems like UPI and operating through banks being entirely different from CBDCs, as noted above). For example, Singapore negotiated one such agreement with India and another with Malaysia in 2021; the details of the link will have to differ in the two cases, since the architectures of the Malaysian and Indian fast-payments systems differ. The same would presumably be true of CBDC linkages. And corridors of more than two countries would require rules and governance arrangements more elaborate than even those of the World Trade Organization and the International Monetary Fund.

Relatedly, one sometimes hears suggestions that a CBDC is desirable for geopolitical reasons. Having a CBDC, it is asserted, would free the issuing country from "the tyranny of SWIFT" – in other words, from the risk that its banks would be barred from using the Society for Worldwide Interbank Financial Transactions, the secure messaging system through which banks send transfer instructions to their branches and correspondents in other countries. Here it is important to be clear what SWIFT is and is not. SWIFT is a secure messaging system through which payments instructions are transmitted; it is not itself a set of payments rails. As payments rails, banks use Fedwire (in the U.S.), CHAPS (in the UK), or an analogous system in another country. Issuing a CBDC would not create an alternative to these systems. Thus, for nearly a decade China has been developing its own set of cross-border payments rails, its so-called Cross-Border Interbank Payments System (CIPS), through which renminbi payments can be transferred between domestic and foreign banks. But CIPS uses SWIFT for sending instructions between participating banks. All this is separate from the e-CNY, and it is not obvious that the operation of CIPS would be significantly enhanced by cross-border use of the e-CNY. Were such enhancements in the cards, we would see SWIFT changing its operations in response to the rollout of the e-CNY. We do not. The argument linking CBDC issuance to "the tyranny of SWIFT" are a logical non sequitur.

Yet another argument for a CBDC is to provide an encompassing platform for the design and dissemination of smart contracts and other DeFi applications. Smart contracts are loan (and related) financial instruments that do not rely on

intermediation and monitoring by a bank or equivalent financial institution. They can be built on a public blockchain, whose nodes then verify the transaction, which can be executed using the native coin circulating on that blockchain (as well as other tokens defined in that chain). Currently, the majority of DeFi transactions run on Ethereum's public blockchain, where Ether is the native coin. The smart contract terms and transactions are actually denominated in U.S. dollar-denominated stablecoins, but Ether is required to execute the payment and pay the transactions fees on the network. Since Ether is a "plain vanilla cryptocurrency" whose value against central bank issued currency can (and does) fluctuate widely, this introduces an element of cost uncertainty that reduces the appeal of DeFi transactions.[13] And Ethereum is not the only public blockchain on which smart contracts are built; the resulting fragmentation arguably limits efficiency gains. A CBDC, in contrast, would be stable in terms of central bank money (since it is central bank money); costs of transacting would be predictable; and it would be universally accessible. A CBDC-based smart-contract platform, it is argued, would be a hothouse for financial innovation.

The counterarguments are of three types. First, if the problem is that plain-vanilla cryptocurrencies like Ethereum are volatile, then the same services could be provided by a vigorously regulated private-label stablecoin. This would overcome a serious market obstacle to CBDC smart contracts, namely government competition in private financial services markets, which can produce its own set of inefficiencies. Second, central banks may have reasons to avoid placing their CBDCs on a public blockchain on the grounds that this is vulnerable to hacking and other security problems. They may prefer a private blockchain where only the central bank itself can verify and finalize transactions, or they may prefer to use another non-blockchain-based form of encryption. But if the CBDC runs on a private blockchain with centralized verification, then it cannot provide a platform of smart contracts and other forms of decentralized finance.

Third, there are still reasons for doubting that smart contract-based decentralized finance is the future. There have been a number of prominent disasters with smart contracts running on Ethereum's blockchain due to programming errors. Smart contracts have been mechanisms for siphoning off the funds of naïve investors by hackers. In most of these instances, programming problems were subtle and remained hidden despite security audits and code reviews (Allen et al. 2020). One wonders whether digital auditors working for central banks can do better.

This third reason for doubt is compounded by the almost entirely undeveloped technical requirements for a programmable CBDC, premised explicitly on the degree to which these instruments can and should be programmable. Smart contracts stand as a high-tier level of programmable CBDC comparable to Ethereum, however, many other lower tiers of programmability – such as simple API access and cryptographic keys, for example – also fall under the umbrella of programmable money. In this respect, it is not only critical for central banks to investigate precisely why, and to what end, they are creating a programmable CBDC

[13] This leads many to prefer using US dollar-denominated stablecoins, at least in principle. However, these come in a range of operational models and are subject to little oversight and regulation, which similarly diminishes their attractions.

– it is also crucial to conduct the necessary technical research and feasibility probes to identify areas of technical vulnerability that arise from any given model.

Relatedly, there are questions about whether DeFi can replace relationship banking. Soft information of the sort that bank loan officers assemble from face-to-face interaction with borrowers may not be replicable in the digital sphere. In addition, on-chain systems like DeFi have available only borrowers' on-chain financial records.[14] Holdings of cryptocurrencies appear to be concentrated in practice, giving grounds for worrying about, inter alia, market manipulation. The fact that the cryptocurrencies around which DeFi transactions are organized are volatile makes borrowing expensive; borrowers have to overcollateralize (offer collateral worth more than what they borrow) in order to protect against sharp falls in the value of that collateral. All these are reasons to question whether DeFi will transform finance as we know it.

Yet another argument for moving quickly to issue a CBDC is the advantages of being first. Actually, it is not clear why being first should be especially advantageous or, conversely, why it should be costly to wait until there exists a proven technology. One argument is that the central banks that move first will be able to define global standards for CBDCs. But it is not clear that other countries will be forced to adopt the exact same technology standards as the first movers, any more than central banks all have to adopt the same standards and technologies as the first bank note issuers. Bank notes continue to differ, after all, in inter alia their security and anti-counterfeiting technologies (special papers, watermarks, luminescent inks, embedded holograms, etc.). Concerns with interoperability may provide an incentive to converge on an early standard but, as we have argued, hopes for interoperability are overblown. It is said that countries moving first will have a leg up on providing technical assistance to later movers, thereby capturing market share for their high-tech sector. But in fact there is no reason why the technology should be developed in the same country that utilizes it for its CBDC. The Bank of Canada and Bank of England, to cite two examples, are partnering with MIT, not with Canadian or British universities, in developing its CBDC-related technology. And that the Federal Reserve is moving slowly relative to other central banks in preparing to issue a CBDC has not hampered the competitiveness of MIT as a technology supplier. Notably, there have also been clear issues in the early CBDC projects that have recently gone live, especially complications arising in the rollout of Bahama's CBDC, the Sand Dollar, and Nigeria's, the e-Naira. The capacity for achieving domestic policy priorities in both cases was hampered by a lack of concurrent development in underlying infrastructure, providing important lessons on the whole-of-economy considerations implicated in these projects.

Finally, there are a wide variety of downside risks associated with rapid CBDC development that specifically implicate end-users. Key among these is the technical design and monetary nature of a CBDC. In this respect, current projects vary between two basic models: bearer instruments and account-based access.

[14] One can imagine a DeFi future in which banks use on-chain and off-chain data to generate a more accurate picture of customers' financial worth in order to craft attractive loan terms. Alternatively, one can imagine crypto companies obtaining bank licenses in order to secure additional off-chain information. We are not yet, and whether regulators will permit this kind of on- and off-chain convergence remains an open question.

Whereas bearer instruments introduce the same privileges and constraints as physical cash, account access frameworks more closely resemble retail banking accounts with distributed liabilities. Vulnerable populations – even in economies rife with digital payments – often rely on physical cash for its bearer instrument characteristics, and India's 2016 experience with the initial rollout of demonetization demonstrates the pitfalls of rapid changes to cash-based segments of the economy. In this respect, rapid CBDC development in the efforts of moving first may harm vulnerable end-users of physical cash in two specific ways. First, if the CBDC competes too much with physical cash – for example, mandating acceptance among merchants in ways that limit cash transactions – then this could disenfranchise vulnerable end-users from key goods and services. Second, if the CBDC is implemented through an account access framework, its capacity to genuinely expand financial inclusion – a stated goal of several projects, including India's – would be severely limited without a parallel effort to target other causes of financial exclusion, including infrastructural issues.

All of which is to say that the case for an Indian CBDC on a fast-track schedule may be less compelling than it first appears. At the very least, CBDC development requires significantly greater trade-offs than current accounts often discuss, and these must be carefully considered in India's potential project.

3. The State of Play

In this section we consider the state of central bank digital currency (CBDC) development in countries which may reasonably be compared to India. We take four approaches to forming the comparison group, which we refer to as economic, institutional, categorical, and technological: we consider countries with similar GDP per capita in purchasing power parity terms (the economic comparison); countries where the central bank has a similar degree of independence (the institutional comparison); other members of the so-called BRICS, large developing and middle-income countries with which India is frequently grouped (the categorical comparison); and countries comparably ranked to India on WIPO's technology competitiveness index. In each case we limit the sample to the four closest comparators.

Table 5 shows the three collections of countries that are closest toIndia along each of those measures, respectively based on World Bank's most recent estimate of GDP per capita in purchasing power parity, Garriga's (2016) data for central bank independence, a binary indicator of whether a country is a co-member of BRICS, and the ranking from WIPO for global technological competitiveness. Different readers may prefer different comparison groups; we focus on all three.

Table 6 next lists eight widely stated policy and economic motivations and rationales for CBDC projects initiated by central banks around the world. (All data are based on public announcements between January 2013 and December 2021.) The Indian government and the Reserve Bank have recently released a report endorsing a CBDC as "a safe, robust and convenient alternative to physical cash," with the intent of focusing on the policy goals in their technical design of a basic CBDC model (Reserve Bank of India, 2021; Singh, 2021). In a July 2021 speech, Deputy Governor Sankar detailed the associated motivations and policy priorities,

including fostering financial inclusion (through reduced payment-associated costs), responding to the declining use of cash (especially physical cash), the desire to enhance the efficiency of banking (particularly the reliability of these systems), facilitating international payments, and heightening fiscal transparency (Sankar, 2021).

Some of these motivations are shared nearly across the board, including improvements in financial inclusion, domestic banking efficiency, and cross-border international payments. Some counterparts share other motivations with India, such as Brazil, Sweden, Norway, and Ukraine in declining cash usage, and Sweden and China in pursuing greater fiscal transparency in domestic operations. Some case countries exhibit motivations not shared publicly by India, suchas pursuing CBDC primarily as a precautionary project in case other countries move quickly (including Norway and Singapore). Whereas some countries appear to have very specific, focused motivations (Russia's wish to circumvent targeted financial sanctions, Nigeria's concern with cost and ease of cross-border payments), the Indian governments motives are more eclectic (some would say "less focused").

Table 7 then summarizes the initiation of CBDC development in each country, the latest publicly announced stateof development, and target dates for next steps, if any. India's initial expression of interest came relatively late, in 2019; only Nigeria and the Philippines were later. In announcing the intent to launch a pilot project in December 2021, India is more or less in line, temporally, with the other countries, which made similar announcements slightly earlier or concurrently. In setting an end 2022 target date for completion of that pilot project and issuance, India is in line with the other BRICS, interestingly, but not with other countries with comparable levels of per capita GDP (which have been more reluctant to commit to a date) or with other countries with comparably independent central banks (which have been cautious about setting a deadline, especially one in the near future). Notably, among its comparably competitive peers in the index of global technological capabilities, India's announcements trail behind others which began in 2018-19, and most of which are in the pilot stage.

Table 8 reports publicly stated preferences for CBDC design based on the BIS typology and Auer and Bohme (2020). This typology distinguishes four main technical features of all retail CBDCs and the distinct options available within each of them. Architecture refers to the actor(s) liable for claims made in CBDC; this could take the form of direct accounts with central banks, more traditional (indirect) architectures intermediated by private banks, or a hybrid model. Infrastructure refers to the nature of the technical ledger system that manages issuance and supply; this could take the form of distributed ledger technology, more conventional centralized ledgers, or a hybrid approach. Access refers to the logic of how CBDC ownership and custody is recognized and validated; the BIS organizes this as either an account (identity-based), token (bearer instrument), or hybrid of the two. Finally, interlinkage indicates whether a CBDC is designed to have cross-border interoperability; this is simply a binary.

In the aforementioned report, the Reserve Bank of India appears to suggest that a hybrid architecture -- in which the CBDC is a claim on the central bank, which periodically records retain balances but in which authorized intermediaries (banks) onboard users, enforce know-your-customer rules and handle retail

payments -- will be the best option for developing a safe and reliable alternative to physical cash. However, the report notes that such technical decisions are particularly difficult in the case of retail CBDC design, and that the "magnitude of issuance/ distribution will also help in identifying the appropriate underlying technology best suited to handle such operations" (Reserve Bank of India, 2021, p. 5). This hybrid architecture similarly seems to be the most popular choice among comparator countries that have expressed a preference for a system operated directly by the central bank (Singapore) and for a system where the CBDC is a claim on an intermediary, not on the central bank (China). In terms of infrastructure, modalities for access (tokens versus accounts versus both), and interlinkages (including with other digital currencies at home and abroad), the intentions of the Indian government and the Reserve Bank remain unspecified, so far as we can tell. This may reflect the fact that there is no consensus, globally as well as nationally, about these aspects of a CBDC's design, as is evident in the table.

4. Conclusion

When so many central banks and governments around the world are contemplating issuance of a CBDC, it is prudent for officials in India to likewise contemplate the possibility. Although the authorities' initial expression of interest came relatively late, compared to the other countries we consider, it has since been making up ground. The timing of its announcement to commence a pilot project was in line with other countries. Its announced intention of the date by which to complete that pilot and issue its CBDC is similarly in line with announcements from other BRICs but more ambitious than in other countries with a similar per capita GDP and similar levels of central bank independence.

But important questions remain to be answered. India has not yet gone as far as other countries in specifying the design architecture that will govern the operation of its CBDC. A pilot requires an explicit design architecture. Effectively rolling out a CBDC and ensuring that the benefits are widespread requires initiatives on multiple fronts: fostering wider smartphone penetration, specifying data privacy and know-your-customer rules, and verifying banks' technical preparation, as described in Soderberg et al. (2022). The central bank will have to build durable, reliable relationships with software suppliers, on the plausible assumption that it does not possess all the relevant expertise in house. The experience of the East Caribbean Central Bank, which contracted with a Barbados-based fintech, Bitt, and whose CBDC, known as DCash, went offline for several months in early 2022 due to an expired system security certificate on the blockchain hosting the ledger, leaving users in the lurch, is a cautionary tale.[15] Such episodes can permanently damage confidence in a country's money; India's own experience with demonetization is a reminder of the importance of preparing infrastructure and implementation capacity in advance of a comprehensive rollout.[16] How long completing these tasks will take is uncertain. In light of those

[15] Evidently, neither the central bank nor Bitt knew of the expired-license problem in advance.

[16] To address these risks, some countries, China for example, are attempting to build in off-line functionality, where the CBDC can be used for transactions even when the central ledger is inoperable – for example, by permitting hardware-based transactions between pair of wallets or cards embedded in two different smartphones. But absence of access to the central ledger created the danger of double

uncertainties, specifying an end-2022 target or deadline strikes us as premature. Rushing may result in problems that prevent the initiative from becoming a success.

Although officials have offered a number of policy rationales for going down this road, we have argued that the case is weaker than they suggest, and that it is weaker than in other countries with which India might be compared. If the country continues to go forward with its CBDC plans, then it is incumbent on officials both to defend and elaborate their rationales and to fill in the gaps on the design front.

In view of the range of questions still to be answered, India should take a cautious and gradual approach toward launching a CBDC. To start, it may take a year for the RBI to form and make available an analysis of the rationale, impact, scope, design and the pace of the launch first of its CDDC pilots and then the digital currency itself. It will need to assess the readiness of the banks, other financial intermediaries, and the public to use that digital currency; its impact on the conduct of monetary policy and its transmission; and its implications for capital flows, the exchange rate, and the composition and management of foreign reserves, if any. It would be appropriate, as has been the practice for other initiatives, to constitute and consult expert groups and to put their analyses and recommendations in the public domain.

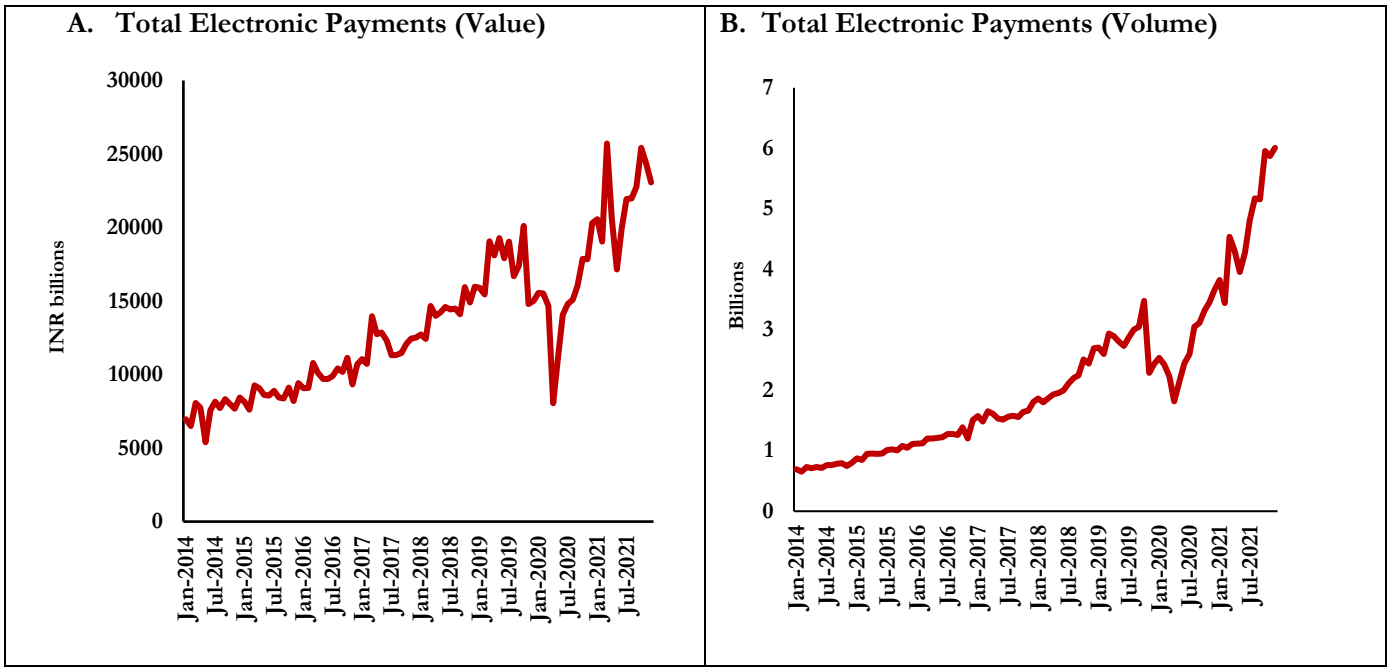
It could then take an additional two-three years to run pilots and assess their results. In the Indian context it will be important to analyze the benefits and challenges of CBDC availability for population groups with different levels of literacy, access to the hardware, and internet connectivity, and to adjust design and rollout strategies in light of this analysis.

Following this pilot period, a more general rollout of the CBDC can be envisaged. As indicated by the RBI, cash will continue to coexist with the digital currency for the foreseeable future. In addition, it is important to understand that the CBDC will be used primarily for domestic transactions, requiring the continued existence of alternative vehicles for cross-border transactions.

A final point: rolling out a CBDC is not going to make stablecoins and plain vanilla cryptocurrencies go away. Quite separate from discussions around possible issuance of a CBDC, the relevant governmental agencies can learn from their experience. They can learn faster if they first put the relevant regulatory systems in place.

spending, which has led the PBoC to limit the number of permissible offline transactions, and the danger of counterfeit transactions, since the central ledger will not be available for verifying authenticity. Central banks are exploring the use of digital signatures and encrypted storage to address these problems. The experience of the Bahamas has revealed yet another problem also relevant to India: such direct phone-to-phone transactions presumably still have to go through a cell tower, and hurricanes and monsoons have been known to topple such towers.

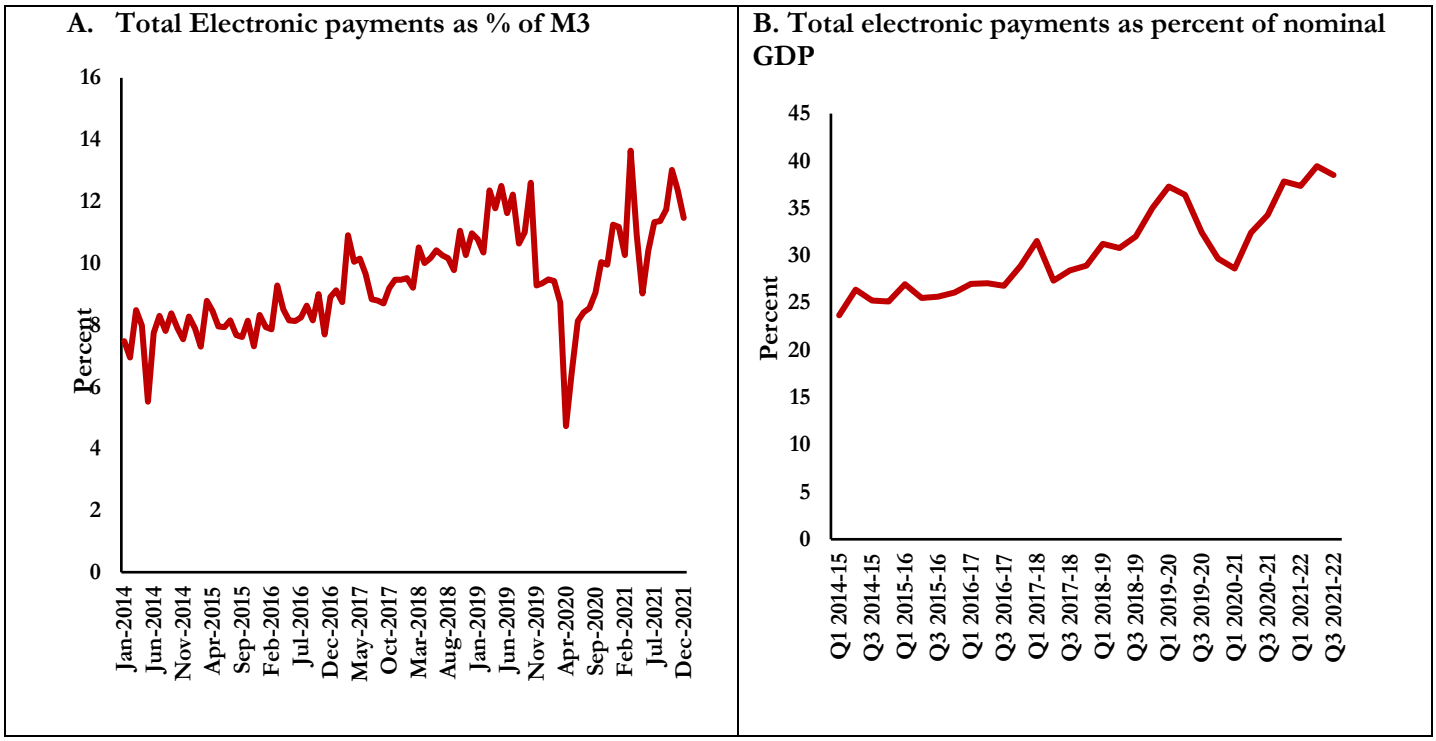
Figure 1: Electronic Payments in India



Source: Payment System Indicators, RBI database.

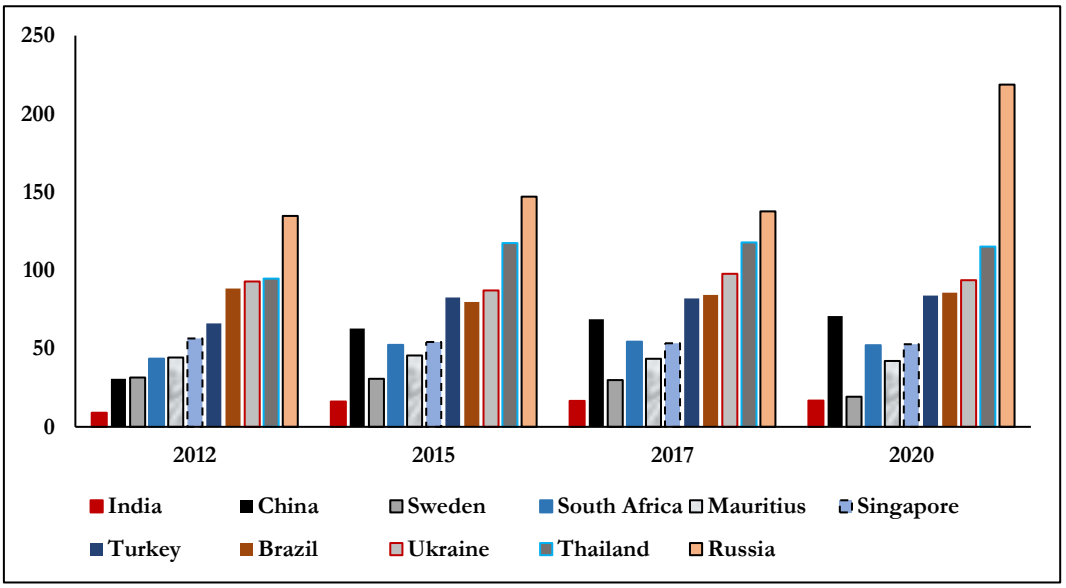
Note: Total electronic payments include Prepaid Payment Instruments (PPI), Mobile banking, NACH, IMPS, CTS, and cards at PoS. PPIs facilitate transactions or fund transfers against the value stored in the payment instrument like smart cards such as the one authorized by Delhi Metro Rail Corporation Limited. Mobile banking is service provided by banks that allows customers to conduct financial transactions remotely using a smartphone device. National Automated Clearing House (NACH) helps banks, corporate houses, governments and other financial institutions to make bulk payments. Immediate Payment Service (IMPS) is an electronic inter-bank fund transfer system using mobile phones as the medium. The Cheque Truncation System (CTS) allows clearance of cheques between banks using an online image based clearance method. Cards at Point of Sale (PoS) is the sum of credit and debit cards used for making transactions at the corresponding location of sale.
Total value of electronic payments have increased from around INR 6500 billion in January 2014 to more than INR 23,000 billion in December 2021.

Figure 2: Electronic Payments in India as Shares of M3 and GDP



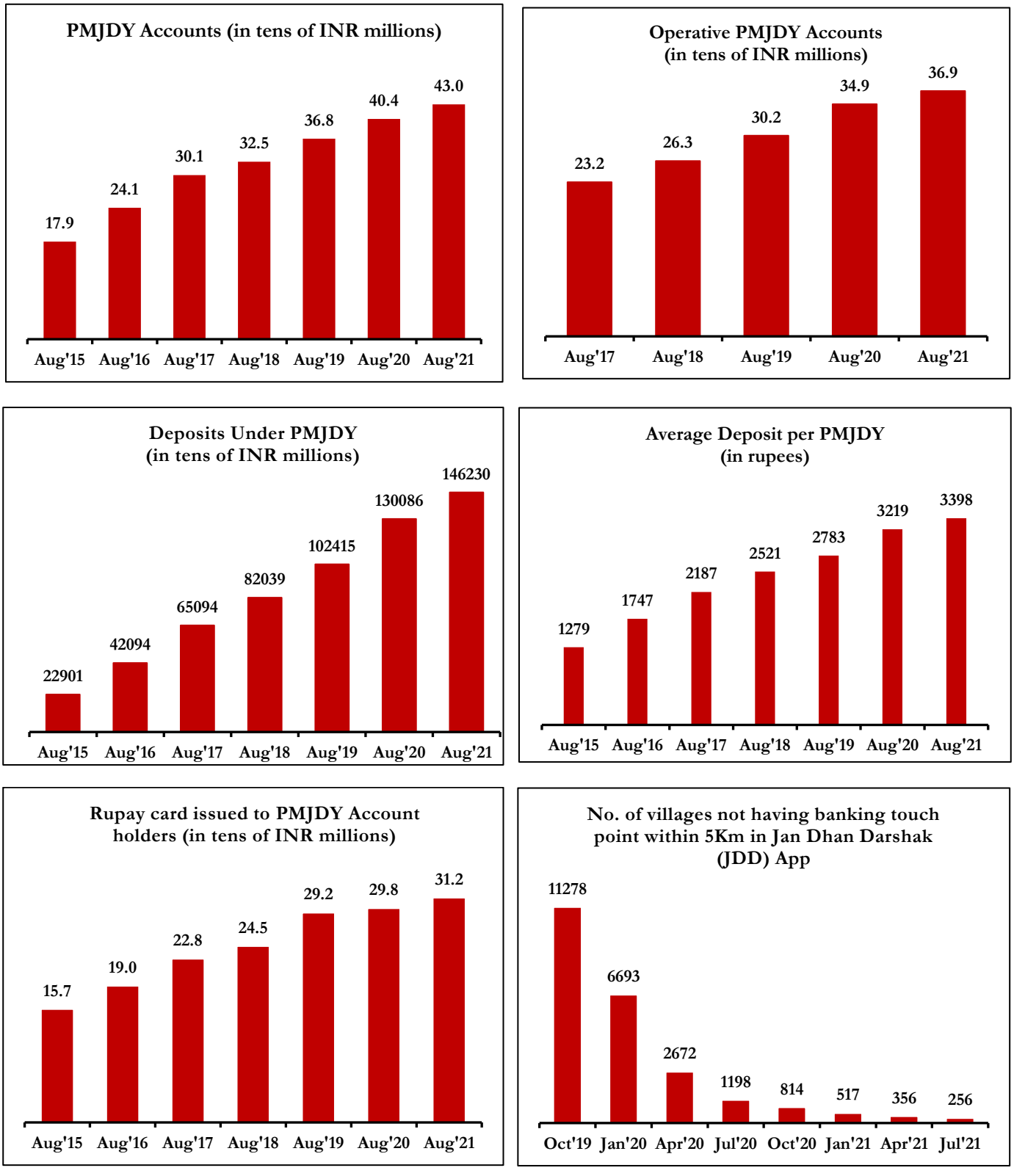
Source: Payment System Indicators, RBI database and National Accounts Statistics.

Figure 3: ATMs per 100,000 adults



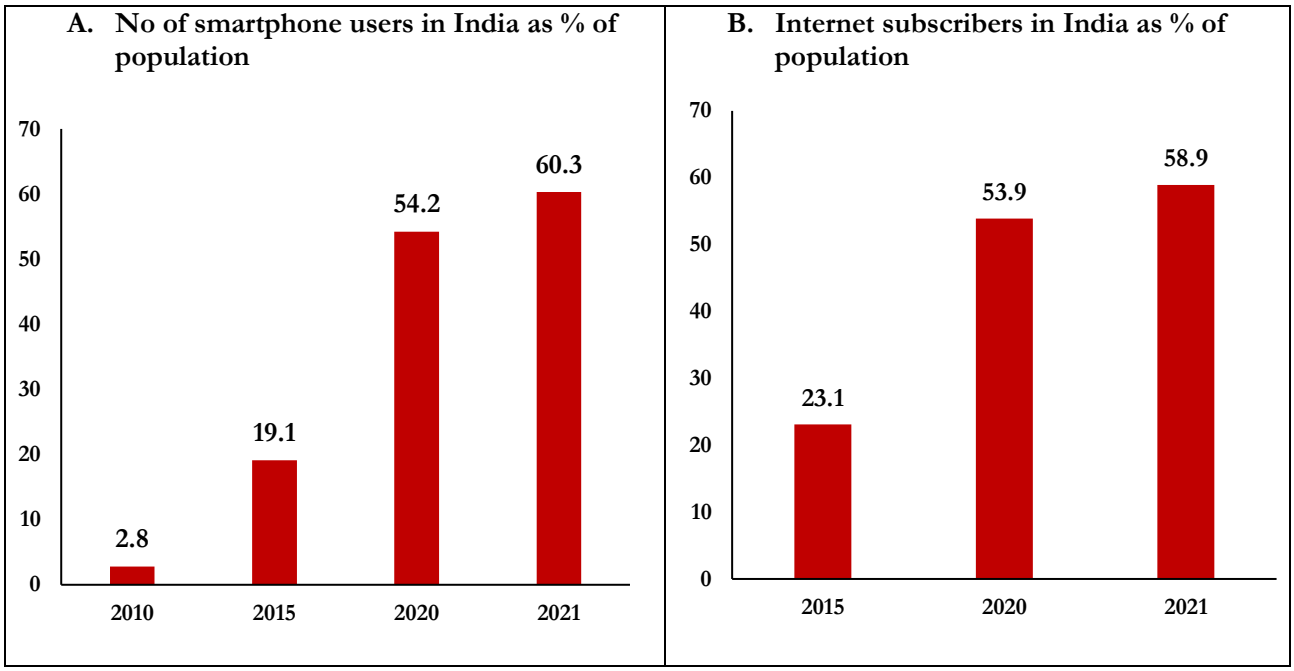
Source: Payments and financial market infrastructures, Red book statistics for CPMI (Committee on Payments and Market Infrastructures) countries, Bank for International settlements (BIS). Population data is from WDI, World Bank

Figure 4: Number of Pradhan Mantri Jan Dhan Yojana (PMJDY) Accounts



Source: PMJDY Progress Report, Press Information Bureau (PIB August 28, 2021), Ministry of Finance.

Figure 5: Smartphone and Internet Penetration in India



Source: Telecom subscription report as on December 31, 2021, released on February 17, 2022, Telecom Regulatory Authority of India (TRAI). Population is from World Bank (WDI database).
Note: Internet subscribers include wired and wireless internet subscribers.

Table 1: Commercial bank branches (per 100,000 adults)

	2010	2015	2020
Ukraine	2.3	0.6	0.4
Ghana	5.3	7.0	8.3
Nigeria	6.6	5.0	4.8
China	7.3	8.5	8.8
Philippines	7.6	8.8	9.2
Singapore	9.8	9.0	7.0
South Africa	9.8	10.4	9.2
India	**10.0**	**13.5**	**14.7**
Thailand	11.0	12.5	10.6
Norway	11.0	7.7	5.5
Turkey	17.9	19.1	15.4
Brazil	18.7	20.9	17.9
Morocco	20.8	24.6	24.2
Mauritius	21.3	21.7	16.4
Sweden	22.5	19.3	13.8
Russia	35.1	32.9	24.6

Source: World Development Indicators.
Note: Due to non-availability of data for 2020, data for 2019 have been taken for Ghana, Nigeria, and Mauritius and 2017 for Norway.

Table 2: Banking Statistics for India

	March 2010	December-2019	December 2020
Banking outlets in villages- Branches	33378	54481	55073
Banking outlets in large villages via Business Correspondents	8390	128980	851272
Banking outlets in small villages via Business Correspondents	25784	383864	385537
Total Banking Outlets in villages via Business Correspondents	34174	512844	1236809
Basic Saving Bank Deposit Accounts - Total (in Lakh)	735	5967	6492
Basic Saving Bank Deposit Accounts - Total (Amount in INR crore)	5500	152826	203061
Kisan Credit Cards - No. of cards (in Lakh)	240	479	490
Kisan Credit Cards - Total (Amount in INR crore)	124000	709377	679136
General Credit Card - No. of cards (in Lakh)	10	200	199
General Credit Card - Total (Amount in INR crore)	3500	184918	173968
Information and Communication Technology -A/C-BC-No. of Transactions (in Lakh)#	270	22500	35183
Information and Communication Technology -A/C-BC-Total Transactions (Amount in crore)#	700	606589	828795

Source: "Ch. 4: Credit Delivery and Financial Inclusion," *RBI Annual Report* (May 27, 2021).
Notes: # denotes transaction during year. Large villages refers to villages where population is greater than 2000 and small villages refers to villages where population is less than 2000. BC refers to Business Correspondents, who are retail agents engaged by banks for providing banking services at locations other than a bank branch/ATM.

Table 3. Progress of Pradhan Mantri Jan Dhan Yojana (PMJDY)

	March 2015	March 2016	March 2017	March 2018	March 2019	March 2020	March 2021
No. of PMJDY accounts (in Crore)	14.7	21.4	28.2	31.4	35.3	38.3	42.2
Deposit in PMJDY accounts (in INR Crore)	15670	35672	62972	78494	96107	118434	145551
Average Deposit per PMJDY account (in INR)	1065	1665	2235	2497	2725	3090	3449
Number of RuPay debit cards issued to PMJDY account-holders (in Crore)	13.1	17.8	22.0	23.7	27.9	29.3	30.9
Operative PMJDY Accounts			23.2	26.3	30.2	34.9	36.9

Source: PMJDY Progress Report, Department of Financial Services, Ministry of Finance.

Table 4. Individuals using the Internet (% of Population)

	2010	2015	2020
India	**7.5**	**14.9**	**57.6**
Ghana	7.8	23.0	53.0
Nigeria	11.5	24.5	33.6
Thailand	22.4	39.3	77.8
Ukraine	23.3	48.9	70.0
South Africa	24.0	51.9	68.0
Philippines	25.0	na	43.0
Mauritius	28.3	50.1	64.9
China	34.3	50.3	70.6
Turkey	39.8	53.7	77.7
Brazil	40.7	58.3	73.9
Russia	43.0	70.1	85.0
Morocco	52.0	57.1	84.1
Singapore	71.0	79.0	75.9
Sweden	90.0	90.6	94.5
Norway	93.4	96.8	97.0

Source: World Development Indicators.
Note: Due to non-availability of data for 2020, estimates of 2019 have been taken for Ghana, Ukraine, South Africa, and Philippines.

Table 5: Countries with Active CBDC Projects: Comparison by Indicators

Country Name	GDP per capita PPP(most recent World Bank estimate)	Central Bank Independence (Garriga 2016)	BRICS Member (Binary)	WIPO Rank: Technology Competitiveness
India	6,503.9	0.264	Yes	48
Philippines	8,389.8	0.579	No	50
Morocco	7,369.5	0.328	No	75
Ghana	5,744.4	0.403	No	108
Nigeria	5,186.4	0.443	No	117
Sweden	55,037.7	0.257	No	2
Taiwan	[*not listed*]	0.273	No	[*not listed*]
Norway	62,644.8	0.242	No	20
Singapore	98,520.0	0.211	No	8
Brazil	14,835.4	0.385	Yes	62
Russia	29,812.2	[*not listed*]	Yes	47
China	17,210.8	0.384	Yes	14
South Africa	13,360.6	0.321	Yes	60
Turkey	27,235.43	0.633	No	51
Ukraine	13,054.76	0.623	No	45
Mauritius	20,530.51	0.201	No	52
Thailand	18,232.80	0.126	No	44

Note: Cells highlighted in green in this table indicate that the country in a row was selected for comparison against India due to its similarity along the indicator in that column, among countriesactively and publicly pursuing central bank digital currencies in my dataset. These countries remain color-coded in reference to these groups in each of the tables below.

Table 6: Publicly Stated Policy and Economic Motivations for CBDC Projects among Case Countries

Country Name	*Financial Inclusion*	*Declining Cash Use*	*Banking Efficiency*	*International Payments*	*Sanctions*	*Precautionary*	*Fiscal Transparency*	*Financial Stability*
India	Yes	Yes	Yes	Yes	-	-	Yes	-
Philippines	Yes	-	Yes	-	-	-	-	-
Morocco	-	-	-	-	-	-	-	-
Ghana	-	-	-	-	-	-	-	-
Nigeria	-	-	-	Yes	-	-	-	-
Sweden	Yes	Yes	Yes	-	-	-	Yes	-
Taiwan	-	-	Yes	-	-	-	-	-
Norway	-	Yes	-	-	-	Yes	-	-
Singapore	-	-	Yes	Yes	-	Yes	-	-
Brazil	Yes	Yes	Yes	Yes	-	-	-	-
Russia	Yes	-	Yes	Yes	Yes	-	-	-
China	-	-	Yes	-	-	-	Yes	-
South Africa	Yes	-	Yes	Yes	-	-	-	-
Turkey	Yes	-	Yes	-	-	-	-	Yes
Ukraine	Yes	Yes	-	-	-	-	-	-
Mauritius	-	-	-	-	-	-	-	-
Thailand	Yes	-	Yes	-	-	-	-	Yes

Note: These values are coded from public statements made by central bank and other relevant government officials regarding the motivations for their respective CBDC projects. The codes were determined from review of data through mid-2021, first through an inductive coding exercised and formalized through cross-assessment on all observations in the data to ensure full coverage. No countries in the data from which this report is compiled detailed motivations that were not captured by any of these eight themes.

Table 7: Timing of Publicly Signaled Project Development among Case Countries

Country Name	*Initially Announced State of Development*	*Current Known State of Development*	*Target Date for Next Developments*
India	Interest (July, 2019)	Intended Pilot (December, 2021)	Pilot Finished (2022)
Philippines	Initial Research (July, 2020)	Design Research (May 2021)	*No Public Target Dates*
Morocco	Initial Discussions (November, 2017)	Initial Research (February 2021)	*No Public Target Dates*
Ghana	Feasibility Research (November, 2018)	Design Research (October, 2021)	*No Public Target Dates*
Nigeria	Announce Pilot (June, 2021)	Issue CBDC Pilot (October, 2021)	*No Public Target Dates*
Sweden	Initial Discussions (November, 2016)	Announce Pilot (May, 2021)	Issue CBDC Pilot (2026)
Taiwan	Announce Interest (March, 2018)	Design Research (June, 2020)	*No Public Target Dates*
Norway	Feasibility Research (May, 2018)	Application Research (April, 2021)	*No Public Target Dates*
Singapore	Initial Research (November, 2016)	Design Research (November, 2021)	*No Public Target Dates*
Brazil	Initial Research (December, 2018)	Announce Pilot (November, 2021)	Issue CBDC Pilot (2022/2023)
Russia	Initial Discussions (October, 2017)	Announce Pilot (June 2021)	Issue, Expand Pilot (2022)
China	Initial Research (January, 2014)	Expanded Pilot (December, 2021)	Expand Pilot Further (2022)
South Africa	Feasibility Research (June, 2016)	Announce Pilot (September, 2021)	Issue CBDC Pilot (2022)
Turkey	Research Feasibility (March, 2018)	Announce Pilot (August, 2021)	*No Public Target Dates*
Ukraine	Research Feasibility (March, 2016)	Design Research (August, 2021)	Issue CBDC (2025)
Mauritius	Initial Discussions (March, 2019)	Announce Pilot (May, 2021)	*No Public Target Dates*
Thailand	Research Feasibility (August, 2018)	Announce Pilot (October, 2021)	*No Public Target Dates*

Note: Initial and current states of development are coded at the general level of: (i) interest, (ii) research, (iii) development, (iv) pilot, (v) issuance, and (vi) terminating CBDC projects. The statesof development listed in the table above are sub-components of each major progress code, whichtypically involve specificity regarding the type of research and development, or stage of pilot.

Table 8: Design Preferences for CBDC Technology Publicly Announced by Case Countries

Country Name	*Architecture*	*Infrastructure*	*Access*	*Interlinkages*
India	Hybrid	-	-	-
Philippines	-	-	-	International
Morocco	-	-	-	-
Ghana	-	-	-	-
Nigeria	-	Decentralized	-	-
Sweden	Hybrid	Centralized	-	None
Taiwan	-	-	-	-
Norway	Hybrid	Hybrid	-	International
Singapore	Direct	Hybrid	Hybrid	-
Brazil	Hybrid	Decentralized	Token	-
Russia	-	-	-	International
China	Indirect	Centralized	Hybrid	-
South Africa	-	-	Token	None
Turkey	Indirect	Decentralized	Hybrid	-
Ukraine	Hybrid	Decentralized	-	International
Mauritius	-	-	-	-
Thailand	Hybrid	Decentralized	Hybrid	International

Note: These design features are the most recent publicly announced preferences by central bank and relevant government officials in each of these countries as of December, 2021. The design features are coded following the technical typology developed by the Bank for International Settlements.

Appendix: Timeline of the discussions and deliberations on the CBDCs (and Crypto assets)

- **December 9, 2016:** Watal Committee Report on Digital Payments provided the earliest reference on adoption of CBDCs.

  The report included the following para on digital currency: "Digital currencies are currency issued in a digital form. This could include cryptocurrencies such as Bitcoins (which are an independent form of money separate from any country's central bank issued legal tender) or digitally issued central bank currencies. In the course of consultations, the Committee was presented with a case for digitally issued Indian currency, as a means to substitute physical currency. Central bank issued digital currency seeks to retain the characteristics of central bank issued M0 currency, but merely changes the form factor from paper to digital. Such a digital currency would have to be issued by the RBI, and used by way of hardware modules. The security of the currency is ensured by cryptographic technology, inspired by existent security features on physical currency. The Committee notes that several benefits of digital currency, including the instantaneous settlement of transactions, reduction of costs of cash, ability to provide a more comprehensive and unified source of credit history and reduction in instances of tax avoidance. The most significant benefit however, is that the technology makes it extremely difficult to counterfeit, and more importantly enables the central bank to detect the existence of counterfeit currency on a real-time basis."

- **November 2, 2017: A high l**evel Inter-Ministerial Committee was constituted by the Ministry of Finance, Government of India (GoI) to examine the issues related to virtual currencies and propose specific action to be taken in this matter.

  February, 2018: Union Finance Minister in his Budget speech announced that the "Distributed ledger system or the Block chain technology allows organization of any chain of records or transaction without the need of intermediaries. The Government does not consider cryptocurrencies legal tender or coin and will take all measures to eliminate the use of these crypto assets in financing illegitimate activities or as part of the payment system. The Government will explore use of blockchain technology proactively for ushering in digital economy."

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- **February 28, 2019:** Inter-ministerial Committee report on Virtual Currencies was submitted. The Committee recommended a ban on private virtual currencies and recommended the study of India relevant CBDC models.

  The Report highlighted the positive aspect of distributed-ledger technology (DLT) and suggested various applications, especially in financial services, for use of DLT in India. As for private cryptocurrencies, given the risks associated with them and volatility in their prices, the Group recommended banning of the cryptocurrencies in India and imposing

fines and penalties for carrying on of any activities connected with cryptocurrencies in India.

The Group proposed that the Government keeps an open mind on official digital currency. As virtual currencies and its underlying technology were still evolving, the Group has proposed that the Government may establish a Standing Committee to revisit the issues addressed in the Report as and when required.

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- **January 1, 2021: An RBI report,** Payment and Settlement Systems in India: Journey in the second decade of the Millennium 2010-20, mentioned that the RBI was examining the requirements and modalities for operationalizing a digital rupee.

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- **February 6, 2021:** It was reported in the media that an RBI internal panel was taking a close look at the CBDCs. https://bfsi.economictimes.indiatimes.com/news/policy/rbi-internal-panel-working-on-model-of-central-banks-digital-currency-decision-very-soon/80718180

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- **February 26, 2021: The RBI's report,** Currency and Finance 2020-21, briefly discussed the potential benefits and challenges of issuing CBDCs for advanced and emerging market economies including India.

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- **July 22, 2021:** Speech by RBI Deputy Governor T Rabi Shankar at a webinar organized by Vidhi Centre for Legal Policy, New Delhi), CBDC- Is this the future of money. He described what a digital currency is, its benefits, and the rationale for India to have its own digital currency.

  "Generally, countries have implemented specific purpose CBDCs in the wholesale and retail segments. Going forward, after studying the impact of these models, launch of general purpose CBDCs shall be evaluated. RBI is currently working towards a phased implementation strategy and examining use cases which could be implemented with little or no disruption. Some key issues under examination are – (i) the scope of CBDCs – whether they should be used in retail payments or also in wholesale payments; (ii) the underlying technology – whether it should be a distributed ledger or a centralized ledger, for instance, and whether the choice of technology should vary according to use cases; (iii) the validation mechanism – whether token based or account based, (iv) distribution architecture – whether direct issuance by the RBI or through banks; (v) degree of anonymity etc. However, conducting pilots in wholesale and retail segments may be a possibility in near future."

- **December 28, 2021:** Report on Trends and Progress of banking in India 2020-21. Briefly discuss role of CBDC and cross border transactions.

  "Given its dynamic impact on macroeconomic policy making, it is necessary to adopt basic models initially, and test comprehensively so that they have minimal impact on monetary policy and the banking system. India's progress in payment systems will provide a useful backbone to make a state-of-the-art CBDC available to its citizens and financial institutions."

- **December 13, 2021**: Lok Sabha 23 Nov 2021 bulletin**:** The Cryptocurrency and Regulation of Official Digital Currency Bill, 2021: To create a facilitative framework for creation of the official digital currency to be issued by the Reserve Bank of India. The Bill also seeks to prohibit all private cryptocurrencies in India; however, it allows certain exceptions to promote the underlying technology of cryptocurrency and its uses. This bill has not been tabled yet in the parliament.

- **February 1, 2022:** In Union Budget for 2022-23, the Finance Minister announced a flat 30 % tax on income from Virtual Digital assets or crypto.

- **February 1, 2022:** The Finance Minister announced in the Union Budget for 2022-23 that India will issue a "digital rupee" during the fiscal year 2022-23 (April 1, 2022-March 30, 2023).

- **March 26, 2022:** Finance bill, 2022 passed by parliament. This bill, inter alia, proposes to insert a clause (aiv) in Section 2 of the Reserve Bank of India Act, 1934, which increased the ambit of the term "bank note" to include notes in digital form.

- **April 7, 2022:** ICRIER Webinar on: Getting Central Bank Digital Currency (CBDC) Right for India: Lessons from G20 and the Rest of the World. (Deputy Governor T Rabi Shankar's opening remarks). The launch of a CBDC for India is inevitable. Not a question of whether, but how to do it well. The RBI is working on it full time since the Finance Minister announced it in the budget. The case for a CBDC was considered to be weaker earlier due to the ubiquity of digital payments. The sentiment has changed with the advent of the stable coins. Since the stablecoins are not volatile, they are deemed to be a more credible alternative/challenge to the fiat currency. Digital Yuan has been another imperative toward a CBDC in India.

  There will be a one to one convertibility between the digital and physical currency. In the RBI's balance sheet, it will be treated in a similar fashion and will be recorded along with the paper currency, not as a separate instrument (as apparently is being considered by the US). It will not earn interest. Since most of the central banks are grappling with these questions; and there is very little to draw from other countries' experiences, India is

unlikely to rush through it. The RBI will introduce and implement it in a gradual/calibrated manner with the course correction as needed; and will do no harm!

- **April 7, 2022:** ICRIER Webinar on: Getting Central Bank Digital Currency (CBDC) Right for India: Lessons from G20 and the Rest of the World. The Chief Economic Advisor to the Government of India said, "With the advent of CBDC, virtual private currencies won't be eliminated or lose their appeal. They have to be tackled separately with other regulatory instruments. He cautioned that the success of CBDCs will be dependent on the inclusion of the lower socio-economic groups in the country; and that likely a phased roll out would be required (first at the wholesale level and then at the retail level; and in further phases even in retail level). He cautioned on the high **storage and processing requirements, as** the ledger grows substantially over time and the need to ensure these capabilities.

- **April 8, 2022:** In the Post Monetary Policy Meeting Press conference, the RBI Deputy Governor clarified that India will first introduce a wholesale currency.

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