



# Data Privacy Considerations for Central Bank Digital Currencies in Asia–Pacific Countries

Nir Kshetri, University of North Carolina at Greensboro

Elena Loukoianova, International Monetary Fund

*Central bank digital currencies (CBDCs) raise various data privacy concerns. This article analyses regulatory frameworks for data privacy related to CBDCs in the Asia–Pacific region.*

**A** current worldwide trend shows that central bank digital currency (CBDC) will likely become the future of banking and payments. According to CBDC Tracker, at least 64 central banks were exploring retail CBDCs as of December 2021. Of those, 20 had launched or tested a CBDC or were

in an advanced stage of exploration.<sup>1</sup> CBDC and crypto asset adoption spark concerns around data privacy for consumers. So far, the consensus is that CBDC privacy goes beyond binary choices of anonymity and full disclosure, with a range of options related to the type of information to keep private and who to keep it private from.

Privacy refers to the use and governance of personal data and is related to rights to control information and how it is used and shared with banks and other institutions.<sup>2</sup> Ultimately, the government has access to all the data in cases where that is really necessary. CBDCs raise sensitive privacy issues since they

entail the collection and use of individual information and immutable records of transactions, which could be accessed by authorities.<sup>3</sup> Indeed, the European Central Bank's consultation with key stakeholders to launch a digital Euro found that consumers and professionals considered privacy to be the most important feature.<sup>4</sup>

One important criterion for consumers using a CBDC is the ability to make anonymous transactions.<sup>5</sup> People prefer anonymity for a variety of legitimate reasons, for

example, to avoid customer profiling and reduce exposure to hacking. Anonymity is related to privacy, which is widely recognized as a human right (as in the “Universal Declaration of Human Rights,” article 12). In this article, we look at regulatory frameworks for data privacy related to CBDCs in some economies in the Asia-Pacific region.

## CURRENT REGULATIONS AND FRAMEWORKS FOR DATA PRIVACY RELATED TO CBDCS

Many countries in the Asia-Pacific region are at various stages in their CBDC initiatives. Examples of how

and clients. This separation of data arguably preserves the privacy of transactions.<sup>14</sup>

### China

Among large economies, China’s digital yuan, which is also commonly referred to by its original project name, Digital Currency Electronic Payment (DCEP),<sup>15</sup> is in the most advanced stage of development. In August 2019, China’s central bank, the People’s Bank of China (PBOC), announced plans to accelerate the currency’s development.<sup>16</sup> The DCEP does not utilize blockchain as its underlying technology. Instead, it employs a “binary operating system.” A binary operating system in-

### Japan

Japan’s central bank, the Bank of Japan, has been exploring institutional arrangements for various issues related to CBDCs, including privacy protection and handling end-user information. A role-sharing arrangement between the central bank and payment service providers has been identified as an important topic to be explored to have an answer about “who obtains and manages what data and under what conditions.”<sup>23</sup> A key focus of the government has been to balance privacy protections and prevent financial crime.<sup>24</sup>

Recently, a consortium of 74 Japanese firms, the Digital Currency Forum, has been established, and it plans to issue a digital yen by the end of 2022. A white paper released by the group in November 2021 tentatively named the digital currency DCJPY.<sup>25</sup> The white paper noted that all nodes will be managed by commercial banks, and cryptography will be used to enhance privacy protection. An account associated with a user will not be shared by the distributed ledger technology. This means that a commercial bank will not be able to access user information managed by other commercial banks.<sup>8</sup>

### South Korea

South Korea has begun a CBDC pilot project in two phases. The first began in August 2021 and was scheduled for completion by December 2021. In it, the key stakeholders focus on basic functions of the digital fiat currency. The second phase, which is scheduled to be conducted in the first half of 2022, will emphasize more advanced concepts, including privacy.<sup>26</sup> End users’ electronic wallets are expected to be with private institutions rather than the central bank. This feature is expected to address some of the privacy concerns associated with the central bank’s ability to access transactions records.<sup>27</sup>

### Thailand

In October 2020, Ethereum development firm ConsenSys announced a

CBDCs raise sensitive privacy issues since they entail the collection and use of individual information and immutable records of transactions.

data privacy is being handled or is likely to be dealt with by six countries are presented in Table 1.

### Cambodia

Cambodia’s central bank, the National Bank of Cambodia (NBC), launched the digital currency Bakong in October 2020. By August 2021, about 200,000 people had used Bakong digital wallets, and roughly 6 million people had benefited from Bakong wallets.<sup>13</sup> In the core Bakong system, all end users’ personal identifiable information is stored by the financial institutions that join the system. A financial institution receives only transactions in which users are counterparties. Thus, it has no access to other data in the system.<sup>13</sup> The Bakong is built on top of Hyperledger Iroha. Transactions are transparent to validating nodes, which are run by the NBC. However, the identity of the parties performing a transaction is not disclosed. The Bakong requires participating institutions to manage know-your-customer information for their end users

interface standard defines a common configuration to enable the movement of executable (ready-to-run) binaries<sup>17</sup> among computer systems.<sup>18</sup> The PBOC serves as the DCEP’s issuance database. Digital wallet operators provide the DCEP’s circulation services.<sup>19</sup>

Privacy is among the biggest concerns critics have about the DCEP.<sup>20</sup> It is argued that the digital yuan is “more about policing than progress.”<sup>21</sup> The PBOC can see every transaction and cancel it if it likes.<sup>22</sup> By putting every transaction onto the PBOC’s radar, the DCEP can strengthen surveillance. The DCEP also has a controllable anonymity feature that requires users to register with their real name and provide personal information to the PBOC. However, users can remain anonymous with their counterparties. Such a framework creates privacy concerns associated with the use of the digital yuan within and outside China. Therefore, some countries might not like the idea of trading CBDCs on a platform designed by China.

plan to devise a proof of concept with Thailand's central bank, the Bank of Thailand (BOT), for a retail CBDC, or digital baht. The solution uses the permissioned enterprise blockchain Hyperledger Besu, ConsenSys' Codefi, and the Ethereum wallet MetaMask.<sup>28</sup> Hyperledger Besu makes it possible to use zero-knowledge methods such as the Aztec protocol to make private transactions available.<sup>29</sup> The prototype utilized Aztec, which ensures that only participants involved in a transaction can see before-and-after

token balances and transfer values. However, the validator can verify transfers' integrity. In the prototype, the BOT could potentially monitor all transactions, which are anonymous and can be seen only by participants and the central bank.<sup>30</sup>

### CAN ONE SIZE FIT ALL?

Central banks face a tricky tradeoff between satisfying customer preferences for privacy and providing regulators with access to data related to user identities and transactions. The

Reserve Bank of New Zealand noted that its proposed retail CBDC would balance privacy protection and the government's traceability requirement to reduce tax evasion/avoidance, money laundering, and terrorism financing.<sup>31</sup> Likewise, a publication of the Reserve Bank of Australia (RBA) has maintained that a key design decision for a wholesale CBDC would involve the degree of privacy and anonymity. The RBA has argued that it is not possible for a CBDC to fully match the levels of anonymity and privacy

**TABLE 1.** How CBDC privacy and personal information are handled in some Asia-Pacific countries.

	Technology used	Status	How privacy is handled
Cambodia	Hyperledger Iroha (blockchain)	October 2020: Project Bakong was launched. August 2021: about 200,000 people have used Bakong digital wallets.	Participating institutions manage know-your-customer information for their end users and store personal identifiable information. Data are expected to be separated to preserve transaction privacy.
China	Binary operating system	Trials of Digital Currency Electronic Payment (DCEP) began in May 2020 in four cities. <sup>6</sup> As of October 2021, the People's Bank of China had no timetable for the official launch of the DCEP. <sup>7</sup>	The government can record details of every transaction, including the amount, foreign exchange involved, and identity of the parties.
Japan	DLT and permission-based blockchain have been identified as promising technologies to develop. <sup>8</sup>	In April 2021, the Bank of Japan began experiments to test the technical feasibility of a CBDC, <sup>9</sup> planning to issue DCJPY by the end of 2022.	All nodes will be managed by commercial banks. A commercial bank will not be able to access user information managed by other financial institutions.
Marshall Islands	The Marshall Islands employ blockchain technology with two additional checks: 1) a sender has an SOV ID issued by a verifier, and 2) the verifier is a member in good standing of the trust network.	On 26 February 2018, the Republic of the Marshall Islands legislature passed a law making SOV the new legal tender.	Personal identified information is not centralized and published to the SOV blockchain. SOV users have a choice of accredited verifiers and can choose the one they trust most. Verifiers issue cryptographically signed SOV IDs that users present, without revealing identifying information, along with transaction data. <sup>10</sup>
South Korea	The country uses Ground X's Klaytn ledger, which is based on Ethereum blockchain.	The first phase focused on basic functions of the digital fiat currency. The second phase, during the first half of 2022, concerns advanced features.	Privacy features are being piloted in the second phase. End users' electronic wallets are expected to be with private institutions (which addresses privacy concerns associated with the central bank's ability to access transactions records).
Thailand	This program uses Hyperledger Besu supported by ConsenSys (blockchain).	Results of the CBDC for Business Prototype Development Project were released in March 2021. <sup>11</sup> Real-world testing is planned for the second quarter of 2022. <sup>12</sup>	Aztec ensures that only participants can see details of a transaction. A concern is that the Bank of Thailand could monitor all transactions.


SOV: sovereign; DLT: distributed ledger technology.

available with cash, due to concerns related to the facilitation of the shadow economy and illegal transactions.<sup>32</sup>

Consumers prefer privacy in CBDCs to avoid various challenges such as being spammed, stalked, and robbed as well as having their identity stolen. There are also public concerns about digital surveillance, especially in jurisdictions characterized by a low degree of trust in public institutions. An

transactions, consumers are required to provide full names, addresses, and phone numbers and link the CBDC wallet with their bank accounts.<sup>1</sup> Likewise, the European Central Bank experimented with a CBDC that involved elements of programmable money. Under this model, individuals are allotted “anonymity vouchers” to use for small transactions. Larger transactions, on the other hand,

make it difficult to circumvent China’s capital control regulations.

While the protection of user privacy rights has been a key priority in most countries’ CBDC initiatives, there are various other goals that governments might choose to pursue. Governments vary widely in these goals, which had led to heterogeneity in the user privacy protection provided by CBDCs. From consumers’ standpoint, a downside of CBDCs is that the authorities may have access to all transactions and use this power if needed. This gives governments unprecedented visibility of financial transactions conducted inside and outside a country, if an interoperable platform is used. As in many other cases, such an ability can be used for good, or it can be misused. 

The RBA has argued that it is not possible for a CBDC to fully match the levels of anonymity and privacy available with cash.

additional drawback of CBDCs is that they may exclude people that lack a government-issued ID.<sup>1</sup> Some consumers may also want to retain full privacy in transacting for various reasons, including unlawful ones.<sup>30</sup>

Governments, on the other hand, are against complete anonymity and privacy to control illicit financial activity. It is the responsibility of most central banks to meet the antimoney laundering (AML) and countering financing terrorism (CFT) standards of the Financial Action Task Force, an intergovernmental body. A common approach has been to apply proportionality rules. For example, in China’s DCEP/electronic Chinese yuan, for users that hold fewer than 10,000 yuan, transactions of less than 2,000 yuan (with daily transactions up to 5,000 yuan) are identified only by their mobile phone subscriber identification module cards. For larger

would be visible to financial intermediaries and the authorities responsible for AML/CFT.<sup>33</sup>

Different privacy approaches to CBDCs provide various degrees of tradeoff between users’ preference for privacy and anonymity protection and regulators’ desire to access data related to identities and transactions. This also depends on how data privacy is regulated in different countries and what kind of rights to data privacy consumers have. For example, the right to data privacy is heavily regulated in Europe and some jurisdictions in the Asia-Pacific region such as Australia, Japan, New Zealand, and South Korea. On the other hand, Chinese consumers do not have a strong right to privacy. Moreover, the Chinese government views the DCEP as a means to control illicit financial flows, which has been a big concern. China has introduced strict restrictions to limit capital outflows, and high-technology tools are utilized to enforce them. For instance, to monitor transactions, places frequently visited by mainland Chinese, such as Macau, are required to install facial recognition software in automated teller machines (ATMs).<sup>34</sup> To withdraw money from Macau ATMs, Chinese nationals must look into a camera for 6 s to have their identity verified. The DCEP is thus likely to

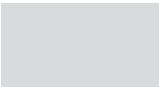
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#### REFERENCES

1. J. Kiff and J. Gross, “CBDCs for the people? Where the current state of digital currency research leads: A look at Central Bank digital currency studies and where they might lead,” *CoinDesk Insights*, Dec. 3, 2021. <https://www.coindesk.com/policy/2021/12/03/cbdc-for-the-people-where-the-current-state-of-digital-currency-research-leads/>
2. K. Schwartz, “Data privacy and data security: What’s the difference?” *ITPro Today*, May 2, 2019. [Online]. Available: <https://www.itprotoday.com/security/data-privacy-and-data-security-what-s-difference>
3. B. Reynolds and D. Parisi, “The missing legal framework for central bank digital currencies,” *Reuters*, Oct. 19, 2021. <https://www.reuters.com/legal/transactional/missing-legal-framework-central-bank-digital-currencies-2021-10-19/>
4. “Central Bank digital currency,” European Data Protection Supervisor. <https://edps.europa.eu/publications/publications/>





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5. T. Mancini-Griffoli *et al.*, “Casting light of Central Bank digital currency,” IMF Staff Discussion Note, vol. 2018, no. 8, 2018, doi: 10.5089/9781484384572.006.
  6. K. Yeung and A. Mullen, “China digital currency: When will the e-Yuan be launched, and what will it be used for?” *China Macro Economy*, Jun. 6, 2021. <https://www.scmp.com/economy/china-economy/article/3135886/china-digital-currency-when-will-e-yuan-be-launched-and-what>
  7. A. Kania, “Will China pave the way for large-scale CBDC usage?” Oct. 22, 2021. <https://thepayers.com/expert-opinion/will-china-pave-the-way-for-large-scale-cbdc-usage--1252296>
  8. Digital Currency (name tentative (DCJPY)) White Paper, 2021, [https://about.deccurrent.com/assets/forum\\_20211124wp\\_en.pdf](https://about.deccurrent.com/assets/forum_20211124wp_en.pdf)
  9. “Japan explores digital currency but is loathe to commit,” Apr. 15, 2021. <https://forkast.news/japan-cbdc-digital-currency/>
  10. “The Marshallese Sovereign (SOV): Fair, sustainable money version 1.3,” SOV Foundation, Sep. 10, 2019. <https://sov.foundation/>
  11. “Results of the Central Bank Digital Currency (CBDC) for business prototype development project,” Bank of Thailand, Release No. 13/2021, Mar. 8, 2021. <https://www.bot.or.th/English/PressandSpeeches/Press/2021/Pages/n1364.aspx>
  12. N. Fronde, “Bank of Thailand plans real-world test of digital currency in 2022,” Oct. 24, 2021. <https://thethaiger.com/hot-news/economy/bank-of-thailand-plans-real-world-test-of-digital-currency-in-2022>
  13. M. Takemiya, “Cambodia’s digital currency can show other central banks the way,” *World Economic Forum*, Aug. 30, 2021. <https://www.weforum.org/agenda/2021/08/cambodias-digital-currency-ismaking-other-central-banks-the-way/>
  14. “Project Bakong next generation payment system,” National Bank of Cambodia, Jun. 2020. [https://bakong.nbc.org.kh/download/NBC\\_BAKONG\\_White\\_Paper.pdf](https://bakong.nbc.org.kh/download/NBC_BAKONG_White_Paper.pdf)
  15. X. Huang, “China’s DCEP project launches biggest digital yuan test yet,” *Forkast*, 2021. <https://forkast.news/china-dcep-digital-yuan-pros-cons/>
  16. Y. Ruolin, “China’s government-backed digital currency, explained,” *Sixth Tone*, May 29, 2020. <https://www.sixthtone.com/news/1005716/chinas-government-backed-digital-currency%2C-explained>
  17. “TechTarget binary file,” *WhatIs.com*, 2005. [https://whatis.techtarget.com/definition/binary-file#:~:text=A%20binary%20file%20is%20a,exactly%20how%20it%20is%20formatted.&text=In%20general%2C%20executable%20\(ready%2D,bin%22](https://whatis.techtarget.com/definition/binary-file#:~:text=A%20binary%20file%20is%20a,exactly%20how%20it%20is%20formatted.&text=In%20general%2C%20executable%20(ready%2D,bin%22)
  18. A. Anderson, M. Cruess, and E. Wiencek, “The binary compatibility standard,” in *Proc. IEEE Int. Comput. Conf.*, 1989, pp. 32–37, doi: 10.1109/CMPCON.1989.301899.
  19. S. Kong, “Can China’s DCEP challenge Bitcoin?” *Decrypt*, 2020. <https://decrypt.co/49517/can-chinas-dcep-challenge-bitcoin>
  20. N. Kshetri, “China’s digital yuan: Motivations of the Chinese government and potential global effects,” *J. Contemporary China*, to be published.
  21. B. Goh and S. Shen, “China’s proposed digital currency more about policing than progress,” *Reuters*, 2019. <https://www.reuters.com/article/us-china-markets-digital-currency/chinas-proposed-digital-currency-more-about-policing-than-progress-idUSKBN1XB3QP>
  22. A. Work, “China’s DCEP will be the world’s Sputnik money moment,” *Forkast*, Aug. 10, 2020. <https://forkast.news/china-cbdc-digital-currency-e-rmb-launch-preview-andrew-work/>
  23. “The release of the Bank of Japan’s approach to Central Bank Digital Currency,” Bank of Japan, Oct. 9, 2020. [https://www.boj.jp/en/announcements/release\\_2020/rel201009e.htm/](https://www.boj.jp/en/announcements/release_2020/rel201009e.htm/)
  24. “Central Bank Digital currencies: Viewpoints from Tokyo and Washington,” Sasakawa Peace Foundation, Washington, DC, Dec. 8, 2020. <https://spfusa.org/event/central-bank-digital-currencies-viewpoints-from-tokyo-and-washington/>
  25. “Japanese Consortium plans to issue bank deposit-like digital Yen by end of next year,” *coindesk.com*. <https://www.coindesk.com/policy/2021/11/24/japanese-consortium-plans-to-issue-bank-deposit-like-digital-yen-by-2022-end/>
  26. C. Bovaird, “Blockchain executive sheds light on bank of Korea, CBDC Trial,” *Forbes*, Aug 2, 2021. [Online]. Available: <https://www.forbes.com/sites/cbovaird/2021/08/02/blockchain-executive-sheds-light-on-bank-of-korea-cbdc-trial/?sh=5da220ac3799>
  27. T. Stangarone, “South Korea’s forward-thinking digital currency pilot program,” *East Asia Forum*, Aug. 10, 2021. <https://www.eastasiaforum.org/2021/08/10/south-koreas-forward-thinking-digital-currency-pilot-program/>
  28. “Bank of Thailand to use enterprise Ethereum for retail CBDC prototype with ConsenSys,” *Ledger Insights*, Oct. 29, 2020. [Online]. Available: <https://www.ledgerinsights.com/bank-of-thailand-retail-cbdc-ethereum-consensys/>
  29. R. Dawson and M. Baxter, “Announcing Hyperledger Besu,” *Hyperledger*, Aug. 29, 2019. [Online]. Available: <https://www.hyperledger.org/blog/2019/08/29/announcing-hyperledger-besu>
  30. “Central Bank Digital Currency: The future of payments for corporates,”

Bank of Thailand, Mar. 8, 2020. [https://www.bot.or.th/English/FinancialMarkets/ProjectInthanon/Documents/20210308\\_CBDC.pdf](https://www.bot.or.th/English/FinancialMarkets/ProjectInthanon/Documents/20210308_CBDC.pdf)

31. H. Partz, "New Zealand central bank releases issue paper on digital currency," *Coin Telegraph*, Sep. 30, 2021. [Online]. Available: <https://cointelegraph.com/news/new-zealand-central-bank-releases-issue-paper-on-digital-currency>
32. T. Richards, C. Thompson, and C. Dark, "Retail Central Bank Digital Currency: Design considerations, rationales and implications," Reserve Bank of Australia. Sep. 17, 2020. <https://www.rba.gov.au/publications/bulletin/2020/sep/retail-central-bank-digital-currency-design-considerations-rationales-and-implications.html>
33. "Exploring anonymity in central bank digital currencies," European Central Bank, Dec. 2019.
34. M. Kärnfelt, "China's tight capital controls fail to address underlying problems," *Financial Times*, 2017. [Online]. Available: <https://www.ft.com/content/1d288888-c613-11e7-b2bb-322b2cb39656>

**NIR KSHETRI** is a professor of management in the Bryan School of Business and Economics, University of North Carolina at Greensboro, Greensboro, North Carolina, 27412, USA. Contact him at [nbkshetr@uncg.edu](mailto:nbkshetr@uncg.edu).

**ELENA LOUKOIANOVA** is a deputy division chief of the Asia Pacific Department, International Monetary Fund, Washington D.C., 20431, USA. Contact her at [eloukoianova@imf.org](mailto:eloukoianova@imf.org).



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