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DESIGN ELEMENTS AND RISKS OF CENTRAL BANK DIGITAL CURRENCY IN TAILORING A PRUDENT ‘RUPIAH DIGITAL’

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Abstract

As the risks associated with the use of stablecoins grow, BI intends to issue Indonesian CBDCs. However, as a financial system innovation, the design of a CBDC must also consider the consequences and risks that may arise from its implementation. In this regard, BI believes that the primary foundation for CBDC implementation should be a strong legal foundation. This normative paper discusses the legal concerns that could arise throughout CBDC implementation in Indonesia. However, because Indonesia's legal framework for cyber privacy and security is still in its infancy, this paper also investigates the privacy and cyber security risks of CBDC implementation. According to the research findings, Indonesia's regulatory framework is still far from being capable of accommodating CBDC implementation. The legality of this CBDC is primarily determined by whether it is a currency or merely a payment instrument. Furthermore, there are privacy and cybersecurity risks that are not mitigated by the current regulatory framework. Despite the passing of the umbrella regulation for Indonesian personal data protection, some aspects of privacy must be taken into account by enacting provisions that protect retail CBDC users. In terms of cybersecurity, there is an urgent need to enact a comprehensive Cybersecurity Law, given the existing cybersecurity provisions still lack adequate protection for CBDC.

Keywords: *Central Bank Digital Currency; Blockchain; Privacy; Cybersecurity*

1. Introduction

Along with the increase of authorities' attention on private stablecoins, in 2021, 90% of central banks are interested in the possibility of issuing their stablecoin in the form of Central Bank Digital Currency (CBDC)¹, a digital version of government-backed fiat money² or in other words, a 'digital banknote'.³ Administered by central banks, CBDC keeps the core function of the widely used private stablecoins while its volatility and circulation are maintained by taking the centralized monetary function of central banks. As such, it could function properly as money in the digital financial ecosystem. Although the concept of CBDC is still nascent, recent studies found that central banks could adapt the five elements of CBDC in designing their CBDC model, comprising

¹ Anneke Kosse and Ilaria Mattei, *Gaining Momentum – Results of the 2021 BIS Survey on Central Bank Digital Currencies*, *BIS Papers*, 2022, 1.

² Lyle Daly, "What Is Central Bank Digital Currency (CBDC)?," *The Motley Fool*, last modified 2023, <https://www.fool.com/investing/stock-market/market-sectors/financials/cryptocurrency-stocks/central-bank-digital-currency/>.

³ Kosse and Mattei, *Gaining Momentum – Results of the 2021 BIS Survey on Central Bank Digital Currencies*, 2.

of (i) functionality (retail, wholesale and cross-border); (ii) distribution model (one-tier, two-tier and hybrid); (iii) underlying technology (legacy technology and distributed ledger technology (DLT)); (iv) accessibility (account based and token based); and (v) remuneration (interest bearing and non-interest bearing).

However, as countries have varying macroeconomic considerations and any other relevant considerations to CBDC implementation, such as privacy concerns,⁴ there is no 'one size fits all' approach in designing the CBDC model.⁵ Policymakers should consider which elements are preferable to their countries' conditions. In relation to this, a recent survey on worldwide CBDC development published by the Bank of International Settlements in May 2022 prescribes that more than 70% of central banks are considering the two-tiered distribution model implementation and working on retail CBDC's interoperability.⁶

In Indonesia, Bank Indonesia (BI) has raised its concerns about CBDC following the increasing risks of crypto-assets and other digital assets to financial and monetary stability in the global financial system.⁷ Previously in 2021, BI planned to launch the Indonesian CBDC named 'Rupiah Digital',⁸ but at the time of this writing, BI made no further official statements on the initiation of such a proposal. The recent stance from BI gave a glimpse of the impending Indonesian CBDC, which aimed to be built upon three critical common foundational principles⁹: 1) CBDC should be implemented based on a strong legal basis which serves as a consensus from several stakeholders; 2) CBDC should support the objectives of the central bank on the monetary, payment system, and financial stability; and, 3) CBDC should promote financial inclusion, innovation, and efficiency of the financial system in the digital era.

In addition, BI also underlined the 3Is principles of CBDC to the money market, namely: (i) integration, (ii) interoperability, and, (iii) interconnectivity.¹⁰ At this stage, the current state of

⁴ Ibid., 5.

⁵ Kristalina Georgieva, "The Future of Money: Gearing up for Central Bank Digital Currency," *The International Monetary Fund*, last modified 2022, <https://www.imf.org/en/News/Articles/2022/02/09/sp020922-the-future-of-money-gearing-up-for-central-bank-digital-currency>.

⁶ Kosse and Mattei, *Gaining Momentum – Results of the 2021 BIS Survey on Central Bank Digital Currencies*, 5.

⁷ Bidara Pink, "Penerbitan Mata Uang Bank Sentral Dinilai Penting, Ini Penyebabnya," *Kontan*, last modified 2022, <https://nasional.kontan.co.id/news/penerbitan-mata-uang-bank-sentral-dinilai-penting-ini-penyebabnya>.

⁸ Lida Puspaningtyas, "BI Luncurkan Konsep Rupiah Digital Tahun 2022," *Republika*, last modified 2021, <https://www.republika.co.id/berita/r4mab1457/bi-luncurkan-konsep-rupiah-digital-tahun-2022>.

⁹ Hongyi Chen and Pierre L. Siklos, "Central Bank Digital Currency: A Review and Some Macro-Financial Implications," *Journal of Financial Stability* 60, no. 100985 (2022): 4, <https://www.sciencedirect.com/science/article/abs/pii/S1572308922000146>.

¹⁰ Bank Indonesia, "[LIVE STREAMING] The Launching of TechSprint Central Bank Digital Currency" (Indonesia: Bank Indonesia, 2022), <https://www.youtube.com/watch?v=pMpy-MmKxBM>.

'Rupiah Digital' is still in the explorative phase¹¹ of designing and formulating its adequate legal basis.¹²

Policymakers have been stressing that in conjunction with financial and technological aspects, the implementation of CBDC would also impose legal challenges.¹³ According to IMF, each CBDC design element would carry different legal implications.¹⁴ This means that policymakers should also consider the legal implications in weighing each design element of CBDC ex-ante, and thus, by taking this approach, a more prudent overview will be seen in tailoring the future 'Rupiah Digital' model.

In light of the above, several key legal aspects exist in transitioning to CBDC implementation in Indonesia. *First*, the design elements of CBDC will give different regulatory challenges in Indonesia. *Second*, CBDC exposes cybersecurity risks and may raise looming privacy concerns.¹⁵ *Third*, CBDC implementation requires a new framework of governance by setting forth a consensual legislation arrangement between stakeholders. In this regard, previous research on Indonesian CBDC still does not elaborate on this aspect under the elements of CBDC but focuses more on its economic and technical implications and considerations. Given that laws will likely lag behind the development of novel technologies,¹⁶ this research aims to close the gap between them.

2. Method

This research uses a normative legal research method. Normative legal research explores the laws and regulations, legal principles, and doctrine of the law to address the relevant legal issue on CBDC.¹⁷ Further, this research investigates the privacy and cyber security risks of CBDC

¹¹ Bank for International Settlements, *CBDCs in Emerging Market Economies*, *BIS Papers No. 123*, 2022, 98.

¹² Bidara Pink, "Penguatan Pengaturan Digitalisasi Dalam RUU P2SK, Junda Agung Singgung Soal CBDC," *Kontan*, last modified 2021, <https://nasional.kontan.co.id/news/penguatan-pengaturan-digitalisasi-dalam-ruu-p2sk-juda-agung-singgung-soal-cbdc>.

¹³ Wouter Bossu et al., *Legal Aspects of Central Bank Digital Currency: Central Bank and Monetary Law Considerations*, IMF Working Paper, 2020, 5.

¹⁴ *Ibid.*, 8–13.

¹⁵ World Economic Forum, "Privacy Concerns Loom Large as Governments Respond to Crypto," *World Economic Forum*, last modified 2022, <https://www.weforum.org/agenda/2022/04/privacy-concerns-loom-large-as-governments-respond-to-crypto/>.

¹⁶ Qamar Nurul and Aan Aswari, "Healing or Hurting: Development of Highway Public Transportation Technology," *Jurnal Dinamika Hukum* 18, no. 3 (2018): 319–328, <https://dinamikahukum.fh.unsoed.ac.id/index.php/JDH/article/view/2144>.

¹⁷ Theresia Anita Christiani, "Normative and Empirical Research Methods: Their Usefulness and Relevance in the Study of Law as an Object," *Procedia - Social and Behavioral Sciences* 219 (2016): 202, <https://www.sciencedirect.com/science/article/pii/S1877042816300660>.

implementation, since Indonesia's legal framework for cyber privacy and security is still in its infancy. This research relies on the general principles and law doctrine related to the design elements of CBDC, as well as existing related laws and regulations intertwined with cybersecurity and privacy issue, which mainly refer to Law No. 7 of 2011 on Currency and Law No. 27 of 2022 on Personal Data Protection.

3. Results and Discussion

3.1. CBDC Design Elements

Considering that a fully-fledged CBDC has not been implemented in any jurisdictions, most policymakers are still putting their hands into designing their most suitable CBDC model. However, it is seen that there is a pattern for central banks to design the model under certain elements. To provide a better understanding, each design element will be briefly classified in Table 1.¹⁸

As prescribed in Table 1, it is quite challenging for the central bank to ascertain the most preferred design. Whilst it is possible to simultaneously implement more than one element under a classification (for instance, it is seen that many jurisdictions intend to develop retail and wholesale CBDC), each has a distinct feature and thus renders different legal implications.

Among other elements, 'functionality' is deemed the most important element as it will determine the legality of CBDC in Indonesia, whether it would serve as a currency or merely a payment instrument. Considering that the nature of CBDC per se is only to accommodate non-physical retail and/or wholesale transactions, which have been existing in Indonesia by the presence of private electronic money (e-money) as well as BI-RTGS, and accordingly, it does not necessarily have to be treated as currency as long as it can function for retail and/or wholesale.

3.2. Retail payment CBDC (rCBDC)

rCBDC is a digital form of money, denominated in the national unit of account, and a direct liability of the central bank, which is usable by members of the public¹⁹; in other words, a new form of "digital cash".²⁰ In emerging markets and developing economies, rCBDC is envisaged to address significant efficiency gaps in the domestic payment infrastructure as part of enhancing

¹⁸ PricewaterhouseCoopers, *Central Bank Digital Currency*, 2020, 6.

¹⁹ Bank for International Settlements, *Central Bank Digital Currencies: Foundational Principles and Core Features*, 2020.

²⁰ Ibid.

financial inclusion. Another, the issuance of rCBDC can provide benefits for the retail payment systems; for instance, reducing the cost of managing cash for central banks and enabling fast, cost-effective, and secure payments, resulting in a more efficient payment system.²¹

Albeit many regulators globally have taken the initiative to embark on their rCBDC journey,²² in this writing, we generally distinguish two potential designs of rCBDC under the prevailing laws and regulations, namely (i) 'Rupiah rCBDC', implemented by extending the scope of the form of currency under Law No. 7/2011 and (ii) payment instrument rCBDC, implemented by the determination of rCBDC as payment instrument similar with electronic money. While both designs are feasible to implement in Indonesia, they have different legal implications.

3.3. rCBDC as a New Form of Currency

In principle, rCBDC requires a legal framework that clarifies whether the central bank has the authority to issue rCBDC as well as rCBDC legal status as Rupiah.²³ Article 11 (3) of Law No. 7/2011 stipulates that Bank Indonesia shall be the only institution authorized to conduct the issuance, distribution, and/or revocation and retraction of Rupiah.²⁴ The law essentially designates Rupiah as both currency²⁵ and legal tender. As a legal tender, any domestic transactions for payment, the settlement of other liabilities that must be settled with money, and/or other financial transactions must use Rupiah.²⁶ However, the applicable laws limit Bank Indonesia's authorities to issue certain forms of currency, solely to banknotes and coins, as governed under Article 2 (2) of Law No. 7/2011. In this regard, Law No. 7/2011 has not included the digital form of money issued by the central bank in the definition of currency. Accordingly, implementation of rCBDC is may only achievable by, at least, amending Law No. 7/2011 and, particularly, expanding the definition of currency to include the digital form of money.

By treating rCBDC as currency, rCBDC would be treated as Rupiah, and under the prevailing regulations, the management of Rupiah is governed by BI Regulation No. 21/10/PBI/2019 on Rupiah Money Management (BI Reg 21/2019). BI Reg 21/2019 generally sets

²¹ Bank for International Settlements, *CBDCs in Emerging Market Economies*, 96.

²² PricewaterhouseCoopers, "The Race to Digital Money Is on – PwC's 2022 CBDC Global Index Shows Which Central Banks Are in the Lead," *PricewaterhouseCoopers*, last modified 2022, <https://www.pwc.com/gx/en/newsroom/press-releases/2022/pwc-cbdc-global-index-2022.html>.

²³ Gabriel Soderberg et al., *Behind the Scenes of Central Bank Digital Currency: Emerging Trends, Insights, and Policy Lessons* (Washington DC: International Monetary Fund, 2022), 18.

²⁴ *Law No. 7 of 2011 on Currency*, 2011, Article 2 Paragraph 1.

²⁵ *Ibid.*, Article 1 point 1.

²⁶ *Ibid.*, Article 21 Paragraph 1.

forth the applicable provisions on how Rupiah be issued and circulated in Indonesia. However, the scope of this regulation is very limitative to the Rupiah in physical form. There are key provisions that strictly will not be applicable for the management of rCBDC, or to some extent, may be relevant in the implementation of rCBDC, but not be expressly stated under the regulation and requires interpretation of the regulation. Such concerns will be elaborated under the Table 2. Within the findings in Table 2, the current regulatory framework in the management of Rupiah only covers its physical form. Accordingly, a fully-fledged rCBDC implementation still requires more well-rounded legislation to accommodate the technological aspects of rCBDC.

3.4. rCBDC as a New Payment Instrument

The aforesaid amendment to Law No. 7/2011 may not be required if rCBDC is only determined as a new payment instrument²⁷ by Bank Indonesia. Such a case is achievable as Bank Indonesia has the authority to determine any form of payment instruments which are allowed to be used for the public under Article 15 (2) letter c of law No. 23/1999 on Bank Indonesia (as amended) (Bank Indonesia Law). Within such an approach, rCBDC is not deemed as Rupiah (i.e., classified as a form of currency) and only serves as a 'media' for transactions using Rupiah. As a payment instrument, rCBDC is like other privately issued retail payment systems and closely resembles electronic money (e-money). E-money issuance requires an initial Rupiah deposit of each nominal value of the circulated e-money, meaning that issuer (i.e., Payment System Providers or PSP) may only issue electronic money in a 1:1 ratio with the deposited Rupiah in advance.²⁸

This condition is likely to be adopted for rCBDC, requiring Bank Indonesia to act similarly to PSPs, stressing that (i) the issuance of rCBDC relies on the deposited Rupiah in Bank Indonesia's rCBDC account and (ii) Bank Indonesia is responsible for administering the ownership of rCBDC users.²⁹ Further, the main distinguishing feature of payment instruments rCBDC and e-money is shown on the liability upon a claim of the issued value. As for e-money, a claim is made to the PSP, and such PSP may have liquidity and solvency issues during its business activities. While for rCBDC, claims are made to Bank Indonesia, it is unlikely that Bank Indonesia would face such liquidity and solvency issues in administering rCBDC.

²⁷ Law No. 23 of 1999 on Bank Indonesia, 1999, Elucidation of Article 15(2) letter f.

²⁸ Bank Indonesia, *Bank Indonesia Regulation No. 23/6/PBI/2021 on Payment System Provider*, 2021.

²⁹ *Ibid.*, Article 164 (1) and (2).

3.5. Wholesale payment CBDC (wCBDC) as a New Interbank-Transactions Infrastructure: Comparison with BI-RTGS

Unlike rCBDC, wCBDC is used for interbank transactions for large-value payments between financial instruments.³⁰ Additionally, a present-day version of wCBDC has long existed in the form of commercial bank deposits with the central bank that are typically used for maintaining reserve requirements and making large-value payments (also known as current accounts or bank reserves). Individuals, however, do not have direct access to such a digital form of central bank money, only physical banknotes.³¹ wCBDC is generally used to settle cross-border settlements, improve settlement efficiency, and reduce credit and settlement risk.³²

The leading project in the Index is the combined effort of the Hong Kong Monetary Authority (HKMA) and the Bank of Thailand (BoT) to launch the mBridge project, focused on developing a proof-of-concept prototype to enable real-time, cross-border foreign exchange payments on distributed ledger technology. Also ranked highly is the work of the Monetary Authority of Singapore (MAS), with two new CBDC projects, as it continues the development of a wholesale CBDC for cross-currency payments.³³ The primary purpose of these experiments was to promote the central banks' understanding of the DLT systems and their applicability in these existing wholesale financial markets, such as real-time gross settlement systems, delivery versus payment systems, and cross-border interbank payments and settlements systems.³⁴

In Indonesia, interbank transfers perform under the Bank Indonesia-RTGS (BI-RTGS) System that is governed under BI Regulation No. 17/18/PBI/2015 regarding the Implementation of Transactions, Administration of Securities and Instant Fund Settlement as lastly amended by BI Regulation No. 23/14/PBI/2021. BI-RTGS System is defined as an infrastructure used as a means of electronic fund transfer in which settlement is conducted on a transaction-by-transaction basis in real-time.³⁵ Parties that may become BI-RTGS System Participants are Bank Indonesia, Bank, the clearing operator and/or settlement operator, and other institutions approved by the operator. In the operation of the BI-RTGS System, participants are required to do several obligations further

³⁰ Bank for International Settlements, *Central Bank Digital Currencies*, 2018.

³¹ Bank of Thailand, *The Way Forward for Retail Central Bank Digital Currency in Thailand*, 2021, 10.

³² Deloitte, *Central Bank Digital Currencies: Building Block of the Future of Value Transfer*, 2022, 9.

³³ PricewaterhouseCoopers, "The Race to Digital Money Is on – PwC's 2022 CBDC Global Index Shows Which Central Banks Are in the Lead."

³⁴ Marlene Amstad et al., eds., *Central Bank Digital Currency and Fintech in Asia* (Tokyo: Asian Development Bank Institute, 2019), 13.

³⁵ Bank Indonesia, *Bank Indonesia Regulation No. 17/18/PBI/2015 Regarding Implementation of Transactions, Administration of Securities and Instant Fund Settlement*, 2015, Article 1 Number 9.

regulated in the Bank Indonesia Circular Letter, such as to maintain smoothness and security and to be responsible for the validity of the transactions and/or settlement instructions and information.

Additionally, fund transfer services made through the BI-RTGS System include single credit, multiple credit, and single debit. As a BI-RTGS System participant, Bank Indonesia can use all those transfer services, while other participants are only allowed to use multiple and single credits. Fund transfers that can be made in the single and multiple credits include the transfer of funds from BI-RTGS System participants to other BI-RTGS System participants, transfer of funds from BI-RTGS System participants to other BI-RTGS System Participant customers, and on the contrary and transfer of funds from BI-RTGS System participant customers to other BI-RTGS System participant customers.³⁶ On the other hand, fund transfers that can be made in the single debit comprise settlement of obligations of the BI-RTGS System Participant to Bank Indonesia, correction of transactions sent by Bank Indonesia, and implementation of fund settlement on transactions and settlement of other obligations as stipulated in the provisions of Bank Indonesia.

Regardless of the design, drafting BI Regulation that specifically governs wCBDC has become the main agenda in preparation for the implementation of wCBDC. On the one hand, the implementation of the BI-RTGS System is based on Law No. 3/11 regarding Fund Transfer (Law No. 3/11). This section will review (1) the legality aspects of wCBDC based on prevailing regulations; and (2) a reflection on the BI-RTGS System arrangement to be adapted in the wCBDC system operation by Bank Indonesia.

Although under Law No. 3/2011 defines 'fund' as money that is stored in the sender's account at the beneficiary operator, money stored in the operator's account beneficiary at another beneficiary provider, overdraft facility or credit facility given by the operator to the sender, wCBDC is only related to the settlement of interbank transfers and wholesale transactions in central bank reserves. Therefore, an amendment of Law No. 7/2011 to extend the definition of "currency" to "digital currency" is not required.

The processing of interbank transactions through the BI-RTGS system is under BI Regulation No. 17/18/PBI/2015 regarding the Implementation of Transactions, Administration of Securities and Instant Fund Settlement as lastly amended by Law No. 23/14/PBI/2021 is based on the main principles of processing fund transfers as stipulated in the Funds Transfer Law. First, the sending BI-RTGS System Participant requires the sending customer to fill in the fund transfer order completely and correctly (containing at least information regarding the identity of the

³⁶ Ibid., Article 42.

original sender, the identity of the recipient, the identity of the organizer of the final beneficiary, the amount of funds transferred, the date of the fund transfer order). Subsequently, the sending BI-RTGS System Participant is required to send funds settlement instructions on the same date as the date the funds transfer is received from the sending customer. After that, the funds set element instruction must be sent by the sending BI-RTGS system participant no later than an hour after the BI-RTGS Participant accepts the fund transfer order from the customer. If the sending BI-RTGS System Participant does not send instructions, the sending BI-RTGS System Participant is required to pay for services, interest, or compensation to the sending customer. The fund settlement is carried out using sufficient funds in the Fund Settlement Account.

Based on the above basis, the acceptance (activities carried out by the sending BI-RTGS System Participant showing approval to carry out or fulfill the received fund transfer order) is required. In addition, referring to the Funds Transfer Law, the Originating Provider may accept as long as the originating organizer has authenticated (a procedure carried out by the Beneficiary Provider to ensure that the issuance of a funds transfer order, amendment, or cancellation is actually carried out by a party in funds transfer order is intended as the authorized sender). In the context of DLT-based wCBDC, the authentication and acceptance process could be enhanced as it has the capabilities to eliminate the need for intermediaries to validate or authenticate financial transactions.³⁷

Based on the above comparisons, given that wCBDC and BI-RTGS bore a close resemblance in its function, further legislation on wCBDC may adopt the provisions under the relevant laws and regulations and BI-RTGS. Underlining that its implementation shall fulfill the requirement and Fund Transfer Law to serve as the legal basis for treating wCBDC transactions.

3.6. Key Cybersecurity and Privacy Risks of CBDC

The increasing dependency on financial systems in technologies raises the risks of cybersecurity and privacy concerns. Along the way, traffic of Personal Data or Personally Identifiable Information³⁸ (“PII”) exchange within advanced technologies (e.g., big data, blockchain) utilization by financial institutions may expose new cybersecurity concerns and gradually affect people’s trust.

³⁷ Bank of Thailand, *The Way Forward for Retail Central Bank Digital Currency in Thailand*, 8.

³⁸ Paul A. Grassi, Michael E. Garcia, and James L. Fenton, *Digital Identity Guidelines*, NIST Special Publication 800-63-3, 2020, <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-63-3.pdf>; *Law No. 27 of 2022 Regarding Personal Data Protection*, 2022.

In the context of CBDC and DLT, centralization of CBDC will store public financial data in a single database, increasing the potential damage in the event of system failure and likely to incur damage public's trust in the government. Another is the transparency nature in the case of DLT-based CBDC implementation. With more information shared in the network, this would render less privacy for PII subjects.³⁹ Aside from technological aspects, there is a privacy risk or even organizational risk if the central bank (or any authorities having control in administering the Indonesian CBDC network) manipulates public CBDCs for its own agenda.⁴⁰ Policymakers shall consider whether its jurisdiction already has the adequate regulatory framework to prevent exposure to such risks in utilizing novel technologies.

As previously elaborated, CBDC implementation can significantly centralize PII in a single ledger (or other similar databases) and aggregate transaction data from all citizens, which is expected to be used by the mass-public in the context of retail CBDC. Alongside, CBDC may also possess similar cybersecurity risks to existing financial systems. Without an adequate regulatory framework and security protocols, CBDC greatly exposes to cybersecurity attacks. In response to such threat, several studies have been made in recognizing novel cybersecurity risks within the technological architecture associated with CBDC, namely: 1) centralized database vulnerability⁴¹; 2) credentials theft⁴²/loss⁴³; and 3) organizational risk.⁴⁴

3.7. Overview of Indonesian Cybersecurity Laws and Regulations in Anticipating CBDC Cybersecurity and Privacy Risks

In Indonesia, Law No. 11 of 2008 on Electronic Information and Transactions (as amended) (EIT Law), including its implementing regulations, has generally covered cybersecurity provisions, which are expected to promote and accommodate reliance on electronic systems while maintaining the principle of neutral technology. The EIT Law requires all electronic systems

³⁹ Vinden Wylde et al., "Cybersecurity, Data Privacy and Blockchain: A Review," *SN Computer Science* 3 (2022): 2, <https://link.springer.com/article/10.1007/s42979-022-01020-4>.

⁴⁰ Maulana Ihsan Fairi, Zainal Abidin Sahabuddin, and Jupriyanto Jupriyanto, "Analisis Penerapan Central Bank Digital Currency Dalam Perspektif Keamanan Nasional," *Jurnal Ekonomi Pertahanan* 7, no. 2 (2021): 233, <https://jurnalprodi.idu.ac.id/index.php/EP/article/view/882>.

⁴¹ Erin English, Amy Davine Kim, and Michael Nonaka, *Advancing Blockchain Cybersecurity: Technical and Policy Considerations for the Financial Services Industry*, 2018, 10.

⁴² World Economic Forum, "4 Key Cybersecurity Threats to New Central Bank Digital Currencies," *World Economic Forum*, last modified 2021, <https://www.weforum.org/agenda/2021/11/4-key-threats-central-bank-digital-currencies/>.

⁴³ Bank for International Settlements, *Central Bank Digital Currencies*, 4.

⁴⁴ Giulia Fanti et al., *Missing Key: The Challenge of Cybersecurity and Central Bank Digital Currency Atlantic Council*, 2022, 7.

operators (ESOs) (including public ESOs) to provide systems in a reliable and secure manner and take responsibility for their proper operation. Security aspects cover the physical and non-physical protection of electronic systems, including the security of hardware and software, based on Government Regulation No 71 of 2019 on the Organisation of Electronic Systems and Transactions (GR 71/2019). Further, this regulation requires ESOs to maintain and implement security procedures, facilities, and systems to prevent and mitigate security threats and attacks.

Further, Pursuant to the Minister of Communications and Informatics (MOCI) Regulation No. 4 of 2016 on Information Security Management Systems, the compliance requirement for information security management standards depends on the risk category of the electronic systems concerned. This regulation classifies the risk categories as follows: a) Strategic: electronic systems having a severe effect on public interest, public services, smoothness of state organization, or national defense and security; b) High: electronic systems possessing limited impact on the interest of certain sectors and/or areas; and, c) Low: any electronic systems which are not classified as strategic or high.

Electronic systems categorized as strategic and high (in this case, it is seen that CBDC would be considered as such) are required to implement ISO/IEC 27001 standards on information security, while electronic systems categorized as low must implement guidelines for an Information Security Index administered by the National Cyber and Crypto Agency (*Badan Siber dan Sandi Negara* or BSSN).

As shown above, Indonesia has already set its protection standard for national cybersecurity interests. However, the state of Indonesian cybersecurity laws and regulations is still far behind in providing a holistic cybersecurity framework, particularly in terms of safeguarding its vital infrastructure. Furthermore, although the establishment of BSSN is expected to offer a dedicated agency to safeguard Indonesian cybersecurity, recent notorious cyberattacks on the national centralized database of BPJS, resulting in losses of approximately IDR 600 trillion, shows the urgency for the Government of Indonesia (GoI) to step up in strengthening security in Indonesian vital infrastructure. A similar scenario undisputedly must be avoided at all costs in implementing prudent Rupiah Digital.

Apart from laws and regulations related to cybersecurity, the new Law No. 27 of 2022 on Personal Data Protection Law (PDP Law) also has an essential role as a legal basis for PII processing, especially for the future implementation of CBDC. According to Global Cybersecurity

Index, the existence of data protection regulations is one of the essential indicators for legal pillar.⁴⁵ Inspired by the General Data Protection Regulation (GDPR) of the European Union, the Indonesian PDP Law provides general principles in processing PII, including lawfulness and transparency, purpose limitation, accuracy, security safeguard, storage limitation, integrity and confidentiality, and accountability.⁴⁶ The PDP Law also provides numerous provisions related to data controllers' and processors' obligations and sanctions for those violating the PDP Law.⁴⁷ Furthermore, the implementation of CBDC must also adhere to data protection by design and by default approach.⁴⁸ The concept has been implicitly regulated in the PDP Law, for instance, by using a security system for the processed PII and/or in processing PII using an electronic system in a reliable, secure, and responsible manner.⁴⁹

Reflecting the aforementioned potential cybersecurity and privacy risks, policymakers must formulate laws and regulations in preparing for CBDC implementation. Regardless of the chosen design, CBDC requires a comprehensive set of laws addressing cybersecurity risk, stressing that CBDC cyberattacks disrupt not only the system, but also national financial system stability. In facing such a threat, recent findings show that it is advisable for policymakers to, where possible, use existing risk management frameworks, and if the enactment of the new legislation is appropriate, it shall be technology neutral, meaning that future laws should be applicable to a wide array of technology (as opposed to regulating specific technological product).⁵⁰ The existence of a comprehensive Cybersecurity Act will further strengthen the legal basis for safeguarding Indonesia's digital space. Hence, it will significantly increase the public trust in the future implementation of CBDC.⁵¹

⁴⁵ International Telecommunication Union, *Global Cybersecurity Index 2020* (Switzerland: International Telecommunication Union, 2021), vii, https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-GCI.01-2021-PDF-E.pdf.

⁴⁶ *Law No. 27 of 2022 Regarding Personal Data Protection*, Article 16; The European Parliament and of The Council, *Regulation (EU) 2016/679 (General Data Protection Principles)* (European Union, 2016), Article 5.

⁴⁷ *Law No. 27 of 2022 Regarding Personal Data Protection*, Chapter VI, Chapter VIII, and Chapter XIV.

⁴⁸ Lee A. Bygrave, "Data Protection by Design and by Default: Deciphering the EU's Legislative Requirements," *Oslo Law Review* 4, no. 2 (2017): 105–120, <https://www.idunn.no/doi/full/10.18261/issn.2387-3299-2017-02-03>.

⁴⁹ *Law No. 27 of 2022 Regarding Personal Data Protection*, Article 39.

⁵⁰ Fanti et al., *Missing Key: The Challenge of Cybersecurity and Central Bank Digital Currency Atlantic Council*.

⁵¹ Deloitte Consumer Insights, *Deloitte Consumer Insights Adapting to the New Normal in Indonesia*, 2021, 34, <https://www2.deloitte.com/content/dam/Deloitte/sg/Documents/consumer-business/sea-cb-deloitte-consumer-insights-id-2021-update.pdf>.

Table 1.
Classification of CBDC Design Elements

Elements	Classifications		
Functionality	Retail payment (general purpose)		Wholesale payment
	Intended for use by the general public for storing value and making payments.	Similar to today's central bank reserves and settlement accounts that intended for the settlement of large interbank payments	
Distribution model	One-tier (direct issuance)	Two-tier (indirect issuance)	Hybrid
	The central bank keeps track of all financial statements and retail transactions and issues the CBDC directly to end-users. Users may directly claim their CBDC to central bank (similar to banknotes).	Central bank issues CBDC to commercial banks. Wholesale payments are managed by central banks while commercial banks manage retail payments. (similar to Indonesian e-money distribution).	Alike the two-tiered model, the role of commercial banks is replaced by financial intermediaries (inclusive of non-bank entities).
Underlying technology	Legacy technology (centralized infrastructure)		Distributed ledger technology (DLT) (decentralized infrastructure)
	Ledger is administered by the government through the central bank and/or any other relevant government authorities.		Ledger is administered by different nodes by using a 'permissioned' blockchain technology. In other words, it may only be accessed and managed by selected network participants. This is different from the widely used 'permissionless' blockchain as found in cryptocurrencies (e.g., Bitcoin) which allows public participation and full transaction transparency. ⁵²
Accessibility	Account-based		Token-based (cash-like)
	Ownership and transactions record require updating the user's account balances. ⁵³ Within transaction, this model settle users' account to conduct a transaction, as similar with the existing bank accounts transfer mechanism.		Transactions record is updated for who holds a particular CBDC representation. ⁵⁴ This model use public-key cryptography infrastructure to conduct transaction. The possession of CBDC is evidenced by users' digital signatures without requiring any disclosure of their identity. As similar to cash-like money, it do not require to settling down user's account balance.
Remuneration	Interest bearing		Non-interest bearing
	A remunerated CBDC could provide central banks with the convenience of CBDC for making transactions: a large part of the stock of deposits with new instruments that could lead to faster and hold with commercial banks are what could be the fuller transmission of monetary policy to deposit rates.		An unremunerated CBDC will have less effect on the disintermediation of the banking system, as households and businesses will have less incentive to shift their value from bank deposits to the CBDC.

⁵² Bank for International Settlements, *Central Bank Digital Currencies for Cross-Border Payments: Report to the G20*, 2021, 5.

⁵³ Ibid., 4.

⁵⁴ Ibid.

Table 2.
Scope of BI Reg 21/2019 in Management of rCBDC

Aspects	Management of Rupiah under BI Reg 21/2019	Application to rCBDC
Planning	Bank Indonesia plans the amount and type of Rupiah denomination to be printed. Planning of type Rupiah denomination includes design planning (i.e., certain characteristics, signs, sizes and safety element) (Article 10 <i>jo</i> . Article 7).	Unlike designing physical Rupiah (banknotes and coins), rCBDC is fully digital and this provision would not strictly suitable for designing rCBDC as it holds different design aspect which revolving the technological aspect of rCBDC.
Printing	BI performs Rupiah Currency Printing in by appointing a state-owned enterprise as the executor of the Rupiah Currency Printing (Article 14). Such state-owned enterprises must maintain the quality, safety, and price compete in carrying out printing of Rupiah (Article 15).	If using DLT, rCBDC is 'printed' through minting process. This is done in the blockchain by creating new units of rCBDC, authenticating data, and thus creating new 'block'.
Issuance	BI is the only institution that authorized to issue Rupiah currency, and it shall determine the date, month and year the entry into force of Rupiah currency issued as legal tender in the territory of the Republic of Indonesia (Article 18).	In DLT-based CBDC, BI has the full authority in managing the rCBDC network, meaning that BI will have the role of 'genesis developer' as the sole party entitled to alter the rCBDC code without requiring any validation from other validating nodes. Moreover, such arrangement will resemble a model of centralized DLT network.
Distribution	BI is the only institution that authorized to conduct distribution of Rupiah. (Article 20).	This provision serves as the basis for distribution of rCBDC in the one-tier model which fully done by BI directly distribute the rCBDC to the users. T6deGiven that the digital nature of rCBDC, commercial bank and technology companies would have a role in the distribution of Rupiah. The current laws and regulations still have not an adequate framework to accommodate such arrangement.
Revoking and withdrawal	BI stipulates that the Rupiah is no longer as legal tender in the Territory of the Republic of Indonesia by revoking and withdraw Rupiah from circulation (Article 56).	Under Article 56 (4) and (7), a replacement of revoked and withdrawn Rupiah may only be done for Rupiah having defect conditions. As for rCBDC, such criteria is impossible for BI to do a replacement of rCBDC, given rCBDC is built over a digital network and if a strict interpretation of the provisions is used, a digital Rupiah may not fulfill such criteria.
Destroyment	BI shall destroy rupiah currency against money that is not fit for circulation, rupiah currency that is still fit for circulation which with certain considerations no longer has economic benefits, and/or is less attractive to the public, and/or rupiah currency that is no longer valid (Art.57).	Given the broad interpretation of Article 57 (1) letter b, in DLT-based rCBDC implementation, this provision may serve as the basis for BI to 'burn' the circulated rCBDC and thus allowing BI to control the national circulation.

4. Conclusion

According to the research findings, Indonesia's regulatory framework is still far from being capable of accommodating CBDC implementation. However, policymakers may adopt the

principles and standards of existing regulation in shaping future legislation on CBDC. As for rCBDC, the laws allow BI to designate rCBDC as a payment instrument rather than a currency. For wCBDC, its function is similar to BI-RTGS, and accordingly, save for the technological aspect of wCBDC, the current prevailing provisions on fund transfer may serve as the reference for BI in formulating wCBDC legal basis. Furthermore, there are privacy and cybersecurity risks that are not mitigated by the current regulatory framework. In terms of cybersecurity, there is an urgent need for the enactment of the draft cybersecurity bill, given the existing cybersecurity provisions still lack adequate protection for CBDC.

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