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Digital Rupiah as Indonesia's CBDC: Challenges, Opportunities, and Design of Project Garuda

Wildha Angsana Putri [1]

[1] Universitas Terbuka, Purwokerto, Indonesia

Abstract

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The global digital transformation of financial systems has encouraged many countries to develop Central Bank Digital Currencies (CBDCs) in response to the cashless society trend, cryptocurrencies, and the demand for payment efficiency. In Indonesia, the rise of digital transactions, the widespread use of e-wallets, and digital banking highlight the urgency of establishing the Digital Rupiah as an official instrument. This study employs a qualitative approach through library research to analyze the urgency, design, and implications of the Digital Rupiah under Bank Indonesia's Garuda Project. Findings reveal that the Digital Rupiah could strengthen monetary sovereignty, enhance financial inclusion, and support national financial market integration. Nonetheless, significant challenges remain, including cybersecurity risks, infrastructure readiness, public literacy, and potential impacts on banking stability. This study emphasizes that the success of the Digital Rupiah requires synergy across technology, regulation, and public education. With careful planning, the Digital Rupiah could serve as a vital pillar in maintaining the relevance of Rupiah as a symbol and legal tender in the digital era.

*Corresponding author:
(Wildha Angsana Putri)

1. Introduction

Digital transformation in the global economic and financial sectors has significantly changed the landscape of payment systems. The development of information and communication technology has encouraged the birth of new trends such as cashless society, mobile-based payments, cryptocurrencies, stablecoins, and Central Bank Digital Currency (CBDC). Several countries have taken strategic steps in responding to this phenomenon, for example China with e-CNY, Sweden with e-krona, and the Bahamas with Sand Dollar. The presence of CBDCs in these countries shows that the digitization of money is not just a technological innovation, but also a monetary policy instrument that has a far-reaching impact on financial system stability and monetary sovereignty (Pocher & Veneris, 2022). In the national context, Indonesia also faces similar dynamics. High internet penetration, the growth of smartphone users, and the massive use of digital banking services and e-wallets have changed people's preferences for financial transactions.

The public is now increasingly demanding fast, easy, cheap, safe, and reliable services. This phenomenon raises urgency for Bank Indonesia to ensure that the Rupiah remains relevant as the only legal tender amid the rampant use of non-Rupiah digital instruments (Handayani et al., 2021). The urgency of developing the Digital Rupiah as a form of CBDC becomes even more evident when considering the risks that arise if Indonesia does not adapt immediately. The dominance of foreign digital currencies can weaken national monetary sovereignty and pose a risk to financial stability. In addition, the absence of a domestic CBDC has the potential to hinder financial market integration and reduce the efficiency of the national payment

system. On the contrary, the existence of the Digital Rupiah is believed to strengthen financial infrastructure by increasing transaction efficiency, supporting the digital economy, and maintaining the position of the Rupiah as a legal tender (Náñez Alonso et al., 2021).

In response to these developments, Bank Indonesia launched the Garuda Project as a strategic initiative to design and implement the Digital Rupiah. This project is carried out through several stages, ranging from public consultation, technology experimentation through sandboxes, proof of concept, and prototyping, to comprehensive policy reviews. In the white paper issued, Bank Indonesia explained that the Digital Rupiah will be developed in two forms: wholesale (w-Digital Rupiah) for transactions between financial institutions and retail (r-Digital Rupiah) for the wider community (Hakim das Neves, 2020). From a technological aspect, Rupiah Digital has the potential to utilize distributed ledger technology (DLT) or blockchain. This technology offers a number of advantages such as decentralization, consensus, immutability, the use of smart contracts, and cryptographic-based security. Bank Indonesia emphasizes that the design of the Digital Rupiah must meet the principles of fast, secure, resilient, interoperable, extensible, and flexible to face future technological developments (Fitriandi, 2021).

However, the development of CBDCs cannot be separated from opportunities and challenges. Opportunities that can be leveraged include increased financial inclusion, payment system efficiency, and financial market integration (Arner et al., 2020). On the other hand, a number of challenges must be anticipated, including the risk of cyber attacks, the readiness of technological infrastructure,

public literacy, and their potential impact on the effectiveness of monetary policy and financial stability. Therefore, a comprehensive study is needed on the design, urgency, and implications of the Digital Rupiah in Indonesia. This research is here to provide a comprehensive overview of the development of the Digital Rupiah through the Garuda Project. In addition, this research aims to fill the gap in the literature that is still limited, especially in associating aspects of technology, policy, and user behavior in an integrative manner. Thus, this article is expected to make an academic and practical contribution in understanding the prospects as well as challenges of CBDC implementation in Indonesia.

2. Literature Review

2.1. Global Trends in Central Bank Digital Currency (CBDC)

The development of CBDCs globally shows how central banks are adapting to the digitalization of the financial system. Countries such as China with the e-CNY, Sweden with the e-krona, and the Bahamas with the Sand Dollar, are pioneers in the implementation of central bank digital currencies. The main goals of CBDC development in various countries are to improve the efficiency of payment systems, strengthen financial inclusion, and maintain monetary stability amid the rapid development of cryptocurrencies and stablecoins. In line with this, Bairizki (2021) explained that the existence of a country's central bank digital currency can change all aspects of the monetary system and facilitate the implementation of monetary policy that is more systematic and transparent.

In addition, CBDCs also play an important role in ensuring that domestic currency sovereignty is maintained in the era of digital globalization (Náñez Alonso et al., 2021). The presence of CBDCs in various countries is not only related to technical aspects, but also economic politics. For example, China uses the e-CNY to expand its currency's influence in international trade, while Sweden emphasizes the security and sustainability of the domestic payment system. Thus, this global study provides valuable lessons for Indonesia in designing the Digital Rupiah to not only function as a transaction instrument, but also as a strategic instrument to maintain monetary sovereignty.

2.2. The Urgency and Implications of the Digital Rupiah in Indonesia

In Indonesia, the urgency of developing the Digital Rupiah is getting stronger with the increasing internet penetration, the widespread use of digital banking, and the high number of transactions through e-wallets. Without the development of CBDCs, there is a risk of the dominance of foreign digital currencies that could weaken national monetary sovereignty. Additionally, the absence of a domestic CBDC can reduce the efficiency of the payment system as well as increase its vulnerability to external interference. The Digital Rupiah is seen as a solution to ensure that the Rupiah remains the only legitimate and relevant means of payment in the digital economy (Alam et al., 2022).

The benefits of the implementation of the Digital Rupiah include transaction efficiency, expanded access to finance, and increased integration of the domestic financial market. The creation of the digital rupiah is also part of the digitalization process of the Indonesian economy that is integrated with each other. And it can

support the country's financial ecosystem in the future, becoming a new solution for cashless transactions in the covid pandemic crisis since 2020 (Paul, 2022). With the right design, the Digital Rupiah can also strengthen the resilience of the national payment system and minimize risks related to the use of non-Rupiah digital assets. Therefore, the urgency of developing the Digital Rupiah is not only technical, but also strategic in supporting national economic sovereignty.

2.3. Technology, Regulation, and Implementation Challenges

The technological aspect is a crucial factor in the development of the Digital Rupiah. Distributed Ledger Technology (DLT) such as blockchain is believed to provide essential features such as transparency, immutability, and cryptographic-based security. In addition, the use of smart contracts can increase efficiency and expand the use cases of Digital Rupiah in various economic sectors. Block Chain creates a decentralized and tamper-proof system for recording transactions. In a property transaction scenario, the blockchain creates a ledger, one each for the buyer and the seller. All transactions must be approved by both parties and automatically updated on both ledgers in real-time (Paul, 2022).

However, the application of this technology must be balanced with the readiness of national infrastructure and the improvement of people's digital literacy. In addition to technology, regulation is also the main pillar. Legal arrangements are needed to ensure the validity of the Digital Rupiah as a legal tender and protect users' personal data from potential cyber risks. Without a strong regulatory framework, the implementation of CBDCs has the potential to cause legal and public trust issues. Therefore, the development of the Digital Rupiah requires synergy between aspects

of technology, regulation, and monetary policy to ensure the sustainability and security of the digital financial system in Indonesia.

3. Methods

This study uses a qualitative approach with an emphasis on descriptive analysis. The selection of the qualitative method is based on the characteristics of the problem studied, namely the urgency, design, and implications of the Digital Rupiah in the context of the Indonesian financial system. These problems are complex and multidimensional, involving aspects of technology, regulation, monetary policy, and user behavior. Therefore, qualitative methods are considered the most appropriate to explore a deep and thorough understanding of this emerging phenomenon. The type of research used is library research. This approach was chosen because the research relies more on secondary data obtained from various written sources, such as books, scientific journal articles, research reports, Bank Indonesia white papers, and official publications of international institutions related to CBDC. The data is critically analyzed to find patterns, relationships, and relevant implications for the development of the Digital Rupiah through the Garuda Project.

The research process is carried out through several stages. First, the data collection stage, which is the researcher identifying, accessing, and collecting literature related to the research topic. The selected literature is relevant, up-to-date, and highly credible, particularly publications in the last five years that discuss CBDC and the digitalization of the financial system. Second, the data processing stage, where all information collected is classified based on themes, such as the global

context of CBDC, the urgency of the Digital Rupiah, technological aspects, regulations, as well as implementation opportunities and challenges.

The third stage is data analysis, where the researcher examines each literature in depth to find the relationship between concepts and interpret the theoretical and practical implications of the findings. This analysis is carried out with an analytical descriptive approach, which describes the facts found in the literature while providing a critical interpretation of these facts. In this way, the research can produce a comprehensive understanding of the position and prospects of the Digital Rupiah in the Indonesian financial ecosystem. The last stage is the drawing of conclusions, which is summarizing the main findings obtained from the literature analysis to answer the research questions. This conclusion not only serves as a summary, but also as a basis for providing theoretical and practical recommendations for relevant stakeholders, especially Bank Indonesia as the issuing authority of the Digital Rupiah. By using qualitative methods based on literature research, this research is expected to make an in-depth academic contribution and enrich the discourse on the transformation of the digital financial system in Indonesia.

4. Results

The development of global financial digitalization has brought major changes to the way people conduct transactions and manage finances. The study found that digital transformation in the financial system is prompting central banks in various countries to consider issuing Central Bank Digital Currencies (CBDCs). Global trends show that CBDCs are not only positioned as a payment instrument, but also

as a means of maintaining monetary stability and supporting financial inclusion. For example, the implementation of e-CNY in China and e-krona in Sweden proves that CBDCs can be a strategic instrument to strengthen the role of domestic currencies in the face of the dominance of cryptocurrencies and stablecoins (Pocher & Veneris, 2022).

The results of the literature review show that Indonesia faces the same challenges. The high internet penetration and the increasing adoption of digital banking and e-wallets have made people more accustomed to non-cash transactions. This condition is driving a change in consumer preferences for fast, cheap, secure, and accessible financial services. Central Bank Digital Currency (CBDC) emerged as a prospective solution to answer these challenges. CBDC is a new form of central bank money that is also a central bank's obligation and has the same denomination as the official currency and can be used as a medium of exchange, unit of calculation, and store of value. The development and adoption of the digital ecosystem will be more optimal if supported by a currency that runs natively in the digital ecosystem (Paul, 2022).

However, this phenomenon also presents a risk if the dominant digital payment instrument does not come from the Rupiah, but foreign currencies or crypto assets. This can weaken monetary sovereignty and create dependence on the global financial system. Therefore, the development of the Digital Rupiah is seen as a strategic step to maintain the existence of the Rupiah in the digital era (Handayani et al., 2021). Bank Indonesia responded to this need by launching the Garuda Project, a strategic initiative focused on the exploration, design and implementation

of the Digital Rupiah. Based on the published white paper, the Garuda Project is implemented through several stages which include public consultation, technology experimentation, sandbox testing, proof of concept, and prototyping. The project also involves a policy review to ensure that the design of the Digital Rupiah is in accordance with national needs as well as international standards. One of the important aspects that is emphasized is the differentiation of the use of the Digital Rupiah, namely wholesale (w-Digital Rupiah) which is used limited in the financial and retail markets (r-Digital Rupiah) which is used by the wider community (Hakim das Neves, 2020).

From a technology perspective, the results of the study show that Distributed Ledger Technology (DLT) such as blockchain has great potential to support the Digital Rupiah infrastructure. DLT allows transactions to run transparently, securely, and immutablely. In addition, the smart contract feature allows transaction automation that can increase efficiency while opening up innovation opportunities in the digital financial sector. The design principles of the Digital Rupiah formulated by Bank Indonesia emphasize speed, security, resilience, interoperability, flexibility, and extensibility. These principles are needed so that the Digital Rupiah is able to adapt to technological developments while supporting integration with the global financial system (Fitriandi, 2021).

However, the results of the literature review also highlight a number of challenges that cannot be ignored. First, cyber risk is one of the most critical issues in the implementation of CBDCs. Digital Rupiah based on digital technology will be vulnerable to cyber attacks, data theft, and potential system abuse. Therefore,

cryptographic security and personal data protection are aspects that must be seriously considered in the design of the Digital Rupiah (Munajat, 2022). Second, the readiness of technological infrastructure in Indonesia is still uneven, especially in remote areas. This inequality can cause access gaps in the use of Digital Rupiah. In addition to the technological factor, regulation also plays an important role. The study found that there are still gaps in the legal framework governing CBDCs in Indonesia. Some legal experts emphasized the need for a clear legal basis to ensure the validity of the Digital Rupiah as a legal tender and to provide legal certainty to the public. Without adequate regulation, public trust in the Digital Rupiah can be disrupted, thus hindering widespread adoption (Zams et al., 2020).

Furthermore, the results of the study also show that the Digital Rupiah has great potential to expand financial inclusion in Indonesia. By utilizing digital infrastructure, Digital Rupiah can reach community groups that previously did not have access to banking services. This is in line with the government's vision to accelerate national financial inclusion. CBDCs can also strengthen the integration of domestic financial markets, improve cross-border payment efficiency, and reduce transaction costs. Thus, the Digital Rupiah is not only a payment instrument, but also a means to strengthen the national economic structure and increase Indonesia's competitiveness in the global economy (Sugiarto & Disemadi, 2020).

However, the adoption of Digital Rupiah is also influenced by user behavior factors. Studies show that the readiness of the Indonesian people for the Digital Rupiah is still diverse. Most people are familiar with e-wallets and digital payments, but there are still concerns about data security and privacy. The level of digital

literacy also plays an important role in determining how quickly the Digital Rupiah can be widely accepted. Therefore, in addition to technology and regulatory development, public education programs need to be carried out intensively to increase public trust and understanding of the Digital Rupiah (Alam et al., 2022).

In addition, the results of the study also found that CBDCs can have implications for monetary policy. By issuing the Digital Rupiah, Bank Indonesia can have a new instrument in regulating the money supply and interest rates. However, there is a risk that CBDCs could affect the role of commercial banks in financial intermediation. If people prefer to save money in the form of Digital Rupiah rather than in banks, then this can reduce banking liquidity. Therefore, the design of the Digital Rupiah must consider the balance between the interests of monetary stability and the intermediation function of banking (Kuncoro, 2021). The literature study also highlights the aspect of personal data protection in Digital Rupiah transactions. With the basis of digital technology, every transaction has the potential to leave a trail of data that can be misused.

Therefore, regulation regarding the protection of personal data should be a top priority. Clear and firm regulations will help create public trust and protect the public from the potential risks of cybercrime (Dhianty, 2022). The results of this study confirm that the development of the Digital Rupiah is a necessity for Indonesia in the midst of the global trend of financial digitalization. The Garuda project initiated by Bank Indonesia shows its seriousness in preparing the necessary infrastructure, regulations, and technology design. However, the success of the implementation of the Digital Rupiah is highly dependent on the synergy between

aspects of technology, regulation, and public education. In addition, the participation of various stakeholders, both from the public and private sectors, is needed to ensure that the Digital Rupiah can truly provide benefits for financial system stability, financial inclusion, and Indonesia's monetary sovereignty.

5. Discussion

The results of the study show that the development of the Digital Rupiah through the Garuda Project is a strategic step that cannot be postponed. From a global perspective, CBDCs have proven to be able to answer the challenges of financial digitalization while strengthening monetary sovereignty. However, a more in-depth discussion is needed to understand how Indonesia's unique conditions affect the design and implementation of the Digital Rupiah. Factors such as digital infrastructure, public literacy, and regulatory readiness are variables that greatly determine the success of adoption. In this case, Indonesia needs to learn from the experiences of other countries, but still adapt it to domestic needs so that the Digital Rupiah is truly effective and inclusive.

One of the main challenges that has emerged is the risk to the stability of the financial system. The widely implemented Digital Rupiah has the potential to change the function of banking intermediation, as people may prefer to store funds in the form of CBDCs rather than in commercial banks. This can reduce the level of banking liquidity and have an impact on banks' ability to distribute credit. Therefore, the design of the Digital Rupiah must take into account the balance between monetary interests and the sustainability of national banking. Certain ownership

restriction mechanisms or incentives for the use of Digital Rupiah can be considered as a mitigation strategy (Kuncoro, 2021).

In addition, the discussion also highlighted the importance of personal data protection and cybersecurity aspects. CBDCs based on digital technology are vulnerable to the threat of cyberattacks that have the potential to disrupt the stability of the national payment system. Personal data protection must be used as the main pillar so that people feel safe in using the Digital Rupiah. Without security and privacy guarantees, public trust will be difficult to build, which can ultimately hinder widespread adoption. Therefore, the synergy between strict regulations, effective supervision, and cutting-edge security technology is a determining factor in the implementation of the Digital Rupiah in Indonesia (Munajat, 2022).

This discussion emphasized that the Digital Rupiah is not just a technological innovation, but a strategic instrument that touches on economic, social, and legal dimensions. Successful implementation will open up great opportunities to expand financial inclusion, improve transaction efficiency, and strengthen Indonesia's competitiveness in the global economy. However, failure to design or implement a CBDC can pose a serious risk to the stability of the national financial system. Therefore, the involvement of various stakeholders ranging from regulators, the banking industry, the private sector, to the public is needed to ensure the sustainability and effectiveness of the Digital Rupiah.

6. Conclusion

The development of global financial digitalization requires every country to prepare new instruments that are able to answer the challenges of the digital era. Indonesia responded to these dynamics through the development of the Digital Rupiah within the framework of the Garuda Project. This study shows that the Digital Rupiah has strategic urgency, both in terms of maintaining monetary sovereignty, strengthening financial system stability, and supporting the growth of the national digital economy. The Digital Rupiah is expected to be able to provide various benefits, including increasing transaction efficiency, expanding financial inclusion, and integrating the domestic financial market. By utilizing Distributed Ledger Technology technology and design principles that are fast, secure, resilient, and flexible, Rupiah Digital has the potential to become an important instrument in building a more modern and globally competitive payment infrastructure.

However, the implementation of the Digital Rupiah is also faced with a number of challenges. Cyber risks, limited infrastructure, public literacy, and their impact on the role of banks in financial intermediation are aspects that must be seriously anticipated. In addition, a strong legal and regulatory foundation is needed to ensure legal certainty, personal data protection, and public trust. Taking into account these opportunities and challenges, the development of the Digital Rupiah cannot only be seen as a technological innovation, but as a national strategy that requires cross-sector collaboration. Bank Indonesia and the government, the private sector, financial institutions, and the public need to work together so that the Digital Rupiah can be implemented optimally. If properly designed and executed, the Digital

Rupiah will be an important instrument in strengthening Indonesia's monetary sovereignty while ensuring that the Rupiah remains a symbol and legal tender in the digital era.

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