

Currency Evolution: A Comparative Study Between Central Bank Digital Currencies And Physical Currencies In Modern Monetary Systems

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Abstrak: *Technology and innovation are the keys used to unlock the impossible imagination to become possible to achieve the unforeseen goals of individuals and organizations. This study focuses on the role of an unprecedented phenomenon called central bank digital currency (CBDC) over physical currency. This study uses a descriptive research method with a qualitative approach. This study is a literature review study aimed at describing the phenomenon. This study assesses the role of CBDC based on three parameters such as features, perceived benefits and challenges of CBDC and Physical Currency. It also reveals that CBDC can replace the use of physical currency only depending on how people, businesses perceive the features, benefits (better allocation, accessibility, interest bearing, convertibility and reduced costs) and possible challenges (opposite of benefits) associated with CBDC compared to its counterpart.*

Keywords: *Central Bank Digital Currency, Physical Currency, Perceived Knowledge, Challenges.*

JEL : E580, N20, O30

1. INTRODUCTION

Information technology now plays a crucial role in a country's economic dynamics. Advancements in this field have brought about significant changes in the economic landscape, creating a different growth pattern from the previous era. With the loss of distance and time barriers, various application innovations are developed to boost economic growth. The level of economic progress of a country today can be reflected in the development of its information technology and communication (Saputra et al., 2023). There is a positive correlation between advances in information technology and economic growth. However, this development also brings its own challenges, such as the increasing potential for misuse of technology for criminal acts by some people. This economic transformation triggered by information technology marks a new era in the development of the global economy, bringing with it opportunities and risks that need to be managed wisely (Riswanto et al., 2024).

Technological advancement is a necessity that goes hand in hand with the development of science. Technological innovation aims to facilitate human activities and provide positive benefits, especially in the last decade. However, the potential for misuse of technology also needs to be watched out for. Information and Communication Technology (ICT) plays an important role in the digitalization of the economy and finance, including the emergence of digital currencies. Physical currencies are considered less than ideal for business transactions, especially across borders, due to their instability compared to other international currencies (Saito & Iwamura, 2019).

Central banks, as a country's highest monetary authority, are responsible for the issuance and management of currency. Faced with modern economic challenges, many central banks are now investigating the potential of Central Bank Digital Currency (CBDC) as an alternative to physical currency. Countries are adopting different approaches in the face of economic and political instability, including corruption, currency devaluation and inflation. Proposed solutions include

digital currencies, virtual currencies (Naheem, 2018), e-money, and cashless systems (Isah & Babalola, 2019). These initiatives aim to modernize the financial system and address the economic challenges that many countries face in this digital era.

Even cryptocurrencies such as Bitcoin, Ethereum, Facebook Diem, Corda, Fabric and Ripple are competing for a place in a cashless world, constantly reinventing themselves in the hope of offering more stable value, and faster and cheaper settlement (Eisenhardt & Martin, 2000; Lagarde, n.d. 2017; Zhang & Huang, 2022). The sole purpose of introducing digital currencies is to reduce the volume of physical currency in circulation, which in turn destabilizes a country's socioeconomic development (Barontini & Holden, 2019).

Technological innovations often face resistance from individuals and businesses. This phenomenon is seen in the adoption of various technologies such as the internet, robotics, artificial intelligence, mobile banking, and digital currencies. Rogers' Diffusion of Innovations Theory (Rogers & Everett, 1983) explains this adoption pattern, dividing society into early, middle and late adopters, each with its own risks and benefits.

The COVID-19 pandemic has accelerated fundamental changes in consumer payment methods (Chapman, 2022). While technological change can cause anxiety and disruption to habits, work and social interactions, the ultimate goal is to optimize benefits while managing emerging risks (Lestari et al., 2023). This transformation reflects society's efforts to adapt to technological developments, although the process is often challenging and requires significant adjustments in various aspects of life.

Furthermore, central banks continue to conduct research on CBDC. Yet there is no evidence of a broad or generalized move to extend this research into experiments and pilot settings. However, some central banks with sufficient motivation continue to pilot various designs (Mutiarra et al., 2024). In general, before the advent of bank cards, automated teller machines (ATMs), electronic payment terminals (POS), and internet and mobile banking services, transactions such as bill payments, salaries, and fund disbursements relied on physical cash. All of these modern payment methods now serve to replace the function of cash in various financial transactions (Akbar, 2019).

E-commerce and e-business have changed the way people transact, with transactions now mostly done through mobile devices or computers. In addition to credit and debit cards, various payment apps such as Google Pay, Apple Pay, and PayPal are gaining popularity. Smartphones have opened up vast opportunities for users to make payments through e-wallets and e-money solutions (Isah & Babalola, 2019). This trend is especially noticeable among the younger generation, who tend to prefer mobile payment methods over conventional credit or debit cards (Bilotta, 2021). This shift marks a significant transformation in the digital payments landscape, reflecting changing consumer preferences and the increasing adoption of financial technology in everyday life. Global central banks are increasingly interested in CBDCs (Central Bank Digital Currency), prompting extensive research on their economic impact (Chapman, 2022). Although familiar in developed countries, CBDCs are still a new concept for many developing countries. CBDCs are defined by experts in different ways. According to Saito & Iwamura (2019) described them as fiat-based electronic obligations issued by central banks. Lagarde, n.d. (2017) calls it a digital form of physical cash, while Davoodalhosseini (2022) describes it as electronic money issued by the central bank and widely accessible.

Barontini & Holden (2019) research identified four main characteristics of currency: issuer, form, accessibility, and technology. CBDCs combine these characteristics in a digital format, offering widespread accessibility via the internet and convertibility to other forms of currency. CBDCs are an evolution of Blockchain-based cryptocurrencies such as Bitcoin, but with a wider scope of use and official support from monetary authorities (Hanafi & Rahman, 2019). This development marks a significant transformation in the global financial system, integrating technological innovation with conventional monetary structures. CBDCs are also hybrid instruments used for payments and are considered financial assets but in digital form. CBDCs are digital instruments that are easily scalable and have no storage costs, unlike physical instruments such as cash (Ferrari et al., 2020). While physical cash is a free and almost anonymous means of payment provided by central banks, which now hope to update it to provide public payment instruments with similar attributes that can also be used for digital payments (Chorzempa, 2021). This reveals that

CBDCs will be a key tool in the future digital economy, and countries that are fluent with the technology will have a competitive advantage (Lee et al., 2021).

Bitcoin, Ethereum and other forms of digital currency or cryptocurrency are backed by blockchain technology. Bitcoin has no physical representation like notes and coins and which is not issued or backed by any government or private company. Its value is determined by various factors, but the most important is the demand for it. When people buy Bitcoin, its value increases; conversely, when people sell Bitcoin, it decreases. For this reason, its value tends to fluctuate greatly (Bilotta, 2021).

Based on the facts claimed in previous studies, this research aims to highlight the role of CBDC over physical currency by providing some of its features, benefits and perceived challenges. This research contributes to the literature and practice regarding the transformation of monetary systems in the digital age. The research utilizes the theory of disruptive innovation in the financial sector, where central banks need to adopt new technologies to maintain the relevance and effectiveness of monetary policy.

The case study of this research is the implementation of central bank digital currencies (CBDC) in several countries, so that it can provide insight into the application of theory to modern monetary policy. Furthermore, the results of this study can be used by central banks and policy makers in determining strategies for developing and implementing CBDC. By developing an official digital currency, central banks can improve the efficiency of the payment system, strengthen financial stability, and adapt to changes in public preferences for digital transaction methods. It is hoped that the implementation of CBDC can strengthen the role of central banks in controlling monetary policy in the digital economy era, while providing a safe and reliable alternative to conventional physical currencies.

2. LITERATURE REVIEW

2.1 Central Bank Digital Currency (CBDC)

According to Indonesia (2022), Central Bank Digital Currency (CBDC) is a form of digital money issued and supervised by the central bank. CBDC is used as an official means of payment that has the potential to replace physical money. CBDCs serve as the digital embodiment of a country's currency and fulfill the three basic functions of money: store of value, medium of exchange/payment, and measure of the value of goods and services. Digital currencies are generally a form of currency that is created and stored electronically. However, it should be noted that not all digital currencies fall under the category of cryptocurrencies (Rose, 2015). Mulyanto (2015), classifies virtual currencies into two types: electronic money such as Flazz BCA, and cryptocurrencies such as Bitcoin. Digital currencies can usually be obtained through purchasing, gifting, or mining processes. It is important to understand the difference between CBDCs issued by central banks and other forms of digital currency. CBDCs have legitimacy and official backing from monetary authorities, while other digital currencies may not have the same legal status or oversight from government agencies.

2.2 Physical Currency

Physical currency is defined as an object accepted by the general public that is used as a medium of exchange in the economy, Sari (2016). The object accepted in this case must be approved by the entire community to use it as a medium of exchange. So that the object can be used for exchange purposes. In order for the object to be used for exchange purposes and accepted as money, it must have several conditions, namely: not experiencing changes in value from time to time, easy to carry around, easy to store without reducing value, durable, limited in number, and the object has the same quality.

Abdullah (2014), Divide physical currency into two main categories: metallic money and paper money. In the context of metallic money, they describe several standards that have been used. The gold standard was considered the most favorable due to its wide global acceptance. The silver standard, although once popular, lacked international acceptance, creating difficulties for the countries that used it. The twin standard combines the use of both gold and silver in a country's monetary system. They also discussed the concepts of full-value money and token money, which refer to currency with intrinsic value equal to its face value or currency

whose value is determined by its monetary function. Meanwhile, paper money has become the dominant means of payment in the modern era. The popularity of paper money is driven by several factors. The cost of production is lower than metal money, either made of gold or silver. Paper money is also easier to carry and transfer from one place to another. In addition, banknotes offer greater flexibility in meeting increasing monetary needs, as they are easier to produce on demand. The evolution from the use of coins to paper money reflects the changing economic and practical needs of the modern monetary system. The ease of use and efficiency of banknotes have made them the primary choice for daily transactions and monetary policy in most countries around the world.

3. METHOD

This study uses a descriptive research method, which is a study that aims to convey or describe a situation or reality that occurs using scientific procedures to answer problems in an actual manner (Sugiyono, 2016). This study is a literature review study aimed at describing the phenomenon of how the role of central bank digital currency over physical currency is scientifically based on existing literature studies. By reviewing various references in accordance with the theory and analyzing scientific articles. The approach used is a qualitative approach. This research relies on secondary data sources. The secondary data was gathered through a comprehensive review of literature relevant to the study. The literature consulted includes scientific journals, books, and credible internet sources, all of which meet high national and international standards. The decision to use secondary sources was made based on considerations of effectiveness and efficiency, with the aim of facilitating the timely completion of this research. This approach aligns with the methodology outlined by Sidiq et al., (2019), which emphasizes the value of secondary sources in certain research contexts. This method enables the researchers to build upon existing knowledge, identify gaps in current understanding, and contribute new insights to the ongoing academic discourse on the topic.

4. RESULTS AND DISCUSSION

This section presents an in-depth analysis of the comparison between CBDCs and physical currencies. Focus is given to the unique characteristics, advantages, as well as challenges faced by each form of currency. CBDCs, as digital innovations, have features that distinguish them from traditional physical currencies. One of the key differences is the ability of CBDCs to earn interest, in contrast to cash which does not earn interest. This has implications for its role as a store of value and means of payment in the economic system. This analysis provides a comprehensive understanding of how CBDCs can influence the financial landscape while recognizing the important role of physical currency in the modern economic system.

4.1 The role of CBDCs over physical currencies based on features

Table 1 describes the main differences between CBDCs and physical currencies. CBDCs serve as interest-bearing stores of value and a broader range of payment instruments, in contrast to interest-free physical currencies (Chapman, 2022). While the term CBDC can be misleading as traditional currencies have physical forms such as banknotes or coins (Shen & Hou, 2021), CBDCs are fully digital. According to Williamson (2022), the main difference is the ability of the central bank to pay interest on CBDCs not on physical currency. Interest-bearing CBDCs also have the potential to reduce transaction costs compared to interest-free versions in identical economies (Chapman, 2022). Overall, CBDCs are designed for use in a wider spectrum of transactions than physical currencies, demonstrating their potential as more flexible and efficient financial instruments.

4.2 The role of CBDC over physical currency based on perceived benefits.

Technology is evolving rapidly and bringing us into the digital age which brings many changes in various fields, especially the financial sector. Today, money is also increasingly transforming into an efficient form and function that balances the public's need for money that can be moved anywhere, quickly and safely. Many fintech startups have emerged that offer digital financial products in the form of electronic money (cryptocurrency) that allow people to make financial transactions without

using cash, or what is now called cashless. Almost all personal and business transactions that previously used conventional means including paper money have changed significantly with the emergence of electronic money platforms.

This study synthesizes and analyzes the results based between CBDCs and Physical Currencies in light of their features, perceived benefits and challenges. Shen & Hou (2021) once explained that digital reserves and deposits are the same as digital currencies. For example, reserves refer to deposits of commercial banks and other financial institutions held at the central bank to protect customers and financial institutions from bankruptcy. As a general obligation or rule, all financial institutions must deposit a certain percentage of deposits collected from various depositors as reserves with the central bank as collateral (bank financial reserves). However, deposits, and reserves are not different from CBDCs as they also enable interbank settlements in terms of digitization. Deposits and reserves perform the same function as digitally stored financial institution account balances (Fernández et al., 2020). Both CBDCs, deposits and reserves are digitized without physical form and can all be accessed through the use of computer-related devices. Whereas the use of physical currency requires direct physical contact between two or more parties for exchange, CBDCs avoid the need for financial institutions such as banks to broker transactions, although some digital intermediary services (with digital devices and the internet) can be used to facilitate transactions (Naheem, 2018).

There are several benefits of using CBDC. First, for consumers, CBDCs can reduce transaction costs directly. Secondly, CBDCs allow for a reduction in the policy interest rate which usually only applies to deposits thereby increasing revenue for banks and reducing the cost of capital-related penalties. Lastly, for governments, CBDCs can reduce public debt and reduce government borrowing rates, which in turn reduces distortions in the taxation system (Chapman, 2022). CBDC was introduced as a financial innovation as well as an alternative payment method for customers as it ensures financial efficiency by providing secure, faster, and cheaper transactions. In addition, its use as a universal medium of exchange challenges the traditional dominance of central banks in currency issuance (Hanafi & Rahman, 2019).

Table 1. Central Bank Digital Currencies and Physical Currencies

Factor	Central Bank Digital Currency	Physical Currency
Accessibility	Virtual accessible	Physically accessible by visiting bank, ATM, POS's locations
Mobility	Simple	Heavy and Risky
Security	More secured as PIN will be used to used to authenticate the owner	It requires physical protection and so for the holders
Acceptability	Low	High
Processing Cost	Moderate	High
Risk	Low	High
Agent	Exists	Exist
Issuer	Direct from the central banks	Form the central bank through the commercial banks
Uses	Payment	Payment
Intermediation	Not exists	Exists
Physical form	Not exists	Exists
Technological Requirement	Account holder's computer-related devices, internet services, etc.	Account holders and Banks' computer-related devices, Internet services, etc
Skills	It requires adequate skills and knowledge	It requires little skills and knowledge since fund can be access physically

4.3. Better Allocation

Digital Rupiah is a form of Rupiah currency in digital format that can be used as physical money (banknotes and coins), electronic money (chip and server-based), and card payment instruments (debit and credit cards). Bank Indonesia is the only entity that issues Digital Rupiah as the Central Bank of the Republic of Indonesia. The use of CBDC aims to enhance the efficient allocation of digital currencies. Consumers will be encouraged to use CBDC instead of cash to reduce cash inflation that can disrupt a balanced allocation. In addition, using CBDC can reduce the cost of storing cash, provided that the transportation cost of CBDC is not too high so that only CBDC is the first choice. However, if the cost of using CBDC is too high, then the use of physical currency or the coexistence of both may be more optimal (Davoodalhosseini, 2022), although this may reduce the attractive benefits of CBDC. Setting CBDC interest rates at zero may create distortions in the choice of payment instruments, which may lead to welfare losses (Agur et al., 2022)

4.4 Accessibility

Accessibility is an important element in CBDC (ahmed et al., 2022). CBDC features can be universal or restricted to a certain number of economic agents, depending on their intended use. Bjerg (2017) also notes that CBDCs can be universally accessible. This accessibility refers to how easy it is to reach one location from another through transportation systems, including factors such as the time, cost, and effort required to travel between locations or regions.

4.5 Interest-bearing Accounts

Interest-bearing accounts are a crucial element of customizable CBDCs (Kumhof & Noone, 2021; Ahmed et al., 2022; Davoodalhosseini, 2022). Research Agur et al., (2022) suggests that this can be an economic counterbalance to political considerations that might encourage central banks to opt for interest-free CBDCs. Such considerations include concerns over the possibility of negative interest rates on publicly accessible central bank liabilities (Mancini-Griffoli et al., 2018). The most significant example of CBDC is the application of blockchain technology and cryptocurrencies in the financial sector, including banking and other related businesses. Kulkarni & Patil (2020) study using the technology, organization, and environment model revealed several factors driving the adoption of blockchain technology. These factors include compatibility, relative advantage, security, enterprise scope, top management support, consumer readiness, competitive pressure, and government policies. On the other hand, perceived cost is a significant barrier in the adoption of blockchain technology and CBDC.

4.6 Convertibility

Convertibility is another important aspect of CBDCs. Based on the features CBDCs are as similar as possible to cash but in digital form and therefore can be converted into cash and or reserves on demand (Fernández et al., 2020; Zhang & Huang, 2022). Kumhof & Noone (2021) revealed that CBDC and reserves are different and are not guaranteed to be directly convertible into each other at Central banks, likewise there is no guarantee of the convertibility of bank deposits to CBDC at commercial banks. Convertibility is the quality that allows money or other financial instruments to be converted into other liquid stores of value. Convertibility is an important factor in international trade, where instruments valued in different currencies must be exchanged.

Freely convertible currencies have immediate value in the foreign exchange market, and few restrictions on the ways and amounts that can be traded for other currencies. Free convertibility is a key feature of hard currencies. Some countries pass laws that limit the legal exchange rate of currencies or require a permit to exchange more than a certain amount. Some currencies, such as the North Korean won, the Transnistrian ruble and the Cuban national peso, are officially non-convertible and can only be exchanged on the black market. If an official exchange rate is set, the value on the black market is often lower. Convertibility controls can be introduced as part of overall monetary policy. For example, restrictions on the Argentine peso were introduced during the economic crisis in the 1990s and removed in 2002 during the following crisis.

Cost Reduction

CBDCs offer the opportunity for dramatic cost reductions, which can translate into faster and cheaper transactions, for example in remittances. CBDCs motivate and promote payment security, resilience, and efficiency, reduce issuance costs, and increase transaction convenience (Zhang & Huang, 2022). Most central banks around the world still prohibit the use of cryptocurrencies as legal

tender. This is because they are not controlled by regional monetary authorities (central banks). Instead, some central banks have begun discussing the creation of a digital currency called Central Bank Digital Currency (CBDC). So, what is the difference between CBDC and cryptocurrency, which is also digital, CBDC is legally created and regulated by a country's monetary authority so that its value fluctuations are more stable. The development of information technology gave rise to the idea of creating virtual money that would eventually eliminate physical money. Virtual (digital) money, often called cryptocurrency, is an asset with a cryptographic code that is difficult to counterfeit or copy. Cryptocurrency is developed in a decentralized system using blockchain technology, which is a collection of data (distributed ledger) managed by a computer network.

Using digital currencies has advantages in the speed and cost-effectiveness of remittances. The decentralized system (blockchain) also reduces the risk of overall system failure. On the other hand, the value of digital currency also has negative sides, including a high level of volatility, meaning that it will fall into the category of high-risk financial instruments if used as a store of value. Mining activities require a large amount of electricity. energy and the risk of being used to support criminal activities because the decentralized system is beyond government control. Most central banks around the world still prohibit the use of cryptocurrencies as legal tender as they are not controlled by local monetary authorities (Central Banks). However, in recent years, some central banks have started discussing the creation of digital currencies known as central bank digital currencies (CBDCs). This CBDC is of course different from the cryptocurrencies currently circulating (Bitcoin, Ethereum, etc.) because CBDCs are legally created and managed by a country's monetary authority so that their value fluctuations are predicted to be more stable.

The creation of CBDCs as an alternative to conventional currencies must at least fulfill the condition that CBDCs must meet the criteria of being as convenient and inexpensive a medium of exchange as a regular foreign currency account (Ahmed et al., 2022). This may mean that CBDC accounts are maintained directly at the Central Bank or that they are accessible to commercial banks through a public-private partnership program. CBDCs provide a return (interest rate) that tracks the return of risk-free financial assets such as government securities, thereby fulfilling the function of a store of asset value. CBDCs can be widely available to the public as an alternative to conventional currencies with scheduled exchange/conversion fees between CBDCs and conventional currencies. The monetary policy framework will likely keep the value of the CBDC stable over time in combination with inflation control policies.

Based on data from BI's official website, CBDCs should be able to function as a convenient and inexpensive medium of exchange like a regular currency account. This could mean CBDCs are managed directly by the central bank or accessed through commercial banks through public-private partnerships. CBDCs also offer yields that track the returns of risk-free financial assets, such as government securities, making them an option for a store of value function. CBDCs are expected to be widely available to the public as an alternative to conventional currencies with exchange fees between CBDCs and conventional currencies scheduled. The monetary policy framework will maintain the stability of CBDC value over time by integrating inflation control policies. The 2019-2020 Bank for International Settlements (BIS) survey shows growing interest from central banks around the world to develop CBDCs.

4.7 The role of CBDCs over currencies based on financial transactions

CBDCs and physical currencies, although under one umbrella, are distinct entities. Digital currencies offer the potential to control financial crime more effectively. However, this requires the establishment of appropriate regulatory bodies and rules to ensure overall transaction security (Yanchao, 2021). Blockchain technology plays an important role in providing end-to-end security for CBDC. It also contributes to increasing the volume and total value of transactions (Altan et al., 2019). CBDCs enable efficient financial settlements, especially in terms of payments, by guaranteeing transaction security from start to finish through the use of blockchain-based cryptocurrencies (Nelson, 2018; Zhang & Huang, 2022). In the case of physical currencies, financial institutions record a customer's entire transaction history. This approach has driven the evolution of regulatory models from simply understanding customers to understanding data, ultimately leading to the establishment of data-driven regulatory models (Yanchao, 2021).

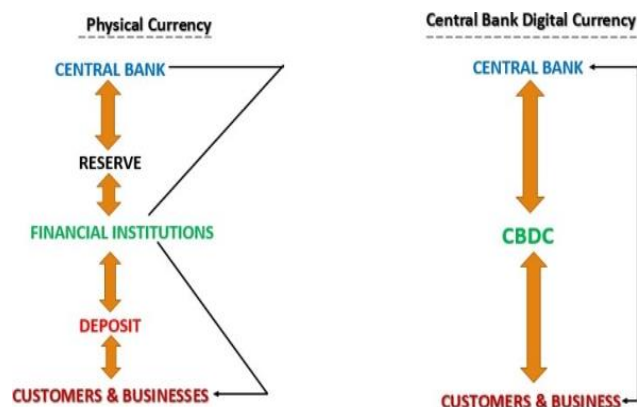


Figure 1. Physical Transactions and CBDC Transactions

However, digital currencies are characterized by decentralization, with data distributed and stored at each node and no concept of a central database. Even digital currency exchanges are only used as trading venues that users can choose from rather than as trading venues required of a centralized model. As a result, digital currency exchange data is still local rather than global, resulting in an inverted development model where all countries regulating digital currencies move from understanding data to understanding customers (Yanchao, 2021). Isah & Babalola (2019) research revealed that cashless economy policies have a positive impact on financial inclusiveness. Therefore, consistent efforts should be made to ensure that cashless policies are extended to reach the entire population of the country to advance economic activities and consequently increase economic growth.

Many countries around the world are busy improving laws on digital currencies. China's financial management department pays close attention to the legislation and application of digital currencies, and is committed to building a complete and scientific legal system for digital currencies (Yanchao, 2021). Regardless of whether digital currency is considered an ordinary commodity (asset) or currency, it cannot be easily judged using the notion of right or wrong (Nelson, 2018). In determining the legal attributes of digital currency and making laws for it, it is necessary to deal with the following three relationships: first the relationship between currency attributes and commodity attributes, second the relationship between centralism and decentralization, third the relationship between traditional fiat currency and new digital currency (Yanchao, 2021).

In the gradual development of the practice of issuing digital currencies by central banks, it is necessary to further summarize the laws of interaction between traditional fiat currencies and digital currencies (Yanchao, 2021). As stated earlier that the coexistence of CBDC and physical currency may lead to underutilization of CBDC, which has the attractive feature of interest-bearing accounts, in turn the choice of coexistence is more likely to be optimal (Davoodalhosseini, 2022). However, taking the CBDC interest rate from zero leads to welfare losses as it creates a price distortion of the choice between these two payment instruments (Agur et al., 2022).

4.8 Challenges of CBDC and Physical Currency

In contrast to physical currencies, CBDCs face several challenges such as policy issues, implementation, scalability, interoperability between chains, acceptability, and convertibility (Fernández et al., 2020; Yanchao, 2021; Zhang & Huang, 2022). Cryptocurrencies, as enablers of CBDC, offer the potential for significant cost reduction, which can result in faster and more economical transactions, for example in remittances. However, it remains unclear whether CBDC can compete with cryptocurrencies in this regard, given that CBDC is based on national payment systems. Nevertheless, Central Banks may be encouraged to develop interconnected payment systems for cross-border transactions if they feel threatened by cryptocurrency competition (Fernández et al., 2020).

In terms of monetary policy, no digital currency currently appears to be so widely used as to

impair central banks' ability to control business cycles and inflation (Nelson, 2018). The emergence of digital currencies reflects the opposition between the non-centralist movement and the centralist model. Digital currencies, which are decentralized in principle, have the potential to overcome the drawbacks of centralism such as credit shortages, high central maintenance costs, and inflation due to excess money issuance (Nelson, 2018).

Digital currencies such as Bitcoin and Ethereum offer simpler payment methods than traditional ones. However, Saito & Iwamura (2019) argue that these currencies are not ideal as a means of payment due to the instability of their market prices. The tendency for prices to rise in the long term and fluctuate in the short term encourages people to hoard rather than use it as a means of payment. The development of information technology gave birth to the concept of virtual money that has the potential to replace physical money. Cryptocurrency, as a form of virtual money, is an asset with a cryptographic code that is difficult to counterfeit or copy. Developed in a decentralized system using blockchain technology, cryptocurrencies rely on a network of computers to manage a distributed data set or ledger.

The digital age and the COVID-19 pandemic have changed the way people interact in the economy, driving the rapid growth of crypto assets amid the global economic slowdown. Accommodative fiscal and monetary policies have also influenced this trend, including in Indonesia. Cryptocurrencies offer the potential to increase the inclusiveness and efficiency of the financial system, but also bring new risks to economic, monetary and financial stability. To manage these risks, an appropriate regulatory framework is required. The cryptocurrency phenomenon has also prompted central banks to explore central bank digital currencies (CBDCs). The majority of global central banks have started research and trials of CBDCs, taking into account the characteristics of their respective countries and input from the industry. Bank Indonesia is also reviewing CBDC and plans to publish a white paper on digital Rupiah along with a consultative paper on the implementation of CBDC in Indonesia (Muhammad & Dirkareshza, 2023).

Digital currencies offer speed and cost efficiency in financial transactions. The decentralized blockchain system reduces the risk of overall system failure. However, digital currencies also have disadvantages such as high volatility, large energy consumption for mining, and potential misuse for illegal activities as they are beyond government control. Although most central banks still prohibit the use of cryptocurrencies as legal tender, some are starting to consider CBDCs. Unlike the existing cryptocurrencies, CBDC will be managed by the country's monetary authority, so it is expected to have a more stable value.

The creation of CBDCs as an alternative to conventional currencies must at least fulfill the condition that CBDCs must meet the criteria of being as convenient and inexpensive a medium of exchange as regular foreign currency accounts. This could mean that CBDC accounts are managed directly at the Central Bank or that they are accessible to commercial banks through a public-private partnership program. CBDCs provide a return (interest rate) that tracks the return of risk-free financial assets such as government securities, thereby fulfilling the function of a store of asset value. CBDCs can be widely available to the public as an alternative to conventional currencies with scheduled exchange/conversion fees between CBDCs and conventional currencies. The monetary policy framework will likely keep the value of the CBDC stable over time in combination with inflation control policies.

Research Engert & Fung (2017) and Naheem (2018), revealed that digital currencies use a peer-to-peer system for direct exchange of value, eliminating the need for formal financial institutions such as banks. Nonetheless, some digital intermediary services can still be used to facilitate transactions. Davoodalhosseini (2022) revealed that to optimize the joint use of CBDC and cash, cash inflation must remain positive. Although it seems counter-intuitive, as negative cash inflation seems to make more sense, negative inflation will actually encourage people to switch from CBDC to cash. This happens because the return on cash will be higher, thus reducing the incentive to use CBDCs. Consequently, the central bank cannot conduct open market operations under negative cash inflation, as CBDCs will not be used. Although the cost of cashless transactions is an important consideration, financial inclusion remains crucial. According to Isah & Babalola (2019) financial inclusion is useful for tracking economic activity, facilitating aid delivery, increasing transparency of government agencies, and facilitating intergovernmental expenditure monitoring.

Overall, central bank digital currencies (CBDCs) will have the potential to transform the financial system by offering greater efficiency and transaction speed than physical cash. CBDCs can improve security by reducing the risk of theft and counterfeiting, and expand financial inclusion for those who do not have access to traditional banking services. For central banks, CBDCs may provide better control and visibility over money circulation, potentially reducing the informal economy. However, implementing CBDCs also presents challenges, particularly regarding financial privacy and the potential for increased surveillance. In addition, CBDC could have a significant impact on the role of commercial banks and the stability of the financial system as a whole. While CBDC offers opportunities for innovation in payment systems and financial applications, its implementation requires careful consideration to balance the benefits with potential risks.

From a macroeconomic perspective, CBDCs can improve the effectiveness of monetary policy transmission by providing central banks with new tools to control interest rates and liquidity. This can be particularly valuable in situations where conventional monetary policy becomes less effective, such as when interest rates approach the zero bound. In a micro context, CBDCs have the potential to reduce transaction costs and improve the efficiency of payment systems. However, it also raises questions about commercial bank disintermediation and its implications for credit creation and capital allocation in the economy. The technological aspects of CBDCs raise interesting research questions around optimal design, interoperability with existing payment systems, and cybersecurity. In addition, the privacy implications of CBDCs require an in-depth analysis of the trade-off between anonymity and the need to prevent illegal activities. From a public policy standpoint, the introduction of CBDCs requires careful evaluation of their impact on financial inclusion, financial stability, and monetary sovereignty, especially in the context of financial globalization and emerging private digital currencies.

5. CONCLUSION AND SUGGESTION

CONCLUSION

This research describes the shift from the use of traditional physical currencies towards the adoption of central bank-issued digital currencies (CBDCs). To conclude, the adoption and use of CBDCs as a substitute for physical currency depends on how people and business entities understand the features, this research emphasizes how CBDCs can change the way monetary policy is implemented, improve the efficiency of payment systems, and potentially increase financial inclusion. The perceived benefits (better allocation, accessibility, interest-bearing accounts, convertibility, cost reduction) that can be derived from their use and the corresponding challenges that should be recognized for preventive measures. In addition, the role of CBDCs based on financial transactions is well explained as the best option compared to physical currency transactions. The research and use of CBDCs is now becoming popular worldwide. But developing countries are yet to accept the use of this emerging technological innovation as a means of payment. This research provides insight into the future of currencies and their implications for the global economy, illustrating how this evolution could reshape the financial landscape in the digital age.

SUGGESTION

Future research should examine the geopolitical aspects of CBDC adoption, including possible shifts in global currency dominance. Large-scale economic simulations can be conducted to predict the long-term impact of the transition to CBDCs. Studies on the optimal design of CBDCs for different economic and social contexts are also important. Aspects of financial privacy and the potential use of CBDC transaction data for public policy require in-depth analysis. A comparison of the effectiveness of CBDCs in handling economic crises compared to traditional currency systems also needs to be researched. The impact of CBDCs on fintech innovation and the evolution of digital financial services is a promising area of research that must consider the differences in adoption between developed and developing countries and analyze the factors that influence the acceptance of this new technology as a means of payment.

REFERENCE

- Abdullah, T. (2014). Lembaga Keuangan. *Bank Dan Lembaga Keuangan*, 1(4318).
- Agur, I., Ari, A., & Dell’Ariccia, G. (2022). Designing central bank digital currencies. *Journal of Monetary Economics*, 125, 62–79.
- AHMED, A. A., SAIDU, A. A., & KAWURE, J. H. (2022). The Roles of Central Bank Digital Currency over Physical Currency. *International Journal of Social Science, Education, Communication and Economics (Sinomics Journal)*, 1(2), 75–92.
- Akbar, E. (2019). *Central Bank Digital Currency (CBDC) As a New Form of Currency In Indonesia (A Comparative Study of Sweden’s E-krona Project)*. Universitas Gadjah Mada.
- Altan, A., Karasu, S., & Bekiros, S. (2019). Digital currency forecasting with chaotic meta-heuristic bio-inspired signal processing techniques. *Chaos, Solitons & Fractals*, 126, 325–336.
- Barontini, C., & Holden, H. (2019). Proceeding with caution-a survey on central bank digital currency. *Proceeding with Caution-A Survey on Central Bank Digital Currency (January 8, 2019)*. BIS Paper, 101.
- Bilotta, N. (2021). A critical self-reflexive account of a privileged researcher in a complicated setting: Kakuma refugee camp. *Research Ethics*, 17(4), 435–447.
- Chapman, J. (2022). Discussion of “The macroeconomics of central bank digital currencies.” *Journal of Economic Dynamics and Control*, 142, 104149.
- Chorzempa, M. (2021). China, the United States, and central bank digital currencies: how important is it to be first? *China Economic Journal*, 14(1), 102–115.
- Davoodalhosseini, S. M. (2022). Central bank digital currency and monetary policy. *Journal of Economic Dynamics and Control*, 142, 104150.
- Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: What are they? *Strategic Management Journal*, 21(10–11), 1105–1121. [https://doi.org/10.1002/1097-0266\(200010/11\)21:10/11<1105::AID-SMJ133>3.0.CO;2-E](https://doi.org/10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO;2-E)
- Engert, W., & Fung, B. S.-C. (2017). *Central bank digital currency: Motivations and implications*. Bank of Canada Staff Discussion Paper.
- Fernández, O. M., Fernández, S., & Krause, M. (2020). Comprensión del cambio psicoterapéutico en adolescentes: voces de pacientes y terapeutas. *CES Psicología*, 13(3), 107–123.
- Ferrari, M. M., Mehl, A., & Stracca, L. (2020). CBDC in an open economy. *ECB WP Series*, 2488.
- Hanafi, S. F., & Rahman, S. A. (2019). Regulating digital currency: taming the unruly. In *Emerging issues in Islamic finance law and practice in Malaysia* (pp. 265–280). Emerald Publishing Limited.
- Indonesia, B. (2022). Proyek garuda: Menavigasi arsitektur digital rupiah. *Bank Indonesia*.
- Isah, H. A., & Babalola, A. (2019). Impact of cashless economic policy and financial inclusiveness in Nigeria: An Empirical Investigation. *Amity Journal of Economics*, 4(2), 47–61.
- Kulkarni, M., & Patil, K. (2020). Block Chain Technology Adoption for Banking Services-Model based on Technology-Organization-Environment theory. *Proceedings of the International Conference on Innovative Computing & Communications (ICICC)*.
- Kumhof, M., & Noone, C. (2021). Central bank digital currencies—Design principles for financial stability. *Economic Analysis and Policy*, 71, 553–572.
- LAGARDE, C. (n.d.). *The Case for New Digital Currency*.
- Lee, D. K. C., Yan, L., & Wang, Y. (2021). A global perspective on central bank digital currency. *China Economic Journal*, 14(1), 52–66.
- Lestari, R., Windarwati, H. D., & Hidayah, R. (2023). *The Power of Digital Resilience: Transformasi Berpikir Kritis dan Penguatan Kesehatan Mental Emosional di Era Disrupsi*. Universitas Brawijaya Press.
- Mancini-Griffoli, T., Peria, M. S. M., Agur, I., Ari, A., Kiff, J., Popescu, A., & Rochon, C. (2018). Casting light on central bank digital currency. *IMF Staff Discussion Notes*, 18(08), 1.
- Muhammad, R. F., & Dirkareshza, R. (2023). Legalitas Penerapan Central Bank Digital Currency (CBDC) Di Indonesia. *Jurnal USM Law Review*, 6(3), 913–930.
- Mulyanto, F. (2015). Pemanfaatan Cryptocurrency Sebagai Penerapan Mata Uang Rupiah Kedalam Bentuk Digital Menggunakan Teknologi Bitcoin. *Indonesian Journal on Networking and Security*, 4(4), 19–26.

- Mutiara, A. C., Astuti, R. P., Rahayuningsih, S., & Rusmiyanti, A. I. (2024). Implementasi Digital Currency Oleh Bank Sentral: Peluang Dan Tantangan. *Gudang Jurnal Multidisiplin Ilmu*, 2(6), 573–576.
- Naheem, M. A. (2018). Regulating virtual currencies—the challenges of applying fiat currency laws to digital technology services. *Journal of Financial Crime*, 25(2), 562–575.
- Nelson, B. (2018). Financial stability and monetary policy issues associated with digital currencies. *Journal of Economics and Business*, 100, 76–78.
- Riswanto, A., Joko, J., Napisah, S., Boari, Y., Kusumaningrum, D., Nurfaidah, N., & Judijanto, L. (2024). *Ekonomi Bisnis Digital: Dinamika Ekonomi Bisnis di Era Digital*. PT. Sonpedia Publishing Indonesia.
- Rogers, E. M., & Everett, M. (1983). DIFFUSION OF Third Edition. teddykw2. files. wordpress. com. *Everet Tm-Rogers-Diffusion-of-Innovati*, 31(1).
- Rose, C. (2015). The evolution of digital currencies: Bitcoin, a cryptocurrency causing a monetary revolution. *The International Business & Economics Research Journal (Online)*, 14(4), 617.
- Saito, K., & Iwamura, M. (2019). How to make a digital currency on a blockchain stable. *Future Generation Computer Systems*, 100, 58–69.
- Saputra, A. M. A., Kharisma, L. P. I., Rizal, A. A., Burhan, M. I., & Purnawati, N. W. (2023). *TEKNOLOGI INFORMASI: Peranan TI dalam berbagai bidang*. PT. Sonpedia Publishing Indonesia.
- Sari, S. W. (2016). Perkembangan dan pemikiran uang dari masa ke masa. *An-Nisbah: Jurnal Ekonomi Syariah*, 3(1), 1–39.
- Shen, W., & Hou, L. (2021). China's central bank digital currency and its impacts on monetary policy and payment competition: Game changer or regulatory toolkit? *Computer Law & Security Review*, 41, 105577.
- Sidiq, U., Choiri, M., & Mujahidin, A. (2019). Metode penelitian kualitatif di bidang pendidikan. *Journal of Chemical Information and Modeling*, 53(9), 1–228.
- Sugiyono. (2016). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. PT. ALFABETA.
- Williamson, S. D. (2022). Central bank digital currency and flight to safety. *Journal of Economic Dynamics and Control*, 142, 104146.
- Yanchao, Y. (2021). On the legal attributes of digital currency. *Social Sciences in China*, 42(2), 123–141.
- Zhang, T., & Huang, Z. (2022). Blockchain and central bank digital currency. *Ict Express*, 8(2), 264–270.