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Article

Do CBDCs promote financial inclusion and strengthen the monetary regulations?

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Abstract: Digital currencies are impacting the financial lives of people and countries around the world; particularly developing countries see the retail Central Bank Digital Currencies (CBDCs) as an opportunity to increase financial inclusion and introduce new monetary policy implementation mechanisms. The decision to launch a digital currency mainly depends upon the goals and objectives being set by the Central Bank of any respective country. Digital currencies help to implement monetary policy more effectively to achieve the financial system stability. Kazakhstan is the leading economy in the Commonwealth of Independent States region; the digital payments market is changing rapidly in Kazakhstan, being driven by fintech innovations and public investments in payment technologies. In this article, we thoroughly discussed how launching of "Digital Tenge" is promoting financial inclusion and strengthening the monetary regulations across Kazakhstan. We took the case of Kazakhstan because it's the first country from Central Asia which took the initiative of launching digital currency, and the National Bank of Kazakhstan has already announced that implementation of "Digital Tenge" would be completed in Kazakhstan by the end of 2025. The implementation of a "Digital Tenge" as a CBDC in Kazakhstan would expand the range of financial services being available to the nation. Having direct authority over the digital currency will empower the National Bank of Kazakhstan to adopt more efficient monetary policy, exerting influence over interest rates, money supply, and general economic stability. Furthermore, by providing digital financial services to marginalized communities, the digital Tenge would also help to solve the difficulties of financial inclusion in Kazakhstan. The article provides the possible policy routes for the governments of developing countries and the financial regulators about adopting CBDCs for promoting financial inclusion and to strengthen the monetary regulations.

Keywords: central bank; digital tenge; financial inclusion; Kazakhstan; monetary policy
JEL Codes: E42; G23; O33

1. Introduction

The potential for implementing Central Bank Digital Currency (CBDC) is a significant and pertinent topic of discussion among the economic experts as well as the monetary authorities around the globe (Abumughli et al., 2024; Aysan, 2024). The banking industry is experiencing a significant transformation due to the emergence of CBDCs (Ali, 2023). These digital representations of conventional government-issued currencies, which are formally controlled and overseen by central authorities, have the potential to fundamentally change the nature of money in the digital era (Ozili, 2023). CBDCs can remove or decrease the expenses associated

with trusted third-party intermediaries in the financial sector. Additionally, they might replace traditional accounts and government-issued securities by providing central bank assets to a broader group of economic participants. CBDCs connect monetary policy, advanced technology, and the dynamic framework of financial rules in this changing environment (Echarte Fernández et al., 2021). With the rise of digitization, CBDCs have become a powerful instrument for Central Banks to adjust to the quickly changing financial landscape. CBDCs allow Central Banks to maintain control over macroeconomic autonomy and legislative oversight. The concerns of global financial institutions, including the International Monetary Fund, the Bank for International Settlements, the European Central Bank, the Federal Reserve, and others, are also influenced by the resilience of national currency systems and the eventuality of central bank funds (Bindseil, 2019).

During the Great Depression, there was a significant outflow of gold from the American Federal Reserve due to people's inclination to keep physical gold rather than paper cash. In 1933, the USA suspended the gold standard due to an incident when the Roosevelt government required individuals to sell their gold to Banks at a rate of $20.67 per ounce. The purpose of this was to revalue gold to $35 per ounce to accelerate the economy's recovery (Michail and Michail, 2021). The inaugural bank card system was introduced in 1946 by John Biggins, a banker from Brooklyn, New York. He unveiled the "Charg-It" charge metal card. When a consumer utilized it to make a purchase, the bill was sent to Biggins' bank. The cards were only functional in stores that were in close access to the bank that issued the card. In 1950, a significant development occurred with the introduction of "The Diners Club," a cardboard credit card that could be utilized at various establishments (Monis and Pai, 2023). The payment card, initially named "BankAmericard" and then rebranded as VISA, was sent by mail, and deposited into mailboxes. After establishing the first plastic credit card in 1959, American Express seized control of the concept by releasing its own purple paper credit card for travel costs (Gontarski, 2020).

In 1973, about 239 Banks gathered from 15 countries to address the shared issue of cross-border transaction communications. With the widespread adoption of plastic cards for financial transactions, the issue of security became a significant problem. Multiple global payment firms reached an agreement to collaborate on the creation of smart-card standards in conjunction with the introduction of EMV chip technologies. The initial iteration of the EMV standard was introduced in Europe in 1994 by Europay, MasterCard, and Visa (Ye et al., 2023). The creation of the World Wide Web led to the emergence of the online purchasing system. In 1998, PayPal introduced a groundbreaking feature in digital electronic payments: a virtual account that allowed users to send and receive dollars by using email address. This method was distinctively different from the old methods of internet credit card operations (Ntumba et al., 2023). The subsequent feasible technology for mobile transactions in the retail industry was Near Field Communication (NFC), which employs electromagnetic radio waves to facilitate data transmission between the two sensors. The emergence of digital cryptocurrency began with the introduction of Bitcoin (Aysan, 2023).

In 2011, Google introduced the Google Wallet mobile payments system, which utilized NFC technology to store card information on a cell phone (Dai et al., 2023).

This system enabled users to make purchases at nearby merchants by just tapping their smartphone. In 2014, Apple Corporation emulated this precedent by introducing Apple Pay. The Quick Response code technology, sometimes known as QR, was developed by Masahiro Hara of the Japanese business Denso Wave. In 2011, it was adopted by the Chinese corporation Alipay (Shneiderman, 2020). This startup implemented QR technology as a mobile payment solution, enabling brick-and-mortar merchants to accept payments by identifying a unique QR code in the Alipay Wallet app on a smartphone. In 2014, Tencent, a prominent Chinese technology company, implemented a QR code functionality on its messaging application, We Chat. Mobile payment emerged as the predominant mode of payment in China (Ye et al., 2023). In 2014, the digital crypto currency sector took a significant stride forward with the introduction of Ethereum through a crowd sale. Ethereum is a publicly accessible block chain platform that supports decentralized apps, decentralized autonomous organizations, and smart contracts. Tether Holdings business, in collaboration with the Hong Kong cryptocurrency trading platform Bitfinex, introduced a stable coin called Tether in 2014, marking a new trend in the digital currency sector. Tether introduced a stable coin that is specifically created to have a value of $1.00 (Griffin and Shams, 2020). This is achieved by ensuring that there is one dollar held in reserves for every tether that is released. The favorable outcome of this initiative was replicated by other firms through the introduction of additional stable coins such as Dai, USDC, PAX, and others (Van Echelpoel et al., 2020).

In 2019, Facebook, an American social media firm, unveiled a new initiative called Libra, which has now been renamed Diem. Diem is a payment system based on a permissioned block chain, and it includes a personal digital wallet. The intention of the Libra token is to secure it with financial holdings, like national currencies, as a means to mitigate the fluctuations in value (Sommerhuber et al., 2022). In line with the prevailing trend of stable coins, J.P. Morgan, a US bank, became the pioneer in 2020 by introducing a digital currency called Link. This coin is linked to the US dollar and is specifically designed for interbank transactions. This block chain solution facilitates safe, peer-to-peer data exchanges with enhanced speed and management for 400 Banks and business users across 78 countries (Jayasuriya Daluwathumullagamage and Sims, 2021). In 2020, China conducted the initial trial of a pilot project involving the digital Yuan, making it the pioneering country in this endeavor. It is evident that the development of a well-established financial system has resulted in the advancement of the payment system. The **Figure 1** illustrates the evolution of monetary policy and payment systems from the inception of online ordering to the implementation of a pilot project including CBDC.

The article hereinafter is organized as follows: The section 02 discusses the opportunities and the risks involved in CBDCs in quite extensive manner. The section 03 sheds the light on the recent developments of CBDCs in Asia and particularly in Central Asia. The section 04 has explored the launching of Digital Tenge by Kazakhstan along with the implications. Finally, the article has been concluded in section 05.

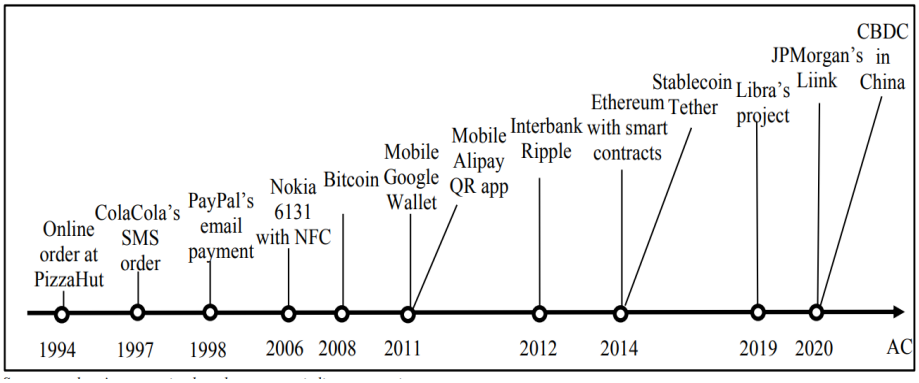

Figure 1. Evolution of payment systems from 1994 to 2020 (Varonin and Baslaviak, 2021).

2. Literature review

Opportunities and risks involved in CBDCs

CBDCs have emerged as a powerful and influential factor in the worldwide financial environment, offering a wide range of potential advantages and disadvantages. Central Banks and governments are weighing the pros and cons of CBDCs. Asia is currently at a critical juncture in its examination of digital currencies, with a focus on promoting financial inclusion, improving cross-border transactions, addressing privacy and cyber security issues, and perhaps replacing existing banking institutions (Wei and Wang, 2021). CBDCs pose several hazards and uncertainties, especially for Asian emerging nations, as they traverse the realm of digital currencies. Initially, the elimination or decrease of financial intermediaries via the implementation of CBDCs entails certain dangers and uncertainties. Bearing CBDCs might provide a threat to conventional bank deposits, perhaps resulting in a crowding-out impact or motivating Banks to raise deposit interest rates (Cesaratto and Febrero, 2023).

Changing the interest rate on CBDCs is a direct way for Central Banks to influence the money supply. Because of this, conventional policy instruments like interest rate adjustments and changes to financial institutions' reserve ratios may become less effective and harder to foresee. To address these problems, it may be preferable to develop CBDCs that do not carry interest rate. This would minimize rivalry with deposits and reduce the danger of destabilizing the banking industry (Barrdear and Kumhof, 2022). Nevertheless, the magnitude of these transition hazards is still being investigated. Conversely, interest-bearing CBDCs might encourage widespread acceptance in the beginning. However, there are potential technological and privacy concerns associated with CBDCs due to the early stage of the underlying technology. The security of CBDCs is a major concern due to the potential for substantial financial losses resulting from any vulnerabilities. CBDCs' significant value renders them an appealing target for cybercriminals. To effectively tackle these cyber security

obstacles, it is crucial to enhance the skills of central institutions and suppliers and create stronger cryptographic methods that ensure privacy while maintaining traceability (Tian et al., 2023).

Furthermore, the simplicity of transitioning between bank deposits and CBDCs could potentially present a hazard during periods of financial volatility. Shifting from traditional bank assets to CBDCs amid a crisis has the potential to increase the risks of bank runs. CBDCs adoption may encounter substantial obstacles in areas with inadequate communication infrastructure and minimal smartphone usage. Moreover, a deficiency in public knowledge and understanding of CBDCs custody technology might give rise to potential dangers, such as the loss of private keys and fraudulent activities involving the digital currency (Mohammed et al., 2023). To tackle these difficulties, it is crucial to allocate funds towards infrastructure, create initiatives for digital literacy, develop user interfaces that are easy to understand, and enforce strong security measures. These initiatives jointly aim to promote the mainstream adoption of CBDCs while guaranteeing inclusiveness for all consumers. Matsubayashi et al. (2021) emphasizes the importance of Central Banks and authorities exercising restraint in rapidly growing credit. The use of novel technologies engenders an ambiguous outlook for credit rates and economic downturns. Therefore, it is crucial to consider this aspect carefully when introducing CBDCs.

The possible replacement of conventional deposits and government bonds with CBDCs and stable coins carries substantial consequences for the stock market, both at the national and international levels. This shift has the potential to create concerns for consumers, impact exchange rates, and lead to adjustments in the strategies employed by financial firms and authorities to manage their finances (Wei and Wang, 2021). This could possibly curtail the borrowing potential of banks, thereby causing a ripple effect on the overall operation of the credit markets. To keep financial systems stable and reduce risks, it is essential to continuously monitor and adapt them throughout this transformation. It is also critical to do more research to see whether this trend could enhance the fiscal policy transmission channels. An integral part of this change is the potential premium in value that CBDCs may achieve during times of turmoil. In times of financial uncertainty, individuals and businesses may seek solace in CBDCs, which provide the prospect of constant supply and interest repayments (Singhi et al., 2020). Therefore, it has become necessary to set up measures that minimize the disparities between the desire for and availability of CBDCs. Alternatively, the rapid adoption of CBDCs during times of crisis might worsen the economic instability.

Moreover, the swift expansion of CBDC derivative markets adds a level of intricacy to the financial terrain. The presence of derivative markets can magnify the influence of CBDCs on the overall financial markets, necessitating careful supervision from policymakers. Maintaining stability and transparency in these markets is essential to mitigate the systemic risks. An international worry stemming from the implementation of CBDCs by the major governments is the possibility of marginalizing electronic currencies from the less developed nations (Tong and Jiayou, 2021). The excessive reliance on foreign currencies may undermine the authority and efficacy of macroeconomic and administrative measures in these smaller countries, resulting in possible difficulties in managing tax collections and general economic stability. To preserve financial independence, policymakers must skillfully negotiate these complex factors. Furthermore, the implementation of

CBDCs must be supported with policies aimed at resolving economic inequalities (Walker, 2022). The accessibility and simplicity of CBDCs pose a possible danger of fast credit growth, which might lead to the inflation of asset bubbles. To maintain the financial stability, it is crucial to build efficient legislative structures that can effectively regulate the correlation between credit development and the potential danger of asset bubbles.

When implementing CBDCs, it is crucial to consider the distribution of assets. If CBDCs are mostly held by a small number of affluent persons or corporations, it has the potential to disturb the balance of the financial system and impede financial inclusivity. Hence, it is crucial to establish restrictions on individual ownership and enforce rigorous Know Your Customer (KYC) protocols in order to uphold equity and inclusivity (Wei and Wang, 2021). Additionally, it is difficult to stimulate the deployment of CBDC in regions with underdeveloped internet and financial infrastructure. Extensive outreach campaigns and training programs are necessary, specifically aimed at the older population who may have little knowledge of digital financial systems. Furthermore, to thwart frauds and fraudulent activities, it is imperative to provide strong protection inside the ecosystem of CBDCs. Overall, the shift towards CBDCs and stable coins signifies a significant and fundamental change in the financial environment (Pirhonen et al., 2020). To manage this transition effectively, it is crucial to adopt a watchful and proactive attitude, modify rules, and allocate resources towards public education. These measures are essential to guarantee the stability and inclusiveness of forthcoming financial systems.

CBDCs have several revolutionary prospects for tackling the distinct obstacles encountered by both emerging and developed economies in the Asian area. CBDCs offer a promising solution for improving financial access in emerging Asian nations. These digital currencies facilitate peer-to-peer transfers without the need for official bank accounts or internet connection (Lee et al., 2023). This accessibility stretches much beyond the scope of conventional banking institutions, hence enabling the provision of financial assistance to previously marginalized communities. Furthermore, CBDCs provide the potential to decrease the significant expenses linked to the creation, printing, delivery, and safekeeping of physical currency. CBDCs might mitigate fraud and forgery threats by reducing dependence on physical currency, therefore ensuring the economic stability of these developing nations.

3. Discussion

Recent developments of CBDCs in Asia

CBDCs in sophisticated Asian economies mark the beginning of a new era in cross-border transactions and refunds. CBDCs possess the capacity to outperform conventional payment systems due to their effectiveness and swiftness, hence enabling smooth and expeditious international transactions (Nikander, 2023). This may significantly advantage the multinational firms and the banks that compete in such economies by optimizing their operations and diminishing the transaction costs. Furthermore, CBDCs have the potential to provide accurate information on illicit economic transactions that are typically not recorded in official financial systems.

This can improve the monitoring and comprehension of economic performance. CBDCs achieve a careful equilibrium between confidentiality and concealment, in accordance with changing legislative frameworks and individuals' worries over the data security. They can be engineered to guarantee the confidentiality of users' digital interactions while upholding the openness in their operations (Chen, 2023).

CBDCs provide a distinctive characteristic that makes them a practical option for Asian governments aiming to safeguard their citizen's data privacy and comply with global data protection regulations. Moreover, CBDCs have a crucial function in protecting and ensuring the effectiveness of macroeconomic and fiscal measures in the area. They can thwart the invasion of non-fiat digital currencies that may jeopardize the independence of local currency. This is particularly vital for territories such as Macau SAR, as its role as a prominent gambling hub significantly depends on the stability of its currency. The Macau Special Administrative Region (SAR) aims to employ CBDC as a means to combat money trafficking and tax avoidance (de Castro Halis, 2022). CBDCs mitigate the potential of destabilizing impacts from foreign currencies by offering a safe and regulated electronic payment network. CBDCs serve as accelerators for development by fostering cooperation and entrepreneurship within the financial sector. By utilizing Distributed Ledger Technology (DLT) and smart contracts, they can decrease the expenses associated with trust and encourage the development of new business endeavors. This advancement encompasses the development of token based CBDCs that can facilitate decentralized financing, providing more stability and confidence compared to current stable coins (Özkan et al., 2021).

Furthermore, CBDCs promote the compatibility and exchange of information between current payment methods and public blockchain networks, which in turn fosters a favorable environment for entrepreneurial prospects and job creation. Furthermore, CBDCs present a significant opportunity for promoting financial accessibility. They prioritize inclusivity by enabling individuals to participate in peer-to-peer operations without the need for legal banking organizations, bank accounts, or internet communication. This ease of access is especially advantageous in areas dealing with restricted or undeveloped financial infrastructure. CBDCs serve to connect and provide financial assistance to disadvantaged groups, hence promoting increased economic engagement and independence. Consequently, inclusivity is an essential characteristic of CBDCs. Furthermore, CBDCs offer a more secure means of distribution in comparison to private payment methods that may have insufficient investment in security measures. CBDCs provide a secure and regulated payment system, which helps reduce the vulnerability to cyberattacks and prevents the misuse of authority by private currency issuers (Amin et al., 2022).

China's e-CNY is expanding its presence by partnering with retail outlets to offer e-wallets, thereby promoting competition in the payment service industry. Furthermore, the introduction of CBDCs effectively mitigates substantial expenses linked to the handling and maintenance of physical cash and coins. The United States' currency operating budget for 2023 amounts to $931.4 million (Han, 2021). The expenses associated with printing, storing, and overseeing physical currency are significant, and a fraction of this currency is removed from circulation each year because of loss or damage. CBDCs offer the potential to reduce these expenses,

leading to significant financial benefits for governments and Central Banks. Asian Central Banks and governments have been carefully observing the worldwide developments in CBDCs and adapting their tactics appropriately. Their goal is to maintain the region's long-term interest and growth in this sector. Asian Central Banks have prioritized the development of CBDCs to tackle issues related to cross-border payment finality, settlement of securities transactions by delivery vs payment, stability of the financial system, expensive remittance costs, obstacles in achieving financial inclusion, and maintaining the significance of home currency (Soderberg et al., 2023). With the introduction of CBDCs, the foreign remittances would also get recorded correctly and accurately. Remittances have always been the most important source of support and financing for Central Asian countries (Nawaz et al., 2023; Kayani, 2021). The advancement of CBDC development differs among Asian nations, with some governments actively progressing towards implementation, whereas others are still in the first phases of study. In 2019, there was a notable shift in the worldwide CBDC research environment. The Bank for International Settlements (BIS) study reveals that almost 70% of its 62 Central Bank members were actively investigating the possible impacts of CBDCs (Brokke and Engen, 2019). There is an increasing desire among central banks to comprehend the consequences and the advantages of adopting CBDC.

Moreover, two crucial elements spurred a rapid increase in the investigation of CBDCs by Central Banks. The onset of the COVID-19 pandemic in 2020 brought about significant changes to the worldwide economic and financial environment. COVID-19 was not only a public health threat, but it was also a serious economic threat to the whole world (Aysan, 2020; Habib, 2024; Kayani, 2024; Kayani, 2022; Mumtaz, 2023; Shaikh, 2024). The pandemic revealed weaknesses in conventional payment methods and increased the need for effective, robust, and secure digital payment solutions (Dsouza, 2024; Kayani, 2024). As a result, Central Banks worldwide started CBDCs as a possible solution to tackle these difficulties. Furthermore, the emergence of stablecoins, namely digital currencies issued by private businesses, has generated apprehension and intensified competition within the digital currency realm. These advancements further motivated Central Banks to accelerate their investigations of CBDCs (Bhatia et al., 2023). About 80% of central banks were actively looking at CBDCs by November 2020, when the trend had really picked up. In the span of a year, there was a dramatic increase in both interest in and adoption of CBDCs. According to the BIS, by 2021, about 90% of the world's Central Banks are investigating the potential of CBDCs. With three operational retail CBDCs and twenty-eight complete pilots, it's clear that many Central Banks are not just researching the topic but are also quite enthusiastic about its implementation (Ngo et al., 2023).

The absence of affordable technology and Asia's isolation from international payment networks have prompted the creation of novel payment methods. These factors have motivated local organizations and authorities to implement proactive actions at an early stage to address the technical and financial gaps in inclusion. Smaller-scale national financial institutions and regional governments are largely taking proactive measures. The advantage of performing smaller-scale trials is that they reduce dependence on global currencies, hence reducing the costs involved with

adjusting to new technological breakthroughs. Financial experimentation has helped smaller economies and banking institutions adapt to a shifting financial landscape without becoming too reliant on major world currencies (Ertz and Boily, 2019). The Asian monetary authorities and Central Banks are now working on validating concepts, doing extensive research, and moving closer to deploying CBDCs. Prominent examples consist of the Central Bank Digital Currency (CBDC) experiments carried out in Thailand and South Korea throughout the years 2020 and 2021, correspondingly (Ito and Kawai, 2021). Moreover, several nations, such as China, Cambodia, Hong Kong SAR, Singapore, Malaysia, India, Japan, and South Korea, along with other neighboring economies, have displayed significant enthusiasm in investigating and potentially implementing CBDCs as a component of their financial and monetary tactics.

Significantly, even countries with lower levels of development and those located on islands, like Nepal and the Marshall Islands, are actively engaging in research, carrying out feasibility studies, and contemplating the implementation of CBDCs as an integral component of their financial systems (Gabusi, 2021). The shared interest among these nations reflects the universal acknowledgment of the significant impact that CBDCs may have in tackling the specific difficulties they confront. It also emphasizes the importance of CBDCs in the region's attempts to innovate and modernize its financial system. Currently, the only jurisdiction to issue CBDCs in Asia is with China and the Philippines. Many Asian governments are adopting a cautious approach while they evaluate the consequences, legal frameworks, and technological infrastructure necessary for the effective issue and administration of CBDCs (Michail and Selvadurai, 2023). Several central banks have initiated proactive measures to investigate and use these digital currencies for routine transactions. Although real-time retail payment systems have been in existence for a while, the banking sector has not always considered them to be a lucrative business opportunity owing to fierce competition (Machkour and Abriane, 2020).

Nevertheless, Central Banks have been aggressively promoting the incorporation and enlargement of instantaneous retail payment systems. Their objective is to establish a cohesive and effective digital payment environment that may be advantageous to both enterprises and consumers. Regarding retail CBDCs, significant progress has been made. The Bahamas and Cambodia have effectively implemented retail CBDC initiatives, enabling their people to use digital money for regular transactions (Hrnjic and Clarke, 2022). Ecuador, Ukraine, and Uruguay have successfully concluded pilot programs, demonstrating their dedication to investigating the viability of retail CBDCs and acquiring vital knowledge (Sethaput and Innet, 2023). The high price tag has been a major deterrent to the broad use of CBDCs and other real-time retail payment systems. Huge expenditures on infrastructure and technology are usually necessary for these systems. It is also common for regulatory officials to publish rules and guidelines to promote their implementation. But there is hope for a substitute in the form of digital currency via emerging DLT payment systems. According to Didenko and Buckley (2022), one distinguishing feature of CBDC money is its token-based unit of account, which only honors claim that are backed by proven knowledge, particularly via a digital signature. These systems provide a way for digital payments that is efficient, safe,

and accessible, which might open economic prospects, especially in emerging nations.

The adoption of digital currencies is a manifestation of the wider movement to modernize financial institutions and enhance financial inclusivity worldwide. In 2014, the People's Bank of China (PBOC) took a groundbreaking step among Central Banks by creating a specialized research team to explore the realm of cryptocurrencies, focusing specifically on the practicality of adopting a CBDC (Aysan and Kayani, 2022). Whereas China also introduced Made in China 2025 with the aim to achieve advanced industrialization, particularly in the field of emerging technologies (Nawaz et al., 2024). The electronic Chinese yuan (e-CNY) was formally released in 2019 because of China's effort. Subsequently, this kind of money has been undergoing public trials, commencing in April 2020, as a component of the wider Digital money Electronic Payment (DCEP) Project. By 2022, the test's scope had greatly expanded, including a total of 23 cities (Agarwal et al., 2021). By the end of December 2021, there were more than 8 million e-CNY pilot scenarios, 261 million wallets had been opened overall, and an astounding 88 billion yuan, or around $14 billion, had been transacted. The e-CNY runs in conjunction with and enhances the current prominent retail payment systems in China, especially Ali Pay and WeChat Pay. It functions inside a dual-level system. At the top level, the PBOC is supremely authoritative and enjoys exclusive power over the e-CNY. The second layer consists of private sector firms that are allowed to communicate directly with end users, who are people and businesses who use the e-CNY for different types of financial transactions. To further facilitate end-user transactions utilizing the digital currency, these private sector companies may also provide services like e-CNY wallets, digital banking, and payment processing. The e-CNY as it stands now requires a commercial bank account. Nonetheless, there are plans to "decouple" it from the conventional banking system. By entering their passport details, visitors and other users would be able to access and utilize e-CNY (Jiang and Lucero, 2022).

In addition, a novel feature is being developed in China that would allow users to conduct transactions using e-CNY even when their mobile device's battery is low. This shows that China is persistent in its efforts to use secure hardware-based approaches to enhance the offline capabilities of the CBDC. At its core, blockchain technology is used to improve system security and provide ownership record inquiry services. In doing so, it emphasizes how China's CBDC system has gradually integrated blockchain-based capabilities with other centralized systems. Asset, payment, and utility-related features are common in digital currency designs. The focus in discussions on digital currencies, however, has often been on their functions as assets and payment systems. The utility function is generally neglected, but China's e-CNY highlights it, adding a new dimension to the discussion. As part of this utility function, hitherto illiquid products and services are tokenized (Ren et al., 2023).

It essentially turns non-tradable assets into exchangeable digital tokens. The ability to facilitate the trading of market offers that are not presently operational is built into e-CNY. Use cases for this kind of asset include time-based services and representing assets with underlying value that are steady. This adaptability makes the e-CNY suitable for a variety of economic activities, since it permits a broad range of

possible use cases. Notably, e-CNY is more often known as digital money in China than as a digital fiat yuan. The use of nomenclature highlights its versatility beyond only replacing physical yuan. Actually, e-CNY's design reflects one of its main objectives, which is to encourage commerce in products and services (Xu, 2022). One real-world use of this utility function in 2023 is when AliPay began accepting e-CNY as an express payment method. The goal of the e-CNY is to stimulate economic development by opening new trade opportunities via the promotion of exchanges in electronic commerce. For this reason, other nations considering creating their own CBDCs would do well to examine China's e-CNY strategy. Lessons in data privacy protection, system robustness, developing legislative frameworks, and tactics for widespread adoption are offered. Additional economic value and new applications for CBDCs might be unlocked by delving deeper into the utility dimension of digital currencies, which is an interesting subject for future academic and policy study (Allen et al., 2022).

In recent years, the main driving force behind the creation of wholesale CBDCs has been the need to improve the efficiency of cross-border payment systems. Interoperability is crucial for the success of CBDCs in a fast-changing digital economy. Effective cross-border transactions are essential for shaping the global economy, as it is influenced by international trade, e-commerce, remittances, and the tourism industry (Alwaely, 2021; An, 2020a, 2020b; Candila, 2021; Mutalimov, 2021; Mikhaylov, 2023; Saqib, 2021;). Considering the current conditions, establishing cross-border payment hubs has become an imperative and indispensable measure. In order to allow cross-border activity, an ideal CBDC design should provide interlinkage possibilities from the beginning (Themistocleous et al., 2023). The overarching goal of these payment hubs is to facilitate the interoperability of CBDCs so that consumers, companies, and banks may trade across borders in an efficient and cost-effective manner. International payments are generally complicated and inefficient due to factors like high fees, delays, and currency conversion troubles; but, with this interoperability, these issues are eliminated. The incorporation of interlinkage possibilities into CBDC designs at an earlier stage of construction is becoming more common in order to realize this ambition (Walker, 2022). Although there is a need to put more efforts into standardization, legal frameworks, and technical infrastructure, overall CBDCs have tremendous possibilities for the cross-border payments. As a result of the revolutionary opportunities, they provide for modernizing financial institutions and achieving economic goals, CBDCs are of interest to both established as well as the emerging nations. Despite this common ground, an IMF poll from 2022 indicates that retail CBDCs will likely be issued only by China and India soon. Furthermore, as of this writing, not a single nation has announced any intentions to issue a wholesale CBDC anytime soon. The fact that adoption timetables are different; highlights the specific dynamics and goals of the CBDC ecosystem worldwide (Chen et al., 2022).

Table 1 presents the significant advancements of CBDC in Asia and offers a thorough summary of the innovative measures used by Central Banks around the Asian continent. This table provides a concise and useful overview of the ever-changing CBDC situation in Asia, making it a great reference for academics, enthusiasts, and policymakers.

Table 1. Significant advancements of CBDC in Asia (Lee et al., 2023; Ozili, 2023).

Country	Status	Type	Project name
Bhutan	Development	Retail and wholesale	Digital Ngultrum (2021)
China	Pilot	Retail and wholesale	e-CNY (2019) mBridge (2021)
Georgia	Research	Retail	Digital Lari project (2023)
India	Pilot	Retail	Digital Rupee (2020)
Israel	Pilot	Retail	Digital shekel Project Icebreaker (2022)
Iran	Pilot	Retail	Crypto rial (2022)
Japan	Pilot	Retail and wholesale	Digital yen (2020) Project Stella (2016)
Kazakhstan	Pilot	Retail	Digital Tenge (2021)
Philippines	Development	Wholesale	CBDCPh (2022)
Palestine	Inactive	Retail	Palestinian pound (2017)
Saudi Arabia	Pilot (for wholesale) Research (for retail)	Wholesale	Project Aber (2019)
Turkey	Pilot	Retail	Digital Turkish lira (2022)

4. Launching of digital tenge by Kazakhstan

In 2018, Kazakhstan's macroeconomic data included a real GDP of $171 billion and a GDP per capita of $9237, with a population of 19 million. The current inflation rate is at 4%.and the domestic debt is at around 28%. The period between 2015 and 2019 had a consistent GDP growth rate of about 5% (Омаров and Кобадилов, 2020). Financial advisors indicate that the magnitude of Kazakhstan's Financial market is relatively tiny in the eyes of prospective investors. A significant proportion of this is owned by banks and the banks' assets amount to 40% of the Real GDP and provide a 21% return on equity annually. The growth of the market in Kazakhstan may be attributed to historical and political transformations that the country has undergone in the last three decades, as well as the successive economic developments that have shaped the current financial market. The weak market may be attributed to a combination of a small number and a huge, impoverished portion of the population, as well as the detrimental and beneficial impacts of economic planners (KPMG, 2019). According to the World Bank research, 59% of people own a bank account, while 92% of firms and small and medium-sized enterprises (SMEs) have an account with registered financial institutions. Therefore, if the market is exclusively dominated by commercial banks, it is evident that financial inclusion beyond the banks is lacking. Furthermore, the majority of the branches of commercial banks are located in the country's two largest cities, Felsenthal and Hahn (2018).

Financial inclusion in other areas is rather low. This might be attributed to the low demand in some locations, leading to limited rivalry among banks in these areas as opposed to the two major cities in Kazakhstan. Out of the whole population of Kazakhstan, 77% use the Internet, with 33% being active mobile Internet users.

In the Republic of Kazakhstan, fiat currency is present in two forms-physical cash and deposit money, liabilities of banks (see for example: Iwańczuk-Kaliska, 2023; Niepelt, 2020). Cash is distributed as physical currency, such as banknotes and coins, while non-cash transactions are recorded as digital entries in bank accounts.

The NBRK is contemplating the implementation of a third kind of the national currency, known as the digital Tenge. The digital Tenge will serve as an additional manifestation of the NBRK's responsibility, possessing all the characteristics and functionalities of currency. Simultaneously, it will amalgamate several attributes of physical currency and digital money, while also introducing novel features for corporate entities and governmental organizations (Sodnomova et al., 2023). Digital Tenge presents new possibilities for individuals, but we must not overlook the potential dangers it may bring. The digital Tenge will be issued by the NBRK, therefore the degree of confidence in the government is likely to be the biggest risk associated with its usage. We are now working on a solution to launch digital Tenge in industrial operation as part of our initiative to introduce it. The prototype was tested with a small group of volunteers in December 2022 after it was finalized. By the end of 2025, the digital Tenge is projected to be fully implemented, according to the objectives of the NBRK (Salimova-Tekay, 2022).

A major stride towards adopting financial technology and updating its monetary system, Kazakhstan's choice to introduce a digital form of its national currency, the Tenge, is commendable. This decision follows the current trend of central banks throughout the world looking into and possibly introducing digital currencies. Blockchain technology is expected to become the foundation of the digital Tenge. To efficiently record transactions, prevent fraud, and ensure data integrity, blockchain provides a transparent and secure ledger system. The precise blockchain protocol that is chosen will determine the characteristics and capabilities of the digital Tenge. Possible protocols include Ethereum, Hyperledger, or a bespoke solution (Tenge and Okello, 2022). With the National Bank of Kazakhstan issuing and overseeing the digital Tenge, it is anticipated that it will function as a CBDC. CBDCs are centralized and often linked to the national fiat currency, which sets them apart from Bitcoin and other cryptocurrencies. Digital wallets are necessary for users to store and transmit digital Tenge. Wallets like this might be in the shape of physical hardware, online software, or even mobile apps (Laboure et al., 2021). Digital wallet solutions that are both easy to use and safe can be developed in collaboration with the National Bank of Kazakhstan and commercial financial institutions or technology businesses.

To develop and operate a digital currency successfully, a strong regulatory framework is essential. To make sure the digital Tenge follows both domestic and international rules, the Kazakh government will probably set explicit rules and regulations for its use, issue, and exchange. Due to the digital character of the money, it is essential that the most stringent cybersecurity measures be put in place. If the digital Tenge is to be protected from cyber threats, hacking attempts, and other weaknesses, the National Bank of Kazakhstan must establish stringent security protocols (Jussupova, 2020). CBDCs adoption might improve regional economic cooperation and commerce by standardizing cross-border transactions. To further aid in the management of inflation and the maintenance of economic stability, digital currencies provide Asian Central Banks with additional instruments for carrying out monetary policy (Foster et al., 2021). In addition, many Asian nations may become less reliant on physical currency because of the transition to CBDCs, which might

lead to increased technology innovation and the creation of more sophisticated digital payment systems.

The implementation of a digital Tenge as a CBDC in Kazakhstan has the potential to expand the range of financial services available in the nation. This might stimulate the development of novel digital financial goods and services. Having direct authority over the digital currency will empower the National Bank of Kazakhstan to adopt more efficient monetary policies, exerting influence over interest rates, money supply, and general economic stability. If adjacent nations also implement CBDCs, the digital Tenge might enhance the efficiency of cross-border transactions, hence fostering more trade and economic cohesion within the area. Furthermore, by providing access to digital financial services to marginalized communities, the digital Tenge might help solve the difficulties of financial inclusion in Kazakhstan. The shift to digital money raises cybersecurity worries, too, and the digital Tenge will need strong protections against cyber assaults (Sodnomova et al., 2023).

5. Conclusion and recommendations

CBDCs help to reduce the significant expenses related to the creation, printing, delivery, and safekeeping of the physical currency; they are also instrumental in mitigating the fraud and forgery threats by reducing the dependence on physical currency. The main goals and the objectives of launching digital Tenge are to increase the proliferation of cashless payments; to increase the competition in the national financial market; to increase the efficiency of payments with the participation of the State and to increase financial market`s competitiveness especially keeping in view the other regional and international players. According to World Bank, Kazakhstan has young population of around 20 million with a median of about 30 years of age. The younger generation is more technological-oriented, and this demographic advantage is playing a critical role in the evolution of digital payments in Kazakhstan. The implementation of a “Digital Tenge” as a CBDC in Kazakhstan would empower the National Bank of Kazakhstan to adopt more efficient monetary policy, exerting influence over interest rates, money supply, and general economic stability. Furthermore, by providing digital financial services to marginalized communities, the digital Tenge would also help to solve the difficulties of financial inclusion in Kazakhstan.

For effective and successful implementation of CBDCs, Kazakhstan needs to address the following issues upon priority. Firstly, if CBDCs are mostly held by a small number of affluent persons or corporations, it could possibly imbalance the financial system and would impede the objective of financial inclusivity. So, it is suggested to establish the restrictions on individual ownership and to enforce the rigorous Know Your Customer (KYC) protocols. This action would help to uphold the equity and inclusivity. Secondly, the concept of digital payments needs to be facilitated even beyond the domestic borders; a transformative effect on international trade and economic integration could be achieved by facilitating the cross-border transactions. To unlock the full potential of cross-border digital payments, Kazakhstan needs to address the challenges of high cost and time delays of cross-

border transfers. It is highly advised that new payment methods and technologies must undergo rigorous security assessments to address the cybersecurity issues. If the digital Tenge is to be protected from cyber threats, hacking attempts, and other weaknesses, the National Bank of Kazakhstan must establish stringent security protocols (Jussupova, 2020). Thirdly, it is difficult to stimulate the deployment of CBDC in regions with underdeveloped internet and financial infrastructure. The extensive training programs are necessary, specifically aimed at the illiterate and the older population who may have little knowledge of digital financial systems. The promotion of financial literacy and education about the responsible use of "Digital Tenge" can help the individuals to make well-informed and safe decisions. The future researchers could explore the impact of CBDCs on environmental sustainability of Central Asia.

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