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Worldwide practice and impact of digital currency of central bank's implementation

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Abstract. The forced digital transformation of the banking industry and monetary policy were a response to the growing trend of increasing adoption of decentralized finance. The transition from traditional, physical forms of money and payment systems to digital currencies and blockchain technology represents a significant shift in the financial landscape. This transition is characterized by the development of unique, non-replicable assets, which define cryptocurrencies and other forms of digital assets. These assets are actively responding to the rapid changes in financial markets and represent a major development in monetary systems. The introduction of central bank digital currencies (CBDCs) represents a key event in this transformation, and their potential as monetary policy instruments should not be overlooked. Governments around the world are addressing the challenges of implementing these new currencies and ensuring their transparency, while also considering their potential benefits for economic stability. This study will explore the current state of CBDC development and its implications for the future of monetary systems. By analyzing the motivations for CBDC initiatives, the challenges of integrating these digital currencies into existing financial systems, and their implications for international payments, privacy, and security, this study reveals the multifaceted consequences of this technological development. The research is based on an examination of global CBDC projects, identifying successful implementations and the diverse approaches taken by various countries. Ultimately, this article emphasizes the importance of international cooperation and the establishment of a regulatory framework in order to benefit from the potential benefits of CBDC while mitigating the associated risks.

Keywords: Central bank digital currency, monetary policy, cross-border transactions, decentralized finance

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Мировой опыт и глобальные эффекты внедрения цифровой валюты центрального банка

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Аннотация. Вынужденная цифровая трансформация банковской системы и денежно-кредитной политики стала последствием реакции на формирующийся тренд роста популярности децентрализованных финансов. Переход от физических денег и устаревших платежных систем к цифровым валютам и технологии блокчейна характеризуется революционной концепцией создания уникальных в цифровом виде, некопируемых активов. Эта особенность определяет криптовалюты и цифровые активы, и финансовые рынки активно реагируют на этот сейсмический сдвиг. Внедрение цифровых валют центральных банков (CBDC) становится ключевым событием в преобразовании денежно-кредитных систем. Не следует также недооценивать влияние пандемии COVID-19 на ускорение развития CBDC из-за их потенциальных преимуществ в качестве инструмента денежно-кредитной политики, поскольку правительства решают проблему прозрачного распределения и отслеживания программ экономического стимулирования, появляющихся с начала 2020 г. Рассмотрено текущее состояние внедрения CBDC, подчеркнут его потенциал в повышении экономической стабильности и пересмотре роли центральных банков. При анализе мотивов, стоящих за инициативами CBDC, проблем интеграции цифровых валют в существующие финансовые структуры и их влияние на международные платежи, конфиденциальность и безопасность раскрыты многогранные последствия этого технологического сдвига. Исследование основано на изучении глобальных проектов CBDC, в которых освещаются успешные реализации и различные подходы, применяемые разными странами. В конечном счете подчеркнута необходимость международного сотрудничества и нормативно-правовой базы для использования преимуществ CBDC при одновременном снижении связанных с ними рисков.

Ключевые слова: цифровая валюта Центрального банка, CBDC, денежно-кредитная политика, трансграничные платежи, децентрализованные финансы, DeFi

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Introduction

As the world becomes increasingly digital, central banks are taking a bold step into the future by introducing digital currencies. This innovative move has the potential to revolutionize the way we think about money, transforming the financial landscape and redefining the role of central banks. In this study, we delve into the worldwide practice and impact of central bank digital currencies, examining the current state of implementation, its effects on the economy, and the opportunities and challenges that lie ahead.

Over the recent past, the topic of central bank digital currency (CBDC) has evolved from a distant concept to a global economic policy agenda. One of the most discussed issues today concerns the implications for the financial system, particularly the impact on international payments, as well as access policies, legislation, privacy and security models, interoperability and integration.

Digitalization has provided an opportunity to rethink the concept of money and the architecture of the monetary system. Over the past few years, digital transformation has led to a strengthening trend towards decentralized finance, which has raised concerns from the government. The merging of traditional financial systems with decentralized finance (DeFi) is an important trend, and financial institutions are expected to use DeFi innovations such as smart contracts and decentralized lending to improve their services. Increased international regulatory cooperation is likely to lead to a single global framework for digital assets, balancing innovation with financial stability and opening up new opportunities for the DeFi sector.

The purpose of the study is to study the world experience and assess the global effects that digital currencies of central banks have on the global economy.

Literature review

The concept of decentralized cryptocurrencies, their volatility and lack of government control over transactions has led to increased regulatory oversight in many countries, and as a result has led to bans or restrictions on use. But the ability to use cryptocurrencies and other digital payment instruments has led to the risk of central bank money being replaced by other instruments in the future (Keister, 2019).

In fact, central bank digital currency expands the functionality and utility of central bank money and promotes new uses for it. The COVID-19 pandemic has led to the emergence of new payment behaviors among users. The use of cards and other means of digital payments instead of cash has shown how quickly payment patterns can change (Brown et al., 2020). A central bank digital currency has high potential to complement existing central bank payment instruments as well as offer new approaches that will change the coverage and geography of central bank money. In addition, more efficient transaction processing methods may emerge. The programmability of the CBDC could also lead to new business models and applications that require smart money features and provide a driver for the deepening of payments markets. Although the new central bank digital currency will settle in a separate financial market infrastructure, integration with existing payment and core banking

systems is considered essential for successful implementation (Auer et al., 2022; Auer, Boehme, 2021). However, discussions regarding the release of different forms of digital currency and their accessibility for ordinary users have only recently begun. Most attention has been paid to the role of central banks, the effectiveness of monetary policies, and the implications for financial stability (Auer, Boehme, 2021).

Methods

The research draws upon secondary data from publications such as journals, magazines, websites, and periodicals, in addition to a review of previous conceptual and empirical studies to assess the paper's objectives.

Development of national and regional central bank digital currency projects

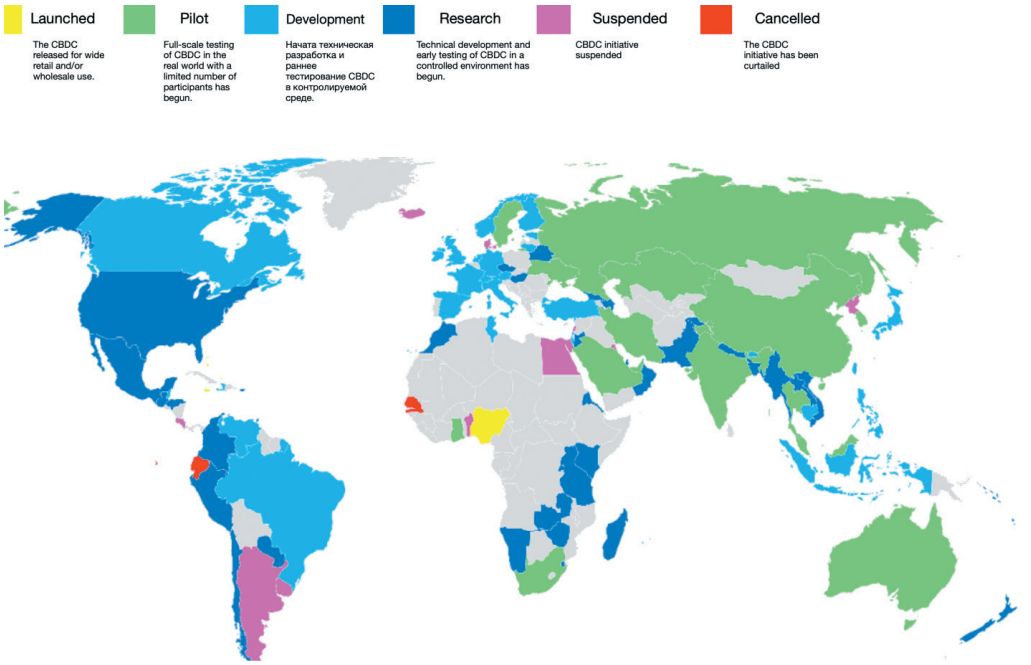
To date, the central bank digital currency project is being developed to varying degrees by 114 countries with a combined GDP of 95% of global GDP. According to a survey conducted in late 2020, 86% of global central banks are performing CBDC research, and as of July 2021, 56 central banks have publicly reported their studies and developments (Boar, Wehrli, 2021; Castren et al., 2022).

It is interesting to note that most developed countries have until recently been cautious about the development of CBDC, which is not the case with developing countries. Particularly, the US FRS, the Bank of Japan and the ECB have not developed unified concept for the development of a digital central bank currency, but at the same time they do not deny the importance of its development (Glavina, 2023; Vaganova, 2022).

We can see that today most of central banks are at different stages of implementing national digital currencies. Most regulators around the world have taken initiatives to start their CBDC journey, either by contacting industry experts to explore different models or are in the testing phase. Some countries like Cambodia and Bahamas have already launched CBDC. The chart below depicts the geographic location of the existing central bank digital currency projects in the world today and their stage of development (Fig.).

Global effects of central bank implementation of digital currencies

Central bank digital currencies, depending on geography, have the potential to provide significant benefits to individuals, businesses and governments, but they also pose the threat of a major transformation of the global financial system. "Programmable money" carries a wide range of new use cases, including spending limits, triggers and usage restrictions. CBDCs also help meet the need to expand access to financial services in the face of limits, costs, and under coverage of existing payment systems. The use of digital distribution channels and infrastructure can provide a broad new level of global access to central bank money and payment services.



Geography and status of central bank digital currency launch initiatives as of 2023
Source: compiled by S.G. Glavina based on Atlantic Council, CBDC Tracker (2023).

Reduction of monetary dependence. In other words, it is about the share of cash to GDP in a country's economy. The anonymity of cash makes it possible for being used in money laundering and financing illegal and terrorist activities (Fernandez-Villaverde, 2021). In general, countries around the world are striving to reduce the share of cash in the country, for example China has achieved 9.2% and Korea 2.1%. It is estimated that the annual social and private cost of the cash processing in the European Union is about 1% of GDP[1]. "The transition to digital payments and digital currency can reduce reliance on cash. This is the function primarily highlighted by BIS, a public good that in digital form offers the unique advantages of central bank money: settlement finality, liquidity and integrity"[2]. A project of Sweden's central bank, the Riksbank, the e-krona, provides a template for using digital currency as a digital alternative to cash and electronic money that is issued directly by the government[3].

Increasing resilience and overcoming infrastructure constraints. However, 100% digitalization of payments will put a strain on the existing financial and banking infrastructure, which may pose a threat to national security. In addition, the transition to a digital payment system, which is a crucial economic infrastructure, increasing

[1] Schmiedel, H., Kostova, G., & Ruttenberg, W. European central bank. Occasional paper series. № 137/September 2012 The social and private costs of retail payment instruments: A European perspective. Retrieved 19.07, 2024, from https://www.ecb.europa.eu/pub/pdf/scpops/ecbocp137.pdf

[2] BIS Annual economic report. 23 June 2021. III. CBDCs: an opportunity for the monetary system. Retrieved 19.07, 2024, from https://www.bis.org/publ/arpdf/ar2021e3.pdf

[3] Sveriges RIKSBANK. E-krona. Retrieved 19.07, 2024, from https://www.riksbank.se/en-gb/payments--cash/e-krona/

the risk of terrorist attacks and its vulnerability. A distributed ledger system will significantly increase the resilience of the system and its security. In this case, the example of India is interesting, where the new umbrella organization (NUE) for digital rupee payments can provide an alternative instant settlement mechanism. The introduction of the digital rupee will contribute to greater diversification of India's payment system by offering alternative payment methods. It will also enhance the resilience and security of the entire payment infrastructure.

Fraud Prevention. According to CVC's Top 100 Fraud Report[4], one of the main causes of non-legitimate transactions is improper end-use of credit funds. While the current system relies on post-facto checks such as audit reports, inventory reports, etc. that are partially reviewed by various creditors, digital currency could proactively address these issues with built-in programmability and regulated traceability. CBDCs have the potential to promote financial accessibility by providing more competition for consumers and allowing transactions to be more direct by reducing mediation, thereby lowering the cost of financial services and making them more affordable. Unlike commercial banks, a central bank's lack of profit motive can also help reduce costs.

Facilitating faster and cheaper cross-border payments. Today, with digital transformation, rapid growth in online commerce and international tourism, disruption of global supply chains, and increasing global instability, cross-border payments are a vital function of the global financial system. It is estimated that cross-border payment volumes could reach $250 trillion by 2027. At the same time, growing risks and increasing sanctions pressure on international relations complicate the development of the industry, opening up "weaknesses" in the existing system. Global supply chains have led to an increase in the number of payments between companies in different countries. Increased migration usually leads to an increase in the number of credit transfers made by migrants to family members in their home countries (called money transfers), which represent a significant inflow of funds for many countries compared to gross domestic product (GDP). In addition, cross-border payments and national calculations are costly, slow, and lack transparency. And this significantly raises the importance of economic and national security at both national and regional levels. Coordination of national CBDC projects can lead to more efficient cross-currency and cross-border payments. This could further lead to the creation of a regional system to realize cross-border payments using the central bank's digital currency (Kulakova, 2023).

It is interesting that there are already several successful projects in operation today, such as Jura, which provides the transfer of euros and Swiss francs in wholesale CBDC between French and Swiss commercial banks on a single platform[5].

Improving the distribution of wealth. In our current monetary system, cash issued by the central bank is only a fraction of the total money supply in circulation. The bulk of the money supply is in the form of deposits in commercial banks

[4] Central vigilance commition. Annual report 2022. Retrieved 19.07, 2024, from https://cvc.gov.in/files/annual-report-pdf/AR-E-2022.pdf

[5] Project jura: Cross-border settlement using wholesale CBDC, December 2021. Retrieved 19.07, 2024, from https://www.bis.org/publ/othp44.pdf

(Andolfatto, 2021; Kim, 2019). A central bank digital currency could potentially strengthen the distribution of wealth and make it more reliable by eliminating leakages, for example, by preventing welfare money from being diverted to unrelated bank accounts. By doing so, it would ensure that funds are used for their intended purpose, such as using allowances or scholarships exclusively for their intended purpose (Gimelstein, Godvan, 2021).

Increasing the speed of government decision-making. The central bank's digital currency is primarily designed in response to the development of decentralized finance. As such, the idea of being able to capture real data about the state of the economy is at the center of the CVCB. The use of programmable money provides data that helps us understand more clearly the dynamics and value of each account. It also allows for more effective monetary policy interventions, more effective spreading of information throughout the economy, and more effective achievement of policy goals (Sitnik, 2020; Gorbacheva, 2023).

Global experience in the implementation of central bank digital currencies

Let's take a look at the most successful projects:

1. **Nigeria.** The first African country to successfully launch a central bank digital currency, eNaira. However, this initiative was subject to many criticisms, largely due to a rather sluggish development. In the 2 years of operation, the app was downloaded more than 700 thousand times — which corresponds to 0.35 %, while it is worth considering that not all downloads of the app were made by Nigerian residents. The appearance of eNaira was intended to strengthen the role of the national currency and reduce the use of cryptocurrencies in the country. However, this has not been achieved — in 2022[6], approximately 33.4 million Nigerians, trade or own cryptocurrencies or digital assets.
2. **Bahamas.** In 2020, The Bahamas became the first country to launch the CBDC Sand Dollar, issued by the Central Bank of The Bahamas as legal tender. All residents can access the digital wallet through a mobile app or physical payment card[7]. Records collected during daily transactions, such as income and expenditure information, can be used to apply for microcredit. The project aims to improve the efficiency of Bahamian payment systems through more secure transactions and faster processing speed. It is the world's second largest retail central bank digital currency.
3. **China.** China is one of the leading countries in the experimental stage. Their CBDC, e-CNY, is currently being tested in 15 major cities. The country has

[6] Deloitte. Central bank digital currencies: Building block of the future of value transfer. 2024. Retrieved 19.07, 2024, from https://www2.deloitte.com/content/dam/Deloitte/in/Documents/financial-services/in-fs-cbdc-noexp.pdf

[7] PwC global CBDC index and stablecoin overview 2022. Retrieved 19.07, 2024, from https://www.pwc.com/gx/en/new-ventures/cryptocurrency-assets/pwc-global-cbdc-index-stablecoin-overview-2022.pdf

also started another trial during the 2022 Winter Olympics in Beijing (Sedunova, Kuvaeva, 2023). At the end of 2022. 4.5 million merchant wallets and 260 million transactions worth more than 83 billion yuan were completed under the experiment. Given the relatively high penetration rate of electronic consumer payments in China, the digital yuan has the potential to enable a full transition to non-cash payments[8]. In addition, cross-border payments between mainland China and Hong Kong, which has a separate legal and banking environment and infrastructure, are being actively tested on a pilot basis. The pilot launch was attended by 200 selected employees and business customers of Bank of China (Hong Kong), a subsidiary of Bank of China and the second largest commercial bank in Hong Kong.

4. **Jamaica.** In June 2022, Jam-Dex, the first CBDC to be officially approved as legal tender, was launched. It aims to provide a digital alternative to cash that is convenient, secure and easy to use. Early examples of Jam-Dex use cases include peer-to-peer payments and payments to small and micro-enterprises, including those without traditional bank accounts, thereby enhancing financial inclusion.
5. **Russia.** The digital ruble is a new form of Russian national currency that will be issued by the Bank of Russia in addition to the existing forms of money (cash and non-cash rubles). The digital ruble will be stored on electronic wallets at the Bank of Russia. In general, the digital ruble represents a new stage in the development of Russia's financial system, which is designed to improve the security, accessibility and efficiency of the national currency. 12 banks, 600 Russians and 22 companies took part in this. As of July 1, 2024, more than 27,000 transfers and over 7,000 payments for goods and services have been made in this system (Khoroshilov, Vasiliev, 2022).
6. **India.** The Reserve Bank of India (RBI) has launched a pilot project for a retail CBDC, the 2022 digital rupee. A key driver of the project is the changing global payments environment, including the rise of private digital currencies. and the vast majority of the world's central banks are exploring potential CBDCs. In India, the widespread use of cash is characterized by high operational costs and risks associated with physical money, which are driving plans for CBDCs. A digital form of cash not only counteracts these risks, but can also stimulate innovation in the payments sector and increase financial inclusion.

Comparison of existing digital currencies

Let's look at eight of the most developed central bank digital currency projects and compare their development according to the following characteristics: underlying form and technology, usability, existing usage limits and restrictions, issuance and distribution features (Table).

[8] Federal reserve system. Money and payments: The U.S. dollar in the age of digital transformation. 2022. Retrieved 19.07, 2024, from https://www.federalreserve.gov/publications/files/money-and-payments-20220120.pdf

Table

Comparison of the key projects of the central bank's digital currency in the world, as of 2024

Country Characteristics	China	Cambodia	Bahamas	Eastern Caribbean	Nigeria	Russia	UAE	India
1	2	3	4	5	6	7	8	9
Name	Digital Yuan	Project Bakong	Sand dollar	DCash	eNaira	Digital Ruble	Digital Dirham (participation in projects mBridge, Aber)	Digital Rupee
Short description	The project was initiated in 2014 to improve the retail payment system. Pilot launched in 2021. Number 3 among retail CBDCs	The Bakong project is sponsored by the National Bank of Cambodia to improve access to financial services for unbanked rural population.	Central Bank of the Bahamas launches its digital currency Sand Dollar for financial inclusion and payment interoperability. Number 2 among retail CBDCs	4 of 8 member countries participate in the launch. Goals: reduce transaction costs and increase financial inclusion for unbanked individuals. Ranked 5th among retail CBDCs	enaira Launch by Central Bank of Nigeria. Goals: increase financial inclusion, facilitate remittances, ensure traceability, and promote integration and security. Ranked 1st in the world among retail CBDCs	Initiation on August 1, 2023. On August 15, a pilot project to test digital ruble transactions was launched. It involves 13 banks, about 600 citizens and 30 trading and service enterprises in 11 Russian cities	The initiative is an integral part of the UAE's financial infrastructure transformation program	The Reserve Bank of India (RBI) has launched the pilot project of retail CBDC, the digital rupee of 2022
CBDC form and access technology	Retail-oriented using account technology for circulation	Retail CBDC using DLT on a hyperplatform	Retail CBDC using DLT	Retail CBDC using DLT	Retail CBDC using DLT	Retail CBDC using DLT	Wholesale CBDC using DLT	Retail CBDC using DLT/ development of wholesale capacity
Ease of use	Yes	No	Yes	No	No	Yes	Yes	Yes
Transaction limit	No	Yes, different wallets will have different transaction limits.	Yes, with a limit of $500 and a maximum monthly transfer of $1,500.	No	Yes, daily transaction and wallet balance limits are set	No	No	No

Ending of Table

1	2	3	4	5	6	7	8	9
Issuance and distribution of currency	Commercial banks distribute to public	Issued by Central Bank. 16 banks supported. 10,000+ users accepting. 2,000 transactions/second throughput	Although the currency will be issued by the Central Bank, banks, credit unions, PSP or MTB can distribute it to customers. The customer can also download an application to make transfers	Dcash will be issued to the East Central Caribbean Bank (ECCB) and will be distributed by licensed banks and non-banks in the region	CBN will issue eNaira and financial institutions will act as intermediaries between CBN and customers	Dissemination with state participation	Dissemination with state participation	Pilot project awaiting trial run
Use case	Internal payments Offline payments	Internal payments Cross-border transactions	Internal payments Offline payments	Internal payments Cross-border transactions	Internal payments	Internal payments Cross-border transactions	Internal payments Cross-border transactions	Internal payments Cross-border transactions
Stakeholders	Commercial banks Authorized operator of the Central Bank	16 banks 20,000 users	Banks/Credit Unions PSP/MTB	Banks Non-bank regulated organizations	Merchants Government agencies Financial institutions agency government	Commercial banks Authorized operator of the Central Bank	Banks Non-bank regulated organizations	Banks Non-bank regulated organizations
Results / Next Steps	Intends to to explore new applied models for economic and social development. At the same time, appropriate data security rules, business continuity measures will be adopted	The project will cover business use cases for the financial market. The central bank is also looking for features such as ATM cash withdrawals, time deposits and linkage to traditional payments	Central banks cooperate with various stakeholders formulate the legal framework necessary to support the payment system	ECCB intends to reduce cash use by 50 % by 2025 and use CBDC as an alternative	The CBN envisages that eNaira will complement the traditional Naira as a less expensive, more efficient, generally accepted, safe and secure means of payment. It is also expected to enhance the effectiveness of monetary policy and social interventions	Expecting the completion of a pilot project for the use of the digital ruble in cross-border payments	The Central Bank of the United Arab Emirates announced that it is embarking on the mBridge project in collaboration with the Bank for International Settlements, the Hong Kong Monetary Authority, the Bank of Thailand and the Digital Currency Institute of the People's Bank of China	Potential future uses of CBDC wholesale trade include: cross-border remittances, interbank loans/demand money market and credit services

Source: compiled by S.G. Glavina.

Conclusion

The introduction of a central bank digital currency could have serious geopolitical implications, especially given that most cross-border trade is currently conducted in U.S. dollars. Many countries are seeking to develop alternative payment mechanisms based on CBDC to improve the speed and efficiency of payments. However, the introduction of CBDCs involves risks such as data privacy, the risk of using CBDCs in the context of sanctions and anti-money laundering and counter-terrorist financing regulations, and cybersecurity issues. The issuance of retail CBDCs may also lead to problems associated with the abandonment of bank intermediation, as customers may prefer to keep their money in CBDCs rather than in commercial banks.

Considering the cross-border capabilities of CBDCs, cooperation between countries and regulators in their use is likely to be crucial.

Most active central bank digital currency projects focus on cross-border payments (for example, Jura, mBridge, Dunbar, Mariana), as cross-border options are considered the most effective for transformation, including with financial system governance, anti-money laundering and countering the financing of terrorism, enhanced data security and privacy, and financial stability. More than one hundred countries, representing more than 95% of global GDP, are exploring the development and implementation of CBDC at various stages of development. The Asia-Pacific region is a leader in this area, with China, India and Thailand at the forefront. However, despite China's progress, the digital yuan (e-CNY) has not yet been widely accepted, due to low levels of citizen confidence and privacy issues. In addition, the spread of the new form of money has been limited by the availability of other developed digital and mobile payment solutions such as Alipay and WeChat Pay. For China, the digital yuan can be a tool to regain control over the development of decentralized finance and transaction tracking. Western countries are lagging behind in CBDC development, mainly due to the reliability and high level of development of existing payment systems. The US is the least advanced in this direction, partly due to the lack of government regulation.

Some smaller countries, such as the Bahamas and Nigeria, have already introduced CBDC into their economies, but these projects have not been widespread due to a lack of internet access and training in the use of the new payment instrument.

Emerging market and developing economies (EMDEs) such as China, Mexico and Nigeria are more enthusiastic about retail CBDCs and have clearer motives for issuing them compared to central banks in advanced economies. Engagement levels are high where financial inclusion is a national priority.

Today, we see Central Banks of several countries cooperating under the CBDC cooperation to develop cross-border payments.

The biggest problem with the concept of central bank digital currencies today is the lack of a clear sense of purpose. Some countries, such as Sweden, Canada, Palau and Bhutan, want to ensure the existence of a digital national currency in case if paper money goes out of circulation or becomes too expensive to print and has a negative impact on the environment. In addition, CBDC could potentially increase financial inclusion in the country. However, a complete transition to a new form of money

requires community engagement programs, such as reduced credit card cashback, lower interchange fees, and other promotional tools.

The pace of development of central bank digital currencies around the world will accelerate in the upcoming years, with more countries moving into pilot projects or trials. Whether used for internal economic purposes or for cross-border transactions, the utility of CBDCs will grow as implementation and use cases expand.

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