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## Central bank digital currencies: Digital Yuan and its role in Chinese digital economy development

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**Abstract.** Under the impact of financial technology and digital currency, “central bank digital currency” has become an international hotspot in recent years and is also one of the current research and development priorities of China’s central bank. Preparations for China’s digital RMB began as early as 2014, and in 2017 China’s central bank clearly announced that it would fully issue the digital currency. The launch of the digital RMB is a major reform and innovation in the historical development of China’s currency. China’s issuance of a central bank digital currency will help enhance the status of the People’s Bank, strengthen the effectiveness of monetary policy, improve macro-prudential management capabilities, and promote cross-border RMB payments, etc. Up to now, China has started pilot tests in some cities, such as Shenzhen, Xian, Chengdu Suzhou. Currently, China’s digital RMB has been tested for the public, with features such as unlimited legal compensation, moderate anonymity, national statutory, dual offline payment, no cost of transaction and centralized management. With the rapid development of scientific information technology and the intensification of international competition, the digitalization of currency has become an irreversible trend. The purpose of this study is to identify the practice of digital Yuan and its role in Chinese digital economy development. The discussion tasks of this paper can be summarized as follows. Clarify the definition of digital Yuan; assess the operational model of digital Yuan; evaluate the operating framework of digital Yuan; identify the features and merits of digital Yuan application. This research adopts case study of China CBDC and literature analysis methods to analyzed the concept, characteristics and design principles of digital RMB. Then it investigates the role of digital RMB for the development of China’s digital economy, which will provide an important basis for understanding and advancing the domestic research on the central bank’s digital currency. For example, digital Yuan plays a key role in facilitating data productivity, driving digitalization of public payment scenarios and opening a healthy digital economy system.

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## Цифровые валюты центрального банка: цифровой юань и его роль в развитии цифровой экономики Китая

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**Аннотация.** Под влиянием финансовых технологий и диджитализации цифровая валюта стала актуальной темой обсуждения, а также является одним из текущих приоритетов исследований и развития центрального банка Китая. Подготовка к выпуску китайского цифрового юаня началась еще в 2014 г. Запуск цифрового юаня — крупная реформа и инновация в историческом развитии китайской валюты. Выпуск Китаем цифровой валюты центрального банка поможет повысить статус Народного банка, усилить эффективность денежно-кредитной политики, улучшить возможности управления на макроуровне, продвинуть трансграничные платежи в юанях. Китай запустил пилотные проекты в некоторых городах, таких как Шэньчжэнь, Сиань, Чэнду, Сучжоу. Китайский цифровой юань был протестирован для общественности с такими характеристиками, как неограниченная законная компенсация, умеренная анонимность, национальный статус, двойной автономный платеж, отсутствие стоимости транзакции и централизованное управление. С быстрым развитием научно-информационных технологий и усилением международной конкуренции цифровизация валюты стала необратимой тенденцией. В данном исследовании на примере Китая анализируются концепция, характеристики и принципы разработки цифрового юаня. Выявлена возрастающая роль цифрового юаня для развития цифровой экономики Китая. Например, цифровой юань играет ключевую роль в содействии производительности данных, стимулировании цифровизации сценариев государственных платежей и формировании эффективной системы цифровой экономики. Целью данного исследования является выявление практики использования цифрового юаня и его роли в развитии цифровой экономики Китая.

**Ключевые слова:** цифровой Юань, роль, цифровая экономика, Китай

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## Introduction

The renminbi has become the fifth most important currency in international payments. According to a recent report released by the Bank for International Settlements, as of July 2020, at least 36 central banks around the world have issued central bank digital currency plans, and countries have obviously accelerated the pace of the establishment and development of digital currencies. Central Bank Digital Currency (CBDC) contributes to optimizing payment functions of fiat money, reducing reliance on payment services provided by the private sector, alleviating regulatory burdens and pressure on the central bank, and strengthening the authority of fiat money.

In China, CBDC is currently undergoing pilots and there is a growing awareness of CBDC's existence among the public in general. The Chinese government has always been open-minded to the commercialization and industrialization of internet innovation (Shen, Hou, 2021). In 2014, the PBOC formed a task force to study digital fiat currencies, including their issuance framework, key technologies, issuance, and circulation environment, and to learn from experiences from other countries (Allen, Gu, Jagtiani, 2022). China's CBDC is termed as e-CNY, digital yuan, digital RMB and digital CNY. E-CNY was also previously known as the Digital Currency/Electronic Payment (DC/EP or DCEP) (Chorzempa, 2021). DCEP is also used to refer to the payment network. China's CBDC will be a cash like liability of the central bank available to the public and foreign visitors. China's CBDC is not only a substitute for M0, but a research and development project for the People's Bank of China (PBOC), China's Central Bank. In 2020, China started the pilot test of its digital fiat currency. Pilot tests include Shenzhen, Xian, Chengdu Suzhou and winter Olympic scenario. With its recent phased trial issuance of DCEP, China has reached a milestone achievement — becoming the first central bank in the world to issue cryptocurrency (Peters, Green, Yang, 2020).

Digital currency has brought many conveniences for people's lives and work, especially by providing more diversified financial services for people living in areas with objectively inconvenient condition.

However, what role does the digital RMB play in the development of Chinese digital economy? What are its features and advantages? After paper analyzed toward research questions, features and merits include a couple of aspects, such as moderate anonymity, no-interest accrual and zero transactions fee, etc. Digital Yuan plays a key role in facilitating data productivity and driving digitalization of public payment scenarios.

The purpose of this study is to identify the practice of digital Yuan and its role in Chinese digital economy development. The discussion tasks of this paper can be summarized as follows. Clarify the definition of digital yuan; assess the operational model of digital yuan; evaluate the operating framework of digital yuan; identify the

features and merits of digital yuan application; consider the role of digital yuan in Chinese economy development.

In the first chapter, current development, and research background of e-CNY would be introduced briefly. In the second chapter, definition, operational model, operating framework, and design principles of e-CNY will be analyzed. In the third part, features and merits of e-CNY would be identified. In the fourth part, role of e-CNY in Chinese digital economy development would be discussed. In fifth part, author would make a review towards main objectives and discussion tasks of paper on the framework of whole text.

### **Definition and operational model of digital Yuan**

China is one of the leading countries making the transition from conventional money to digital money (Taskinsky, 2021). E-CNY is the digital version of fiat currency issued by the PBOC and operated by authorized operators. It is a value-based, quasi-account-based and account-based hybrid payment instrument, with legal tender status and loosely coupled” (Sun, 2021). The digital RMB uses blockchain technology, while blockchain (BC) is a type of immutable, traceable, distributed ledger technology (DLT). BC has garnered a significant attention recently. PBoC’s introduction of the Digital Yuan offers a digital currency that can compete with other digital assets and other CBDCs (Radic et al., 2022). However, the concept of E-CNY is not clear exactly what “loosely-coupled account linkage” means. This paper will briefly analyze the management model and layered system of e-CNY, along with its digital wallet system and its principles.

#### **A centralized management model**

Compared with the high circulation cost of traditional CNY, Digital Yuan is convenient to use, and has no handling fee, just like the traditional CNY (Yang, Zhou, 2022). The PBOC manages the entire lifecycle of the CBDC and is responsible for cross-institutional connectivity, meaning that all cross-institutional transactions need to pass through the PBOC in order for value transfer to occur. For the E-CNY wallets discussed below, the PBOC is responsible for the management of the wallet ecosystem and sets the rules for E-CNY wallets. E-CNY wallets are subject to both centralized management and unified perception.

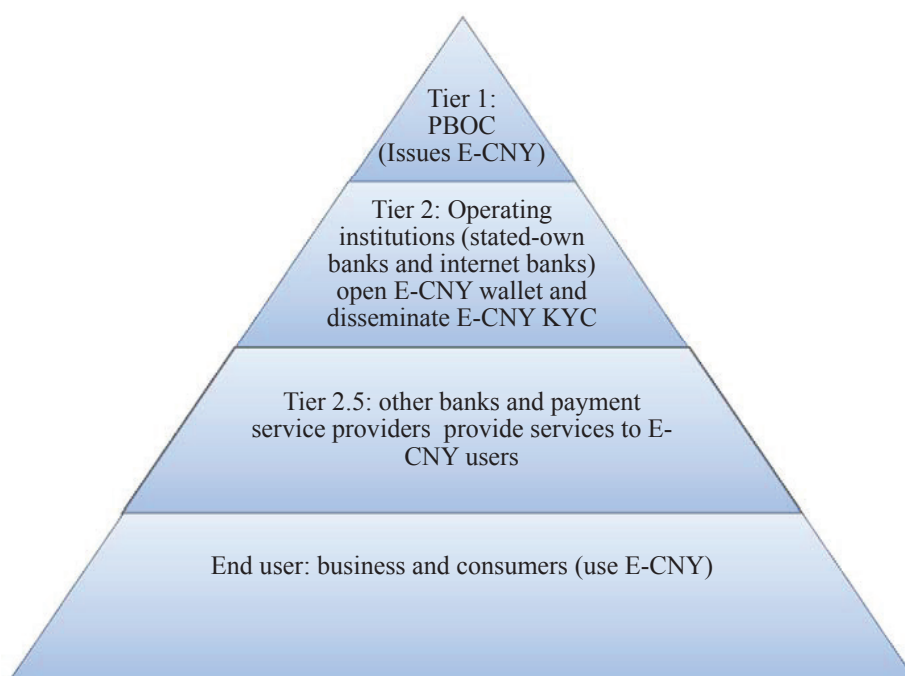
CBDC operators submit transaction data to the central bank in a timely manner via “asynchronous transmission”, enabling the central bank to keep track of the necessary data.

E-CNY will revolutionize the regulator’s ability to review the country’s payments and financial systems, with additional powers to track currency usage. e-CNY will provide China with visibility into the use of E-CNY and allow China to use the big data generated by E-CNY transactions. In essence, a centralized system for the E-CNY contrasts with private cryptocurrencies, which aim to decentralize power away from the government.

## A two-layer system

One of the important design choices facing CBDC issuers is the customers that they are targeting. The rights and responsibilities of central banks and other financial service providers may vary depending on the users (Cheng, 2022). China's CBDC features a two-layer, hybrid operational system that deals with issuance and circulation respectively. The private sector is also given the role of circulation of the e-CNY via various e-wallets, granting it an easier and faster adaptability (Bhattacharya, 2022). The digital RMB adopts a two-tier operation system of “central bank — commercial banks/other operators”: the first tier is the central bank, while the second tier consists of commercial banks, telecom operators and third-party payment network platform companies.

According to Fan Yifei, deputy governor of the central bank, the central bank is at the center of the digital RMB system and is responsible for the wholesale of digital RMB to designated commercial banks and its full life-cycle management, while commercial banks and other institutions are responsible for providing digital RMB exchange and circulation services to the public (Tsang, Chen, 2022). Other banks and providers are “Tier 2.5 institutions” that can supply payment and other services to e-CNY holders, but they cannot provide e-CNY exchange services. What's more, issuance of e-CNY will have profound chain effects on the evolution of commercial banks and other financial institutions. An elaborate structure of e-CNY is shown in the Figure 1 (below).



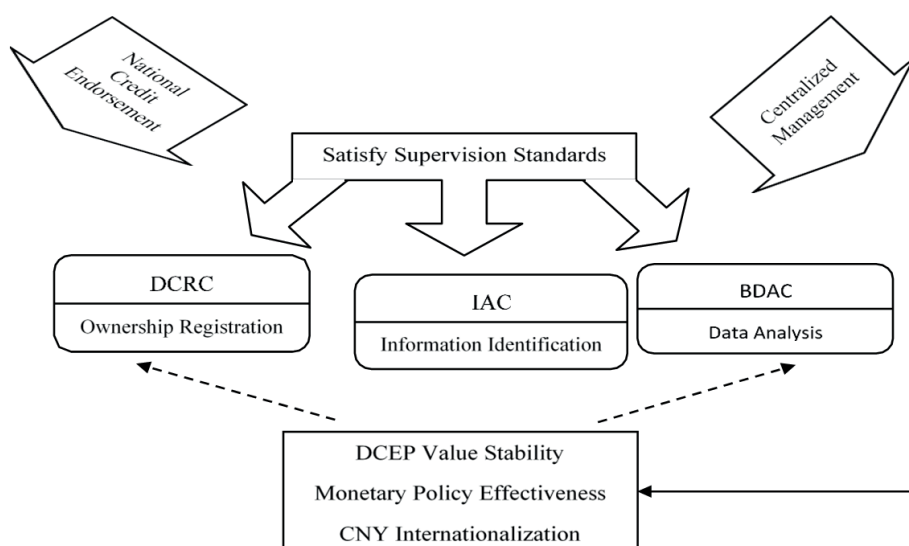
**Figure 1.** The Structure of e-CNY

Source: compiled by the authors.

## The operating framework of E-CNY

E-CNY is the legal tender in digital form issued by the central bank of China. Its operating framework is summarized and shown in Figure 2.

DC/EP is the only national digital currency in China that is endorsed by the state credit and issued by the central bank. DC/EP is the Chinese equivalent of the RMB, and at the same time, it possesses the characteristics of centralization. The People’s Bank of China is the sole issuer and is responsible for issuing DC/EP to commercial banks rather than directly to the market. Commercial banks are responsible for accepting DC/EP from enterprises and individuals. The responsibilities of the Digital Currency Registration Center (DCRC), Identity Authentication Center (IAC) and Big Data Analysis Center (BDAC) are shown below.



**Figure 2.** The Operating framework of DC/EP

Source: compiled by the authors.

DCRC records users’ personal information and cash flow for ownership registration. IAC confirms users’ identity. BDAC analyzes transaction data based on big data, cloud computing, blockchain and other technologies, and can effectively monitor capital operations. In this case, it can ensure the security of transactions and effectively combat illegal operations. The operational framework of DCEP is important for centralized management, which ensures the independence of monetary policy and the stability of DC/EP values.

### Digital wallet

There is an ecosystem of digital Yuan wallet that appears to consist of three levels: (i) rules set by the PBOC; (ii) authorized operators, which include selected banks, providing basic functionality; and (iii) authorized operators working with

relevant market participants to further develop various payment and financial products. A digital wallet is different from a bank deposit account: the balance in a bank deposit account represents the bank's liability, while the DC/EP in a digital wallet (including RMB digital wallets and sub-wallets) represents the direct liability of the PBOC, and the digital wallet provided by the bank is only an interface that allows users to access its DCEP (Fullerton, Morgan, 2022).

Authorized operators co-develop and share applications on mobile devices and develop wallet eco-platforms that enable operator-specific visual systems and special features as well as online and offline applications to work in all scenarios. End-users will download a digital wallet application authorized by the People's Bank of China, which can be linked to their bank account. The services provided by the e-RMB wallet then enable end-users to conduct electronic transactions and store their payment data.

### **Principles of designing E-CNY**

*Compliance with laws and regulations.* e-CNY systems are designed to comply strictly with regulations on RMB management, anti-money laundering and counter-terrorist financing (AML/CFT), foreign exchange management, data and privacy protection. e-CNY operations should be included in the regulatory framework.

*Security and convenience.* The e-CNY system is based on broad-based accounts, loosely integrated with bank accounts, and has its own value system. This allows it to accommodate a wide range of online and offline payments. Difficulties due to limited technical knowledge and telecommunication coverage are minimized to meet the demand for a secure and convenient payment instrument. e-CNY operating systems are highly secure, highly available, highly scalable and concurrent to ensure business continuity.

### **Openness and Compatibility**

The PBOC leverages the strengths and expertise of authorized operators and promotes technology competition and upgrades in line with the principle of keeping up with the times in order to avoid excessive concentration of risk in system operations, thereby keeping technology up to date. e-CNY system supports interoperability with traditional electronic payment systems. It makes full use of the existing financial infrastructure, connecting digital wallets of different operators, as well as connecting electronic cash wallets and bank accounts, thus increasing the interoperability of payment instruments.

### **Features and merits of E-CNY**

Since CBDC is still in the process of research and development, there is no uniform and conclusive definition of this digital currency, but it generally has some unique characteristics that distinguish it from physical money, e-money, and conventional cryptocurrencies. E-CNY is characterized by a combination of the advantages of cash

money and digital money, and the E-CNY is essentially a form of cash money, but with features that coincide with the current trend of digitization; the E-CNY is also a currency issued by the central bank of China, and it has the same financial validity as paper cash.

### **Moderate anonymity**

DCEP will probably operate under the principle of ‘controllable anonymity’. E-CNY is defined as digital cash, that is, physical cash in digital form. Its anonymity comes from the anonymous nature of cash. Of course, its anonymity is somewhere between physical cash and a bank account. This is demonstrated by the fact that when you open a digital wallet, you only need to provide your cell phone number. Accordingly, with the People’s Bank, the only information it knows about you is a cell phone number.

You may say, what’s so anonymous about that? Nowadays, cell phone numbers are registered with real names. Through my cell phone number, you can find out my ID card, address and many other information, which is not the same as opening a bank account. Due to the real-name system of cell phone number, it is indeed so. But according to the relevant national laws, the People’s Bank of China is not able to retrieve the information of the registrant behind the cell phone number from telecommunication operators like Telecom, Mobile and Unicom. Only in the case of a crime, the competent authorities can retrieve the personal information associated with the cell phone number from the telecom operators. Therefore, the People’s Bank and the telecom company are separated, and the People’s Bank cannot access the information of the registrant behind the cell phone number through the cell phone number. This is a manifestation of “moderate anonymity”.

The above-mentioned moderate anonymity is limited to small payments. The E-CNY is certainly not completely anonymous, because if it were completely anonymous, like Bitcoin, the central bank would be concerned that the E-CNY could be used to facilitate crime. Therefore, the anonymity mentioned above is limited to when making small payments, and the current limit is 2,000 yuan. Payments under this limit are essentially close to anonymous. But a large payment, say a payment over 2,000 RMB, will have to be tied to a bank card, and then it will be similar to a bank card payment without the anonymity.

### **Dual offline payments**

The offline payment function of electronic financial systems is defined as a transaction function that does not require internet or telecom connectivity (Chu et al., 2022). E-CNY payment without network is called “dual offline payment” in technical terms. In other words, even if neither the payer nor the recipient has internet access, the payment can still be completed as long as the phone has power. In contrast, all other digital currencies and third-party payment instruments require both transaction parties to be online.



The E-CNY, being digital cash, is dedicated to the same function. Even if both parties to a transaction are offline, the payment remains unchanged. This is where the convenience of E-CNY exceeds that of WeChat and Alipay.

For example, in the underground cafeteria of an office building, when you charging your meal card with WeChat or Alipay, you often can't charge it because the underground network signal is bad. If you use E-CNY, you don't have this worry, you don't need to have a network signal (Jiang, Lucero, 2021).

### **National statutory**

The legal validity of E-CNY is very high and is in no way comparable to that of WeChat or Alipay. You can't pay with paper money and no merchant can refuse to accept it, otherwise it's a breach of national regulations on the use of RMB. Since the country considers the e-CNY as legal tender, all private entities in the PRC have a legal obligation to accept it as payment.

E-CNY does not need to be tied to a bank account. WeChat, Alipay and Cloud Flash are all essentially the same — they require a bank account to be bound and use the existing bank bookkeeping system to complete the transaction, which is a traditional bank transaction, but the user experience is much more convenient and friendly (Lo, 2022).

Digital wallets can be used without being tied to a bank account, so you can say that you are out of the bank system. It is the same as if you were using cash, you don't need to go through an intermediary bank system to complete a transaction.

*Non-interest accrual.* The e-CNY is a substitute for M0 (Li, Huang, 2021). Thus, it is treated the same as the physical RMB under M0, which carries and pays no interest.

The cash you hold in your hand, such as banknotes and coins, has no interest. If you press 10,000 yuan notes under your bed, in three years' time, it will still be 10,000 yuan and will not grow by a cent. E-CNY, being digital cash, is likewise interest-free. So don't think that if you have a lot of E-CNY in your digital wallet, you can just sit back and wait for your money to grow. There is no such thing. There is no interest on E-CNY.

*Zero transaction fees.* There are no fees for E-CNY. E-CNY is a digital currency and there are no services, fees or charges to pay, and there are no fees for the recipient and withdrawals are free. Because E-CNY is legal tender and non-profit making in nature, no additional fees are incurred, even with the help of Alipay.

*Advantage of counter criminal activities.* CBDC would be implemented in a manner that would be compatible with compliance requirements on money laundering and terrorist finance (Goodell, Nakib, 2021). The E-CNY has a separate ledger system where all transactions can be traced. Although E-CNY transactions are anonymous, they are still controllable. A digital currency should also be cheaper to operate, and ought to reduce fraud and counterfeiting. Its biggest function is to fight crime. The financial sector and telecom operators hold a portion of the data separately. The flow of funds is recorded one by one, and if there is a problem with the law, it is possible to trace the source of the funds directly, and the relevant

evidence trail can be handed over to the judiciary, so that law enforcement agencies can combat criminals. The emergence of the E-CNY is another manifestation of fiat currency, which is still essentially a circulating currency issued by a central body and controlled by it. But it also adds a way for us to make everyday payment transactions, while the digitization of the RMB helps the state to exercise effective control over the circulation of funds.

### **The role of E-CNY in Chinese digital economy development**

E-CNY inspires a surge in data productivity. The development of digital technology, such as digital devices and electronic payment, stores a large amount of information in the form of data and realizes the production of data resources; big data and algorithm technology can analyze and process the data, make the information and knowledge in the data visible and automatically serve for decision-making. This not only helps to grasp the market demand more accurately and open up new economic scenes, new industries and new models, but also amplifies the value of traditional factors of production such as labor and capital in the flow of the value chain of various social industries, improves production efficiency.

The digital RMB will build on this foundation to further unlock our country's data productivity. At present, the enabling role of data for economic development is still limited: first, data resources are not sufficiently liquid, the second is the insufficient market allocation of existing data resources. As digital payments are a private product of large technology companies, they use the "payment barrier" to create a "fiefdom" where currencies and products can only be traded within the scope of their own platforms.

For example, Alipay and WeChat cannot be used on Jingdong and Alibaba respectively. On this basis, large technology companies hold the monetary value flows and related data generated through their own digital payments, and also monopolize the new revenues obtained from the production and processing of these data resources based on new scenarios.

Since digital RMB is legally reimbursable, it must be accepted in any business scenario and purchase and sale transactions. This breaks down the payment barriers of large technology companies, ending the fragmentation of private payment scenarios and facilitating the free trade of data assets across society. This can unlock more data resources and create greater productivity.

*Digitization of public payment scenarios.* The digital RMB can not only break down payment barriers between platforms and become the hard currency that allows wealth to be exchanged and traded across society. Another key reason for unlocking data productivity is to drive the digitization of public payment scenarios. The core is where the value of data resources is transformed into capital. Although large technology companies have completed the early development of digital ecology, the primary construction of digital industry chain and the initial development of data

productivity. They have realized the online consumption of individuals in different business scenarios of daily life.

However, due to its commercial nature, the core of digital payment is on the personal side, it means that the digitization of private payment scenarios for household residents. For enterprises and government departments involved in public data and public finance, their fund flow is entirely based on the bank account system. It is difficult for technology companies to complete their internal financial operations and payment settlement digitization. The digital RMB can facilitate the digitization of public payment scenarios based on the bank account system. The digital renminbi is backed by national credit and is guaranteed and signed by the central bank for a specific amount. The large technology companies do not have access to the data activity and information exchanged during the circulation of the currency. Since the entire digital assets and their transaction data are monitored by central bank, it can reduce the risk of the financial system.

The digitization of public payment scenarios can increase data productivity. Economic activities between enterprises and governments can become part of the data resources of society, making up for the lack of data available only in private payment scenarios.

*Open up a healthy digital economy ecosystem.* In addition to promoting the growth of data resources and opening up a variety of payment scenarios, the digital RMB is conducive to the scale of data resource value realization and the formation of an open and healthy digital economy ecosystem.

In the era of private digital payments, the participation of ordinary people in economic and social activities is divided into two account systems: banking and digital. At the same time, consumers can only purchase digital goods or make online purchases from their own dedicated platform accounts, which are tied to their own platforms, within each platform. By controlling the digital payment channels for monetary flows and data activities, large technology companies continue to take ownership of data, they continue to grow in scale, capture excessive profits and eventually move towards monopoly. This data market-based business order is based on a closed and fragmented digital ecosystem that uses digital payments as a barrier to competition, which is not conducive to productivity progress and industry innovation.

As a hard currency that can be traded with all assets, the digital RMB will reconfigure the fragmented and closed digital ecosystem by reconciling the current payment barriers between internet platforms. The digital RMB is guaranteed and signed by the central bank, which issues encrypted strings representing specific amounts, and is issued and operated by the central bank and commercial banks, with an authentication center, registration center and big data analysis center within the banking system. This means that the digital RMB can become a digital currency circulating in all digital payment channels, within the platform, without replacing digital payments such as Alipay or WeChat, on top of the existing system. This essentially provides individuals with a “super account” that is applicable to all platforms in business scenarios, “re-unifying” the monetary value scale in the

digital space at a lower cost, redefining the way payments, economic activities and user data interact. Thus, by unifying payment scenarios, digital RMB will form an open and healthy digital ecology.

## Conclusion

China's DC/EP stands at the forefront of R&D and implementation of CBDC in leading economies (Tong, Jiavou, 2021). DC/EP features a "centralized management model" and two-layer, hybrid operational system. Central bank plays a key role in digital RMB operation because of the operating frame work of e-CNY. The PBOC is the sole issuer and is responsible for issuing DC/EP to commercial banks rather than directly to market, then commercial banks are responsible for the acceptance of DCEP to enterprises and individuals. The digital yuan itself is a moderately anonymous legal tender with dual offline payment capability. The e-CNY system is based on broad-based accounts, loosely integrated with bank accounts, and has its own value system. Therefore, this allows it to accommodate a wide range of online and offline payments. Consumers do not need to link the digital yuan to a bank account, and no interest is charged on the digital yuan because e-CNY is a substitute for M0. Among the advantages of the digital yuan are identified: institutional security, scenario, convenience, zero transaction fee, and countermeasures against criminal activity. Additionally, E-CNY plays a key role in facilitating data productivity, driving digitalization of public payment scenarios and opening a healthy digital economy ecosystem.

As CBDC receives significant attention, more central banks have announced that they will issue digital currency in the future (Tsai et al., 2018). Digital currency and electronic payments will definitely replace some of the cash, and the issuance and circulation of cash will be significantly reduced, but it will not completely withdraw from the historical stage (Kshetri, 2022).

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