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Why China Became the First Major Country to Implement the CBDC

Yanze Yang[1,a,*]

[1]*Capital University of Economics and Business, Beijing 100042, CHN*
a. yanzeyang0601@163.com
**corresponding author*

Abstract: It took only four years for China to transform CBDC research and development into pilot projects. Among the countries engaged in CBDC research, China may have made the fastest progress in CBDC research and development. However, the current research focuses mainly on mechanism and the design of e-cny and its geopolitical implications, and does not answer the question why the people's Bank of China became the first major country to implement CBDC. To answer these questions, this paper analyzes the institutional foundations from a macro strategic perspective that have allowed China and the PBoC to lead the world in testing CBDC. Then this paper analyzes China's CBDC development process with a focus on the role of China's financial regulatory institutions and policy innovation. It identifies the key agencies and key decision makers in the process of China's CDBC research and development process. It also provides a comparative analysis of China's institutional feature vis-à-vis the United States to further illustrate China's institutional settings for it to be the first to launch CBDC.

Keywords: Central Bank Digital Currency (CBDC), the People's Bank of China (PBoC), China, Digital Currency Electronic Payment (DCEP)

1. Introduction

China has made perhaps the fastest progress in CBDC research and development among countries that have been engaged in this research since the concept of CBDC was first put forward by Tobin in 1987. It only took 4 years for China to transform its CBDC research and development into the actual practice of the pilot project. China also has plans to test the e-CNY on a larger scale. Other countries/central banks have also researched the efficacy/possibility of CBDC but have not yet launched pilot programs. Following China's (the PBoC's) lead, however, the issue of CBDC become more urgent for many countries (central banks). For example, ECB, BoJ, Fed, BoE, RBA, BOK, CBRF. In 2015, the central bank began to further study the operation framework of digital currency issuance and business, key technologies of digital currency, etc., and the prototype scheme of issuing legal digital currency has also undergone two rounds of revision. In 2017, the digital currency Research Institute of the People's Bank of China(PBoC)was quietly established. By the end of 2019, digital RMB will be tested in Shenzhen, Suzhou, Xiong'an New District, Chengdu, and the future Winter Olympics. In October 2020, six pilot test areas including Shanghai, Hainan, Changsha, Xi'an, Qingdao and Dalian will be added. On April 10, 2021, Shenzhen will launch the digital RMB

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pilot program from that day until April 23, and the test population will be expanded by another 500000. This pilot project mainly focuses on "using digital RMB to enjoy preferential consumption", with a total amount of 10 million yuan.

Other countries and organizations have not implemented or tested it, but they have been researching it (shown in Table 1). For example, at the suggestion of the Bank of England, researchers from University College London have proposed and developed a prototype system of legal digital currency, namely, the central bank cryptocurrencies Rscoin system. On April 5, the Bank of Japan (BoJ) announced on its official website that from the beginning of 2021, the Bank of Japan began to prepare for the CBDC test, in order to explore the technical feasibility of the core functions and features of CBDC. With the completion of the necessary preparations, the BoJ started the first phase of the proof of concept (POC) on that day. According to the announcement, the phase will last for one year until March 2022.

Table 1: Major central banks research activities on central bank digital currencies.

Central Bank	Current Status	Timeline to launch	Modification	Stakeholders
Bank of England	Researching	April 16, 2021: the Bank of England announced that it would establish a central bank digital currency (CBDC) working group with HM Treasury to coordinate the exploration of domestic digital currency. July 2021: cryptocurrency and stable currency are included in the list of financial reforms the government plans to carry out in the next few years		Bank of England HM Treasury Private sector solicited along with other Central Banks(BoJ, BoC,etc.) for joint Working Groups
Bank of Japan	Researching	January 2020: BoJ joined the Working Group with the EU. Canada. UK. Sweden. Switzerland to cooperate on interoperability of CBDCs & Privacy/Compliance issues. July 2020: Announcement that the BoJ is boosting its CBDC Working Group efforts and wishes to perform tests, without giving further details on the implementation timeline. October 2020: Announcements on next steps: Basic tests (Issuance / Distribution) win be performed from April 2021 -Preference for an indirect distribution model via commercial banks instead of direct BoJ distribution of Digital Yen. April 2021, the Bank of Japan said that it would start the demonstration test of CBDC from today. According to the announcement, the phase will last for one year until March 2022.	Contradictory messages from the BoJ that showed little interest for CBDC re. Japanese economy in Dec. 2019, then now rushes efforts probably due to the fast progress of other nations, esp. China's Digital Yuan	Bank of Japan
Reserve Bank of Australia	Researching	November 2020: the Bank of Australia announced the launch of a project to explore the potential use and significance of "batch" central bank digital currency (CBDC) using DLT. This is also part of this bank's ongoing research on "wholesale" CBDC.		

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Table 1: (continued).

European Central Bank	Researching	May 2020: Launch of Working Groups between ECB & EU members' Central Banks to analyze Retail CBDC's concerns (Risks/Compliance/Legal). In parallel, the Working Group Program by French Central Bank [April 2020] to brainstorm on CBDC applications with a focus on 3 areas: 1. Payments against other CBDCs 2. Payments against Digital Assets 3. Payments against Financial Instruments October 2020: the European Union issued the "digital Euro report", which systematically elaborated on the digital euro. ConsenSys joins Working Group with SG Forge among others June 2021: Fabio Panetta, a member of the Executive Board of the European Central Bank, said that if all goes well, the digital euro will come into use in about five years	September. 2020: ECB Seems to confirm the focus on a Wholesale CBDC arguing that Blockchain technology may not be necessary for retail exchanges as the Euro Zone already has a mature, efficient & secured system November 2020: ECB announces the publication of the report in January 2021 with the potential shift to a Retail Digital EUR (2-4 years implementation timeline)	EU members' central banks ConenSys, SG forge, etc.
Federal Reserve	Researching	Slow process with Congress representatives quite skeptical about the necessity to issue CBDC June 2020: Publication of Whitepaper urging for a move on CBDC implementation (DDF) August 2020: Announcement of cooperation program between the Fed NY & the Bank of International Settlements (BIS) "Innovation Center Lab" to accelerate the launch of a pilot August 2020: Cooperation between Fed Boston & the MIT to assess the best technical solutions for a CBDC (Most advanced research work) October 2020: J. Powell clarified the FED view: "Issue a CBDC but not hurry the process" May 2021: Federal Reserve Chairman Jerome Powell announced that the Federal Reserve would prepare a paper to discuss the benefits and risks of CBDC.	September 2020: Currently actively analyzing the possibility of direct distribution of Digital $ to US citizens w/o commercial banks intermediation (Not defined though)	Fed Accenture/Digital Dollar foundation (DDF)
Bank of Korea	Researching	May 2021: the Bank of Korea said that it was seeking technical partners through the bidding process to test the operation of CBDC in a virtual environment. The pilot is expected to start in August and will last until June next year.		

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Table 1: (continued).

Bank of Canada	Researching	June 2016: Imperial Bank of Canada, Bank of Montreal, Royal Bank of Canada, Scotiabank, Dominic Bank of Toronto, and R3, the blockchain alliance, jointly launched CAD coin, a Canadian dollar digital currency based on blockchain technology. February 2020: Bank of Canada develops guidelines and instructions on CBDC research. November 2020: Recent launch of the CBDC Project Team (Members recruited in June) to design & test a Retail CBDC May 2021: Timothy Lane, vice president of Bank of Canada, said at a panel discussion on cryptocurrency that the bank is considering more specifically the appearance and operation of its digital currency, but has not seen a strong reason to issue digital currency. If necessary, the central bank can issue digital currency similar to cash.	Bank of Canada (Internal Working Group & Project Team), Bank of Montreal, Royal Bank of Canada, Scotiabank, Dominic Bank of Toronto, R3 BoC shares views & progress with BIS dedicated Working Group Inthanon-LionRock Wholesale CBDC Libra high-level Model JPM Coin description
Central Bank of the Russian Federation	Researching	October 2020: Russia issued a consultation document on promoting the digital ruble. June 2021: Elvira nabiullina, governor of the Russian central bank, said that the pilot and test of Russian digital currency may begin next year (2022) September 2021: Sberbank plans to register its digital asset issuance platform with the Central Bank of the Russian Federation by mid-September.	State-owned banks in Russia

Since China (the PBoC) launched the CBDC pilot project, there has been lots of debate/discussion over the mechanism and the design of e-CNY and its geopolitical implications. However, what has been left out of the discussion is the question of why China (PBoC) became the first major country to implement the CBDC. In other words, what are the domestic (and international) political economic factors that made China to launch the e-CNY so fast? Answering this question. will help to solve the limitations of the current research on CBDC in terms of political system and organizational structure, accelerate the research progress of global central bank digital currency, and contribute to the iteration of new payment methods.

Although the global CBDC research and testing continues to heat up, because major economies need to properly solve the problems faced by CBDC, such as payment security, payment efficiency, cross-border use and settlement, most major economies will not choose to fully implement CBDC for the time being, but some small and medium-sized emerging market countries may take the lead. At the same time, countries with major economies have a more significant impact on the world economy, and their systems are more perfect and typical. Therefore, this paper only focuses on major countries.

To answer these questions, this paper analyzes the institutional foundations from a macro strategic perspective that have allowed China and the PBoC to lead the world in testing CBDC. It does

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not concern itself with specific questions such as the difference between CBDC and cryptocurrencies and questions like that.

Description of the structure of the rest of this paper. Section 2 examines existing scholarship on CBDC. Section 3 analyzes China's CBDC development process with a focus on the role of China's financial regulatory institutions and policy innovation. It identifies the key agencies and key decisionmakers in the process of China's CDBC research and development process. Section 4 concludes with a brief of key findings in this research. It also provides a comparative analysis of China's institutional feature vis-à-vis the United States to further illustrate China's institutional settings for it to be the first to launch CBDC.

2. Literature Review

Many Central banks in the world have started their own research on CBDC and provided their own definitions. The Bank of England defines it as a digital currency issued by the central bank through specific rules, which is equivalent to legal tender and generates interest. It is a way of electronic access to the central bank's balance sheet anytime, anywhere [1]. The Bank of Canada's definition emphasizes its payment medium function: "a form of digital value issued by the central bank's liabilities for payment"(Bank of Canada) [2]. The definition of the European Central Bank is digital base money, which has two characteristics: first, like circulating paper money, it represents the right to claim debt from the central bank; Second, unlike paper money, it is a digital central bank debt. Therefore, CBDC is different from the cryptocurrency represented by bitcoin. First, cryptocurrency has the attribute of decentralization, while CBDC is centralized. Second, cryptocurrency is a financial product, and the CBDC is the legal tender issued by the central bank.

Scholars have discussed different modes of CBDC issuances and a wide range of CBDC applications in retail, wholesale, and in service to monetary policy. According to BIS (2020), CBDC has both "Nontiered issuance" and "Tiered issuance." [1] In terms of the scope of application of CBDC, the use of wholesale central bank digital currency is limited between the central bank and financial institutions and is not open to the public. Retail CBDC is also known as general target currency, which is used for the public [3]. CBDC can be divided into account based and non-account based. For example, the European Central Bank believes that the digital base currency issued by the central bank has two optional forms : account-based and value-based [4], while a scholar have proposed central bank digital account (CBDA) and CBDC [5]. These two forms are complementary to a certain extent and can be used preferentially in different application scenarios to meet different needs. Whether the CDBC can be used as a monetary policy tool is dependent upon whether the CBDC is interest-bearing or not. Like physical cash, interest-free CBDC is only a payment tool, whereas interest-bearing CBDC is an interest-bearing asset and has become a new price monetary policy tool. For example, at the wholesale end, when the CBDC interest rate is higher than the Reserve interest rate, it will replace the Reserve interest rate as the lower limit of the money market interest rate corridor. At the retail end, CBDC interest rate will become the lower limit of bank deposit interest rate [6].

Existing literature on CBDC has also explored the benefit/impact of the implementation of CBDC over monetary policy, financial regulation and the overall financial system stability. In terms of monetary policy, implementing CBDC can make the transmission of monetary policy more accurate because CBDC payment transfer is point-to-point, efficient and accurate [7,8]. CBDC can also expand the space of monetary policy and transfer the policy interest rate more efficiently, hence address the current liquidity trap problem [9]. CBDC allows monetary authorities to monitor and manage the monetary system more accurately and efficiently. For example, by using CBDC, monetary authorities can leverage big data and analyze money circulation data, which allows them to accurately regulate the total amount and structure of money supply, making it easier to match the

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speed of money supply with the growth of money demand [10-12]. However, according to a BIS research jointly conducted by seven major central banks, including the ECB and the Federal Reserve, pointed out that the practicability of CBDC needs to be more thoroughly studied in spite of its theoretical benefits for monetary policy implementation [13].

Existing literature have evaluated the long-term benefit of CBDC for financial regulation and supervision. Scholars pointed out that CDBC is traceable and can supplement the necessary data for supervision at M0 level, so as to provide necessary means for prudent management, combating terrorist financing, money laundering and debt evasion [10,12]. However, compared with completely anonymous digital virtual currency or linked digital currency, the traceability of CBDC may reduce its attractiveness or competitiveness, which may trigger concerns about transaction privacy and affect its wide use.

With regards to financial stability, CBDC can reduce systemic financial risks by providing some core payment services that do not depend on the existing payment system, so as to improve the ability of monetary authorities to control systemic risks [1]. The issuance of CBDC can expand the capital source of commercial banks and reduce the risk of converting funds into loans [14]. However, CBDC may also bring some new risks or challenges to financial stability. For example, if a country provides CBDC through the single-layer model, the overall economic loss may be caused because the resource allocation efficiency of the monetary authority is lower than that of the private sector [15].

Existing literature on CBDC has focused primarily on technical choice of CBDC. Scholars have argued that the impact of CBDC on the financial system largely depends on its attractiveness or competitiveness, which in turn depends on its design and technology selection [14]. The technology of CBDC should meet the consumer's demand for CBDC that "it has a function similar to cash and can be transferred point-to-point" [1,13], "the use of CBDC should not be more complex than the existing electronic payment, and should be fast and scalable [1,15,16], "CBDC should be easy to operate, privacy, security and compliance [14,15,18,19], CBDC payment system should support interoperability, have open and standardized interfaces, have perfect infrastructure, be free from the influence of intermediary technology and network failure, and have various mature and flexible encryption technologies. At present, most of the two types of monetary instruments issued by the private sector are associated with DLT. They take advantage of DLT heterogeneity, flexibility, strong reliability, difficult to tamper, high security, peer-to-peer cooperation, cost saving, smart contract, automatic execution and so on. The central bank digital currency can also use DLT to disperse the pressure of central bank centralized payment, settlement and clearing and reduce the risk of centralized payment system [20]. However, DLT still has defects. In terms of elasticity, DLT may not be able to ensure elasticity similar to cash in the case of long-term power failure [21].

Scholars have analyzed the motivations driving China’s launch of CBDC, the technology used in China’s CBDC pilot project, the impact of China's CBDC on Commercial Banks, and the broader significance of China’s CBDC in promoting renminbi internationalization. Jiang and Lucero pointed out five motivations behind China’s launch of CBDC, including reducing the cost of currency casting and circulation, improving the efficiency of currency circulation, preventing illegal use of money, improving financial inclusion, ambition for RMB internationalization, and solve the duopoly monopoly of Alibaba and Tencent in the payment market [22]. On the one hand, the core element of China's central bank's digital currency lies in "one currency, two Treasuries and three centers": one currency refers to CBDC, that is, the encrypted digital string representing the specific amount guaranteed and signed by PBoC; Two Treasury refer to the issuing treasury of PBoC and the bank treasury of commercial banks; Three centers refer to certification center, registration center and big data analysis center [23]. On the other hand, China's central bank's digital currency adopts a "two-tier operation system": the first tier is the central bank to the operation institutions (mainly commer-

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cial banks), and the second tier is the connection between the operation institutions and users, which makes the commercial banks, as an important part of the DC / EP two-tier operation system, occupy an important position in the "delivery" of the central bank's digital currency. In the context of the synergy between blockchain technology and digital economy, the issuance and circulation of DC / EP in China will have a significant impact on commercial banks. This impact includes both positive and negative impacts at the constructive level [24]. China actively responds to the impact of blockchain technology by issuing DC / EP, which will have a positive impact on commercial banks. As a representative country under the civil law system, China's indirect financing market represented by commercial banks is more developed [25]. In the new stage of central bank digital currency, China's DC / EP adopts the dual operation system of "central bank commercial bank". Commercial banks connect the issuing institutions of DC / EP upward (PBoC) and effectively connect the user groups of DC / EP downward, Such an operation system is conducive to preventing financial disintermediation of commercial banks. As China's CBDC is positioned as the digitization of cash in circulation (M0), it helps commercial banks reduce the operating costs of management, inventory, exchange and transportation. And help commercial banks improve the level of financial risk prevention [26]. The central bank's digital currency will also bring some negative effects to commercial banks. CBDC is an innovative financial product. It adopts a two-tier operation system, which can directly connect the user's identity without binding the account of commercial banks. Therefore, it also gets rid of its dependence on the traditional account system of commercial banks, which may bring risks at the governance level [27]. For such new financial products, CBDC brings external legal risks to commercial banks, because China's legislation on CBDC is still in the blank stage.

What has been largely understudied in existing literature is the institutional foundations that have allowed China and PBoC led the world and first launched CBDC. A lack of a systematic understanding of China’s institutional features underlying China’s first move in CBDC would lead to confusions and misunderstanding of China’s motivations and strategic plans regarding the implementation of CBDC. A more accurate analysis of these institutional foundations can advance scholarly understanding of China’s financial policymaking institutions and the process of China’s policy innovation. From policy perspective, it provides critical background and lessons for policy sharing. This helps foreign policymakers better understand the process of China’s CBDC policymaking and implementation. For practitioners in the financial services industry, a more precise understanding of the institutional landscape leading to the creation of China’s CBDC could help them improve their risk management process and adjust their business strategies.

3. The Institutional Foundations of the Digital Renminbi

3.1. The Establishment of the Digital Currency Research Institute

The PBOC had conducted robust research on the feasibility, technicality, and theoretical applications of CBDC before the launch of digital renminbi. The 2021 CBDC White Paper published by the PBoC documented the process of the research on CBDC. According to the White Paper, the PBoC started the research on CBDC in 2014 with the establishment of an internal research group. Since then, the research group has conducted in-depth research on various aspects of a potential state-backed digital currency, including the issuance, operation framework, key technologies, circulation environment, and international experience. The research not only accumulated theoretical experience but also paved way for the creation of a CBDC conceptual prototype. After two years of efforts, the PBOC built the conceptual prototype of China’s first-generation CBDC in 2016 and applied to the State Council for the establishment of a Digital Currency Research Institute on this technical basis. In the same year, PBOC proposed the top-level design and basic features of digital

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renminbi, such as double layer operation system, M0 positioning, loose coupling of bank accounts, controllable anonymity and so on [28].

With the approval of the State Council, the PBOC launched the Digital Currency Research Institute in 2016, which officially started operation in Beijing in July 2017. The Digital Currency Research Institute is administered by the PBoC, specializing in the research and development of CDBC technology and application. The Institute has established seven internal departments, including digital currency, financial technology and so on.

The Institute is a unit of the PBoC's FinTech Committee established in May 2017. The FinTech Committee aims to strengthen the research planning and coordinates financial technology development. The Committee overseas the research on the impact of financial technology development on monetary policy, financial stability, payment and clearing and many other fields, so as to assist the PBoC with designing China's financial technology development strategy and policy. The Committee also aims to strengthen the practice of RegTech, or regulatory technology, and apply cutting-edge technology to financial supervision, such as big data and cloud computing. Housed under the FinTech Committee, the Digital Currency Research Institute can get technical support from other committee members, which is conducive to the research of CBDC.

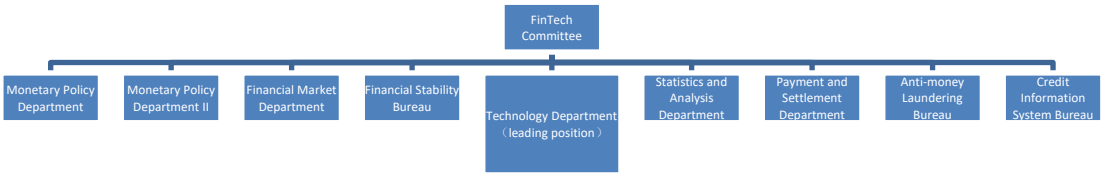

Figure 1: Organizational structure of FinTech committee.

The Institute's headquarter being in Beijing has advantageous policy implications. Beijing is China's capital, where major policy decisions are made. Being able to conveniently communicate with all major policymaking agencies reduces efficiency losses caused by changes in government policies. Moreover, this geographic centrality allows the Institute to put forward policy recommendations to Chinese decisionmakers on issues related to fintech development. The policy recommendations proposed by the Institute can inform regulations discussed during the National People's Congress.

At the end of 2017, with the approval of the State Council, the PBOC began the research and development of digital renminbi. At this time, the PBOC has accumulated rich experience in the development of CBDC and achieved certain research results. In the process of research and development, PBOC cooperated with large commercial banks, telecom operators, and Internet enterprises, systematically studied various aspects of digital currency. Eligible institutions selected to join CBDC research and development are those that have leading assets under management, large market share, and strong technology development capability. These institutions included both state-owned enterprises and large private enterprises. This public-private partnership approach can respond to market conditions and incorporate the state's interests in FinTech and RegTech development.

3.2. The Establishment of Regional Digital Currency Research Centers

The Digital Currency Research Institute has successively established many regional research centers, such as Shenzhen Fintech Company, the Yangtze River Delta FinTech Company, and Nanjing FinTech Research and Innovation Center. These research institutions are market-oriented enterpris-

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es and they each have their respective research orientation. These regional research centers are not duplicates but have international division of labor. Shenzhen Fintech Company is the first one established in June 2018 with a registered capital of RMB 2 million. It is the only financial technology development company wholly controlled by the PBoC's Digital Currency Research Institute. The other regional research centers are partnership with local government agencies, research universities, and banks. Shenzhen Fintech Company undertakes services including FinTech-related technology development, consultation and transfer. It also carries out the construction, operation and maintenance of FinTech-related systems. The Yangtze River Delta FinTech Company was established in March 2019. The general manager is Di Gang, deputy director of the Digital Currency Research Institute. The company is mainly responsible for the construction and stable operation of CBDC infrastructure. It undertakes key technology research and provides pilot scenario support to CBDC. Its research focuses on blockchain, cryptography and other cutting-edge financial technology. The Nanjing FinTtech Research and Innovation Center focuses on the research and development of digital currency encryption algorithms and other core new technologies such as mobile Internet, blockchain, big data and artificial intelligence.

The first regional research center company was founded in Shenzhen for three reasons. First, Shenzhen has a relatively completed market system and developed economy. Shenzhen is a special economic zone in China, with a high degree of urbanization and intensive innovation resources. It has a large number of leading scientific and technological enterprises, and its scientific and technological achievements and innovation ability rank in the forefront of the country. Besides, it has a relatively young population structure. It is also a financial science and technology demonstration zone with policy advantages. Therefore, the combination of Shenzhen's market advantages and preferential policies makes its research on CBDC have high advantages. Second, Shenzhen has strong research and development technology advantages: for example, the city has Shenzhen Financial Technology Research Institute (Financial Technology Research Institute of PBOC), a research institution and enterprise operation subject approved by the central bank and established by the digital currency Research Institute in Shenzhen, which was established in January 2017. In addition, there are Internet enterprises such as Tencent in Shenzhen, which has formed the location advantage of information technology research and development. In October 2020, the general office of the CPC Central Committee and the general office of the State Council issued the comprehensive reform pilot implementation plan for building a leading demonstration area of socialism with Chinese characteristics in Shenzhen (2020-2025) [29]. The document requires Shenzhen to establish a financial science and technology innovation platform based on the Shenzhen subsidiary of the digital currency Research Institute of PBOC. This can support the internal closure pilot of digital renminbi, promote the research and development, application and international cooperation of digital renminbi, and explore and innovate cross-border financial supervision.

3.3. The Development of Digital Renminbi Pilot Project

In 2018 and 2019, PBOC and participating research institutions went through three stages: development and testing, internal closed verification, and external controllable pilot to build and improve the digital Renminbi app. This digital Renminbi app has completed the construction of three main functions: exchange and circulation management, interconnection, and wallet ecology. Meanwhile, around the digital RMB research and development framework, PBoC explored and established a relatively complete standard system. After that, the pilot project was carried out after discussion and approval by the CPC Central Committee and the State Council. The project is led by the central bank and participated by the Industrial and Commercial Bank of China, Agricultural Bank of China, Bank of China, China Construction Bank, China Mobile, China Telecom and China Unicom.

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The implementation of the digital renminbi pilot project received strong administrative support from the central government. For example, on August 14, 2020, the Ministry of Commerce issued the overall plan for comprehensively deepening the pilot of innovative development of service trade [30]. http://images.mofcom.gov.cn/fms/202008/20200814092010526.pdf] requiring the pilot of digital Renminbi. On March 25, 2021, the National Development and Reform Commission and other 28 departments jointly issued a new plan to promote the implementation of digital renminbi pilot project through consumption [31]. The pilot project of digital renminbi was implemented in several different Chinese cities, which is conducive to the accurate evaluation of the project in different economic areas. Shenzhen, Suzhou, Xiong'an, and Chengdu started the pilot project in December 2019. In November 2020, Shanghai, Hainan, Changsha, Xi'an, Qingdao and Dalian were added to the pilot areas. The 2022 Beijing Winter Olympics also carried out digital renminbi project.

4. Conclusion

In the research process of CBDC, PBOC has absorbed large commercial banks, telecom operators and Internet enterprises as participants, and is highly dependent on commercial banks and other enterprises in the promotion process. Up to now, 19 banks have supported the digital RMB recharge business, which reflects the high cooperation between China's central bank and commercial banks. China's central bank is a state organ with regulatory power over commercial banks. At the same time, the vast majority of China's commercial banks are state-owned joint-stock banks. The establishment of such institutions can maintain the consistency of decision-making, make it easier to implement the plan, and thus accelerate the research and promotion of projects. Under the joint efforts of PBOC and commercial banks, China's CBDC project can be implemented rapidly.

This research has discussed three primary factors that contributed to China’s taking a lead in global CBDC experiment. First, Chinese policymakers and central bankers became aware of the significance of CBDC research very early and started the research in as early as 2014. At that time, very few governments in the world were looking into this issue. Second, China’s successful launch of its CBDC, the digital renminbi, much earlier than other countries is indicative of China's institutional advantages. China’s CBDC research process involved both state-led research and market-based experiment. The combination of centralized state-led research and test in the market creates timely and effective feedback and update mechanisms. Combining state guidance with market improves the practicality of high-level government-led, theoretically-oriented research. Moreover, the state can effectively communicate its preference and policy priority through the PBoC’s Digital Currency Research Institute and its regional research centers. This central-local and state-market alliance improves the research efficiency and minimize potential waste of resources due to conflictual research agenda. In other words, in the process of research and development of CBDC in China, it is not a single research conducted by the central government, but a process jointly developed by the central government and local research participants. Third, in the research and development of CBDC, PBOC joined forces with commercial banks and enterprises. This partnership allowed banks and other financial market participants to provide their feedback and contribute their industry expertise to the research and experiment of digital renminbi conducted by the central bank. Financial market reactions are critical because they improve the practicality of the digital renminbi when it was a research in progress. In short, the process of digital renminbi research and development has been a partnership between central and local governments, national regulatory innovation and market innovation.

There are some differences between China's CBDC research system and such research in other major economies, such as the United States. In the United States, the Fed as a joint stock bank is the central bank. There may be inconsistency between its research objectives and the interests of shareholders, which may lead to the loss of efficiency. Moreover, there is no clear superior-subordinate

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relationship between the Federal Reserve and commercial banks. When there are differences of interests, commercial banks may hinder the implementation of economic and financial policies by the Federal Reserve and the U.S. government, which also causes a waste of efficiency. For example, there are concerns among commercial banks about financial disintermediation associated with the implementation of CBDC. Private commercial banks in the United States may hold a negative attitude towards the promotion of CBDC, and even oppose to the research of CBDC. In contrast, the process of digital renminbi research and experiment is not a solo practice by the PBoC but engaged with a wide range of participants and stakeholders, including large commercial banks, telecom operators and Internet enterprises. The process has relied upon the expertise of commercial banks and other enterprises. So far, 19 banks have supported the digital renminbi operation, which reflects the high cooperation between China's central bank and commercial banks. China's central bank is a state organ with regulatory power over commercial banks. At the same time, the vast majority of China's commercial banks are state-owned commercial banks. Such relationship can maintain the consistency of decision-making and decision implementation, conducive for accelerating the research and promotion of cutting-edge research projects like CBDC.

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