

DLT solutions for trade and finance

China focus

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Preface

It was in October 2019 that China's President Xi Jinping made a historic speech in which he called for the country to accelerate the adoption of blockchain technologies as a core for innovation. President Xi stressed the importance of blockchain for technological innovation and transforming industries.

I remember the day well, because I was sitting at my desk and suddenly the WeChat on my phone started buzzing non-stop.

Even before President Xi's speech I had seen, through my work with Hyperledger – the open source blockchain project of the Linux Foundation, the incredible growth, innovation and entrepreneurship happening in blockchain development in China.

As Hyperledger's Vice President Asia Pacific, I have been meeting with Chinese government bodies and companies - from major corporations to small startups - since 2016, seeing firsthand their exciting, accelerating work in developing blockchain technologies for industry.

The pace at which Chinese companies are creating blockchain solutions for business applications is breathtaking. Industries in China which actively use blockchain or have solutions in the works include banking, finance, transportation, supply chain, energy, healthcare, food safety and more. And President Xi has talked about the importance of state guidance and transparent regulations to assist with this development.

One of the most exciting areas for blockchain development in China is in trade and trade finance. With this in mind it is timely and beneficial to see this paper on *'Dlt solutions for trade and finance - China focus'*.

I work with the paper's author, Eugenio Reggianini, and Andrea Frosinini, through Hyperledger's Trade Finance Special Interest Group. Andrea, as TFSIG Chair, and Eugenio, as a volunteer, have built detailed knowledge of blockchain developments, goals, regulation, challenges and opportunities in trade finance.

For this paper they have researched and written in-depth on the technological, regulatory, business and financial development of blockchain for trade and finance in China. How China is digitizing trade finance and the goals, opportunities and impact this could have.

Hyperledger has among its members many Chinese companies and academic institutions, contributing projects, code, expertise and assistance to our global blockchain open source collaboration. Many of these members are involved in the exciting development of blockchain for trade and finance in China and globally.

DLT solutions for Trade and Finance - China Focus

Through this paper, you will learn about China's blockchain infrastructure development, its Blockchain Services Network (BSN), key banking and trade finance consortiums, regulation and administration, initiatives, progress and goals.

This is a rapidly developing story, so Eugenio and Andreas will continue through the TF-SIG to update this document, making it a living paper. They would be happy to have contributions, corrections and comments from others in the community.

They are looking to also document the development of trade finance in other countries and regions and look forward to publishing these here for the information of Hyperledger's members and wider community. It is wonderful that these volunteers are providing this as a community service.

By Julian Gordon

VP, Asia Pacific, Hyperledger at The Linux Foundation

An overview of the Chinese blockchain infrastructure for finance

Part 1 - Introduction.

The purpose of the following document is to provide an essential description of the blockchain infrastructure China is willing to develop in order to realise the potential of distributed ledgers.

In the development plan 2019-2021 issued by People's Bank Of China "PBOC" six priority tasks are identified to strengthen the strategic position for financial technology over the long term.

This framework refers to the main government investment guideline "Made in China 2025", the National Policy that aims to create a core portfolio of national assets as a model to export abroad.

Blockchain takes a key role in this project, in enabling the convergence of data flows from end users to corporations and institutions and vice versa. It constitutes a "new engine for high quality financial services development and for supervised systems against cybersecurity risks".

Since China issued its 13th Five-Year National Informatization Plan in 2016, it has set out to establish national standards for blockchain technology, policy frameworks, and relevant legal standards. This plan listed blockchain as one of the key cutting-edge technologies, and emphasized the need to strengthen the innovation, testing and application of new technologies, including blockchain.

Since then, Chinese corporations have started investing through SPV or startups in blockchain technology, building a route that geographically starts from Beijing, China's capital and center of administrative power, then moving to Hangzhou, base of one its biggest corporations Alibaba and other relevant startups and spin offs, Shanghai, the financial center of mainland China, Shenzhen, its technological hub and Hong Kong, as a strategic hub for global operations.

Initially many of these initiatives started competing with each other, but eventually the Government decided to pursue national projects in order to build industry collaboration to push the nation towards a position of global leadership.

Now, according to the just released 14th Five-Year Plan, it is suggested to build a modern central bank system, improve the monetary supply control mechanism, steadily promote the research and development of digital currency, and improve the market-based interest rate formation and transmission mechanism.

The national DLT infrastructure in the finance industry seems to have two key pillars that are based on projects: Blockchain Service Network (BSN) and Digital Central Economic Payment (DCEP) system, sometimes referred to as the Chinese Central Bank Digital Currency.

Chinese corporations and associations will provide their blockchain operation services around these two pillars, which will include IT, trade finance, supply chain, healthcare, insurance and digital identity technologies developed by enterprises network consortiums.

Before going into deeper detail it is worth examining the main authorities overlooking blockchain activities in mainland China.

Cyberspace Administration of China (CAC): regulates blockchain service providers, all of which are required to register with the CAC through a dedicated registration system. The definition of a blockchain information service provider covers private and public chains, protocols, decentralized applications (DAPPs), blockchain browsers and any other businesses that provide or use blockchain technology.

Any new blockchain product is also required to report to the CAC or its relevant local authority to conduct a security assessment before launch. If foreign blockchain companies have a legal presence in China and their business meets the definition of blockchain information service providers, or they delegate an entity in China to run their blockchain technology or nodes, then they also need to register with the CAC.

The number of blockchain information service projects filed with the CAC has risen to 730 in total, following the unveiling of a third batch.

The third batch of registered blockchain information service projects unveiled by the CAC consists of 224 in total, with financial institution registrants, including the Postal Savings Bank of China, CITIC aiBank, China Merchants Bank and Ping An Bank. The 730 blockchain projects filed with CAC so far are heavily concentrated in the four locations of Beijing, Shanghai, Guangdong and Zhejiang. These centers are home to 571 projects, approximately 78% of the total. Beijing accounts for 83 projects in the third batch, followed by Guangdong with 44 and Zhejiang and Shanghai with 27 and 17 respectively. In central China, Sichuan hosts 14, followed by Hunan province with 13 and Chongqing municipality with 11.

Ministry of Industry and Information Technology (MIIT): evaluates and produces ratings for blockchain projects and organizes blockchain technology research projects and blockchain forums.

State Administration for Industry and Commerce (SAIC): regulates blockchain businesses' activities, such as internet advertising and e-commerce.

People's Bank of China (PBOC): regulates the financial institutions in China and drafts policies to prevent financial risks.

China Banking and Insurance Regulatory Commission (CBIRC): regulates banking institutions, online-lending institutions, insurance institutions, and other deposit-taking institutions.

Municipal Finance Offices: executes central government authorities' policies. It also regulates and supervises regional blockchain sectors to prevent any potential financial risk.

China is also working to improve general standards for data transmission. As of 1st January 2020, a cryptography law has entered into force with the goal to switch the approach in regulating the cryptography sector and further develop cyber security and data protection in China. The law classifies cryptography into core, common and commercial cryptography. Commercial cryptography is for the protection of information that is not state secrets, and can be used by citizens, legal persons and organizations in accordance with the law to ensure the security of cyberspace and information.

In addition, cryptography management departments, relevant departments and their personnel must not ask practitioners in commercial cryptography to disclose confidential information about cryptography, such as source codes, and must keep business secrecy and privacy.

The law also features a chapter on the legal liability related to misconduct concerning cryptography. For instance, those who steal encrypted information, hack into others' cryptography security system or use cryptography to engage in illegal activities that harm state security, public interests or others' rights and interests, will be held accountable based on the Cybersecurity Law and other laws and regulations. In terms of data management and data transfer operations, the new Personal Data Protection Law broadens the binding obligations to overseas data management operations. In fact, it is applicable to a foreign company processing the personal data of individuals physically located within China if the company supplies goods or services to individuals located within China, or has processed data to analyse or assess the behaviour of individuals in China. The regulations apply even if the processing activities occur outside of China. Foreign companies will also be required to establish organisations or appoint representatives within China to handle data protection related matters. Regarding cross border data transfer, Critical Information Infrastructure (CII) operators and other non-CII data controllers whose processing activities have reached certain levels, the standard for which has not yet been published, these companies are required to store in China all personal data collected within the territory. No cross-border transfer is allowed unless the transfer passes security assessments organised by cybersecurity administrative authorities by the CAC. For other general data controllers wanting to transfer personal data collected within the territory to a foreign country, they must either obtain certificates issued by designated testing institutions or sign data-protection contracts with the foreign recipients of the data and ensure that the processing activities of the recipients comply with Chinese regulations.

1.1 Chinese standards for DLT financial operations.

1.1.1 Operational standards CIPS – CNAPS2 complying with ISO20022

Asia Pacific is widely considered to be the world's most innovative region in terms of payments technology, with the Chinese market at the forefront of developments. It should,

therefore, be no surprise that in the global migration to ISO 20022, the People's Bank of China (PBOC) published its ISO 20022 migration plan as long ago as 2011.

By 2013, the country's primary payment system, spanning both RTGS and ACH payments and known as CNAPS2 (China National Advanced Payments System), went live using ISO 20022 with multiple messages. A particular advantage of using this new standard in China is that the format can carry Mandarin characters as well as Roman ones, as used in traditional payment formats like Swift's MT FIN messages.

In 2016 SWIFT signed a memorandum of understanding with China's Cross-border Interbank Payment System (CIPS) to develop the nation's cross-border payments infrastructure.

The agreement sets out plans to use Swift to connect CIPS with its global user community. CIPS now also uses ISO 20022.

CIPS processes Renminbi (RMB) clearing and settlement for international trades and cross-border investments and financing and financial market business; it supports the global use of RMB, also providing RMB liquidity to foreign banks and offshore markets, safeguarding the onshore market against shocks from offshore capital.

It is a direct participant of the High Value Payment System (HVPS) which handles HVPS, mainly inter-city and local credit transfers exceeding a given value, as well as urgent low-value transfers made electronically, and sets up a clearing account in the HVPS. CIPS has its own participants, which include direct and indirect participants and custodian banks.

Direct participants are domestic and foreign banks with designated CIPS codes and CIPS zero-balance accounts that can process RMB cross-border payments directly through CIPS. Foreign direct participants do not have HVPS clearing accounts and therefore need to set up custodian accounts at custodian banks under a custodian agreement. Custodian banks themselves are domestic direct participants of CIPS.

Indirect participants are domestic and foreign banks with designated CIPS codes but no CIPS zero-balance accounts. They need the help of direct participants to process RMB cross-border payments.

CIPS does not only process funds, it also processes information in cross-border payments, since its participants include more than 800 banks from around 90 countries, either as direct or indirect participants.

CIPS is a game-changer, providing controlled cross-border access to the onshore RMB clearing system CNAPS2. This control makes CIPS an essential milestone in making the RMB easier to use globally. China's low-value real-time payments system, known as the Internet Banking Payments System (IBPS), already uses ISO 20022 and has seen steady adoption with over 200 banks using the system. As well as the widespread usage of ISO

20022 for payments, The China Foreign Exchange Trade System (CFETS) has developed ISO 20022 messages covering post-trade foreign exchange activities.

The switch to the ISO 20022 standard allows payments to carry a great deal of more structured data, as well as standardizing payment formats that were previously inconsistent. It includes more information about all parties in the transaction, making it easier for banks to comply with anti-money laundering (AML) requirements for transaction screening. Another significant advantage is that ISO 20022 messaging increases efficiency, which results in lower cost and higher straight-through-processing (STP) rates.

The increase in information provided also reduces the risk of errors, as users can include additional payment details and references, making reconciliation easier for the beneficiary. It is noteworthy that, although Chinese payment systems are highly advanced in their adoption of ISO 20022, they do not use the Swift messaging network for their payment systems. It is thought that this is because China wants to minimize its reliance on Swift, whose governance is dominated by US and European banks. Hence, China prefers to manage its proprietary messaging network, albeit using a modern international messaging standard, ISO 20022.

Looking beyond payments, namely in the securities industry, China Securities Central Depository & Clearing (CCDC) is exploring the adoption of ISO 20022, even though Swift and the global securities industry have agreed not to lay down a hard end-date for a mandatory migration to ISO 20022.

1.1.2 Technical standards for financial applications.

Recently, the "Financial Distributed Ledger Technology Security Specification" (JR/T 0184-2020) financial industry standard was officially released by the People's Bank of China. The standard specifies the security system of financial distributed ledger technology, including aspects concerning basic hardware, basic software, cryptographic algorithms, node communication, ledger data, consensus protocols, smart contracts, identity management, privacy protection, regulatory support, operation and maintenance requirements, governance mechanisms, etc. The standard applies to institutions engaged in the construction of distributed ledger systems or service operations in the financial sector.

Distributed ledger technology is a distributed infrastructure and computing paradigm formed by the high integration of multiple core technologies such as cryptographic algorithms, consensus mechanisms, peer-to-peer communication protocols, and distributed storage. The issuance and implementation of this standard will help financial institutions in implementing system deployment and maintenance in accordance with appropriate security requirements, avoiding security shortcomings, providing business assurance capabilities and information security risk restraint capabilities for large-scale applications of distributed ledger technology, and shape industrial applications. This standard is under the centralized management of the National Financial Standardization Technical Committee, proposed and drafted by the Digital Currency Research Institute of the People's Bank of China, in cooperation with the Science

and Technology Department of the People's Bank of China, Industrial and Commercial Bank of China, Agricultural Bank of China, Bank of China, China Construction Bank and China Development Bank. The standard has been extensively solicited by the industry and passed the review of the National Financial Standardization Technical Committee.

On October 16 2020 were officially released the "Technical Framework of Cloud Computing Technology Financial Application Specification" (JR/T 0166-2020), "Cloud Computing Technology Financial Application Specification Security Technical Requirements" (JR/T 0167-2020), " Three financial industry standards including "Cloud Computing Technology Financial Application Specification Disaster Recovery" (JR/T 0168-2020).

These three specifications put forward comprehensive requirements for the financial industry cloud computing platform from the technical architecture, security requirements, and disaster tolerance of the financial industry cloud computing platform. Based on the 2018 version, combined with the financial cloud operating mechanism and risk Features, put forward targeted technical requirements from basic capabilities, network security, data protection, operating environment security, business continuity assurance, to ensure that the financial cloud meets regulatory requirements and industry requirements in terms of security, stability, and adaptability. It is necessary to prevent risks caused by cloud service defects from being transmitted to the financial sector.

"Cloud Computing Technology Financial Application Specification Technical Architecture" stipulates the technical architecture requirements of cloud computing platforms in the financial sector, covering cloud computing service categories, deployment methods, participants, architecture features, architecture systems, etc.

The specification points out that cloud services mainly include IaaS, PaaS and SaaS. According to the service content, they can also be divided into specific service categories such as NaaS and DSaaS. IaaS provides basic resource services such as computing, storage, and networking. PaaS provides software development and operating environment services running on cloud computing infrastructure. SaaS provides application software services running on cloud computing infrastructure. NaaS is a cloud service category that provides transmission connections and related network capabilities for cloud service users. DSaaS is a cloud service category that provides configuration and usage data storage and related capabilities for cloud service users.

Based on the technical characteristics of cloud computing, combined with the main implementation methods of the financial cloud computing platform, from top to bottom, the cloud computing platform architecture system is divided into basic hardware facilities and equipment layer, resource abstraction and control layer, cloud service layer, operation and maintenance operation Management and other parts, among which, the operation management runs through all parts.

Basic hardware facilities and equipment include computer room and machine ancillary facilities, computing equipment, storage equipment, network equipment, and other equipment. Resource abstraction and control include resource pools, storage resource pools, network resource pools, resource management and scheduling platforms, etc. Cloud services include IaaS, PaaS, SaaS and other types of services. Operation and maintenance operation management includes daily management, resource monitoring, operation and maintenance management, self-service, service management, etc.

"Cloud Computing Technology Financial Application Specification Security Technical Requirements" proposes specific implementation requirements from three categories: basic requirements, extended requirements, and enhanced requirements.

The basic requirements are universal and basic security requirements, and cloud computing technology financial applications should all be met; the expansion requirements are based on the general requirements and the scalability requirements for the group cloud; the enhancement requirements are based on the development trend of security technology and financial The forward-looking needs of users start with the enhancement requirements.

The cloud computing security framework consists of basic hardware security, resource abstraction and control security, application security, data security, security management functions, service capabilities, and optional component security. Basic hardware security includes requirements for computer room security, network security, and equipment security. Resource abstraction and control security include general requirements, network resource pool security, storage resource pool security, and computing resource pool security. Data security includes security requirements for the entire process of data generation, data transmission, data storage, data access, data migration, data removal, data backup and recovery. Security management functions include security requirements for identity and authority management, operation and maintenance management, centralized monitoring, centralized auditing, secret key management, and risk warning. Safety technology management includes requirements for safety strategies and management systems, safety management institutions and personnel, safety construction management, and safety operation and maintenance management. Optional component security requirements include requirements for container security, middleware security, and database security.

The "Cloud Computing Technology Financial Application Specification Disaster Recovery" stipulates the technical requirements that all cloud computing participants should follow when measuring the cloud computing platform's disaster recovery capabilities and carrying out the cloud computing platform disaster recovery work. The specification divides the disaster tolerance level of cloud computing platforms in the application and financial fields into 6 levels according to the scope of the failure or paralysis of the cloud computing platform and the degree of damage, as follows. The cloud computing platform in the application and financial fields should meet at least Level 3 requirements for disaster tolerance. Subsequently, the specifications put forward corresponding technical requirements in terms of key

indicators, data backup, data processing, network capabilities, and operation and maintenance capabilities.

On 21 October 2020 new standards were issued and especially related to application tests for fintech innovation (JR/ 0198 2020), security specifications (JR/T 0199 2020) and risk monitoring specification (JR/T 0200 2020).

The application of financial technology innovation refers to the premise of complying with the current laws and regulations, departmental rules, regulatory documents and other requirements related to design products or services for financial users using new technologies in areas where management rules are not yet in place.

Financial Technology Innovation Application Test specifications regulate the operation process of fintech innovation regulatory tools throughout their life cycle, such as pre-announcement, in-process complaint supervision, and post-evaluation. It clarifies the requirements in terms of declaration form, testing process, risk control mechanism and evaluation method, so as to provide a basis for financial management departments, self-regulatory organizations, licensed financial institutions and technology companies to carry out innovation testing.

General Safety Code for Fintech Innovation specifications regulate all the transaction security, service quality, algorithm security, architecture security, data security, network security, internal control management, business continuity assurance, etc. We will make clear the basic and universal requirements for financial technology innovation-related technology products, and ensure the safety of financial technology innovation.

Transaction security includes transaction verification, transaction confirmation, transaction monitoring and transaction risk disposal. The algorithm security provides the requirements of algorithm design, algorithm interpretability, algorithm traceability and algorithm attack prevention. Architecture security includes cloud computing architecture and block chain architecture.

Data security includes data quality requirements, personal financial information for the whole life cycle protection, in line with the corresponding security management requirements. Network security includes the basic security requirements, Internet of things security requirements, security requirements.

Financial Technology Innovation Risk Monitoring Standards state the monitoring framework, objects, processes and mechanisms of financial technology innovation risk are defined, and real-time analysis of the operation status of innovation applications is required by means of institutional reporting, interface collection, automatic detection, information sharing, etc. To achieve the potential risk dynamic detection and comprehensive assessment, to ensure that the overall risk of innovative application of fintech control.

Financial technology innovation risk monitoring activity mainly refers to the application of financial technology innovation data collection, correlation analysis, identification and display the possible safety time and risks, grasp the risk situation of financial technology application, ensure the safe and stable operation of financial technology application, and protect the legitimate rights and interests of consumers.

In the implementation of risk monitoring, in addition to the real-time analysis of the operation status of innovative applications by means of institutional reporting, interface collection, automatic detection, information sharing and so on, it is also necessary to carry out manual verification, that is, to verify the verification of the running system without informing the innovation organization in advance, and to verify whether the business function, processing flow and control measures of the system are consistent with the contents reported in advance.

The monitoring content mainly includes personal financial information protection, financial transaction security, business continuity, service quality, technology use security, internal control management, network security, opinions and complaints, public opinion, etc.

The Financial Science and Technology Innovation risk Monitoring Code also stipulates what requirements should be followed by monitoring institutions, innovation institutions, self-regulatory organizations and regulatory agencies in all aspects of monitoring content.

Next, we will examine how BSN and DCEP will try to unify the Chinese blockchain industry with the goal to support national and international economic development plans

Part 2 - Blockchain Cloud Architecture - Blockchain Service Network BSN.

Blockchain Service Network (BSN) is a cross-cloud service, cross-portal, and cross-blockchain framework for the deployment and operation of blockchain applications. It is a global public infrastructure network system with 131 resource pool city nodes around the world and 3 types of portals. To build a blockchain application on BSN, the minimum cost for a year is 1,500 yuan, which is approximately 200 Euro.

BSN mainly solves two major problems: the first is to solve the problem of cost, and the second is to solve the problem of interoperability.

At present, the entire BSN network is divided into "BSN China" and "BSN International" according to the "one network, two systems". They abide by the laws and regulations within their respective service areas, and both parties maintain common technology and consistent versions.

In short, as a cross-bottom framework, cross-cloud service, and cross-portal blockchain public infrastructure, the common goal is to continuously optimize BSN to lower business development costs, allowing all bottom layers interoperability of heterogeneous blockchain application data.

The design and creation of BSN aims at a public infrastructure network that allows the low-cost development, deployment, operation, maintenance and regulation of consortium blockchain applications.

As a global public network, BSN will support the underlying frameworks of both consortium and public blockchains. However, portal operators responsible for actual operations should carry out legally compliant filtering and administration in accordance with local laws and regulations concerning the support of underlying frameworks and the deployment of certain blockchain applications.

Essentially, BSN will act as the backbone infrastructure technology for massive interconnectivity throughout the mainland, from city governments to companies and individuals alike. The network will also form the backbone of the Digital Silk Road, to provide interconnectivity to China's trade partners around the globe. BSN will be a new internet protocol, to allow a more efficient way to share data, value and digital assets in a completely transparent and trusted way between anyone who wants to be a node on the network.

2.1. Participants.

There are three types of players directly involved in BSN:

- 1) Cloud service providers that, through the installation of free BSN public city node software, make their cloud service resources (CPU, storage and bandwidth) accessible through the BSN and carry out sales through the BSN;
- 2) Blockchain framework providers, designated consortium blockchains, that, in accordance with the local laws and regulations concerning the support of underlying frameworks and the deployment of certain blockchain applications.
- 3) Portal operators that can use BSN with existing cloud service portals or developers' portals to create Blockchain as a Service (BaaS) platforms, quickly and at low cost; they can then provide BSN-based blockchain application development.

2.2. Starting founders and members.

1. **Government Agency:** State Information Center of China.
2. **Communications Industry:** China Mobile Communications Corporation Design Institute Co., Ltd and China Mobile Communications Corporation Government and Enterprise Service Company.
3. **Financial Industry:** China UnionPay Corporation and China Mobile Financial Technology Co., Ltd.
4. **Software Industry:** Beijing Red Date Technology Co., Ltd.

2.3. Advantages.

It must be considered as an information infrastructure. BSN participants do not need to purchase any additional physical servers or cloud services to build their own blockchain operating environment; instead, they can use uniform public services provided by the BSN and lease shared resources as needed. More in depth, this picture features the following additional advantages:

1. Lower barrier to entry for blockchain application development
2. Easier access to different blockchain applications
3. Interoperation with different protocol for business internationalization

2.4. Key components of the architecture.

2.4.1. Public city nodes.

Public city nodes are a basic operational element of the BSN. Their main function is to provide system resources such as access control, transaction processing, data storage and computing abilities for blockchain applications.

In principle, the BSN is a multi-framework, multi-chain, multi-ledger blockchain system. Each application deployed on a certain number of city nodes uses a dedicated channel for transaction processing, data communication and storage.

There is complete isolation from channel to channel; however, if two applications share mutual authorizations, data can be mutually allocated. This type of mechanism thus guarantees the absolute privacy of each application while maintaining sufficient flexibility to carry out cross-framework and cross-chain business.

2.4.2. Blockchain framework.

The blockchain framework can be viewed as the operating system of blockchain applications. BSN supports mainstream consortium blockchain frameworks and public blockchain frameworks. In terms of public blockchain frameworks, developers can purchase corresponding resources, select any given public blockchain framework, create public blockchain nodes through any BSN portal and connect the nodes to the main network of the selected public blockchain. To do so, BSN applies Cosmos network technology in order to interoperate different blockchain solutions.

The mechanisms of consortium blockchain frameworks and public blockchain frameworks feature massive differences. Adapting a public blockchain to the BSN is quite simple, since most public blockchain networks are fully open-sourced. BSN development teams can easily implement the adaptation on their own. At the moment, the BSN already supports Hyperledger Fabric and other consortium blockchain frameworks currently being adapted, including Fabric with Chinese SM2/SM3 Encryption Algorithm, FISCO, BCOS, CITA, XuperChain, Wutong Chain and Brochain. In regard to public blockchain frameworks, BSN currently supports Ethereum and EOS.

How is it possible for these technologies to interoperate?

2.5. BSN Portal.

Each BSN portal has extremely high levels of autonomy and independence. Besides purchasing resources and deploying applications, all other functions are provided by the portal itself, namely user registration and management, billing and payment systems and developer

communities. Each portal collects its own fees and, once it has deducted its own revenue, the balance is paid to a settlement company authorized by the BSN on a weekly settlement basis.

The main goal of the project is to build a network of city nodes worldwide interoperating with China for blockchain solutions.

2.6. BSN Alliance.

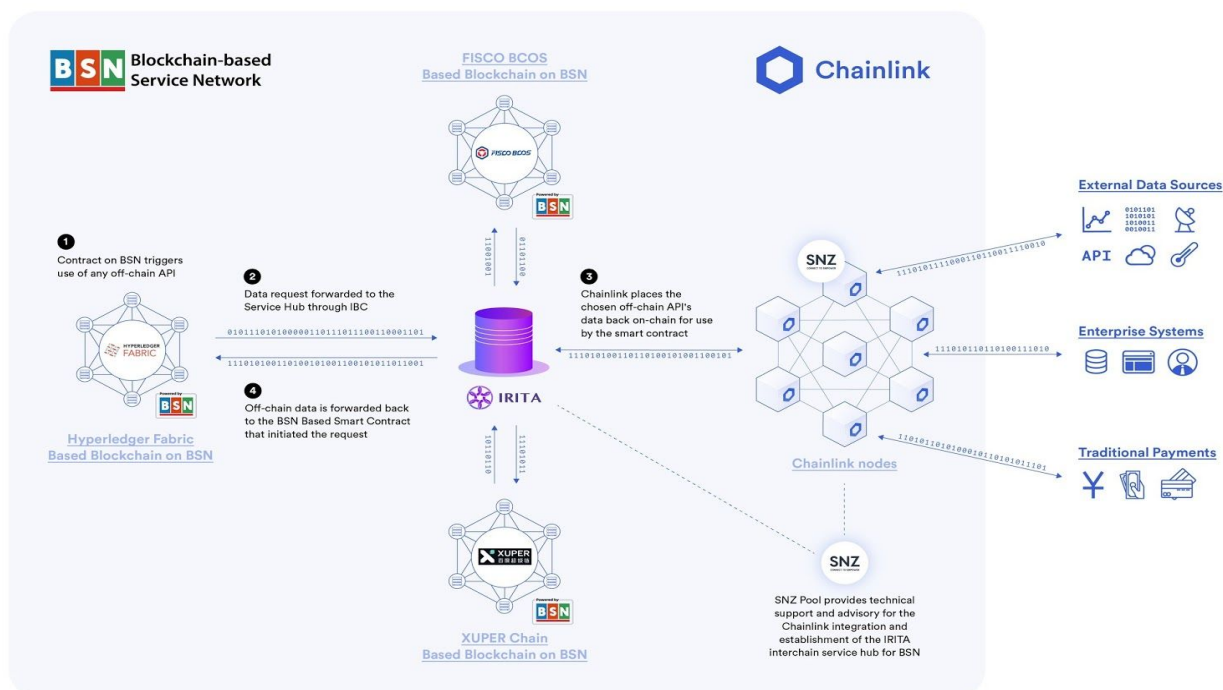
Upon completion, the project will offer three services: cross BaaS solutions, cross cloud portal connections, cross framework interoperation. The BSN launch schedules have been adjusted due to the COVID-19 outbreak. The project has a starting phase of 150 nodes around China Mainland and overseas locations. BSN International nodes (Tokyo, Paris, Sydney, São Paulo) would be linked to the BSN-China network, although they would need to operate independently and comply with the laws and regulations of the areas in which they are active. BSN has already partnered with AWS China, Google Cloud, Microsoft Azure, in order to speed up the process for internationalization. It can be seen as a way to enhance interoperability between enterprise cloud and governments' cloud. It can represent a perfect duo to let private and public data management initiatives achieve the best performance results. What are the roles of the key players involved?

The State information Center is driving the alliance to let the technology be consistent with political programs and administrative infrastructures, developing plans in terms of smart cities connected to nodes and the digital economy. China Mobile Design will be in charge of building the cloud infrastructure around China mainland and will allow it to interoperate with international partners, such as AWS Microsoft Azure and Google Cloud. China Union Pay will be in charge of all financial norms and operations ruling inbound and outbound transactions. Beijing Red Date Technology will be in charge of managing network operations and software development. Recently, BSN also announced a partnership with Chainlink Technologies in order to set up cross-chain communication hubs and implement the mechanism Dapps to interact with data outside the network, such as weather information, stock information, Iot data etc. This key integration will enable governments and enterprises to incorporate validated real-world data into their BSN applications by using Chainlink oracles via the Iris Foundation interchain service hub. Chainlink's oracle network will help BSN with sourcing reliable real world information. Meanwhile, the Iris Foundation will integrate businesses by Cosmos network, assisting BSN with interoperability or allowing different systems to work in conjunction with each other.

From a business point of view, this feature will be fundamental to let BSN interoperate with other systems (like DCEP) and in supporting domestic and foreign corporations in collecting and deploying a trusted stream of data for securing strategic investments plans. Last but not least, BSN partnered with DAML open source smart contract language and toolkit for developing DApp. DAML is a smart contract technology that can run seamlessly on multiple platforms including Hyperledger Fabric, Besu, Fisco Bcos, Corda. The intent of the

cooperation is to create a unique contract language able to perform with different frameworks active into BSN.

BSN Integration of Chainlink Oracles with IRITA and SNZ Pool



2.7. BSN open chain Consortium.

BSN has been highly valued by governments at all levels, and has been written into the government's three-year action plan for new infrastructure construction or the development plan of the blockchain industry.

This is happening not just for first tier provinces and cities. Recently Fujian Province, Yunnan Province, Jiangxi Province, Changsha City and Hubei Province have added BSN into their own development plans. Three provinces included BSN in their "14th Five-Year" digital economy development plans.

Focusing on the latest operations, the BSN alliance has launched an open chain consortium project to unite leading companies and public chain projects in the industry to truly push the implementation of blockchain technology in China.

On September 27th 2020, the "BSN Open Alliance Chain Project" launched by the Blockchain Service Network Development Alliance was announced in Beijing. "BSN Open Consortium Chain" is based on BSN's domestic public city nodes and through the licensing transformation of public chain technology it becomes an "open consortium chain" deployed in the BSN ecosystem and acceptable for supervision.

The project aims to further promote the healthy and orderly development of blockchain technology in China in a legal and compliant manner, helping developers to develop, deploy

and run various blockchain applications at low cost and high efficiency, and to achieve chain-to-chain integration.

The operation of the BSN open alliance chain involves technology development, node management, multi-portal docking, cloud service coordination, developer training, and cross-chain collaboration. It is a project with a complex operating system. It is expected that after going online in December 2020, the BSN Open Consortium Chain project will have a dedicated official portal and detailed developer manual to facilitate users to learn. Let's explain some of the operational details of the project.

1. As a blockchain infrastructure, BSN provides a resource environment, underlying system and portal channels for specific open alliance chains. Whether through the transformation of the internationally renowned public chain framework or the self-developed open consortium chain framework, as long as it meets the technical standards and regulatory requirements of the BSN, everybody can deploy their own open consortium chain framework on the BSN by purchasing resources on the BSN and starting a legal and compliant operation.

All open consortium chain operators must be limited liability companies registered in China, and the framework used must not infringe the intellectual property rights of any third party.

2. Whether through transformation or independent research and development, all BSN open consortium chain frameworks must meet the following three mandatory requirements:

- all nodes are set for authority control, which can only be deployed by the BSN operation and maintenance party in the public city nodes of BSN China Internal and external nodes cannot join;
- the open alliance chain absolutely prohibits the use of any form of virtual currency, and can only pay for the GAS costs incurred by the deployment and operation of smart contracts through RMB recharge;
- once the RMB recharge is completed, the GAS accounts cannot be withdrawn, and horizontal transfer of GAS accounts between different users is absolutely prohibited;
- all open alliance chain operators shall accept the supervision of the BSN Development Alliance and strictly abide by the regulations stipulated in the written regulations. After discovering violations, the BSN Development Alliance can easily remove the relevant open alliance chain, and make corrections in accordance with regulations and pass the acceptance before it can be released again. If any application on the open consortium chain violates regulations, the open consortium chain operator and the BSN development alliance can take blocking measures to remove it;
- the entrance of all BSN open consortium chains will be pushed to all BSN portals through the BSN empowerment platform. The BSN portal is responsible for real-name registered users and keeps user information. User information will not be sent to the BSN. The BSN portal is also responsible for the user's RMB recharge, GAS account recharge, and collection of corresponding payments. After the recharge of the GAS account is completed, the portal party can confirm the income. After deducting its own income, the remaining part will be paid to the corresponding open alliance chain

operator and other related parties in accordance with the regulations of the BSN Development Alliance;

- low-cost cross-chain interoperability is one of the core concepts and technical directions of BSN. BSN will enable all open consortium chains to interoperate through the "cross-chain communication hub" deployed in all public city nodes, that is, smart contracts on different chains can call each other. All open alliance chain frameworks must technically support cross-chain communication hubs, but corresponding mechanisms can be set to allow or restrict the implementation of cross-chain mechanisms. BSN can also provide technical solutions so that all BSN open consortium chains can interoperate with other open consortium chains outside of BSN and are legally active in China. The above interoperability mechanisms will all be implemented in the first half of 2021. The interconnection between the domestically deployed open consortium chain and the international blockchain ecology under the premise of legal compliance will be a trend, but the technical solutions and interworking mode must be approved by the relevant regulatory authorities. There is currently no specific timetable for the international interoperability of the BSN open alliance chain;
- The reason why the BSN open consortium chain project encourages the multi-chain model is to establish a competitive environment between technical frameworks. Only in a healthy competition ecosystem can we truly promote technological development and innovation. The BSN Development Alliance will require all BSN open consortium chains to undergo major version updates at least once a year. If there is no framework upgrade iteration for a long time, the open consortium chain framework and operators may be dissuaded.

The open consortium chain will form an industry in China and will also become one of the core foundations for the rapid development of China's blockchain technology. Any new version iteration of the BSN open alliance chain must pass technical review before it can be deployed and upgraded by the BSN operation and maintenance party.

At the end of the day, the main goal of BSN is to create a harmonized DLT ecosystem through different cloud solutions, different kinds of networks, different smart cities and administrations, different geolocations in terms of corporate governance and business operations.

Interacting with other open chain Consortia like AntChain or FSCO may be a challenge. According to our understanding the main difference between BSN and other initiatives is represented by its goal. While BSN seems to be led to support national policies, the other networks focus on business operations. In this way BSN may represent a free and secure marketplace for IT corporations DLT networks challenging and benefit from each other's competitors. All the big players Ant Group, Tencent, Huawei, will provide different product solutions over the city nodes architecture provided by BSN in a free but safe market competition.

In this unique case scenario Hyperledger open source projects like Cactus, an open-source blockchain integration framework backed by Accenture and Fujitsu that aims to integrate several projects like Hyperledger Fabric, Besu and Quorum, may represent an international gateway for a comprehensive DLT adoption into BSN.

2.8. IT Providers - Blockchain Solutions.

Now, let's see how the most important IT corporations are working on the possible integrations of blockchain solutions with BSN.

Basically, most of the key IT corporations in China have launched a Blockchain as a Service “BaaS” cloud solution. BaaS is a peculiar service as a cloud solution allowing end users to build, host and use blockchain applications and smart contracts over a blockchain architecture.

At the same time, the most important corporations are structuring business related entities offering specific business case applications, or public beta source solutions to develop interoperability and software development.

Let us now explore in deeper detail who the major players are in this field.

2.8.1. Hyperchain - China UnionPay.

Hyperchain is a Chinese Enterprise-level blockchain platform operating in supply chain finance. Operations started in 2016, offering blockchain solutions, blockchain open cloud platform and smart contracting tools, with a strong orientation towards supply chain digitization. Through those digitization efforts, it aims to help bring digital certificates and supply chain traceability to the ecosystem, driving value for participating companies' tamper-proof, traceable and shared assets.

One of the main applications of Hyperchain deployed by China UnionPay and China Everbright Bank is a trusted electronic credential system. Using this, bank customers can atomically send their electronic credentials with electronic signatures to the platform, which can be stored, hashed, encrypted in order to support transactions and issue electronic credentials with absolute data credibility and traceability. It is estimated that 1.2 million yuan has been saved daily on average due to the reduction of paper credentials.

Hyperchain has worked with a host of banking, financial, and technical partners including the People's Bank of China, Bank of Beijing, Shanghai Stock Exchange, Huawei, Google, and China Telecom, to name a few. In addition to its supply chain finance achievement, Hyperchain is also working closely with the Ministry of Industry and Information Technology in order to draft industry standards.

It has also developed supply chain traceability products with the goal to improve efficacy and reduce business risks of information flow.

Lastly, it offers an energy assets solution called “green ledger”, which is basically an open platform integrating IoT energy data stored within a DLT platform in order to provide efficient credit trading or financing solutions to assets.

2.8.2. Alibaba - Ant Group.

Alibaba offers a Blockchain as a service “BaaS” solution on Alicloud Blockchain, which is an enterprise-level platform service based on leading blockchain technologies. Basically this service helps SMEs with inbuilding a secure and stable blockchain environment, saving the costs of operations and maintenance, and at the same time facilitating business development. Alibaba BaaS service supports Hyperledger Fabric, Ant Blockchain technologies and Quorum.

BaaS is integrated with a range of financial services that Ant Financial, a subsidiary of Alibaba Group focusing on financial services like Alipay, provides, such as providing for cheaper remittance solutions. The service provides 24-hour real-time remittances at competitive exchange rates, with low transaction costs. The smart contract on the blockchain notifies all participants contemporarily, hence enabling customers to track payments. However, all details are encrypted so that only the relevant people get to see them.

Again, Ant Financial has recently launched a blockchain consortium called “Open chain”, which is meant to support SMEs in deploying blockchain applications and smart contracts at cheaper costs, also thanks to BSN, within the Ant Financial environment.

The biggest difference between "Open chain" and the BaaS service is that developers can use the blockchain without purchasing servers or building nodes. Specifically, small and medium-sized developers can directly access the blockchain and carry out business on the chain through the IDE, smart contract development templates, DApp development assistants, and other components provided by the Ant blockchain. Open chain offers solutions in terms of traceability, assets digitalization, notarization and privacy.

In August 2020 the Bank of China and Alibaba Holding Group signed a comprehensive agreement to hasten internet linked services in finance, and the two companies will jointly carry out financial technology services.

2.8.3. Tencent.

Tencent is another key player in China’s fintech industry. Starting from managing data, Tencent now also offers Blockchain as a service solution (TBaaS) built on Tencent Cloud, allowing organizations to quickly build their own IT infrastructure and blockchain services on a flexible and open cloud platform. TBaaS integrates the three underlying blockchain engines, which greatly reduces the cost of implementing the underlying blockchain technology, simplifies the construction and operation of blockchain, and meets your personalized needs in the face of various industry scenarios. It also supports Hyperledger Fabric and FISCO BCOS protocols, one of the largest blockchain consortiums in China. It is an open source solution compatible with Hyperledger and Corda, whose founding members include WeBank, Tencent’s subsidiary focusing on digital banks, and Huawei, and also includes several banks

and corporations. It is not a single blockchain, rather a blockchain application ecosystem, a set of blockchain applications aimed to serve the general public.

The main business areas are supply chain finance/operations, judicial services like escrow agencies for arbitration, health, IP and copyright.

Tencent has developed its own business solution called Wechain. Once the documents are verified by WeChain and acknowledged by the core buyers, transaction banks will acquire the receivables from the suppliers, in a picture similar to a reverse factoring transaction. Banks and securities companies will then package the assets into ABS products and further distribute them to investors. The factoring + ABS model has now become common among financial institutions and tech companies, improving corporate liquidity. In this type of fintech collaboration, banks normally act as the financial service providers, while technology companies provide technological support.

Standard Chartered Bank has become a partner through Linklogis, a blockchain-enabled supply chain platform, based in China, allowing upstream suppliers to access financing in a proficient way and at a competitive rate by using WeChain.

2.8.4. Baidu.

Baidu Cloud, part of China's dominant search engine, unveiled its Blockchain as a Service platform (BaaS) offering the Baidu Blockchain Engine (BBE), which Baidu refers to as the "blockchain operating system". This BaaS platform currently supports three blockchain protocols: a permissioned version of Ethereum, Hyperledger Fabric and Baidu's own XuperChain which is open sourcing.

Xuperchain was released in 2018. The service is supposed to let small and medium-size businesses and developers cheaply launch so-called decentralized applications. The white paper is available in Chinese, and it is clear that the basic intent of the project is the same as for other corporations, as the implementation of blockchain solutions at cheaper costs and in an easier way from the end user point of view.

2.8.5. Huawei.

In 2018 Huawei launched its own BaaS, with the support of the open source solution Hyperledger Fabric running over Huawei Cloud infrastructure.

The blockchain service (BCS) on Huawei Cloud is designed for enterprises, supported by open source blockchain technologies and is a rich experience in distributed parallel computing, PaaS, data management, and encryption.

The BCS is a general, basic technology that is open, user-friendly, flexible, and efficient. Centering on the blockchain cloud platform, it can support enterprises quickly and flexibly developing blockchain solutions and applications on Huawei Cloud. Huawei works with enterprise customers to promote the deployment of blockchain solutions and applications and to build reliable, public infrastructure and an ecosystem based on blockchain and shared success.

The BCS is delivered on Huawei Cloud, which is reliable and open, serving global customers.

Huawei Cloud delivers diverse cloud computing products and customized industry solutions to enterprises, with the support of their technologies, offering low cost, flexibility, telecom-level security and efficient, on-demand management. The BCS can be integrated with existing Huawei Cloud products and solutions to support enterprises in moving towards the era of cloud in a secure, efficient, and tamper-proof approach, quickly deploying new solutions and applications.

2.8.6. JD.

JD.com launched its JD Blockchain Open Platform targeting enterprise customers. This platform helps companies in building their own applications and hosting them on public or private clouds. It's a Blockchain as a Service (BaaS) platform designed with one-click deployment.

A wide range of applications are available, including track and trace for goods, transaction settlement and digital copyrights.

First to launch on the platform was China Pacific Insurance Company (CPIC) which deployed a traceable system for e-invoices. The system applies unique blockchain IDs to each document to streamline the accounting process.

The company is also launching the JD Chain Open Source Community to encourage collaboration. This is made available under the Apache 2.0 license and is now on Github.

The company said the aim is to improve blockchain performance in five areas: data ledger, consensus protocols, cryptographic algorithms, data storage and APIs. The company also claims the current iteration is capable of 10,000 transactions per second.

Part 3 - DCEP Digital Currency Electronic Payment system

3.1. Introduction - Blockchain as a Financial Infrastructure (BaaFI).

At present, there are two models of financial infrastructures: the account model, which is represented by the 2-tier bank account system, and the second is the token model, which is made possible by blockchain and related technologies. These two models are quite different, although they can both record financial assets and transactions. Under many circumstances, they complement or substitute each other.

The best-known and most studied example of an account model is the 2-tier bank account system, which consists of a central bank and commercial banks. Individuals, enterprises, and government departments open deposit accounts in commercial banks, which in turn open deposit reserve accounts in the central bank.

The token model is created by a token with a specific denomination. The transfer of a token from one party to another does not require reconciling two databases; it is rather the near-immediate transfer of ownership, very much like handing over banknotes from one person to another.

3.2. DCEP: the framework.

On 24th October 2019, during the 18th collective study of the Political Bureau of the Communist Party of China Central Committee, China's President Xi Jinping pointed out that "the application of blockchain technology has been extended to digital finance". DCEP is a project run by the central digital currency national research institute of the PBOC and is a pillar for those who wish to understand Chinese digital finance.

DCEP should have the following key characteristics:

Design features	DCEP adoptions	Key info
Architecture	Hybrid CBDC	It is a direct claim of the central bank. Commercial banks execute services under authorization. Central bank holds track of the transactions.
Technological infrastructure	Centralized ledger + dlt	Centralized ledger is managed by PBOC and records transactions. Dlt is "suggested" to be implemented at 2 layer for business use eg. trade finance, supply chain finance etc.
Finance model	token model	Loose account model, accounts grant privacy to third parties, such as commercial banks or users, but

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		Central banks still have access to info.
Use	Retail & Wholesales	Traditional 2-tier system: from central bank to commercial ones for wholesale. Commercial banks distribute to the public by means of ATM or mobile POS.

DCEP is backed 1:1 by deposit reserves, pays no interest, and undertakes no social or administrative functions other than the four functions of money, i.e. unit of value, medium of exchange, method of payment and store of value. Its aim is to replace M0.

To ensure that the issuance and redemption of DCEP do not impact the aggregate amount of central bank money, there is an equivalent exchange mechanism between deposit reserves and DCEP. During issuance operations, the PBOC reduces deposit reserves and issues the DCEP for the equivalent amount. Likewise, in redemption operations, the PBOC increases deposit reserves and destroys DCEP for an equal amount .

The circulation of DCEP follows the traditional 2-tier system of the central bank and commercial banks. The PBOC issues DCEP to commercial banks in a wholesale approach. Commercial banks then distribute DCEP to the public for retail use. The PBOC works with commercial banks to ensure the normal operation of DCEP.

DCEP takes the shape of an encrypted numeric string representing a specific amount of money, guaranteed by the PBOC. It contains serial number, amount, owner and issuing bank signatures etc. The serial number is a unique identification and unrepeatable and can be used as an index of DCEP. DCEP is programmable and can incorporate any user-defined executable script.

The registration center and certification center of DCEP: The registration center records all DCEPs and corresponding users. It also records all DCEP transactions, including the whole life cycle of issuance, circulation, and redemption. It is basically a digital coinage center, built in a traditional centralized approach. The certification center plays an important role in the “controlled anonymity” of DCEP. For instance, PKI (Public Key Infrastructure) can be used for authentication of financial institutions or high-end users, while IBC (Identity Based Cryptography) can be used for authenticating low-end users.

3.2.1. “Loose account coupling and centralized management model”.

DCEP transactions almost do not rely on accounts, so DCEP can circulate as easily as cash and can achieve “controlled anonymity”, which means that it only discloses transaction information to the PBOC. Without its permission users, commercial banks and merchants

work together, but still are not able to determine the true identity of DCEP users or to trace their transaction history. DCEP users can expand the use of RMB abroad and promote RMB internationalization. In contrast, bank cards and internet payment follow the “tight account coupling” model.

Distributed ledger technology (DLT) is not used in the registration center, it may be used in order to verify the authenticity of DCEP, providing an internet website for external inquiries. Thus, it works like an online DCEP verification machine. This design brings two benefits: on the one hand, the registration center is securely isolated in case of external attacks, while DLT improves verification efficiency. On the other hand, DCEP transactions are not processed by a DLT, thus avoiding its efficiency bottleneck.

3.2.2. System independence.

DCEP is universally flexible; it can be transacted in all kinds of payment methods, channels and platforms and is compatible with existing financial infrastructures. In theory, whatever payment network boundary bank deposits and electronic money reach, DCEP can also reach. The following infographic is adopted from the DCEP prototype system discussed by YAO Qian, the former head of the Digital Currency Institute of the PBOC .

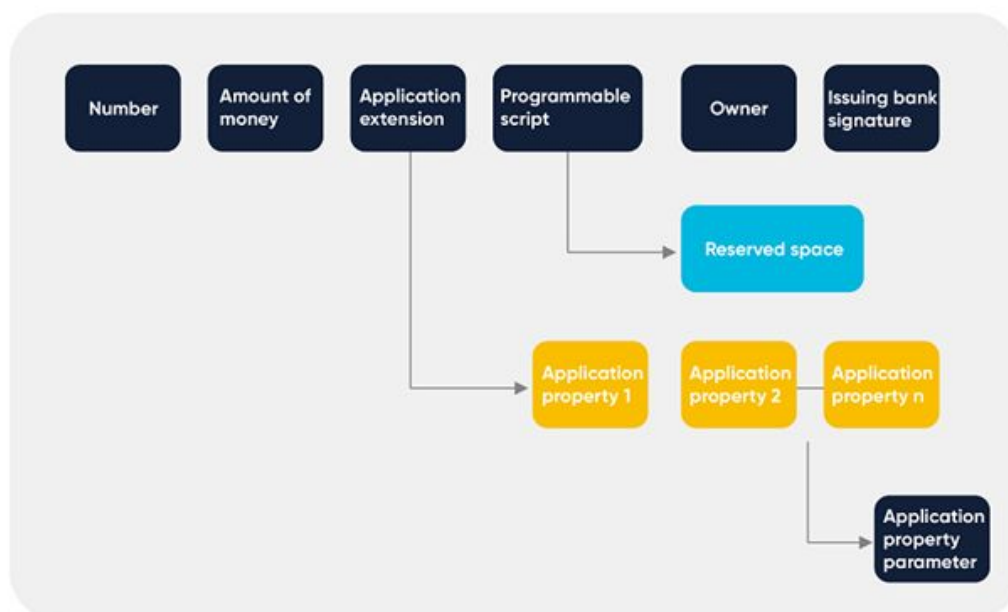


Fig.2 From of presentation of CBDC

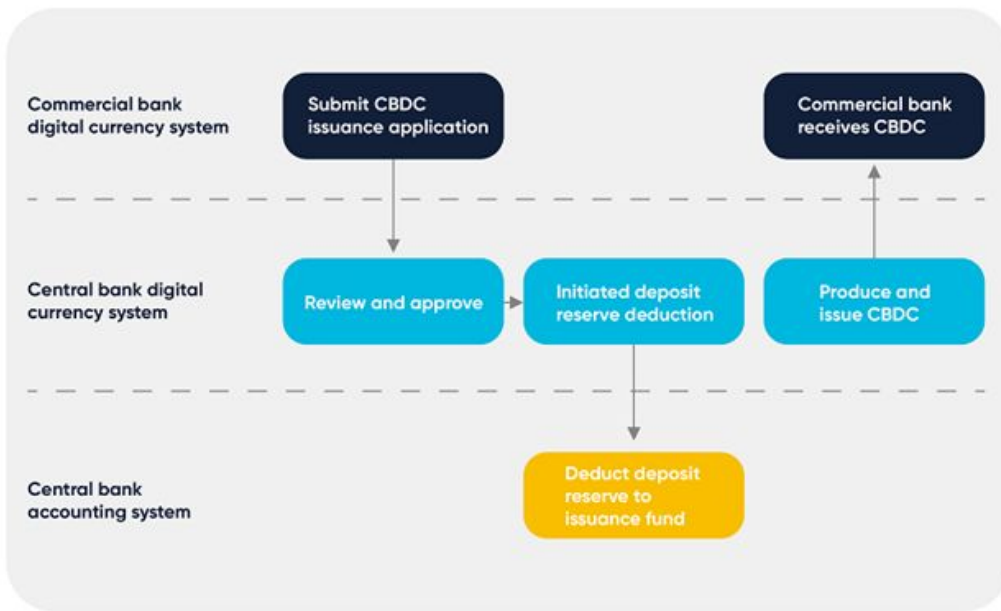


Fig.3 Issuance process of CBDC

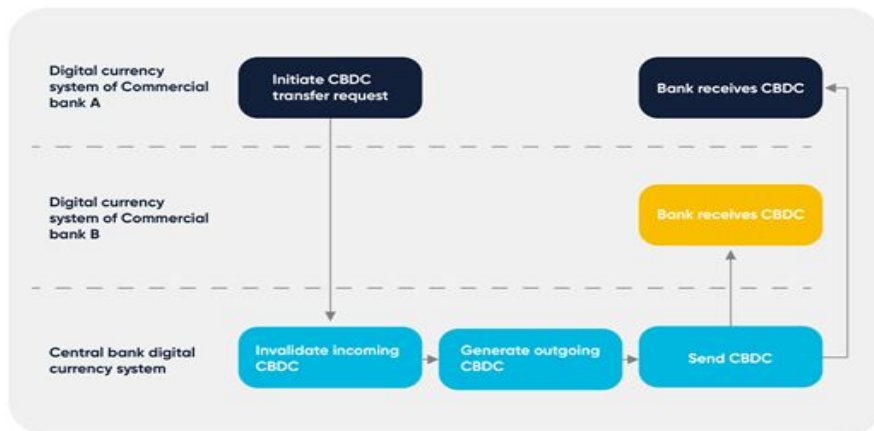
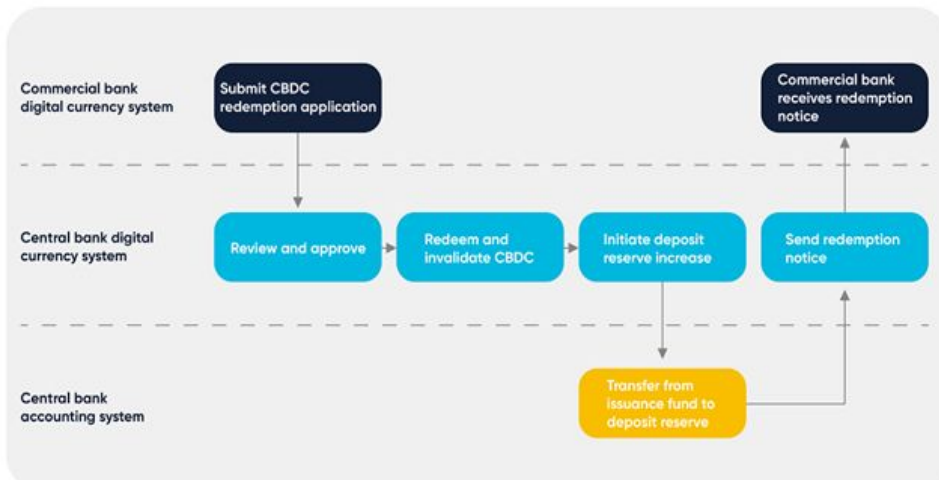


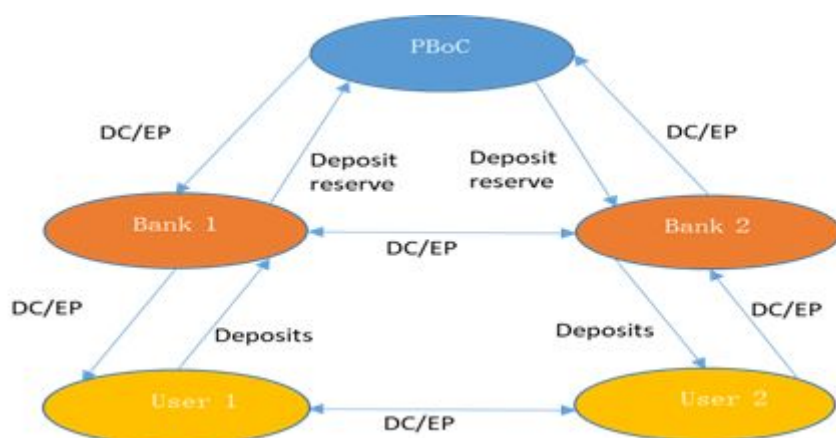
Fig.5 Transfer process of CBDC

3.2.3. The DCEP prototype system: key design features.

Although DCEP is not a token inside a blockchain, it shares the following features with tokens: no “double spending”, anonymity, unforgeability, security, transferability, divisibility and programmability etc. Therefore, it still belongs to the token model rather than the account model. At the core of DCEP is its registration center, which is managed by the PBOC in a centralized approach and does not need to run any consensus algorithm. This way, it can be highly efficient. In DCEP, blockchain may be used in the online verification system, providing a supporting role.

Based on the DCEP prototype system, we can make the following inference on its design. DCEP uses a centralized ledger based on the UTXO (Unspent Transaction Output) model. This centralized ledger is embodied in the DCEP registration center. Of course, this centralized ledger can be structured via Hash functions and Merkel trees, just like it happens with a DLT. Nevertheless, it will not make much difference, since it is managed by the PBOC. More important, the credibility of the PBOC is significantly higher than that of commercial banks and other private institutions, so it is unnecessary to introduce a DLT as a decentralized trust mechanism. We consider the centralized ledger based on the UTXO model as a “degraded” blockchain with only one node. DCEP wallets. Users need to have DCEP wallets to own and use DCEP. At the core of DCEP wallets is a pair of public and private keys: key is also the address where the digital representation of RMB is stored. Users can see the addresses of other users, although they do not necessarily know the true identity of the address owners. The corresponding relationship between addresses and user identity is known only by the PBOC through a KYC (“know your customer”) process, which can be far from a strong real-name system. Commercial banks are heavily involved in the DCEP wallet setup and KYC processes. Users can initiate address-to-address transactions with their private keys. Unlike on-chain token transactions which are first broadcast to a peer-to-peer network, then packaged by miners into blocks and become blockchain consensus, DCEP transactions are processed directly by the PBOC in the centralized ledger.

DCEP’s Impacts on Payment: the chart below displays the flow of funds in DCEP.



3.2.4 DCEP end point E-wallet solution and offline payments

On October 30 2020 Huawei's consumer business CEO Yu Chengdong announced that the Mate 40 series mobile phones will support the "digital yuan hardware wallet" function in accordance with the unified standards of the People's Bank of China Digital Currency Research Institute. This is the first domestic smartphone that supports digital RMB hardware wallets.

Judging from the currently known pilot information, digital renminbi has two forms: software wallet and hardware wallet. The software wallet is the "digital renminbi" wallet experienced in previous activities and exists in the form of a mobile app; the hardware wallet is based on the "chip" wallets that exist in the form of smart cards or mobile eSIM.

Therefore, it is certain that for consumers, in addition to being able to exchange and use digital renminbi through mobile apps in the future, digital renminbi can also be used in the form of the above hardware wallets. However, as the R&D and application of digital renminbi are constantly updated and developed, the following descriptions are only extrapolated based on current market conditions and patent descriptions, and do not represent the final specific form of digital renminbi, and are for your reference only.

The hardware wallet works as a "digital currency chip card" based on the recent understanding of industry participants and the patent details announced by the central bank. Currency chip cards can specifically include five forms: visual Bluetooth IC cards, IC cards, mobile eSIM cards, mobile SD cards, and mobile SIM cards.

The above classification is summarized in a series of patents such as the central bank "Method and System for Offline Payment Using Digital Currency Chip Cards". Therefore, in the view of mobile payment networks, the form of hardware wallet means that the device carrying digital currency is a physical device that is different from software, whether it is a smart card chip or a mobile phone chip.

From devices perspectives, vBluetooth IC cards and IC cards are mainly smart card forms, while mobile eSIM cards, mobile SD cards, and mobile SIM cards belong to mobile phone forms.

A visual Bluetooth card generally refers to a smart card with a screen that displays information such as transaction amount and balance, and interacts with the smart phone through Bluetooth and other methods, and can cooperate with the mobile phone App to query and synchronize account information. IC cards include ordinary smart cards, ultra-thin cards, and other forms. They have no active interaction capabilities and need to interact with the receiving terminal before they can be used.

Mobile phone eSIM card, mobile phone SD card, and mobile phone SIM card usually refer to a solution based on three different modes of NFC such as the full terminal of the mobile phone, NFC-SD, and NFC-SIM card. The security information is stored in different SE chips

and then passed the mobile phone's NFC method interacts with the receiving terminal, of course, it may also interact through Bluetooth or other methods.

The hardware wallet supported by Huawei Mate 40 series mobile phones is the aforementioned mobile phone eSIM form.

In case the acceptance terminal and the payment device are both offline, how to solve this so?

Basically the entire transaction process has not undergone essential changes, but the networking process has been appropriately postponed. According to public information related to the patent, the offline payment defined in the digital renminbi system refers to near-field payment, during which the receiver needs to confirm the payment online afterwards.

The same as the transaction process above, the receiving terminal accepting the digital currency can verify the authenticity of the received digital currency through the form of "plug-in" and verify the identity of the user, but it cannot verify whether it has made repeated payments. To avoid the "Spending" problem, you must wait for it to be verified after going online.

According to the design idea described in the patent, the digital currency that requires repeated payment verification is marked as "Pending Repeat Payment Verification" in the client e-wallet program (such as POS machine). Once the POS machine is connected to the network, it will automatically send it to the digital currency system. Repeat payment verification application. The digital currency system receives the verification application to perform corresponding operations, supplements the transaction flow in the registration center, and updates the owner of the digital currency.

In other words, offline payment cannot be circulated to the market before online verification. For example, A transfers 100 yuan to B through digital RMB dual offline payment. Although B receives 100 yuan of transaction information, the 100 yuan will be marked as "Pending Repeat Payment Verification" status and cannot be spent by B again, You can only resume use after the verification is completed on the Internet.

3.2.5. Flow of Funds in DCEP.

The central bank's digital currency system includes one currency, two banks, and three centers. The digital currency registration center needs to verify the legality of the transaction digital currency, record the transaction flow, modify the new owner of the corresponding digital currency, and register other required information.

The two libraries refer to the central bank's digital currency issuing library and the digital currency commercial bank library. Commercial banks pay an equal amount of reserve funds

to the central bank in exchange for digital currency to be stored in the commercial bank library and recorded in the central bank's registration center.

When a user opens a digital currency wallet and exchanges a certain amount of digital currency from a commercial bank deposit account, the commercial bank first needs to check whether there is enough digital currency in the digital currency bank library, and provides users with deposits if sufficient. After the commercial bank feeds back the operational information to the central bank, the central bank registration center records the transaction and changes the corresponding digital currency owner from the commercial bank to the user.

When the digital currency in the wallet is used for transactions, taking the carrier as a "digital chip card" as an example, first enter the transaction amount on the receiving terminal, and the user takes out the card to interact with the receiving terminal in a non-contact manner, and after obtaining the transaction based on the amount, the transaction information is sent to the acceptance terminal (the transaction information includes the digital chip card information and the digital currency equivalent to the transaction amount).

Then, the accepting terminal transaction information is sent by the commercial banks to the digital currency system. Commercial Bank receives transaction information after the central bank sends a digital currency system change by owner request.

If the digital currency wallet account opened by the merchant and the user's digital currency wallet account are not the same operating institution, what about the fund flow behind? For example, user A uses a digital currency wallet opened in the Bank of China and exchanges 100 yuan from an ICBC personal bank account to deposit it, and then pays to merchant B through the digital wallet, and the digital wallet that merchant B receives is opened at ICBC, that was exchanged back to B's personal bank account in ICBC.

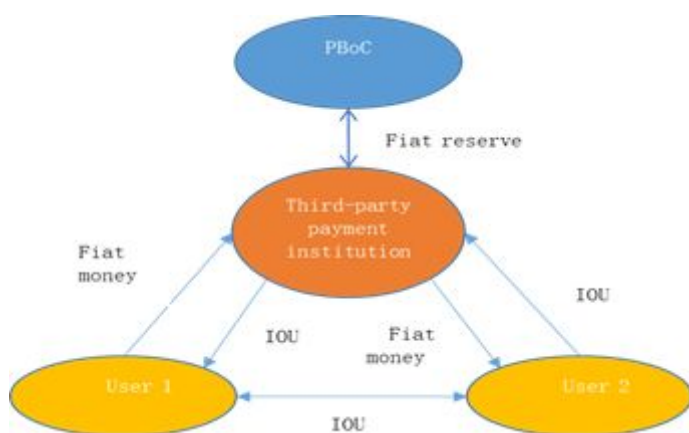
The specific fund flow may run in a way that PBOC first confirms the fund inventory in its digital currency bank library, and after reporting the information to the central bank registration center, the central bank changes the owner of the 100 yuan digital currency from the Bank of China fund library to user A. When user A will pay to B, ICBC, the operator of B's wallet, first confirms its digital currency bank treasury inventory and information to the central bank registration center. The registration center changes the owner of the 100 yuan digital currency from user A to user B. When B deposits 100 yuan into the ICBC bank account, ICBC reports the information to the central bank registration center, and then the central bank cancels and records the 100 yuan digital currency from the ICBC digital currency bank library, and restores ICBC's 100 yuan digital currency exchange quota.

Due to the cross-bank circulation of digital currencies, there will naturally also be "clearing" issues. According to my understanding the "clearing" role would be played by the central bank itself. Of course, judging from the recent signing of strategic cooperation agreements between the Central Bank's Digital Currency Research Institute and other clearing institutions such as City Bank Clearing and Rural Credit Bank, small and medium-sized banks will not be

responsible for exchange operations in the future, but they must participate in the circulation of digital renminbi and subsequent capital Circulation may require these clearing institutions to achieve interconnection capabilities.

PBoC		PBoC		PBoC	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
	Deposit reserve DC/EP	Deposit reserve -A DC/EP +A		Deposit reserve-drr*B DC/EP	
Bank		Bank		Bank	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
Deposit reserve DC/EP	Deposits	Deposit reserve -A DC/EP +A	Deposits	Deposit reserve-drr*B DC/EP -B	Deposits -B
User		User		User	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
Deposits DC/EP		Deposits DC/EP		Deposits -B DC/EP +B	
		(Issuance/Redemption)		(Deposit/Withdrawal)	

3.2.6. Third-party Payment after “Direct Link Disconnected”.



Easily, one can realize that the DCEP shares lots of similarities with third-party payment after China’s “direct link disconnected” reform. At present, all user funds of third-party payment institutions in China are kept in the PBOC. Allegedly, this is already a type of synthetic DCEP based on the account model. If DCEP performs well enough in terms of technical efficiency and business development, DCEP should produce user experiences similar to third-party payment. This indicates that DCEP and third-party payment may compete with each other in the future.

In addition to the above, DCEP and third-party payment share the following similarities:

1. Both focus on retail users.
2. Both are centrally managed and based on the 2-tier bank account system.
3. Both have complex impacts on money supply and money multipliers.

4. Neither DCEP nor third-party payment balance pays interest to users.

However, DCEP is fundamentally different from third-party payment:

1. They have very different implications regarding privacy protection. Third-party payment follows the tight account coupling model and is not anonymous. In contrast, DCEP follows the loose account coupling model and achieves a “controlled anonymity”.
2. Third-party payment is a payment tool and only users with the same third-party institution can make direct transfers between themselves. In contrast, DCEP is a legal tender.
3. DCEP will help the PBOC to monitor the flow of funds and enforce regulation such as AML, CFT, and anti-tax evasion. The programmability of DCEP will lead to innovations in macroeconomic policy. In contrast, third-party payment mainly replaces payment tools, such as bank cards and cheques and does not have much significance as a macroeconomic policy tool.

3.2.7. DCEP’s Monetary Impacts.

The DCEP monetary features significant impacts from three perspectives: first, implications for monetary policy; second, impacts on RMB internationalization, and third, the mode in which the private sector can participate in infrastructure building and promotion of DCEP.

3.2.8. DCEP’s Implications for Monetary Policy.

DCEP does not pay any interest. Also, the PBOC has no plan to fully replace cash with DCEP. As a result, the DCEP will not become a new monetary policy tool. This is quite different from the scenario where the DCEP fully replaces cash and pays an interest. In this scenario, the interest rate of DCEP will be a powerful monetary policy tool, which enables direct transmission from central banks to the public. It will not be constrained by zero lower bound (ZLB) of the nominated interest rate.

It is expected that multiple DCEP wallets will exist in the market. Both commercial banks and leading third-party payment providers can launch their own wallets. However, in any DCEP transaction, the actual flow of funds only takes place between the payer and the payee, thus not involving the wallet operator. As a result, the role of DCEP wallet operators is completely different from card issuers or acquirers.

3.2.9. The Settlement of DCEP.

There are three possible options for settling DCEP transactions:

1. Real-time Gross Settlement (RTGS): between users are updated immediately in the DCEP registration center. In this case, DCEP payment, settlement and clearing are all independent from card payments and third-party payments; furthermore PBOC directly processes DE/CP retail payments. This requires a high level of security and efficiency of this system. For instance, it should not be lower than the standard of NetsUnion, China's non-bank online payment processing and settlement platform.

2. Delayed Net Settlement (DNS): there are three key considerations in this case. Firstly, DNS may not provide good user experience. Secondly, DCEP transactions occur directly between wallets. This means payment acquiring, collection and netting only happen at the level of the wallet. As most DCEP wallets are held by individuals, for small-value transactions, netting is not necessary. Thirdly, whenever commercial banks are the wallet operators, DCEP transactions between wallets do not trigger inter-bank settlement, unlike interbank transfer. Hence, the only applicable scenario for DNS is for DCEP transactions between commercial banks. However, DCEP transactions between commercial banks are "wholesale" in nature, since they can be processed by RTGS. There is little benefit, if none at all, in switching to DNS. Hence, DNS is a less viable option for DCEP settlement.

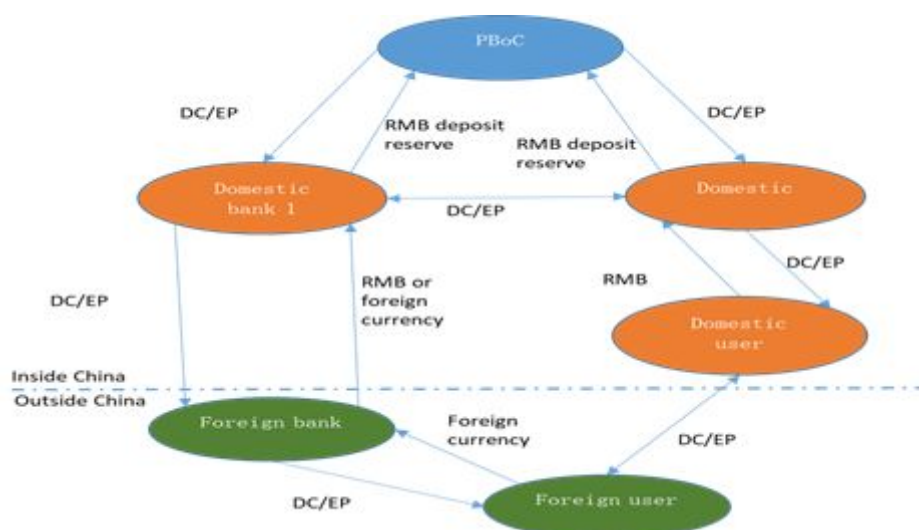
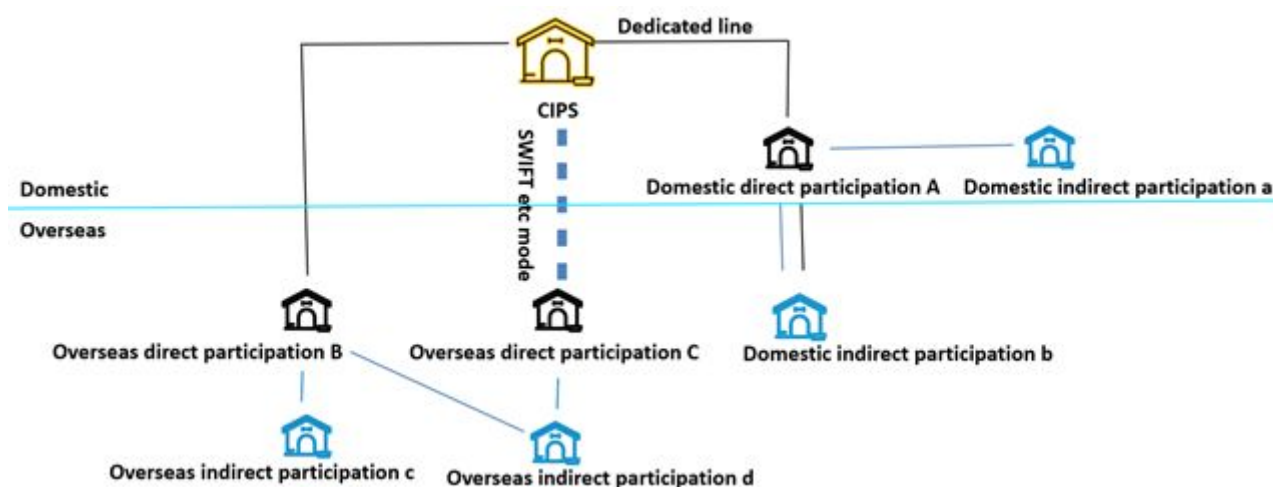
3. Settlement via DCEP Custody and Payment Institutions (CPCPI). Nowadays, clients' reserves are deposited centrally at PBOC by the third-party payment providers. CPI is similar to the third-party payment model, the only difference being in that it replaces payment reserves at PBOC with DCEP. In other words, CPI users transfer their DCEP to the CPI's DCEP wallets which are, in return, entitled to the equivalent account balance of these institutions. As for the users of the same CPI, DCEP transactions are processed and settled within the CPI's own balance, delivering the same user experience as today's third-party payment services. For the users of different CPIs, DCEP transactions will be netted at the CPI's account level before being updated into the DCEP registration center.

3.3. Impact of DCEP on RMB Internationalization.

RMB internationalization is perceived mainly on cross-border payments. DCEP is expected to trigger a regime shift from the account model to the token model.

Before 2015, there were two main models of RMB cross-border payments, i.e. the correspondent model and the clearing model. Then, the PBOC launched CIPS which serves as the "highway" for RMB internationalization, providing clearing and settlement services across time zones for cross-border and offshore RMB transactions. All of those methods follow the account model; to participate, foreign banks need to offer RMB services and foreign users need to have RMB deposit accounts.

3.3.1. CIPS.



In contrast, DCEP only requires users to have DCEP wallets, which are much more easily obtained, rather than having to open RMB deposit accounts. DCEP transactions are therefore cross-border by nature and are indeed able to promote the use of RMB abroad effectively.

However, cross-border payments are only a necessity not a condition sufficient for RMB internationalization. In order to be an international currency, RMB should be freely convertible, stable in value, extensively used in international trade and widely accepted abroad. Beside that, it opens a new challenge for Chinese financial market in terms of smart digitalization of assets, products and operations complying with the underlying policies and regulations.

3.4. Use of RMB Abroad: 3 use cases

3.4.1. Use Case 1 – RMB as the Settlement Currency for International Trades.

RMB acts as the unit of account and medium of exchange in international trade exchanges. When corporations, government departments and other organizations and individuals located in China purchase goods and services from overseas in RMB, the RMB deposit balance owned by foreign institutions and individuals increases. Similarly, when goods and services produced in China are purchased by foreign institutions and individuals, the balance of their RMB deposit automatically decreases. This example shows how outbound and inbound flows of RMB work in a different way than the import rather than export of goods and services. In the current age of fiat currency and book-entry settlement, money moves in a system based on bank accounts, rather than through physical cross country borders.

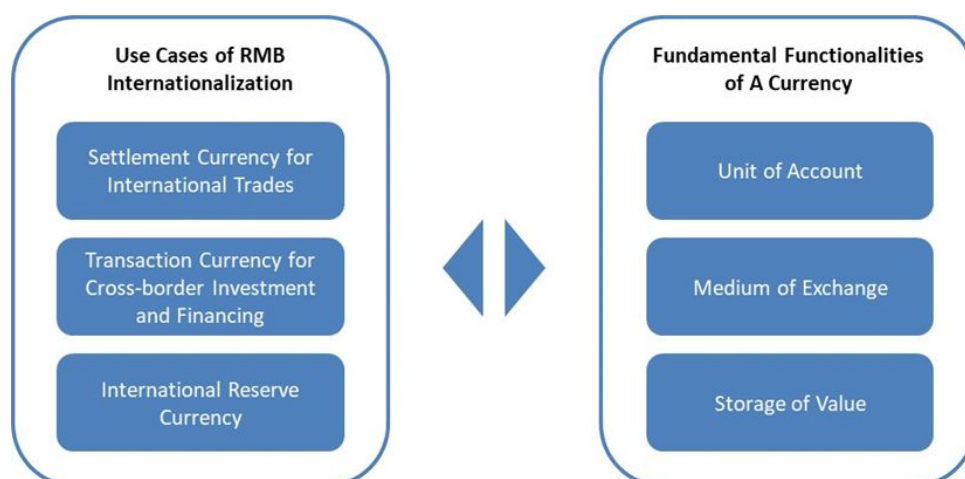
3.4.2. Use Case 2 – RMB as the Transaction Currency for Cross-border Investments and Financing.

When Chinese institutions and individuals use RMB to purchase foreign financial assets, or foreign institutions and individuals buy RMB denominated financial assets, RMB acts as the unit of account and medium of exchange in cross-border financial transactions.

3.4.3. Use Case 3 – RMB as an International Reserve Currency.

When foreign central banks hold RMB-denominated financial assets as part of their official reserve assets, this reflects the role of RMB as an international reserve currency. Foreign countries can invest in China or import goods and services from China using their RMB reserve assets. However, they cannot ‘bring back’ the RMB reserve assets and use them domestically.

All of the three use cases of RMB internationalization correspond to the three primary functions of money: a unit of account, a medium of exchange and a store of value.



Foreign individuals and Institutions only need to set up DCEP wallets in order to participate in RMB cross-border payments. This way, they establish a direct debtor-creditor relationship with PBOC, thus avoiding the involvement of any domestic or foreign banks as intermediaries. Given the openness of the DCEP system by design, it will be much easier for them to own DCEP wallets than bank accounts in RMB, thus enabling more foreign individuals and institutions to own and use DCEPs. As a result, different KYC requirements and onboarding procedures need to be applied to foreign and domestic users of DCEP wallets. However, all wallets are worth being used from the perspective of PBOC. Peer-to-peer transactions can be initiated irrespective of the two DCEP wallets involved and it is not necessary to differentiate among onshore, offshore or cross-border transactions, just like two people in the world that can communicate via email, without knowing where the email servers are located. DCEP transactions could reach a very high transaction hype if domestic and foreign users are recorded in PBOC's DCEP registration center.

The introduction of DCEP cross-border payments may create a new chapter for overseas application and adoption of RMB. Foreign travelers who wish to visit China can enjoy mobile payments using DCEP wallets without opening a local bank account in Mainland China. On the other hand, overseas merchants who are willing to accept payments in RMB can set up DCEP wallets in order to accept cross-border payments from Chinese travelers. Notably, additional requirements on RMB capital account liberalization may arise, if foreign users demand to buy DCEP using foreign currencies.

3.5. International cross-border digital currency platform and project Inthanon - Lion Rock

The proposal was issued in May 2020 by a member of the China National Party Committee as implementation of the initiative to create a China-Japan-Korea Free Trade Zone set up in 2012.

A "Cross-border Digital Stable Coins in Hong Kong" would suggest an alliance whose aim would be to let RMB, Japanese yen, South Korean won and Hong Kong dollars join in a sort of package of digital stable coins that could be used in cross-border trade, payments supervision and in promoting the DCEP in order to achieve cross-border applications in China's Greater Bay Area and even East Asia.

The specific suggestions put forward are to form a basket of digital stablecoins in the renminbi, yen, South Korean won and Hong Kong dollar, as well as applying them to cross-border trade payments in the regulatory sandbox, to establish a reserve fund custody system for electronic wallets, to ensure the safety of funds, to promote cooperation between the Mainland and Hong Kong, to explore the research scenario, for testing and evaluating the docking of digital stablecoins with the central bank's digital currency, and final, for promoting the central bank's DCEP, which would take the lead in achieving cross-border applications in the Greater Bay Area.

With reference to the development experience of the Belt and Road Initiative, the internationalization of DCEP is expected to take the overseas business of state-owned enterprises and large Chinese private enterprises as a breakthrough; most foreign-funded enterprises and financial institutions are already adapting their business to this perspective.

The structure of Hong Kong's cross-border digital currency should be to establish a stable alliance with financial institutions and large multinational companies as nodes, pledge DCEP and other legal digital currencies of various countries on the alliance chain to form a package of digital stable coins. In addition, the Hong Kong Monetary Authority and other regulatory agencies can also conduct real-time supervision through the pledge information on the chain.

In the future, the central bank's DCEP could take full advantage of its unlimited legal compensation feature and use Hong Kong cross-border digital stable currency as a way for foreign investors to participate in mainland financial activities.

This cross-border digital currency may act as a glue for trade relations between China, Japan and South Korea. As an important trading partner of Japan and South Korea, Hong Kong will inevitably formulate corresponding laws and regulations for private companies joining Hong Kong's stable currency alliance. This will also enable the Japanese and South-Korean central bank to indirectly understand and refer to the design of China's DCEP, promote regional capital flows between China, Japan and South Korea, and reduce the Japanese and South-Korean' economic dependence from the US dollar.

Actually, the Hong Kong Monetary Authority is already working on a cross national border project with the National Bank of Thailand in Project Inthanon-LionRock.

Project Inthanon-LionRock is a joint initiative between the Bank of Thailand (BOT) and the Hong Kong Monetary Authority (HKMA) to explore the application of Distributed Ledger Technology (DLT) to increase efficiency in cross-border funds transfers. With an understanding of the challenges in the existing environment, the project is designed to overcome pain points including inefficiencies, high cost, limited traceability and complex regulatory compliance. The adoption of DLT in the model aims at facilitating real-time cross-border funds transfer and pursues the path of atomic PvP for foreign exchange transactions.

Launched in September 2019, Project Inthanon-LionRock seeks to build a proof-of-concept (PoC) where a THB-HKD cross-border corridor network is set up as a bridge between the Inthanon and the LionRock networks (DLT-based local payment network of each jurisdiction). Originally built on Corda in partnership with Cryptoblk, the final goal is to create the corridor network designed to allow Inthanon and LionRock networks' participants to conduct funds transfers and foreign exchange transactions on a peer-to-peer basis which helps reduce settlement layers. The cross-border funds transfer process is enhanced to enable real-time transfers and atomic PvP settlements. Leveraging smart contracts, funds transfers, and foreign exchange transactions are bundled together. The corridor network is designed to

enhance banks' foreign currency liquidity management, adopted the liquidity saving mechanism for multiple currencies and incorporated compliance to local regulations where possible.

In the phase 1 the project was focused on the tokenization and economics to explore the capabilities of DLT by developing a PoC for a shared cross-border network where cross-border funds transfers can be efficiently processed, and FX transactions can be settled on an atomic PvP basis.

On September 2020 the project has entered in phase 2 with the intent of improving cross-border settlement efficiency, liquidity management efficiency and local regulations compliance

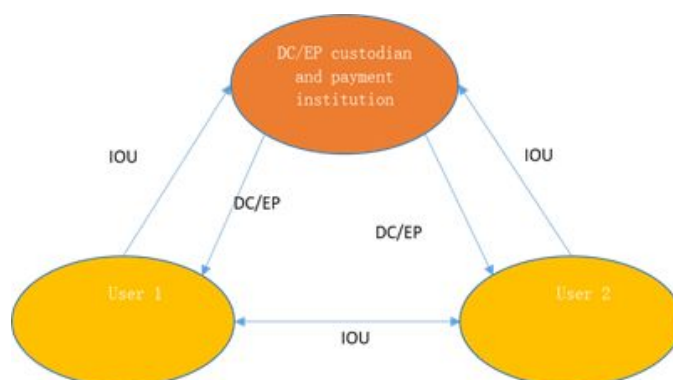
The parties have selected ConsenSys, as the trusted partner for Phase 2. According to ConsenSys, the cross-border payment network study project would be done in conjunction with PricewaterhouseCoopers and Forms HK.

ConsenSys revealed that it will be using ERC-20 smart contracts as a standard for triggering the most fungible tokens issued on Ethereum. The solution will see at the core the permissioned enterprise blockchain Hyperledger Besu, that offers interoperability solutions between Quorum and Fabric as well as ConsenSys' Codefi and MetaMask, the popular Ethereum wallet. To deliver the solution, ConsenSys is partnering with local blockchain developer Atato.

3.6. The Private Sector's Opportunities in the Development of DCEP.

At the core of DCEP's user interface is a pair of public and private keys. However, private keys, unlike traditional passcodes or passwords, also differ in storage and management. Reasonably, we can argue that in the future there will be DCEP custodians and payment institutions (Picture). These will help users in managing their private keys by using a combination of account model and token model. Users will be therefore able to send DCEP to addresses of DCEP custodian and payment institutions. In return, those institutions will give users a special account balance, essentially a DCEP IOU users can pay with.

A DCEP IOU payment system can be highly integrated with current third-party payment systems.



3.7. DCEP and Libra: a comparison.

Upon careful comparison DCEP shares some basic points with Libra: First, both digital currencies are centralized, which reduces the cost of paper currency issuance, improving the efficiency of payment and settlement. Second, in order to prevent over-issuance, they both adopt 100% reserve support measures and both adopt a two-tier operation model during issuance. Third and last, both DCEP and Libra have controllable anonymity and both can protect the legal privacy of the public.

There are four main differences between DCEP and Libra:

1. the technical route: although they both adopt a hybrid architecture, the subsequent use of blockchain technology depends on commercial banks. In the technical route of commercial institutions, the bottom layer of Libra is a centralized structure, while the top-level settlement uses a blockchain technology.
2. the perspective of asset reserves: DCEP uses RMB as its asset reserve without any risk of exchange rate fluctuations. On the other hand, Libra uses a basket of currencies as its asset reserve, which obviously features some risks of fluctuations in the exchange rate.
3. functional positioning: DCEP is an alternative to M0 and does not involve M1 and M2 itself. Although, Libra can theoretically be used to issue loans, hence expanding its range to the field of M1 or M2.
4. the perspective of debtor risk: DCEP is issued by the central bank and is endorsed by national credit, while Libra is the debtor of the Libra Association. The public will face the double credit risk of the Libra Association and the issuing agency.

3.8. Other takeaways.

A two-tier model comprising the PBOC and commercial banks serving as operating agencies would therefore be a suitable approach to DCEP operation in China and could optimally secure the support of commercial banks without wasting any existing resources, mainly

because it would not change the current creditor-debtor relationships in currency circulation. Commercial banks would need to pay the central bank 100% reserves against the DCEP issued, so the money issued to the public would remain as the central bank's liability backed by its credibility, thus qualifying it as legal tender. Then, would not change the existing currency circulation system and two-tier account structure may not stress the relationships with commercial banks in the savings market. In other words, a two-tier DCEP would not increase banks' reliance on interbank borrowing or affect their lending capacities, thus allowing them to avoid disintermediation. Moreover, since it would not affect the existing monetary policy transmission mechanism or intensify procyclicality in different stress scenarios, issuing DCEP would not lead to any negative impact on the way the real economy operates. Lastly, the recommended model would make currency operation more cost-effective, improve money circulation efficiency and ultimately enhance the user-friendliness and security of related payment services. Also, endorsement by the central bank would smooth out potential spikes in consumers' demand for the crypto assets.

PBOC should pursue a two-tier strategy. On one side, digital money would be a liability in the central bank's book, meaning that the creditor-debtor relationship would not change with the introduction of the new form of fiat money; as a result, the PBOC should assume a central position in the operation process.

On the other side, efforts should be made in order to grant and strengthen the central bank's functions in terms of monetary policy execution. The existing two-tier account system should be kept with the goal to retain the current monetary policy transmission mechanism. Last but not least, the central bank must be able to track, to monitor and to supervise DCEP operation in order to avoid oversupply by the authorised operating agencies.

DCEP should be based on 'loosely coupled account links', so that transactional reliance on accounts could be significantly reduced. This way, the new money could attain a similar function of currency to cash and be used on a controllably anonymous basis. The society could use it directly for various purchases and it would prove conducive to the yuan's circulation. Without third-party anonymity, DCEP transactions may jeopardise personal data and privacy, although third-party anonymity may encourage criminal activities such as tax evasion, terrorist financing and money laundering. The only way to strike a balance between the two is to keep the degree of anonymity within a controllable range, namely disclosing transaction data to the PBOC as the sole third party. With the loose coupling of accounts, the operating agencies should submit transaction data to the central bank via asynchronous transmission on a timely basis. This would allow the central bank to keep track of necessary data to implement prudent regulation and crack down on money laundering and other criminal offences, as well as easing the workload for commercial banks.

Furthermore, non-cash payment tools, such as traditional bank cards and electronic payment, are reliant on strict account coupling, meaning that they cannot meet the public's needs for user-friendly and anonymous payment services. These tools cannot replace M0 completely, especially in areas with limited account and telecommunication services, where cash and coins are still the prevalent means of payment. The PBOC's DCEP would retain the main

characteristics and properties of cash. It would be very convenient to use and could grant for user's anonymity, making it an ideal surrogate, mainly for cash and coins.

The DCEP would be introduced to substitute M0, meaning that no interest would be paid. Therefore, it would not cause disintermediation or lead to a rise in inflationary expectations, neither would it have any significant impact on the current monetary and financial systems or on the real economy. Furthermore, being defined as a replacement of M0, the DCEP would be subject to existing cash management, anti-money laundering and counter-terrorist financing regulations of China's financial intelligence unit and the global Financial Action Task Force. Of course, the DCEP would observe all State Administration of Foreign Exchange capital management regulations. The PBOC could require relevant organizations to report large and suspicious transactions to clamp down on money laundering activities. To avoid the 'crowding out' effect on bank deposits, arbitrary trading the use of the DCEP should be limited to small retail transactions at first by setting maximum daily and yearly limits, and introducing policies stating that DCEP conversions exceeding a certain amount can only be processed by appointment. If necessary, multi-tier charges may be introduced, small-sum and low-frequency transactions could be processed free of charge and service fees could be charged on large-sum or high-frequency transactions in order to increase the exchange cost and the system friction. Such arrangements would also make it easier for the central bank to implement a negative interest rate policy if the need arose in future.

PBOC plays a central role in the digital renminbi system and is responsible for wholesale digital renminbi to designated commercial banks and full life cycle management. Commercial banks and other institutions are responsible for providing digital renminbi exchange and circulation services to the public.

The provision of digital RMB exchange services by commercial banks is set as a requirement by laws and regulations. The "Renminbi Management Regulations" grants "financial institutions that handle RMB deposits and withdrawals" the right to cooperate with the People's Bank of China to manage the circulation of RMB. The issuance of RMB banknotes is mainly realized through the bank's cash receipt and payment business. Therefore, commercial banks have the legal basis to provide exchange and circulation services for digital renminbi. At the same time, Article 9 of the "Administrative Measures for Online Payment Services by Non-bank Payment Institutions" stipulates that non-bank payment institutions shall not operate or disguisedly operate currency exchange, cash deposit and withdrawal services, and do not have the institutional basis for providing exchange services for the digital RMB positioned by M0 . Therefore, in accordance with current laws and regulations, only commercial banks can provide digital RMB exchange services to the public.

Specifically, commercial banks, as designated operating institutions, are responsible for opening different types of digital renminbi wallets based on the identification strength of customer information under the quota management of the People's Bank of China and providing digital renminbi exchange services undertaking the circulation services of digital renminbi under the supervision of the People's Bank of China. Last but not least they are

responsible for the management of retail links, so as to realize the safe and efficient operation of digital renminbi, including payment product design innovation and scenario expansion.

On the October 23 2020 PBOC publicly solicited opinions from the public on the "People's Bank of China Law" one of the intents of these provisions is to fully embrace digital money assets within enforcing regulation. The provision has been included in the 2020 legislative plan with the intent of modernizing the central banking system to digital finance innovations.

Here you may find some important references:

- article 20 Renminbi Issuance: the Renminbi shall be uniformly produced and issued by PBOC
- article 22 Tokens: no unit or individual may make or sell token tickets and digital tokens to replace Renminbi in circulation in the market.
- article 39 Financial Infrastructure Supervision: PBOC is responsible for formulating important financial infrastructure construction plans and coordinating their implementation, promoting the interconnection of financial infrastructure and drafting relevant business rules, coordinating the establishment of a transaction reporting system covering the entire market, and building and operating the total transaction report library.
- article 65 Responsibilities for Making and Selling Tokens: for the production and sale of tokens, coupons and digital tokens to replace rmb in the market, PBOC shall order the cessation of illegal activities and destroy the illegally produced and sold tokens. For tickets and digital tokens, the illegal income shall be confiscated and a fine of less than five times the illegal amount shall be imposed; if the illegal amount cannot be determined, a fine of 100,000 rmb up to 500,000 rmb shall be imposed. If the circumstances are serious, penalties shall be imposed in accordance with the second paragraph of Article 61.

3.9 Conclusion: DCEP Pilot project, how can interoperate with dlt solutions?

The DCEP project is fully managed by the Digital Currency Research Institute of the People's Bank of China, a research body under the aegis of the Chinese central bank that focuses on the research and development of digital currencies and blockchain-related technologies.

According to public information at the start of 2014 PBOC established a special research team to discuss technical and regulatory issues in relation to the development of a State digital currency.

In July 2017 PBOC launched a R&D work on a digital notes transactions platform based on blockchain technology, which would serve as a trial application project for the subsequent development of a digital currency. More than three years ago the People's Bank of China

arranged for a seminar in relation to digital currencies, then subsequently established the central bank's digital currency research institute.

As of June 2018, DCRI had applied for a total of 63 digital currency patents, including 57 in 2017 and 6 in 2018. In April 2019, the People's Bank of China chose 4 cities (Shenzhen, Suzhou, Hebei, Chengdu) to start a pilot program on the use of DCEP in domestic payments. In 2022, DCEP will be tested in the Beijing Winter Olympics, marking the DCEP's first step to serve foreign users.

It is reported that the Shenzhen Financial Technology Research Institute undertakes the development, technical consulting, technology transfer, and technical services related to financial technology; the construction and operation and maintenance of financial technology-related systems.

Yangtze River Delta Financial Technology Co., Ltd. undertakes the construction and stable operation of legal digital currency infrastructure; undertakes key technological research and pilot scenario support for legal digital currency, supporting research and development and testing; focuses on the frontiers of financial technology such as blockchain and cryptography.

The Nanjing Financial Technology Research and Innovation Center will be supported by new technologies such as mobile Internet, blockchain, big data, and artificial intelligence. It will focus on the development of digital currency encryption algorithms and the underlying core technology of the blockchain, and complete the digital currency deployed by the Central Bank Digital Currency Research Institute key technology research.

The pilot project of DCEP is led by the People Bank of China, with the participation of China Mobile, China Telecom and China Unicom, as well as the four state-owned commercial Banks, ICBC, Agricultural Bank of China, Bank of China and China Construction Bank.

Four functions have been displayed to the media: QR code for payment, remittance, QR code for receipt and "touch to touch" payment.

Under these functions, four extra services options are displayed: DC exchange, wallet management, transaction query and account linking.

Big corporations like Starbucks, McDonalds, or non Financial Institutions like Ant Group or JD Digital are cooperating the Digital Currency Research Institute for empowering retail operations and services.

Last, PBOC took another step forward in its strategy to build a digital central bank, setting up a financial technology subsidiary, Chengfang Financial Technology Co. Ltd., that will help drive the government's broader goal of modernizing the financial system, boosting innovation and improving governance.

On July 30 2020 Chengfang was officially established in Beijing by five institutions and companies controlled by the PBOC with registered capital of about 2 billion yuan (according to the National Enterprise Credit Information Publicity System). The company's main businesses include software development, technology consulting and services, data processing, computer system services, and leasing and sales of equipment, according to its registration documents.

PBOC has already set up two similar subsidiaries in Shenzhen and Suzhou, each with a different focus. The Shenzhen fintech subsidiary, set up by the PBOC's digital currency research institute, is widely believed to be engaged in blockchain technology as it was hiring blockchain engineers, while the Shenzhen and Suzhou subsidiaries are both focus on financial technology development, consulting, as well as system construction and operation.

In May 2020 the Chengdu Municipal People's Government and the People's Bank of China Chengdu Branch issued the "Chengdu Financial Technology Development Plan (2020-2022)". The "Plan" stated that key tasks include enriching payment and settlement application scenarios. Based on the pilot results, they will explore the construction of digital currency application scenarios with promotion value and more secure payment models based on feature recognition in order to achieve the unity of payment security and convenience.

In August 2020, MOFCOM, China's commerce ministry, launched 122 initiatives as a support to global trade; at one of these points, it is expressly announced the launch of the digital currency pilot program in some cities, including those in the northern Chinese region of Beijing-Tianjin-Hebei, in the eastern region of Yangtze River Delta, in the "Greater Bay Area" around the Pearl River Delta and some cities in Midwestern China.

To sum up, DCEP is a pilot project run by PBOC as tested within mainland transactions. It represents a test for CDCC, with an indirect circulation system of M0, where commercial banks still take a place at operative services. From an asset point of view it is close to a tokenized model where accounts are a loose coupling account that are only verified with PBOC. The core system is a registration center that verifies all transactions and indirectly implies DLT solutions, whose main feature is based on the UTXO (Unspent Transaction Output) model. This centralized ledger is embodied in the DCEP registration center and directly processes transactions. Of course, like any DLT, this centralized ledger can be structured via Hash functions and Merkle trees. The end users interact with DCEP by wallets paired with public and private keys that are provided by commercial banks and third payment financial institutions like.

How could DCEP embrace DLT notarization capability, and still be operative on a centralized ledger? A DLT may be used to verify the authenticity, providing a function like an online DCEP verification machine, which may bring several benefits. The registration center is securely isolated from external attacks, while DLT improves verification efficiency.

On the other hand, DCEP transactions are not processed by DLT, thus avoiding any efficiency bottleneck.

Any suggested business application scenarios? The project could of course be expanded by including medical, education, tourism, and e-commerce services. However, most of the technical staff believes that these application scenarios are C-oriented and have a large transaction payment processing volume; moreover, they do not yet have the conditions to enter in execution at large scale. As a matter of fact, they are still testing the non-network transfer function

Rumours state that the digital renminbi application scenarios that are currently being implemented are mainly “recharge”, “cash withdrawal”, “transfer” and “scan code consumption” in small closed scenarios such as catering and retail. With controllable risks and technical system support, relevant business departments can choose application scenarios based on their own business advantages.

DCEP anti-money laundering monitoring methods seem to be relatively complete, mainly because of the current low application scenarios and the entire closed pilot. Once the application scenarios will be gradually liberalized, the number of users and transaction payments will sharply increase. Whether the bank will be able to implement real-time anti-money laundering monitoring of massive digital RMB payment transfers, will undoubtedly constitute a greater impact on the bank’s related digital currency operating system research and development capabilities, as well as any anti-money laundering technology updates.

For instance, the government in cooperation with the Shenzhen municipality used DCEP to reward about 5,000 medical and health care workers involved in the treatment of Covid-19, the disease caused by the coronavirus.

The currency is being used for multiple payment methods, including barcode, facial recognition and tap-and-go transactions. As of September 2020 more than 113,300 personal digital wallets and about 8,800 corporate digital wallets have been opened as part of the pilot programs. The central bank's digital currency has currently processed 3.13 million transactions and conducted more than 1.1 billion yuan.

The pilot project has implemented more than 6,700 use cases, involving transactions from bill payment and transportation to government services.

On the 8th October 2020, Shenzhen Municipal Government Service Data Administration released the event information "Luohu Digital RMB Red Packets". The event distributed 10 million yuan to individuals in Shenzhen, the amount of each red packet is 200 yuan, and the total number of red packets is 50,000. This figures out the first time the central bank's digital currency issued to the personal public consumption market. It is reported that this event is a routine test in the digital renminbi research and development process.

“To support digital renminbi consumption, relevant payment systems must be reformed” Fan Yifei, deputy governor of the People’s Bank of China, said that in the process of digital renminbi circulation, considering the high technical foundation and system management requirements, commercial banks as designated operating institutions can cooperate with other commercial banks and related institutions to clarify responsibilities and rights.

Could BSN represent a good DLT architecture solution to support DCEP transaction accountability mainland and overseas?

In order to try to solve this question, one has to make it clear whether it is possible to provide interoperability between a centralized and a decentralized solution. My answer is yes, as interoperability BSN has recently launched a partnership with Chainlink technologies in order to set up cross chain communication hubs to implement the mechanism through which Dapps interact with data outside the network.

This key integration would enable governments and enterprises to incorporate validated real-world data into their BSN applications using Chainlink oracles via the Iris foundation interchain service hub.

This way, wholesale transactions would be managed by PBOC at the registration center level and by means of oracles, added as immutable off-chain data recorded on DLT solutions managed by commercial banks for retail.

In the long term, we may be likely to witness the interaction in terms of off chain transactions usage in a second layer context for connecting consumers, while the first layer would be supported by on chain transactions connected with a centralized authority (PBOC). This solution may help shape a payment system capable of better performing when dealing with a huge number of transactions per second.

In addition to this, China UnionPay Corporation and China Mobile Financial Technology Co., Ltd. are now involved in current digital transfers of currency and are now both founders of BSN, which recalls a possible integration of DCEP over BSN for empowering mainland and overseas transfers.

To conclude, it looks quite clear that BSN and DCEP will stand as the key pillars on which Chinese corporations will empower their business driving different services over the mainland and overseas within the fintech industry.

How do they boost Chinese economy into a digital inclusive finance transformation?

My suggestion is that DCEP will provide a centralized management tool for M0 acting as a first financial layer of the economy and BSN will work as cloud architecture supporting interoperable dlt solutions provided by chinese corporations for M1, M2, M3.

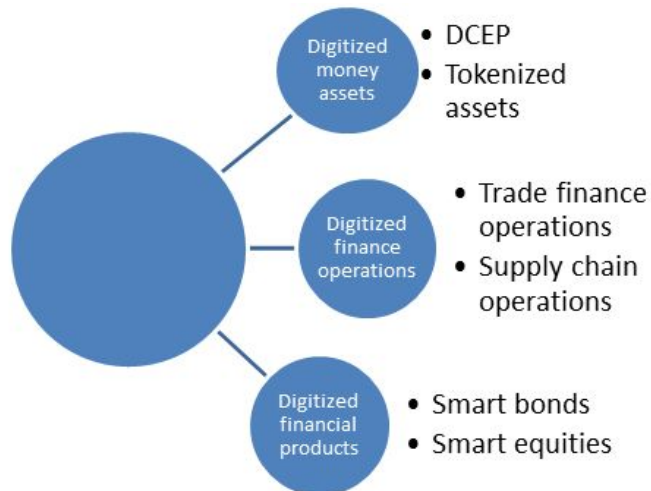
In this case scenarios if DCEP works at M0, commercial banks could run DLT platforms issuing financial services at M1 and supporting retail operations by non financial institutions as custody for M2 or M3.

The research and development and promotion of DCEP is closely related to a dual cycle vision of the economy. The internal cycle will benefit in reducing society managing costs and

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improving the efficiency of social operations. The external cycle will benefit with a new way for international trade settlement. Thanks to the extremely strong cross-border mobility of digital currencies, international trade settlement will become more convenient and transaction costs will be greatly reduced.

My suggested digital finance ecosystem in a dual cycle economy.



Part 4 - the Administrative plan: building a seamless data flow running within the National Administration network.

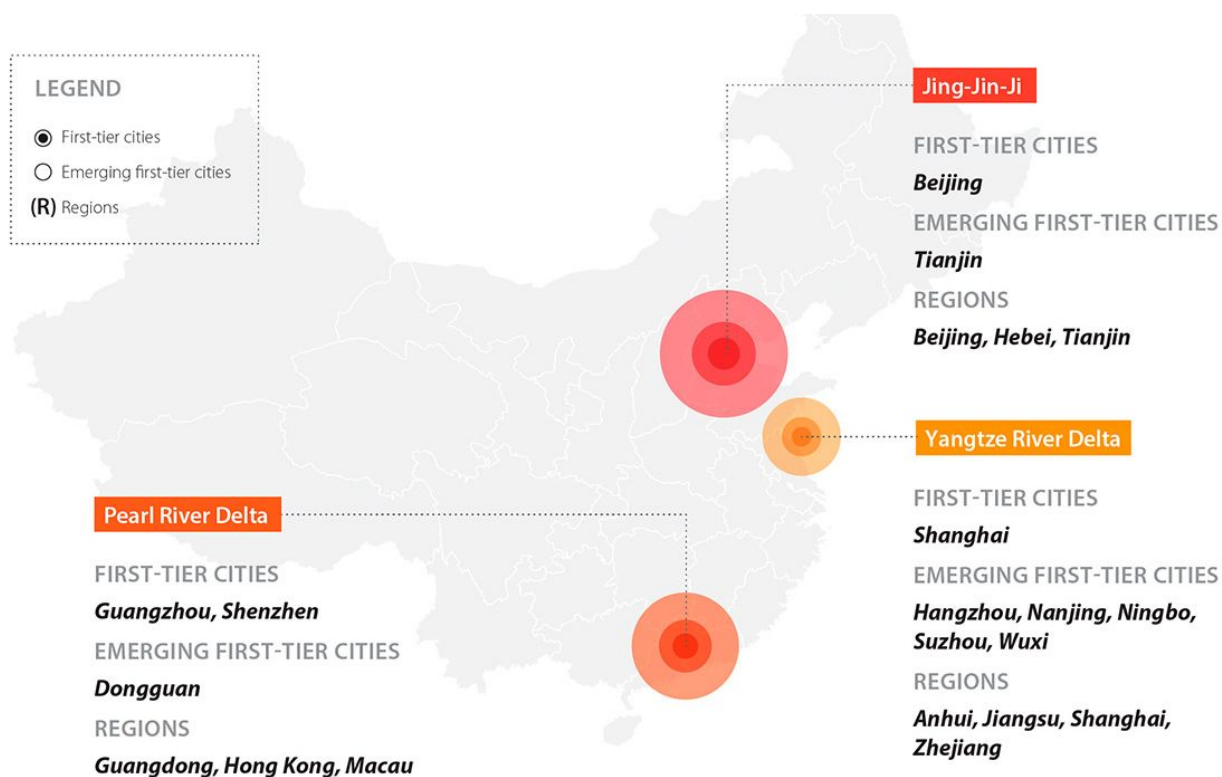
As of the end of June 2020, 25 provinces, cities, autonomous regions and special administrative regions have issued their own blockchain-related policies, and number are growing every day.

4.1. Key strategic development areas.

According to my knowledge we may divide China in at least 3 main huge clusters driving national economic development:

- Jing-Jin-Ji (Beijing- Tianjin - Hebei) Tianjin Port and free trade zone;
- YRD (Yangtze River Delta) Shanghai Port and free trade zone;
- PRD (Pearl River Delta Greater Bay Area) HK and Hainan Ports and free trade zone.

Technology will support economies by boosting connectivity within and between the clusters, each of which has a pivotal municipality leading economic development according to NPC plans.



These are the main areas of influence, and they follow the same strategy, a huge free trade zone has been set up and in these areas special provisions are issued in order to support technology implementation (AI, DLT, IOT applications) to different fields (e.g. financial

services). Recently The Government has released a plan to create new clusters to connect western and less advanced regions to the most innovative financial Pilot projects (eg.DCEP test) and services by the creation of new Free Trade Zones and special provisions.

4.1.1 Jing-Jin-Ji.

This project is known as the “Beijing-Tianjin-Hebei Integration Plan”, as well as “Jing-Jin-Ji” and the “capital economy circle”. The Jing-Jin-Ji plan is looking for different areas in the region, to focus on their own comparative advantages, avoiding duplication enhancing mutual complementation , thus maximizing synergies.

Within the Jing-Jin-Ji region, a few areas are already showing their own strengths in specific branches . Beijing, for instance, is known as a political, educational, cultural, and R&D center, while Tianjin is known as northern China’s logistics center, with one of the busiest ports in the world. On the other hand,Hebei province is known for its heavy industries, including steel production.

Compared to the other clusters, the Jing-Jin-Ji region is not sufficiently internationalized yet; therefore, it is not sufficiently integrated with the global supply chains.

4.1.2. YRD.

The Yangtze River Delta region was one of the first regions in China to develop and open-up. It is now renowned thanks to its competitive and innovative industries. The automotive industry has good foundations in the region, with Shanghai and all three surrounding provinces contributing to its success.

However, some areas within this region also have their own points of strength. Shanghai is a logistics center and mainland China’s financial center, while Zhejiang and Jiangsu provinces have strong manufacturing bases.

These two provinces are also well known thanks to their large number of industrial parks, mainly located in cities such as Hangzhou and Suzhou, and huge quantities of foreign direct investments they are constantly attracting. Anhui province benefits from abundant natural resources and is a large energy and coal provider for the whole of eastern China.

Industries under development with absolute priority the Yangtze River Delta will be active in include marine and high-tech ships, new energy vehicles, power equipment, advanced rail, medical technology, aviation and aerospace, and ICT.

4.1.3. PRD.

The Pearl River Delta Greater Bay Area represents the southeast cluster. Hong Kong is known as a world financial center. Shenzhen is known as China’s “Silicon Valley” because of its

innovation and startup culture. Guangzhou is known for its manufacturing industry and as a logistics hub. Last, Macau and Zhuhai are known for leisure and tourism.

The region is already China's most international one, with Guangdong province representing 26 percent of China's trade and 28 percent of China's exports.

An initiative was taken in order to turn the delta into the "Guangdong-Hong Kong-Macau Greater Bay Area", by further integrating Hong Kong, Macau, and nine other cities in Guangdong and let them become a world class city cluster.

However, integrating the region's mainland cities with the two special administrative regions of Hong Kong and Macau, not just physically, but with coordinated and complementary laws and policies it is and it will keep being challenging.

These special regions will interoperate with strategic mainland connections within PRD as Hainan and Shenzhen.

After this quick overview at a "regional level", we can go into deeper details regarding the specific initiatives the main municipalities have so far set up in order to promote and develop DLT solutions for empowering national plans for economic development.

According to my knowledge the main goal is to set the groundworks for the "Infrastructure of the Infrastructure", a strategic network involving the main cities located in each mainland city cluster, as well as to strategic overseas locations.

This network will be orientated by BSN city nodes over main backbone connection hubs belonging to local governments for mainland China operations. This project will interoperate with an international foundation managing IP rights, settlement operations and so on.

My idea is the Administration is planning to achieve this through projects building on blockchain interoperability frameworks for data governance, facilitating data-sharing between agencies and businesses and enabling cross-departmental and cross-regional collaboration through smart cities nodes.

Obviously it is an ongoing process, new special areas in Anhui, or Hunan provinces are developing.

They all have the same process: a special free trade zone has been set up and within the area a digital research center manages innovative financial services to attract investments and promote efficient business overseas.

At the moment only 11 cities and Beijing are taking the lead by issuing the Beijing Blockchain Innovation Development Action Plan 2020-2022.

4.1.4. Beijing.

The Capital has recently issued the so-called “Beijing Blockchain Innovation Development Action Plan 2020-2022”. What are the goals of this initiative?

1. Promoting "data sharing and business collaboration" in government services. Promoting the construction of common infrastructure for government services based on blockchain, facilitating the trustworthy sharing of government data across departments and regions, the efficiency of business collaboration.
2. Promoting "multi-party mutual trust, reduce costs and increase efficiency" in financial services. Focusing on the pain points of traditional financial service information such as complex verification, high cost and long process, the aim is to promote the implementation of a batch of application scenarios in the fields of supply chain finance, asset securitization, cross-border payment, trade finance, intelligent supervision, and support related projects to apply for financial technology.
3. Accelerating the "credible collection and credible sharing" of credit information. Based on the city's credit information platform, blockchain technology is used to implement social credit supervision and provide public credit services. Innovating the collection and integration of government and social credit data, information sharing, monitoring and evaluation, and independent application, building a social credit system of co-construction, co-governance, sharing, form a blockchain-based credit application innovation demonstration in the fields of medical care, housekeeping, and recruitment mode.
4. Empowering urban management with "trustworthy interconnection and fine governance". Exploring the application of blockchain technology in the construction of urban transportation, electricity, water conservancy, information and other infrastructure construction, mobilizing multiple parties that will actively participate in the public green travel carbon inclusive demonstration and reliable monitoring of urban water resources, promoting the availability of urban data.
5. Promote public safety "the whole process can be checked and the process can be traced". Facing key management objects such as food, hazardous waste, emergency equipment and materials and rescue funds. Promoting the application of blockchain technology in administrative law enforcement, data storage and traceability management scenarios, strengthening security risk analysis, assessment and early warning capabilities, as well as government departments.
6. Helping health on "credible sharing, proven traceability". Focusing on the needs of medical and health management system construction through data security, process reliability, and regulatory compliance, exploring the creation of blockchain technology application scenarios.
7. Promoting e-commerce transactions to be "efficient, transparent, and traceable." Promoting the application of blockchain technology in the field of commercial

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circulation, and developing business scenarios for online and offline integration of digital trade, cross-border trade and online retail.

What are the initiatives triggered by the local Government in order to achieve all of these goals?

- Building a blockchain integrated industrial chain system, creating innovative leading companies with global influence, cultivating a group of unicorn companies and high-growth companies, providing application scenarios support for small and medium-sized innovative companies and promoting the industrial chain coordinated development of downstream.
- Create a blockchain innovation and entrepreneurship service platform. Support scientific research institutions, universities and enterprises in order to jointly build joint laboratories, technology transfer centers and other blockchain collaborative innovation platforms. Promote the landing and transformation of scientific and technological achievements through the transfer of results, license use and equity investment.
- Set up a blockchain industry investment fund, a special sub-fund of blockchain industry investment under the city's technology innovation fund of funds to coordinate government investment and social capital. actively support blockchain innovation projects to become bigger and stronger and establish a service mechanism for blockchain companies to connect with the capital market and encourage larger companies to go public for financing.
- Promote the construction of the blockchain industry alliance, such as BSN or other blockchain consortia. Promote the construction of blockchain industry alliances around technology, application and industrial development, attracting political, industry, academic, research, capital, and users to join in the blockchain technology, results, applications, standards, training, evaluation, etc.

The local Government has deliberated 12 pilot business cases and will promote interoperation between different public administrations within the municipality of Beijing, also cooperating with other cities. The following is a short list of projects that will be deliberated starting from November 2020.

Project Name	Function	Goals,
Municipal Commercial Bureau Airport International Logistics Blockchain Platform	Logistics, cross-border trade	Data sharing between merchants, logistics operators, customs authorities, regulators, airport authorities to facilitate customs in cross-border air cargo trade.
Beijing-Tianjin-Hebei Port Customs Clearance	Logistics, cross-border trade	Data sharing between port authorities, tax agencies and customs authorities in order to coordinate between port terminals.

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City Financial Electronic Identity Authentication System	Enterprise banking	Reduce time and application materials, whilst ensuring identity authentication in enterprise banking.
City Electronics Bills System	Billing	Improve the ability of businesses to issue bills and track reimbursement.
Haidian District Finance Platform for SMEs	Finance for SMEs	Improve access to capital for SMEs and risk management for their lenders.
Municipal Real Estate Registration System	Property management	Revamp the management of real estate, including mortgages, deposits, utility bills, tax audits and more.
Multi-terminal Business Licensing System	Enterprise Regulation	Improve authentication processes for businesses, as well as collaboration between firms through electronic certificates.
Internet+Government Haidian District Pilot	E-governance	Create a “national benchmark” for comprehensive blockchain-powered government. More than 100 government agencies will implement blockchain for managing anything, from high-tech enterprises to unemployment benefits.
Xicheng District Government Services Pilot	E-governance	Improve bureaucratic efficiency for various government services through data sharing and electronic certificates.
Chaoyang District Government Services Pilot	E-governance	Improve bureaucratic efficiency for various government services through data sharing and electronic certificates.
Shunyi District Government Services Pilot	E-governance	Improve bureaucratic efficiency for various government services through data sharing, smart contracts and electronic certificates.
Beijing Economic and Technological Development Zone Government Services	Enterprise governance	Create a “one-stop” service platform in the special economic zone that manages government services. This will help make the area “a world-class business environment”, according to Beijing.

Recently, the Beijing Municipal Financial Supervision and Administration Bureau and the Beijing Municipal Bureau of Economics and Information Technology issued the "Implementation Plan for the Establishment of Beijing International Big Data Exchange".

On the whole, the implementation plan mainly includes, under the guidance of the People’s Bank of China, exploring the application of the central bank’s legal digital currency in the data transaction payment and settlement of the Beijing Digital Exchange, and building a

payment and settlement system that meets the characteristics of data transactions. The plan has five major functional platforms: data information registration platform, a data transaction platform, a data operation management service platform covering the entire chain, a financial innovation service platform and new technology-driven data financial technology platform.

It includes five major services: data information registration, data product transactions, data operation management, data asset finance, and data asset financial technology.

The transaction types mainly fall into the following four categories:

1. data product ownership transactions, which are mainly the transfer of property rights of data analysis tools and data solutions;
2. data product use rights transactions, that is, through transaction access rights without changing the ownership of data products;
3. data product revenue rights trading, that is, the future revenue generated by data products, mainly data asset securitization products;
4. cross-border transactions of data products.

The registration and settlement system of Beijing trading venues has been incorporated into the Beijing Municipal Data Cross-border Flow Security Management Pilot to realize real-time monitoring of the transaction process and fund settlement.

4.1.6. Shanghai.

In July 2018, the Shanghai Committee of the Communist Party of China published a proposal to accelerate the application of blockchain and other innovative technologies to financial services, financial infrastructure construction and financial supervision with the goal to push the financial sector better serve the real economy.

In September 2018, the Yangpu District Government of Shanghai issued Several Policy Provisions on Promoting the Development of Blockchain (trial). The regulation provides twelve supportive policies for the development of blockchain industry within the jurisdiction, including subsidies for organizational expenses, subsidies for office use, consortium support and financing support.

In January 2019, according to Shanghai Yangpu District government's press release, Yangpu District set up a blockchain industry fund, mainly in the form of equity investment, to support the development of start-ups and high-growth enterprises. Meanwhile, the Yangpu Government will introduce various VC funds to increase investment in seed-stage, start-up blockchain enterprises and encourage different financial institutions to provide all-around financial services for blockchain enterprises, thus promoting the materialization of blockchain technology's application.

Later in 2019, CIIE Shanghai Customs, the Municipal Commission of Commerce and representatives from six banks, including the People's Bank of China (PBOC) and Bank of Communications, set up a Blockchain Alliance proposal for the city's e-port area.

On September 28, the Digital Currency Research Institute of the People's Bank of China and the People's Government of Changning District of Shanghai signed a strategic cooperation agreement with the municipal government, aiming to jointly build a high-quality financial technology functional platform and a blockchain technology application demonstration zone for Shanghai financial technology. According to the agreement, the two parties will gather technology, talents, scenarios and service advantages to establish a Shanghai financial technology company, and gradually realize the implementation of a trade finance blockchain platform and technology research and development center. This move is an important link for the People's Bank of China's Digital Research Institute to promote the ecological construction and national layout of the trade finance blockchain platform.

In addition to this, many different DLT uses are spreading within the district administration of the city. For instance Xuhui district notary public office can collect, fix and save the evidence with technological support from digital signatures, time stamps and hash algorithms, to ensure the legitimacy and efficacy of legal evidence and its relevance to a lawsuit.

4.1.7. Shenzhen.

As China's most innovative city, Shenzhen has been continuously providing policy support for the development of blockchain technology. In November 2016, Shenzhen Municipal Financial Regulatory Bureau published the 13th Five-Year Plan for the Development of Shenzhen's Financial Industry. The document states that the municipal government will support financial institutions in the effort of strengthening research and exploration on emerging technologies such as blockchain and digital currency.

In September 2017, the Shenzhen municipal government issued a notice to encourage financial innovation and set up a special fintech award focusing on the outstanding projects in the fields of blockchain, digital currency, financial big data application etc.

In April 2018, Shenzhen set up a government-led blockchain fund, the Shenzhen Blockchain Venture Capital Fund.

The first phase of the fund was 500 million yuan with 40% contribution by Shenzhen Angel Investment Guidance Fund. The blockchain fund is managed by one of Shenzhen State-owned Assets Supervision and Administration Commission's subsidiary investment management companies.

The "blockchain + tax" project jointly developed by Shenzhen Municipal Taxation Bureau and Tencent issued its first blockchain-powered invoice for a local restaurant.

Relying on the blockchain platform provided by Tencent, enterprises can apply for invoices and declare taxes on the blockchain. After the transaction is completed, the blockchain system automatically generates the invoice content and amount and makes it out in real-time.

Shenzhen comprehensive reform pilot program was released in October 2020 to support digital RMB testing. It requires the establishment of a financial technology innovation platform on the basis of a Shenzhen subsidiary of the People's Bank of China Digital Currency Research Institute that support the development of internal closed pilot tests of

digital renminbi, and promote the R&D application and international cooperation of digital renminbi. The plan requires that a pilot project of cross-border fund pooling of domestic and foreign currencies be launched in order to support Shenzhen to take the lead in advancing the internationalization of the RMB, and promote the improvement of the foreign exchange management system. Qualified foreign financial institutions will be supported to initiate the establishment of securities companies and fund management companies in Shenzhen according to law. Support qualified foreign institutions will obtain payment business licenses in Shenzhen in compliance with laws and regulations and promote the establishment of a financial rule system in line with international standards.

Part 5 Focus on banking industry, trade finance operations: Bay Area Trade Finance Blockchain Platform - Etrade Connect - Interbank Trading Blockchain Platform.

Shifting our attention towards the trade finance world, the banking industry is definitely dynamic in specific areas, such as finance, with the goal to enhance blockchain solutions capable of interoperating with other overseas business consortia and catalyse transactions within the mainland.

Led by the PBOC Chinese Bank Association, CBA has recently formed the Trade and Finance Interbank Trading Blockchain Platform. This consortium works on key features and figures out a way for sharing data in a compliant way, rather than changing individual processes within each bank, allowing for competitive neutrality and seamlessly digitized processes. The platform has been working mainly in digitized domestic letters of credit harmonization and forfaiting operations.

The other members of this consortium are:

- Industrial and Commercial Bank of China
- Agricultural Bank of China
- China Construction Bank
- Bank of Communications
- China Merchants Bank
- China Everbright Bank
- Shanghai Pudong Development Bank
- China Postal Savings Bank
- Ping An Bank
- HSBC Bank (China)

This set-up configures a strategic network for deploying transactions all over mainland territory.

This platform supports strategic development plans for specific areas, such as the “ Bay Area Trade Finance Blockchain Platform” (BATFB) in Shenzhen, in order to support supply chain finance solutions for SMEs.

PBOC has recently announced a set of rules, whose intent is facilitating cross border transactions, asset allocation and trade finance operations by promoting interactions with Hong Kong and Macao areas.

PBOC reportedly acquired approximately 5 million USD in special funding in order to finance the ongoing development of its blockchain or distributed ledger technology (DLT)-enabled trade finance platform. The funding, which will be gradually injected during a three-year period, should help make enhancements to the DLT-based platform, which has been developed for small and medium-sized enterprises (SMEs). The platform allows Chinese SMEs to gain access to a wide range of financial software packages and it is actually onboard by almost 35 national commercial banks.

SAFE Cross-Border Finance Blockchain Platform is a trusted and collaborative financial services platform managing overseas operations. Its core technology is the Blockchain Registry Open Platform (BROP) developed by Zhongchao Blockchain Technology Research Institute, a subsidiary of the China Banknote Printing and Minting Corporation. Launched in March 2019, SAFE Cross-Border Finance Blockchain Platform aims at solving the problem of difficult and expensive SMEs cross-border financing and comprehensively promote the development of cross-border trade and finance by utilizing blockchain's technical features.

Relying on blockchain technology, through the establishment of institutional information exchange tools and effective verification between banks and enterprises, and real-time interaction of inter-bank trade financing information.

In November 2019, the central bank re-discounted the fast-track project on the chain, once again enriching the business scenario of the central bank's trade and gold platform. News reported that according to Xing Yujing, president of the Shenzhen Central Branch of the People's Bank of China, the central bank's trade finance platform has already operated a number of services such as supply chain accounts receivable multi-level financing, cross-border financing, international trade account supervision and foreign payment tax filing forms.

According to official statements on July 20th 2020 the scope of the cross-border blockchain platform pilot program has been extended to all regions of China, participating in more than 250 corporate banks, and completed 39,048 financing loans, with the loan amount equivalent to 36 billion U.S. dollars, and a total of 4.183 service companies. Among them, SMEs account for more than 75%. Especially since January the 24 2020 the cross-border blockchain platform loan amount is equivalent to 19.92 billion U.S. dollars, which continues to help alleviate the cross-border financing problems of SMEs.

Since the platform has been online for more than a year, the number of connected banks and enterprises has continued to increase. According to the official data, as of the middle of January 2020, 44 banks and 485 outlets have participated in its promotion and application,

while 1,898 companies have conducted business. More than 30,000 business transactions have been registered and more than 8,000 business transactions have occurred, the cumulative business volume exceeding 90 billion yuan.

The platform takes “export accounts receivable financing (after delivery)” as the business scenario, and through the tamper-resistant blockchain data, manages the whole business process on the platform, which from its side verifies the authenticity of information on the “customs declaration form”, export trade finance core documents through the blockchain system. It also automatically calculates the financing balance corresponding to the customs declaration form in order to prevent repeated or excessive financing, whose efficiency is at the same time greatly improved, as import/export financing time is consistently shortened from 1-2 days to 15 minutes.

The first phase of the cross-border blockchain platform uses the two application scenarios of "export accounts receivable financing verification service" and "corporate cross-border credit information authorization verification service" as the entry point, which can be used as a reference for banks when reviewing financing projects.

In December 2019, a new application scenario of "Service Trade Payment Facilitation (Tax Filing Electronic Bank Inspection)" was added to realize the linkage between the tax filing form and the service trade foreign exchange payment business, simplifying the complex process of offline verification by banks, and improving the online verification efficiency enhances the sense of acquisition of small and medium-sized enterprises.

On July 16 2020, the cross-border blockchain platform "Facilities of Payment Facilitation for Capital Project Income" facilitated capital item income payment operations without having to pay the bank in advance on the promise of ensuring true compliance with the use of funds. Provide authenticity certification materials.

From the banks' perspective, the blockchain platform lowers the risk for banks on the platform, as all trade information uploaded must be true and certified by SAFE or any other authority. On the other hand, all banks on the platform share every trade finance transaction. As such, banks are able to identify and block trade finance applications whose underlying trade documents have already been used in other trade finance applications.

The platform utilizes blockchain technology to record core documents and key business processes, interconnecting each and every step in the trade financing business. On both sides, any intermediate participant included, the quick access to authentic information and the use of smart contracts as a tool to facilitate rapid transaction execution is granted, thereby reducing the total cost of corporate financing. As blockchain can realize real-time sharing of unified ledgers among the members on the platform, commercial banks and PBOC/SAFE can have real-time access to information that cannot be tampered with from enterprises that input

cross-border trading information This will simplify the verification process and improve the efficiency of enterprises, financial institutions and regulators.

The Hong Kong Interbank Clearing Limited (HKICL) is a private company owned by the Hong Kong Monetary Authority (HKMA) and the Hong Kong Association of Banks (HKAB). The key objective of the company is to develop and operate a safe and efficient multi-currency and multi-dimensional financial infrastructure in Hong Kong.

The Hong Kong Trade Finance Platform Company Limited (HKTFPCL) is a wholly-owned subsidiary established by HSL on 6th February 2018. It is a single-purpose company, whose aim is to provide local and overseas participants with trade or trade finance platforms, through a digitalised platform developed using distributed ledger technology.

This service, called Etrade Connect, is an Asia-Pacific consortium managed by the Hong Kong Trade Finance Platform Company Limited (HKTFPCL) and is powered by Hyperledger Fabric. The consortium aims to enhance trust among trade participants, improve efficiency, reduce risks and ease trade counterparties when trying to obtain financing by digitizing trade documents and automating trade finance processes. ETrade Connect features functions for digitizing purchase orders and creating invoices, managing pre- and post-shipment trade finance through open accounts, carrying out duplicated financing checks, and updating payment status. The network is currently working on digitizing the connections with logistics service providers, with different trade finance platforms from other jurisdictions and on its integrations with ERP systems.

Originally initiated by seven banks, including Australia and New Zealand Banking Group Limited, Bank of China (Hong Kong) Limited, The Bank of East Asia Limited, DBS Bank (Hong Kong) Limited, Hang Seng Bank Limited, HSBC and Standard Chartered Bank (Hong Kong) Limited, and facilitated by the Hong Kong Monetary Authority (HKMA), eTrade Connect has since grown to 12 banks. In October 2018 the network signed a memorandum of understanding with the European we.trade consortium that operates on the same underlying technology. While eTrade Connect primarily focuses on the Asia-Pacific region, this partnership may help open a broader trade corridor between Asia and Europe.

In November 2019, eTrade Connect announced a proof of concept to connect the platform with CargoSmart and shipping industry participants that are proposing to form the Global Shipping Business Network (GSBN).

Hong Kong can also leverage on the presence of the Global Trade Connectivity Network (GTCN), a collaboration between the Monetary Authority of Singapore (MAS) and the Hong Kong Monetary Authority (HKMA) in order to develop a DLT infrastructure for cross-border transactions. The initiative strikes out to reduce the number of pain points involved in traditional trade finance transactions, leveraging on Distributed Ledger Technology (DLT) in order to build an infrastructure for making cross border trade and trade finance transactions more efficient .

In addition to this, Hong Kong is home to a cross border open account solution called Atlas Alfa Network, a supply chain finance platform supported by R3 (Corda protocol) on Microsoft Azure cloud architecture.

ATLAS is a single, simplified channel for all the companies' open account trade finance needs. The web portals offer an at-a-glance overview of all open trade financing loans and connections across multiple trade parties, eliminating digital silos and bringing together buyers, suppliers, financiers and other stakeholders onto a single trusted platform.

For financiers, ATLAS offers opportunities to reduce risks and improves services; it also enjoys significant cost reduction through increased digitization in financing processing.

Atlas is a DLT solution devised by by Cryptoblk, a Blockchain solution provider based in Hong Kong, specialized in building enterprise grade DLT systems and applications, with a special focus on trade finance, supply chain and logistics, InsurTech (Insurance Technology), Central Bank-issued Digital Currency (CBDC), payment and settlement (e.g. Delivery-vs-Payment, bond repo) and crypto-tokens or tokenization for the transformation to digital assets.

As a member of E Trade Connect and founder of Trade and Finance Interbank Trading Blockchain Platform, PBOC is actually working as an international collector for trade finance operations directed to mainland territories.

International transactions will therefore be able to reach capillary locations all over the mainland territory.

5.1. Private initiatives.

5.1.1. Ping An Bank - One Connect.

Ping An OneConnect is an associate company established by the insurance conglomerate Ping An Bank & Insurance. It developed interesting innovations embodied by the FiMAX S3C, a fully encrypted blockchain architecture to address the challenges of privacy protection, system performance and interoperability in the development of blockchain. The company has applied the technology in business scenarios, including trade finance, asset-backed securities, supply chain finance and reinsurance. Not only OneConnect provides customized blockchain solutions for business entities, it also creates BNaaS (Blockchain Network as a Service) that can be implemented on a large scale. Unlike traditional BaaS platforms, where a blockchain and its nodes are generated by a single account, BNaaS enables users to independently create and publish new blockchain networks as well as to join existing commercial blockchain networks through BNaaS Marketplace.

These networks include

1. **International trade finance network eTradeConnect**, a blockchain trading platform led by the Hong Kong Monetary Authority, designed, developed, and configured by OneConnect, launched in October 2018.
2. **IFAB Trade Finance Network**, built by Ping An OneConnect in association with Internet Finance Association of Small and Medium-sized Banks based on blockchain, launched in March 2019.
3. **Tianjin Port Blockchain Cross-Border Trade Verification Pilot Project**, built by Ping An OneConnect, the first cross-border trade network and ecosystem powered by blockchain technology in China, launched in April 2019.
4. **OneSme**, a seamless cross-border digital trade platform launched in partnership with IMDA, United Overseas Bank. The solution will help Singaporean SMEs in their collections and payments, trade financing, foreign exchange and working capital needs. SMEs will be able to apply for financing directly on the OneSME platform, thus making it easier for them to access the funds needed to seize business opportunities in China.

5.1.2. China Construction Bank - BCTrade.

China Construction Bank actively implements the central government's requirements for accelerating the development of blockchain technology and industrial innovation, promoting the deep integration of blockchain with the real economy. It actively implements new finance and integrates blockchain, artificial intelligence, and Internet of Things (IoT) with new technologies. The combination of trade finance solves the industry pain points and difficulties in identity authentication, information transmission and data security in traditional interbank trade finance.

Since its launch in April 2018, BCTrade has successfully deployed functions such as domestic letters of credit, forfaiting, international factoring, re-factoring and logistics finance. The cumulative transaction volume has exceeded 400 billion yuan, satisfying transaction matching and message sending and receiving, as well as documents delivery and other requirements for online information interaction in the whole process of trade finance.

In October 2019, China Construction Bank officially released the "BCTrade2.0 Blockchain Trade Finance Platform", which, since then, has successively deployed core functions, such as domestic letter of credit, forfaiting, international factoring, and re-factoring. Participants include 54 domestic and foreign branches of China Construction Bank. In January 2020, China Construction Bank and Postal Savings Bank of China successfully handled the industry's first blockchain cross-chain forfaiting transaction, achieving cross-chain interoperability between different blockchain platforms and inter-industry cooperation, carrying on its deep technological development.

5.1.3. ICBC e-icbc 3.0.

On 6th November 2019, during the Financial Technology Forum of the 2nd China International Import Expo, ICBC released an innovative intelligent trade finance platform, the ICBC Intelligent Trade Finance Platform, also referred to as "Smart Trade Finance Platform". This platform is an innovative platform carefully created by the International Settlement Document Center and domestic and foreign institutions. Relying on the information advantages of document intensive activity and on the professional strength of the document center, after preliminary investigation, analysis and identification of pain points, the bank accurately sorted out the real needs of the foreign trade market, selecting three smart trade financial platform services showing particular relevance and a broad market prospects.

1. China-Europe e-Single Pass;
2. China-Africa e-Link;
3. Cross-border e-Trade;

All of these initiatives were successfully released during the launch ceremony of the "Smart Trade Finance Platform".

The platform takes the China-Europe “train” as the “link” and selects the multimodal transport "one-to-one system" application in the Qingbaijiang Free Trade Zone in Sichuan as the first project, creatively integrating the blockchain and other cutting-edge technologies with international logistics rules, as well as government and banks, The three-party cooperation digital platform for enterprises provides three-dimensional, all-round and reproducible trade finance solutions.

"China-Africa e-Link" is the first China-Africa trade finance blockchain platform jointly launched by our bank's independent innovation, together with South Africa Standard Bank. Targeting the pain points of traditional trade finance processes such as the complex business processes and the high transaction costs, the platform relies on the distributed accounting and consensus mechanism of blockchain technology in order to achieve real-time data sharing, collaborative efficiency improvement, public trust system construction, creating mutual trust for transaction participants, transparent and efficient cross-border trade and financial environment.

"Cross-border e-Trade" embeds trade financial services into third-party comprehensive trade service platforms, cross-border e-commerce platforms and foreign trade enterprises through a unified standardized interface, as well as directly connected online trade financial service functions. Among them, the docking of Singapore's NTP interconnected trade platform is

China's first overseas bank-government cooperation project, laying a solid foundation for convenient replication in the future.

In terms of cross-professional platform combination, "Cross-border e-commerce" integrates document products, cross-border collection butlers, cross-border e-commerce integrated financial service platforms, aggregate payment and other interbank cross-border financial products to achieve product integration, consistent services, The integration goals of information sharing, process linkage and internal and external collaboration have thus enhanced the comprehensive cross-border financial service capabilities of the banking sector.

5.1.4. Agricultural Bank of China.

Since 2018 Agricultural Bank of China implemented DLT solutions for supporting the lending system.

"E-blockchain Loan" system marks the first practical blockchain-based use case in the domestic banking industry. The blockchain system works as a financing tool for farmers and agricultural products. In addition, ABC is also promoting the development of a financial digital credit system based on blockchain technology.

5.1.5. Suning Group - Suning Finance.

At the end of 2019, Suning Financial Technology launched Suning's BaaS platform, simplifying and merging the original 20 steps, along with more than 100 parameters into 5 steps and 20 parameters, providing a data encryption SDK, and users can call private data Encryption and decryption API interface to conduct customized private transactions, providing all access institutions with alliance chain network establishment, node establishment, container start and stop, channel establishment, contract deployment, contract invocation, transaction monitoring, log query and other complete alliance chain service life Cycle management, more than 100 blockchain nodes can be deployed within 3 minutes. Developers can use the graphical interface to quickly build blockchain applications, or customize development based on interface documents and related technical documents, combined with business scenarios. The overall efficiency of blockchain project construction and application deployment has increased by 50%.

The platform was later upgraded to Suning's blockchain cloud service platform SBaaS, focusing on exporting Suning's application and building blockchain capabilities, accelerating the promotion of blockchain applications for financial institutions and small and medium-sized enterprises, enhancing the ability of various enterprises to cooperate in data security and reducing the cost of building a blockchain by more than 30%. In addition, more than 10 companies are connected to the platform, enhancing the application of blockchain technology in supply chain finance, data sharing, consumer finance and other branches.

At the beginning of 2020, the blockchain asset securitization service system created by Suning Financial Technology was launched. Its blockchain modules were all built on the

SBaaS platform. The first wayward loan ABS was issued for 800 million yuan, divided into priority A level, priority Class B, sub-level three, storage racks of 8 billion yuan, and multiple rounds of non-public fund trust plans, accumulating assets for 2 billion.

The SBaaS platform uses the funder, asset side and SPV as alliance chain nodes, uses private keys to ensure proper visibility of shared ledger, protecting the confidential business information of each participant, jointly maintaining data transparency and authenticity and mastering and verifying the liquidity of the underlying assets.

This opens up an efficient channel between the asset side and the capital side, ensuring the authenticity of the underlying asset data of consumer financial service companies. It cannot be tampered with or traced in order to improve institutional investor confidence, thereby lowering the threshold for consumer financial service companies to issue ABS and issuance costs; at the same time, it can manage the entire life cycle of ABS in order to identify and manage risks in a timely manner.

5.1.6 AntChain & Alipay: Trusple.

AntChain is a platform run by AntGroup offering different kinds of blockchain based products that have been issued by My Bank and Alipay.

AntChain in September 2020 launched Trusple, an international trade and financial service platform powered by AntChain, the company's blockchain-based technology solutions. Trusple aims to make it easier and less costly for all participants – especially Small-to-Medium Enterprises (SMEs) – to sell their products and services to customers around the world. It also reduces costs for financial institutions so they can better serve SMEs in need.

Trusple works by generating a smart contract once a buyer and a seller upload a trading order on the platform. As the order is executed, the smart contract is automatically updated with key information, such as order placements, logistics, and tax refund options. Using AntChain, the buyer's and seller's banks will automatically process the payment settlements through the smart contract. This automated process not only mitigates the intensive and time-consuming processes that banks traditionally conduct to track and verify trading orders, but also ensures information is tamper-proof. Further, successful transactions on Trusple enable SMEs to build their creditworthiness on AntChain, making it easier for them to obtain financing services from financial institutions.

Trusple was designed to solve problems for SMEs and financial institutions involved in cross-border in order to make cross-border trading safer, more reliable, and more efficient for buyers and sellers, as well as for the financial institutions that serve them. Trusple leveraged AntChain's key technologies, including AI, Internet of Things (IoT), and secure computation, to build trust among multiple parties.

To help optimize cross-border processes, Trusple has partnered with various leading international financial institutions, including BNP Paribas, Citibank, DBS Bank, Deutsche Bank and Standard Chartered Bank. On September 25, Standard Chartered Bank announced

that it had successfully completed the first cross-border real-time transaction on the newly launched digital international trade and financial service platform Trusple on AntChain.

Ant Financial's OpenChain provides developers with dozens of readily available modules that can be used in various combinations to build trust in multi-party collaborations, including in areas such as supply chain finance, product provenance, digital invoices and charitable donations.

Ant Group and Alibaba Group signed a deal with COSCO Shipping to explore using Ant Blockchain technology for the global shipping industry. COSCO is the third largest container shipping company in the world and is also a member of Global Shipping Business Network (GSBN) built on Hyperledger Fabric.

Ant stated the motivation is to address the complexity of the shipping process, the numerous steps involved with many participants. Blockchain aims to link all the organizations from logistics providers and shipping companies to ports and financiers. Ant specifically highlighted supply chain finance, which is the top use case for enterprise blockchain in China.

5.1.7 FSCO BCOS: Tencent - WeBank & Huawei - Forms Syntron.

FSCO BCOS, the Shenzhen based open consortium blockchain, offers mainly digital financial services through WeBank and Forms Syntron.

WeBank provides high quality financial services as a bank founded by Tencent Group. WeBank has maintained a clear focus on providing inclusive financial services to underbanked individuals and small-and-medium-sized enterprises through WeChat and QQ's wallets supported by AI, Blockchain, Cloud computing, Big Data.

WeBank was the first bank to fully deploy its core banking systems on private cloud. It has constructed a 100% in-house designed distributed core banking system with self-owned intellectual properties, capable of handling high-volume, high-frequency transactions. WeBank's big data platform houses over 15 petabytes of data, with over 300 thousand batch jobs being processed daily.

Forms Syntron designed a blockchain-based supply chain financial platform, that achieves an efficient transfer of assets in the supply chain, thus reshaping the supply chain ecosystem. By introducing the mechanism of accounts payables and endorsing the actual sales contract, both the virtualization and the digitization of assets and credit are completed.

Huawei and Forms Syntron jointly release the distributed open platform solution "Fincube" an open banking model based on distributed architecture. Based on the advanced computing, network, and storage capabilities provided by FusionCube, the Forms Syntron Universe Analytics Platform uses FusionCube as the basic unit of the distributed architecture and bears platform management and control capabilities. It also uses the Lego Open Banking Solution built based on the SolApp containerized microservice framework of the Universe Analytics

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Platform. The BaaS (Banking as a Service) capability library consisting of thousands of microservices enables customers to quickly innovate based on standard versions and continuously integrate and deliver new services.

Part 6 Conclusion: a unique flow of data and transactions for driving the economy.

All of the contents in this paper are summed up in order to abstract as much as possible a potential path that might lead to the national technological investment strategy to rely upon.

BSN can be seen as the first “national” cloud architecture to operate worldwide, offering a lead to Chinese business data internationalization. It’s a unique technological solution because it helps to boost internationalization of the whole Chinese cloud industry in supporting Chinese enterprise internationalization processes and in connecting companies located worldwide with Chinese national data infrastructure. This is clearly one of the main points supporting “Made in China 2025” initiatives in terms of the latest advanced information technology to be exported worldwide.

From a technical point of view, BSN works as a multi-hybrid cloud architecture offering IaaS solutions through nodes, and PasS through portals. It is capable of connecting China mainland and overseas strategic locations by AWS, Azure or Google Cloud offering BaaS solutions for Chinese IT providers operating in different business sectors (finance, logistics, health care etc.).

BSN is still the first layer since it works as a cloud solution for blockchain application providers; the fact that big players like China Union Pay are involved in the project may lead to the conclusion that Digital State Currency issued by PBOC may be installed on the network.

DCEP is a digital currency, according to schedules, centralized by PBOC. It will be acting as a digital coin over the stable, “fiat” value of renminbi. Blockchain technology is likely to be involved in terms of accounting and certifying internal operations for assets allocations to commercial banks, which many corporations and commercial banks are testing nowadays.

In the near future, the two “pillars” are likely to work this way: DCEP will act as a centralized crypto running over a decentralized cloud architecture (BSN) capable of providing different blockchain solutions to different business enterprises. The combination of these two assets will constitute a safer, stronger and quicker way for supporting investments.

In order to make further suggestions, amongst all BaaS assessed providers, Hyperchain is also likely to play a major role as a solution working globally over BSN, which in turn may interact with DCEP. As a matter of fact, the company based in Hangzhou has developed a software called FiLoop that is capable of digitizing documents, such as invoices and warehouse receipts, in an immutable way, so that parties across the supply chain are able to streamline their accounts. SMEs are hence increasingly able to gain credit and insurance. It

further integrates biometric authentication, such as facial recognition, and smart contracts for business processes.

Big Chinese corporations like People's Bank of China (PBOC), China Construction Bank, Agricultural Bank of China and China Merchants Bank all use FiLoop for supply chain finance. The company has also developed digital deposit certificates with UnionPay, one of the founders of BSN.

Business sector associations like Chinese Bank Association are starting to implement their own solutions focusing on particular sides of industries, namely trade finance, supply chain finance, supply chain operations and logistics, copyrights and IP, judicial and legal, health, digital identity, while blockchain service providers like Aliyun, Baidu, will run their BaaS into BSN nodes providing blockchain solutions at cheaper implementation costs and in an easier way, crossing different markets demanding different solutions for each business case.

In the long run, BSN can be considered as a pivotal strategic architecture that would be able to reach businesses ranging from mainland China to overseas strategic locations, under a secure and distributed network. DCEP could therefore represent a way to fully drive overseas investments in terms of political orientation and economic accountability.

BSN will be home for the development of new DLT applications in mainland China and overseas at cheaper costs and in compliance with international standards.

DLT applications will impact many areas from digital identity governance, notarization of corporate supply chains or accounts or cross border payments on specific portals running in smart cities all over the world.

Focusing on the financial layer, DCEP will constitute the first financial ground at M0, the foundation of new financial infrastructure for mainland and cross border payments, managed by a centralized ledger run by PBOC as a support for renminbi internationalization operations such trade finance or capital market operations.

By deepening finance operations, private financial and non financial institutions will work out their own DLT solutions at M1 or M2 by their own development or in a consortium environment.

These solutions will bring more efficiency, security and forecasting accountability to strategic investments like Belt and Road initiatives.

This is a remarkable achievement since these solutions will technically interoperate on BSN architecture as they will be run by open source software frameworks and smart contract code. Also they will be able to communicate and collect information from external networks thanks to off chain oracles.

As a result, the big challenge is represented by compliance with regulations and standards.

China has proved to be able to work at the national level in order to create a technical and business sandbox with the intent to harmonize the system. The Ministry of Information Technology and People Bank of China, and main private corporations like Ant Group, Tencent, UnionPay are fully committed to this common intent and achieve the final goal, building the infrastructure to empower the data economy of the country.

One bigger challenge is represented by the international implementation for overseas business operations: how will these projects interoperate at the international level?

According to my opinion the institutional world is constantly deepening its approach to DLT projects with large scale and recognition. For instance, many international institutions such as the EU Union with EBSI project, as well as many key players, like central national or international banks, or international payments systems like Master cards, Visa are testing financial large scale DLT applications, so China will not be alone into the digital transformation of financial market and system.

International projects in different areas are on the way with a specific focus on finance operations. According to my opinion China is actually one step forward due to the fact that, according to IPSOS, the country represents the largest mobile payments market. So the society is quite ready for this change.

At the national level, China has just given rise to a harmonization process involving technical and financial standards to apply to DLT technologies.

Hard and soft laws have been implemented at the national level, especially in specific areas which at local level have enforced regulations which will consolidate DLT application plans being executed in the upcoming years.

At the same time, China is also taking its role seriously at the international level, by supporting ISO when establishing blockchain technical committees on ISO/TC 307 and International Telecommunication Union Focus Groups in DLT, data managing and processing and legal digital currency.

In conclusion, leveraging the borderless nature of DCEP and BSN will ease the release of foreign investments and at the same will free the traditional cross-border payment transaction system from any restrictions, providing investors from abroad with safer reserve assets, boosting the internationalization process of the RMB.

By joining forces, these two pillars will create a continuous flow of assets, basically data and transactions, in order to support efficiently the execution of the Belt and Road Initiatives, and other international programs for the development of investments that are currently struggling in some areas of the world, due to a of lack of interconnectivity, transparency, governance and accountability.



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