

Establishing An Open and Shared Financial System with Blockchain

Ping An Blockchain(2019)

Foreword

According to IDC research, the total spending in China's blockchain market reached 160 million US dollars in 2018, and such a strong growth is expected to continue in the next three years. By 2022, total spending in the market is expected to reach 1.67 billion US dollars, with over 80% CAGR in the 2017-2022 period. With the support of blockchain, distributed architecture will become the key foundation of data market by 2021. The core value of blockchain technology, shaping digital trust, will also make a far-reaching impact on the existing business society. With continued technological progress, blockchain technology will "make rapid advances on multiple fronts" and lead to breakthroughs in all walks of life.

OneConnect, the flagship manufacturer in China's blockchain market, has achieved scenario-based application of the technology in financial and several other industries. As a result, IDC has conducted this research on the development of blockchain technology and its market prospect in an effort to explore more possibilities of blockchain application in various industries, as well as the future trend of the technology's development.

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The Development Environment of Blockchain Technology

1. Overview of blockchain technology

The blockchain concept originated from the paper *Bitcoin: A Peer-to-Peer Electronic Cash System* published under the pseudonym Satoshi Nakamoto in 2008. This paper included designs for a brand-new electronic currency system, where ledgers are distributed in a network and are maintained and updated in a decentralized manner to ensure the authenticity, effectiveness and immutability of transaction records. Since the debut of Bitcoin, people have gradually realized the importance of the underlying technologies and have refined them as the blockchain technical infrastructure. Therefore, Bitcoin is the first application of blockchain, and blockchain refers to the technical infrastructure of Bitcoin. The two are related yet different.

Compared with the traditional database, the blockchain has the following notable characteristics:

IDC defines blockchain as a digital, distributed ledger of transactions or records. The ledger, which stores the information or data, exists across multiple participants in a peer-to-peer network. There is no single central repository that stores the ledger. Distributed ledgers technology (DLT) allows new transactions to be added to an existing chain of transactions using a secure digital or cryptographic signature.

- **Distributed architecture:** There is no centralized hardware or a central party in the blockchain system. The rights and obligations of each node are almost equal. Each node can obtain a complete copy of the ledger, and the system is jointly maintained by multiple nodes.
- **Decentralized consensus:** The centralized administrative settlement role of approving transactions has been eliminated. There is no need for mutual trust between nodes. The data entering the chain is verified through a consensus mechanism. The data content and system operation rules are open and transparent. The trust relationship between nodes is automatically realized through means of the consensus.
- **Transparency:** Through the consensus mechanism, ledgers and business rules can be reviewed by everyone, and the timestamp mechanism can be used to trace the user's behavior, thus ensuring the openness and transparency of the system.
- **Immutability:** Blockchain is an append-only chain of blocks. Transactions can be written onto a blockchain by adding new blocks; previous records will not be tampered.

According to the degree of openness, the blockchain can be divided into three main types: public chain, private chain and consortium chain:

- **Public chain** is the earliest type of blockchain, which is characterized by complete openness. Anyone can read the contents of blocks, initiate transactions and obtain record-keeping rights.
- **Consortium chain** usually exists among multiple organizations and require prior authorization to obtain access such as reading, transacting and record-keeping. Consortium chain can achieve good connection between nodes and can maintain operation at very little cost.
- **Private chain** is a blockchain that belongs completely to an organization. Its reading, transacting and record-keeping accesses are highly restricted. It can improve auditability, but cannot completely solve the trust problem.

Type	Read Access	Transacting Access	Record-keeping Access
Public chain	Anyone	Anyone	Anyone
Consortium chain	Authorized entity	Authorized node	Authorized node
Private chain	Completely private	Limited number of authorized nodes	Limited number of authorized nodes

Source: IDC, 2018

2. Blockchain development environment

1) Regulatory policies

In China, the attitude of the government and relevant regulatory agencies towards the blockchain is characterized by “distinct differences”. On the one hand, they will resolutely crack down on illegal fund-raising activities for a virtual currency, cryptocurrency and/or token ICO (Initial Coin Offering). On the other hand, they actively affirm the potential of blockchain technology as an emerging technology and guide its development standards. As early as 2016, the State Council issued the *National Plan for Information Technology During the Period of the Thirteenth Five-year Plan*, which identifies the blockchain as a strategic frontier technology and encourages innovation, testing and application of this technology. When digital currency financing intensified in 2017, seven ministries and commissions, including the People’s Bank of China, jointly issued the *Announcement on Preventing Financing Risks of Token Issuance*, pointing out that there are multiple risks of token issuance financing and transactions, requiring that all kinds of token issuance financing activities be stopped immediately, and that organizations and individuals that have completed token issuance financing should make refunds and other arrangements. Subsequently, a number of policies were issued from the central ministries, commissions and local governments to encourage and standardize the development of blockchain technology, and a clear policy support for advocating “coinless blockchain” was formed in 2018.

Meanwhile, the Chinese government is actively promoting the standardization of blockchain in China. In 2016, the Ministry of Industry and Information Technology (MIIT) released the first *White Paper on the Development of China’s Blockchain Technology and Applications*, and in the following year the MIIT released the first blockchain standard, *Blockchain - Reference Architecture*, which systematically describes the ecosystem of blockchain and helps the industry to build consensus. As of 2019, the MIIT has issued numbers of standards, including *Blockchain Reference Architecture*, *Data Format Specification*, *Smart Contracts Implementation Specification*, *Privacy Protection Specification*, and *Guide for Application of GDRs*. These documents have important guidance and reference value for the selection, development and application of blockchain in various sectors.

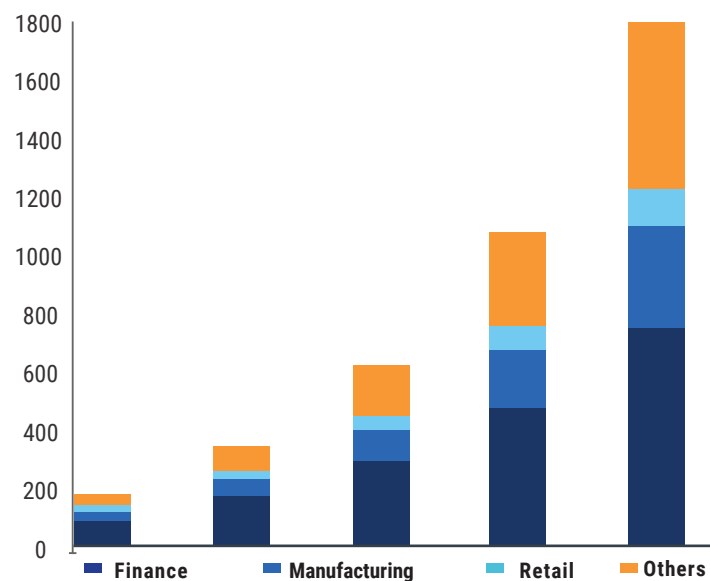
Internationally, all countries in the world are still cautious about digital currency, but they are actively embracing and encouraging the development of blockchain technology. The governments of Germany and South Korea have listed the development of blockchain technology as part of their national strategies. The South Korean government has tried many times to implement blockchain technology in core sectors such as logistics and energy as of 2018. The US government upgraded blockchain to the status of “revolutionary technology”, actively implemented blockchain technology and supported the issuance of legal security tokens (Security Token Offering). Singapore is at the forefront of blockchain-based financial innovations; the Monetary Authority of Singapore (MAS) has launched a number of blockchain pilot projects, focusing on the application of blockchain in cross-border payment, trade finance and other aspects.

2) Market spending

The potential of blockchain has gained increasing recognition, and enterprises' investment has also increased. According to IDC's latest *Worldwide Semiannual Blockchain Spending Guide*, the spending on China's blockchain market in 2018 totaled 160 million US dollars, up by 108% from 2017. Meanwhile, more enterprises plan to increase associated budgets in the future. Affected by this, it is expected that China's blockchain market will maintain rapid growth in the next three years. The market spending in 2022 is expected to reach 1.67 billion US dollars, with a CAGR of 83.9% from 2017 to 2022.

Viewing from a sector-based perspective, finance, manufacturing and retail sectors have spent the most on blockchain. The market spending of these three sectors in 2018 accounted for more than 75% of the total market spending. The financial sector has the largest blockchain spending and the highest proportion in the total market spending.

Figure 1 Spending Scale of China's Blockchain Market, 2018-2022 (\$M)



Source: IDC's Worldwide Semiannual Blockchain Spending Guide, March 2019

3) Technological development

Blockchain is not a single technology, but a combination of a number of technologies. Its core technology components include distributed ledger technology (DLT), encryption algorithms, P2P communication and consensus mechanisms. Each technology has more than a decade or even several decades of development history, they are quite mature and can implement rapidly, and that is reason why pilot projects have mushroomed in the market after the concept of blockchain became fashionable. However, on the other hand, when the component technologies were developed in combination to form innovative blockchain systems, the characteristics of an emerging technology began to unfold and we saw a new

development path. Judging from the current technological paradigm, the key directions for blockchain development are in scalability, cross-chain interoperability, privacy protection and governance rules. These are all aimed at reducing the defects of existing systems. Because every breakthrough in a core technology requires significant manpower and material resources, the high cost of innovation has become a major obstacle hindering the development of blockchain technology.

Blockchain, as a new integrated application system of computer and network technologies, generally still has a long way to go to realize large-scale commercial deployment. The system performance, security, privacy protection, governance and cross-chain interoperability aspects still need continuous optimization before and after actual implementation.

4) Application ecosystem

As mentioned earlier, according to the degree of openness, blockchain can be divided into three types: public chain, private chain and consortium chain. In practice, private chains are usually deployed within an enterprise, which means from a business perspective they are not much different from traditional databases, while public chains and consortium chains are more widely implemented, and their implementation paths and approaches have unique characteristics with different development trends.

At present, Decentralized Application (DApp) is the main blockchain project based on a public chain model; its expansion has just begun and the overall development is immature. DAppRadar's statistics show that, as of April 2019, there were only 2,000 DApps on mainstream public chain platforms, and they were concentrated in a few fields such as quiz games, gambling and crypto-collectibles. Compared with Internet applications, there was an order of magnitude gap in application number, category, number of users and user activity.

In contrast to that of a public chain, the implementation of consortium chain is mainly in the enterprise-level market. End users usually face certain pain points and try to combine the technological characteristics of blockchain with business scenarios to bring the value of blockchain into play in terms of trust, efficiency and cost. At present, the enterprise-level blockchain applications commonly seen in the Chinese market include those for financial applications, track and trace applications and certificating applications, all of which are in an active exploration phase. We expect that the application of enterprise-level blockchain will still be dominated by consortium chains until the "Blockchain Trilemma"¹ is solved.

Overall, China's blockchain market is relatively active. The main focus of the market has gradually changed from "what is blockchain" and "why to use blockchain" to "how to use blockchain". Many use cases emerged and correspondingly, so did some great challenges. In the following section, we will introduce the industry application of blockchain technology and corresponding challenges.

6 1. The Blockchain Trilemma means that at a fundamental level blockchain system can only achieve 2 out of 3 of the following traits at one time: scalability, decentralization and security.

Industry Application of Blockchain Technology and Corresponding Challenges

1. Thoughts on the application of blockchain in various sectors

1) Blockchain is one of the innovation accelerators for the digital transformation of enterprises

In the growing digital economy, digitalization will permeate all sectors, cross-border integration will blur the boundaries between sectors, and the growth of all sectors will be driven by digitally enhanced products, operations and relationships. Digital transformation will become the consensus of all enterprises. Through digital knowledge and technology, the business model will be changed to gain competitive advantages in the new era.

IDC believes that at the core of the digital transformation is the support of enterprise business growth and innovation based on third platform technology, and the development of the third platform has moved from the phase of “pilot innovation” to “multiplied innovation”. It is showing five development trends, namely, ubiquitous insight (Insights), infinite dynamic edge (Reach), explosive growth of application (Development), evolved social evolution (Expectations) and ubiquitous security (Trust).

Blockchain is one of the seven innovation accelerator technologies² in the new phase of digital transformation, and it is also the key support for realizing multiplied trust. With blockchain technology, the trust relationships between people and between enterprises across all sectors will be reshaped in a digital manner to promote greater production innovation.

2) Blockchain technology has wide-scale application in various sectors

According to IDC FutureScape’s prediction, by 2021, with the support of blockchain, the value chains within the early adopting sectors will expand the digital platform to the entire all-round experience ecosystem, thus reducing transaction costs by 35%. Meanwhile, distributed architectures will become the foundation of the future data market. The greatest value of blockchain technology lies in building digital trust, which will have a profound impact on the business community. With the development of technology and the popularization of ideas, the application of blockchain technology will drive a trend of “multi-point flowering and accelerated advancement”, to achieve breakthroughs in all sectors.

Figure 2 Third Platform Technology and Digital Transformation



Source: IDC, 2018

² Innovation accelerator technologies include blockchain, artificial intelligence, Internet of Things, next-generation security, , robotics, 3D printing, and AR/VR technologies.technologies.



Smart city

In smart cities, blockchain technology can be well integrated with environmental protection, energy, personal record management, property-rights notarization, election voting, academic accreditation and public welfare charity. Distributed non-fossil energy is one of the main development directions in the energy sector. Blockchain technology-based smart grids will make power planning and distribution more transparent and efficient. The chain can record the power production and consumption of each user, thus realizing effective management of power supply and consumption and improving energy efficiency. The problems of complicated notarization procedures and opaque real estate transactions can also be solved through the traceability and immutable features of blockchain. The distributed consensus verification, openness and transparency of blockchain can help improve the credibility of political election and corporate shareholder voting. The identity authentication information stored in a centralized way may be incomplete or maliciously tampered with. To mitigate this, blockchain technology can secure identity information to ensure at multiple levels across the business processes to avoid potentially huge losses to enterprises and individuals. IDC FutureScape report shows that by 2022, 150 million people worldwide will have blockchain-based digital identities.



Real estate

In the real estate sector, the blockchain can contribute to leasing transactions, investment thresholds of real estate and property registration. The distributed ledger technology of blockchain plays an important role in transaction and leasing. The distributed ledger enables key data information such as timestamps, property rights, management rights, validity periods and transaction prices to be stored and synchronized in a distributed manner, so as to achieve data transparency and credibility. Meanwhile, distributed ledger technology can effectively simplify the intermediate procedures and save a lot of time and cost. The technological characteristics of blockchain can effectively reduce the complexity of real estate transactions and simplify the transaction information processing procedures of various related entities, including sellers, buyers, intermediaries, lawyers, banks and government departments.



Medical

In the medical sector, blockchain has bright prospects in the application in securing electronic medical records, drug anti-counterfeiting, medical wastes management, gene-data storage and medical wearable devices. Electronic medical records enable medical data sharing, which greatly facilitates hospitals and patients in accessing complete medical records and historical data. Supervision over drug anti-counterfeiting are implemented from the pharmaceutical and device manufacturers to the consumer end. All links along the drug supply chain will be recorded and verified on the blockchain, and counterfeit and inferior drugs will be eliminated through the traceability characteristics of blockchain. Blockchain technology can help supervise medical waste and improve the in-hospital circulation tracing mechanism of medical wastes, so that medical wastes can be registered and traced.



Automobile

In the automobile sector, blockchain technology brings innovation to the traceability of automobile parts, automobile insurance, used car valuation and other scenarios. As for the traceability of automobile parts, the whole supply chain can be traced from raw material suppliers, manufacturers, distributors to consumers, so that consumers will have a more comprehensive understanding of the flow of automobile parts from factories to repair shops. In the automobile insurance scenario, blockchain can store the driver's driving behaviors and habits, and the insurance company can generate individualized insurance policies accordingly to realize automatic settlement of claims. In addition, in the used car market, information asymmetry is one of the main factors that hinders the healthy development of the market and compromises the interests of car owners and consumers. Chaining up the life-cycle information of used cars can create a more open and transparent used car valuation system and effectively protect the interests of merchants, car owners and consumers.



Finance

Financial service is currently one of the sectors with the largest number of blockchain technology implementation projects and adoption scenarios. For financial institutions, data is the core asset of risk control and credit. The advantages of blockchain technology in addressing information asymmetry and "Information Island" problems in Finance enabled blockchain to be developed earlier and to reach greater maturity in this sector than in other sectors. Today, the adoption of blockchain has reached greater economies of scale in supply chain finance, asset-backed securities, credit investigation and risk control segments, and is being actively extensively explored and implemented in other fields.

2. Development and practice of blockchain in the financial service sector

1) Attributes of blockchain technology suited to Financial Sector

The characteristics of blockchain technology determine that it can be widely used in many fields, but for the financial sector, the application of blockchain is more significant and representative, and plays a vital role in reshaping financial products and services. The distributed ledger technology, data immutability and traceability inherent in blockchain are highly consistent with the essential requirements of the financial sector for information and data security and transaction data traceability. Therefore, blockchain will play a constructive role in the financial sector. The changes blockchain can bring to the financial sector include:

a) Improving data reliability

By recording relevant data, blockchain can be an add-on to the original centralized intermediary system of the financial sector and provide more secure, credible and efficient financial services. The financial service platform established with the blockchain technology can link enterprises and financial institutions and can record data completely. The data on the blockchain are recorded and confirmed by multiple parties, immutably, but also traceably, thus effectively improving the reliability of information.

b) Improving the efficiency of financial services

The financial services sector is an important driving force for global economic development, as well as one of the sectors with the highest degree of centralization. The traditional financial service mode has the problems of low information transmission efficiency and high financial service cost. The distributed storage, immutability, timestamp verification and other attributes of blockchain technology can help financial institutions optimize financial infrastructure, reduce information asymmetry, improve financial service efficiency and cut costs.

c) Data security and protection in the digital era

The current financial system is based on a centralized structure, and the fully centralized structure faces the greatest risk - if the central node is threatened and attacked, the entire system structure faces the risk of collapse. The centralized structure requires financial institutions to invest a lot of manpower and material resources in risk prevention and information security, which also causes an increase in supervision costs. The distributed architecture of blockchain can help financial institutions improve the current architecture and service mode, reduce the cost of risk control and supervision with an open architecture and an overall consensus mechanism, and effectively promote the progress and development of financial services and products.

2) Typical scenarios of blockchain facilitating financial services



Trade finance

Trade finance is a short-term financing tool, the financing is based on goods and accounts receivable in commodity transactions. It is one of the most important businesses in corporate banking. Trade finance has long suffered issues around a complicated verification process, poor timeliness and opaque information. Banks need to verify a large amount of information, data and money on both sides of the transaction. The transmission of documents and information through traditional channels will deprive the transaction of timeliness. All participants in the transaction have a single source of information, and the information is opaque and incomplete, which not only makes the transaction risky, but also costlier.

The application of blockchain in trade finance can effectively solve the existing pain points.

- **Improving efficiency:** The blockchain-based network system can cover all the participants in trade finance, so that many entities share a unified ledger, eliminating the reconciliation procedure, connecting trade data flow and improving efficiency. Trade finance-related processes such as pre-loan investigation, in-loan review and post-loan management can be simplified through digitally encrypted transmission and the implementation of smart contracts. Traditional labor input and paper documents required are processed electronically, which greatly improves the document circulation speed and efficiency.
- **Reducing fraud risks:** Data flow on the chain can reduce human-induced risks. The trade finance platform based on blockchain can connect multi-party trade data flow, enabling banks to verify the authenticity of data more quickly and conveniently, verify and compare identities and information, effectively reduce the risk of fraud, and avoid double financing and financing fraud.



Supply chain finance

Supply chain finance is a service where banks take core enterprises as a starting point, connect their upstream and downstream small and medium-sized enterprises, and provide financing services for these enterprises. In the supply chains of core enterprises, upstream and downstream small and medium-sized enterprises often face difficulties such as long accounting periods and poor liquidity, while banks have no sense of the risk information and financial status of small and medium-sized enterprises and are unwilling to provide financing services, which leads to financing costs and difficulties for small and medium-sized enterprises.

The application of blockchain in supply chain finance will effectively address the pain points of all participants and create new value.

- **Facilitating turnover of funds:** By creating an open, transparent and efficiently distributed network, the blockchain connects upstream and downstream enterprises, core enterprises, banks and other participants in the supply chain, thus realizing multi-level penetration of core enterprise credit. It chains up the processes of confirmation, circulation, financing and sorting of assets such as receivables and payables to ensure the ownership of assets; meanwhile, assets on the chain can be split and circulated in multiple levels to promote the movement of capital flow on the chain and resolve the financing difficulties of small and medium-sized enterprises at the end of the supply chain.

- **Reducing financial risks:** For banks, the data of the whole supply chain will enable them to have a better digitization of the supply chain and the enterprises along it. Meanwhile, the multi-level transmission of credit can help banks obtain more guaranteed quality assets and reduce the non-performing loan rate.
- **Increasing the stickiness of chain-based enterprises:** The use of blockchain can grant new value to traditional supply chain finance. This can not only help solve the financing challenges faced by suppliers and distributors at various levels on the chain, but also increase the stickiness of chain-based enterprises and core enterprises, thus enhancing the overall competitiveness. Efficient integration of enterprise information flow is also conducive to enhancing the cooperative ability of the industry chain and enhancing overall benefits.



Asset-backed Securities (ABS)

Asset-backed Securities use the cash flow generated in the future as repayment support for assets that lack liquidity but have predictable income, to carry out credit enhancement through structural design, and to issue securities in the capital market for sale, in order to obtain financing and maximize the liquidity of assets. The traditional pain point of Asset-backed Securities lies in the complexity of product structure design and financing process. It can only be issued through issuers, securities companies, rating agencies, accounting firms, law firms and distributors. Investors cannot access the asset status of the capital pool, which leads to difficulties in asset pricing, and in turn results in insufficient investment confidence and poor market liquidity.

The distributed, open and transparent characteristics of blockchain technology can address the corresponding pain points for Asset-backed Securities.

- **Information penetration:** Blockchain can help realize information penetration on the ABS transaction chain and help establish a trust mechanism. Nodes are deployed to all participating entities by using the blockchain. Thanks to the open, transparent and distributed characteristics of the blockchain, participants can "see through" the underlying assets, realize the authenticity and openness of asset information, and effectively prevent risks. All participants can share information interactively in real time and monitor the whole process of historical information and real-time performance of assets, so that the ABS sector can no longer rely on the credit rating of entities, but ensure fair asset pricing through blockchain technology, and promote the development of ABS market.
- **Improving efficiency:** Blockchain technology can also provide a strong impetus for the development of ABS market in terms of efficiency improvement. Through synchronous transmission of ABS information data flow, the cumbersome inefficient situation of the traditional point-to-point unidirectional transmission mode is changed, mesh-type sharing is realized, information through-trains are built, and information transmission efficiency is improved.



Reinsurance

Reinsurance, which aims at dispersing the risks and responsibilities of the original insurance, is known as "the insurance of insurance". There are many pain points in the reinsurance market: First, the informatization level of Chinese reinsurance institutions is relatively low at present. Business processing relies on a large number of manpower to communicate with primary insurance companies through mail and telephone, business personnel have to repeatedly asking for prices and

negotiating terms, and then the transaction information is manually entered into the local management system, which is inefficient and might result in input errors, generating accounting information error risks. Second, the reinsurance company cannot directly contact the insured of the original policy and can only obtain relevant information through the primary insurance company. Due to the information asymmetry, the primary insurance company might conceal potential risks and the reinsurance company cannot fully evaluate the risks of the original policy. Moreover, it is difficult for primary insurance companies to contact multiple reinsurance companies at the same time, so they need to find counterparties through intermediary companies. Due to the existence of intermediary companies, the transaction between the two sides becomes a three-way transaction, which increases the transaction cost of primary insurance and reinsurance companies and makes the transaction inefficient.

Applying blockchain technology in the reinsurance business can bring exponential benefits to the sector.

- **Improving operation efficiency:** Deploying local clients for reinsurance companies and connecting them to the blockchain can improve the informatization capability of reinsurance companies. The informatization and automation of transactions reduce the labor cost of operation, and at the same time avoid the errors generated by manual input. Smart contracts can also realize intelligent compensation and revolutionize the payment mode. After each insurance policy that meets the reinsurance conditions, the smart contract automatically triggers reinsurance compensation, which can realize real-time settlement instead of quarterly or semi-annual settlement.
- **Increasing information transparency:** Using the blockchain to achieve the penetration of underlying assets protects the reinsurance company's right to know. The primary insurance company uploads the policy object information to the blockchain when accepting the policy, and the reinsurance company can obtain the business update notice in real time, and can also evaluate risks more comprehensively through the information of the original insured and then set up more reasonable insurance amount and odds.
- **Cost reduction and efficiency enhancement:** The two sides of the transaction seek the counterparty through the blockchain reinsurance transaction platform and conduct point-to-point transactions, eliminating the intermediate procedures and greatly reducing the transaction process. The smart contract can automatically find matching transaction inquiry forms for reinsurance and primary insurance companies, thus reducing the time for repeated communication and inquiry negotiation of business staff, so improving the transaction efficiency.



Cross-border payment and settlement

At present, cross-border remittance between banks is usually handled by the SWIFT (Society for Worldwide Interbank Financial Telecommunication) network, which needs to go through a number of institutions such as remitting bank, central bank, correspondent bank and receiving bank for 3 to 5 working days, with a long transaction process and high cost. Besides, each organization has its own accounting system and clearing system, which makes it difficult for system docking.

Blockchain based cross-border payment can solve the pain points and make cross-border payments faster, more economical and safer.

- **Reducing transaction time and cost:** The cross-border payment system and network based on blockchain technology will integrate all entities involved in the cross-border payment process, such as traditional financial institutions, third-party payment companies and cross-border Internet e-commerce platforms, to realize low-cost, direct cross-border and cross-currency payment transactions without the need for a central management platform

like SWIFT. A blockchain system linking banks can record all transactions openly and transparently, meaning that all transactions can be settled directly on the blockchain. For banks, this can also help them effectively save business resources. When different banks process cross-border payments on the blockchain network, they can remove the need to use intermediate banks, thus they are able to make real-time payments, speed up clearing and settlement, and reduce cross-border payment and settlement costs.

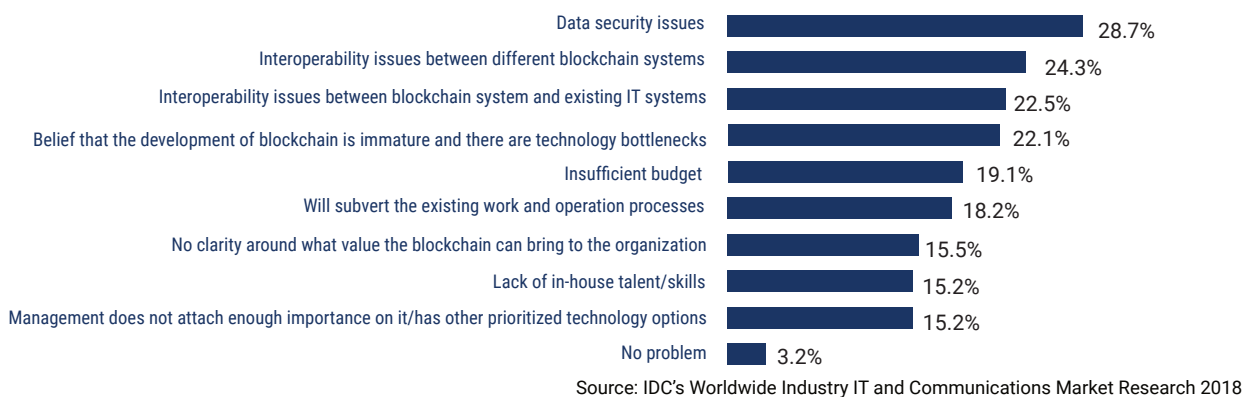
- **Improving transaction security:** The distributed ledger technology of blockchain can eliminate the relay transmission mode of traditional cross-border payment processing, realize synchronous confirmation of business nodes, and ensure that the whole remittance process is monitored and traceable. The multi-party verification technology of blockchain can also effectively reduce the risk of data being tampered with or forged. Even if one or several nodes are attacked, the operation of the system will not be affected, thus effectively improving the security of cross-border payment.

In general, all business scenarios in the financial sector have some pain points, such as inefficient process operation and lack of trust among all parties involved. The reason is that the business process is complex, with many participants and a high degree of manual participation and paper-work, which cannot guarantee true reliability of the data. Meanwhile, the layer-by-layer transmission of data also poses challenges to data verification, resulting in complicated and inefficient coordination of the entire business process. Theoretically, the blockchain can ensure the strong consistency of the data on the chain, reshape the trust mechanism, reduce the risk of data forgery and tampering, and improve the data integration and operation efficiency. However, in practice, it is difficult for enterprises to balance the contradiction between data privacy and data sharing. It is believed that the insufficient computing power and transaction performance of blockchain deter many enterprises from being included in the blockchain, which poses a serious challenge to the large-scale application of blockchain in the financial sector.

3. Challenges in the application and development of blockchain in the financial sector

According to IDC's survey of 457 financial institutions (including those in banking, insurance and securities segments) in 2018, the concerns of financial institutions when using blockchain include data security, interoperability and technological maturity. (As shown in Fig. 3) **In this study, IDC, based on global survey data and observation of the Chinese market, believes that the major challenges faced by the large-scale application of blockchain in the financial sector are as follows.**

Figure 3 Worries about the Use of Blockchain in the Financial Sector
Q: What are the three most worrying issues when your organization uses blockchain? (Finance sector)



1) Security

In IDC's global research, data security is the most worrying issue for financial institutions when using blockchain. Blockchain is essentially a distributed digital ledger that records information and data. With the increasing number and volume of ledgers, enterprises' demand for data retrieval and analysis also increases accordingly. Many enterprises try to connect data analysis software directly into the blockchain ledger shared by many entities to form direct retrieval, analysis and utilization for internal and external information. However, to a certain extent, this poses a threat to the privacy of other users and challenges to the safe use of blockchain technology.

Usually, the enterprise's security and privacy requirements for the blockchain include authentication, authorization, encryption, data integrity, availability, auditability, monitorability, non-repudiation, identity management, accident feedback and security policy management. The blockchain system should fully consider these requirements to ensure data security and privacy.

On the other hand, in the practice of financial institutions, there is usually a contradiction between data privacy and data sharing, that is, enterprises cannot and are not willing to upload data to the blockchain due to concern for the privacy of business data. Most of implemented blockchain applications do not support a fully encrypted infrastructure, this further reduces the willingness of enterprises to upload data. Therefore, strengthening security protection in data encryption, key storage, privacy protection, identity authentication and other aspects, and realizing efficient management and utilization of data on the blockchain while ensuring privacy, are effective paths for promoting large-scale application of blockchain.

2) Interoperability

In IDC's global research, the worrying issues ranked second and third for financial institutions when using blockchain are poor interoperability between different blockchain systems as well as between the blockchain and existing IT systems. In order to meet diverse business needs, the blockchain usually adopts different consensus mechanisms, encryption protocols, ledger models and deployment methods to construct a specific blockchain ledger. These blockchain ledgers are independent of each other, easily creating "Blockchain Islands". However, in the era of digitalization, breaking down

data silos and realizing interconnection are the inevitable requirements for building a credible business ecosystem. Therefore, realizing the interoperability of blockchain ledger is an important prerequisite for the effective application of blockchain.

Cross-platform blockchain interoperability includes the interaction and collaboration between sector users as well as between different suppliers. It is also necessary to realize the interaction and coordination between blockchain systems as well as between traditional IT applications and blockchain systems. Therefore, finding how to adopt a unified application program interface (API) and block data format, to achieve cross-chain interoperability with efficient network communication protocols and connection mechanisms is the second challenge to blockchain in achieving large-scale industrial adoption.

3) System performance

IDC research also shows that 22.1% of users believe that the development of blockchain is immature, and the existence of a technology bottleneck is one of the three most important factors limiting its application. Specifically, distributed ledgers require high data integrity, and the addition of every block must be based on reliable records of the previous block and consensus reached by nodes. Consequently, in order to pursue the security and accuracy of data, it takes the blockchain longer to input data than traditional technologies. Meanwhile, due to the distributed architecture characteristics of blockchain, as well as the different computing capabilities and network conditions of various nodes, throughput and transaction speed are difficult to improve, making it unable to meet the commercial needs in real-time or near real-time transactions.

At present, solutions to the challenges of blockchain performance mainly include adjusting block size, improving the consensus algorithm, layering, sharding and use of a lightning network. However, these solutions do not perfectly solve the Blockchain Trilemma. Therefore, how to achieve a real balance in this trinity, break the bottleneck of throughput and latency, and meet the needs of large-scale commercial transactions remain important challenges for the development of blockchain.

4) Ecosystem development

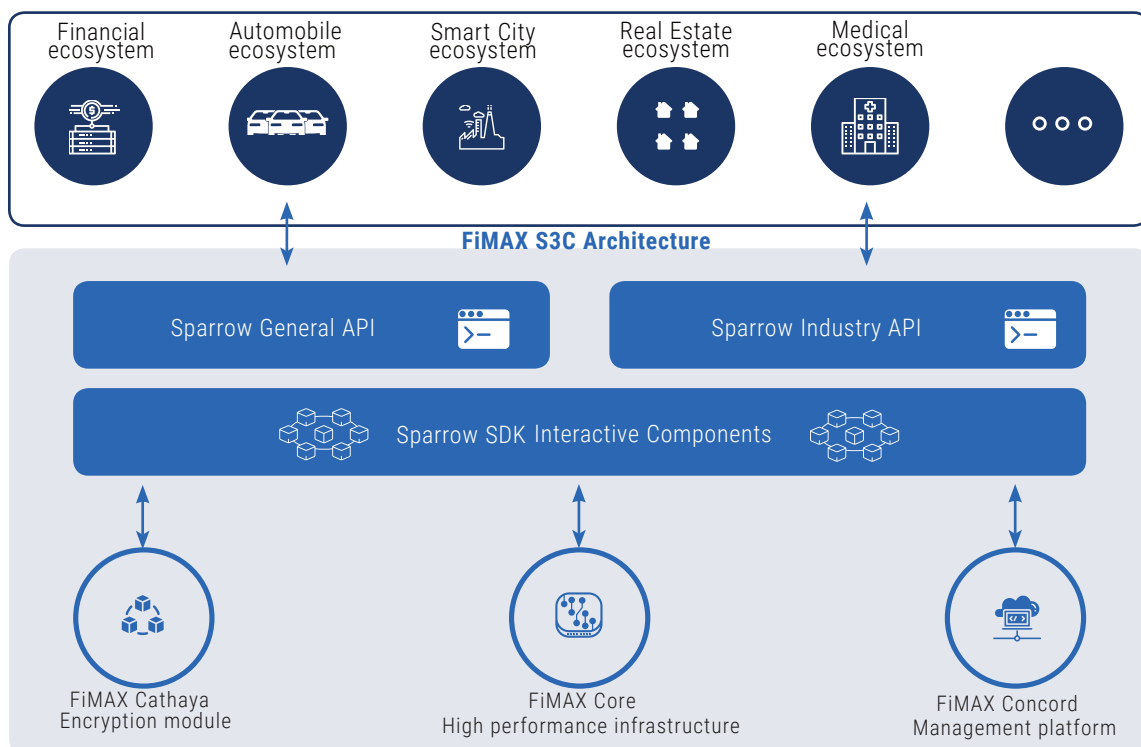
The application potential of blockchain in the financial sector has been generally recognized, and the focus has also shifted from the basic concept of blockchain to the application of it in this sector. However, most of the implementation cases of blockchain are still in the trial phase, and more application scenarios are yet to be explored. This hinders the benefits of the economies of scale and the network effect. The reason is that the market is still at an early stage of development and financial institutions need to further improve their understanding of blockchain. Worrying that blockchain will subvert the existing workflow and being unsure what value blockchain can bring to the organization, financial institutions are reluctant to join the blockchain network that is not completely controlled by themselves, and are even less willing to share their own assets such as customers and data. This will hinder the further application of blockchain in financial institutions.

Although the implementation of small-scale pilot projects is of exploratory significance, it cannot give full play to the value of blockchain technology. The further development of blockchain in the sector requires more financial institutions to work together and build a less centralized network ecosystem to achieve sufficient data sharing and efficiency improvements. Another challenge is to persuade the traditional financial sector users to accept the concept of “less centralization”, to establish a large-scale network ecosystem, and to form a brand-new cooperation model to seek common development.

Ping An Blockchain Solution

Considering the challenges in privacy protection, system performance and interoperability in the development of blockchain, and combining the experience in blockchain implementation, OneConnect³ blockchain team has innovatively developed the FiMAX S3C fully encrypted blockchain architecture. A fully encrypted architecture implies that all data on the chain are encrypted and uploaded by the data owner. Leveraging sophisticated cryptographic schemes, participants will have full control over their own data. Meanwhile, FiMAX blockchain features a number of independently developed and advanced technologies, and it has several competitive advantages such as low latency, high TPS and system integrity. It provides not only customized blockchain solutions for business entities, but also BNaaS blockchain network ecosystems that can be implemented on a large scale.

Figure 4 FiMAX technological solutions
Major ecosystems



Source: Ping An Blockchain Research Institute, 2019

17 3. OneConnect is a technology service platform for the entire financial industry chain under the flag of Ping An Group.

1. FiMAX Cathaya resolves conflicts between data privacy and data sharing

FiMAX Cathaya is the data encryption and privacy protection module. With an independently developed cryptographic solution, Cathaya believes that it has effectively resolved the conflicts between information sharing, data privacy and data ownership rights. Enterprises can easily share data on blockchain without any worries about data privacy. Cathaya helps remove a big obstacle for mass adoption of blockchain.

1) 3D Zero-knowledge Proof (3D ZKP)

The Zero-Knowledge Proof (ZKP) algorithm plays an extremely important role in cryptography. It means that one party (the prover) can prove to another party (the verifier) the truthfulness of a certain statement without providing any useful information. In the application scenario of blockchain, zero-knowledge proof can meet the verification requirements for encrypted data.

Based on the concept of Zero-Knowledge Proof, FiMAX Team innovatively developed 3D Zero-Knowledge Proof technology, which can validate any relationship ($<$, $>$, $=$, $<=$, $>=$) and any mathematical operation (" $+$ ", " $-$ ", " $*$ ", " $/$ ") on any set of encrypted data within three milliseconds. 3D ZKP is designed to make full use of encrypted data on the FiMAX blockchain without revealing any information.

The emergence of 3D ZKP facilitates cross-checking of encrypted data, especially between different data sets with complex business logic. This addresses the legal and compliance concerns in business transactions, greatly improves the risk control capability among participating entities, and makes it possible to implement blockchain technology on multi-level business scenarios. So far, FiMAX 3D zero-knowledge proof technology has generated great economic benefits from the implemented projects.

2) Field-level Crypto-controlled Data Sharing

Crypto-controlled Data Sharing technology is independently developed and patented by FiMAX Team. Combined with field-level encryption technology, it enables data sharing with field-level accuracy. As is discussed in previous section, under FiMAX fully encrypted architecture, all data are automatically encrypted and uploaded by the data owner, and the private key is owned and preserved by the data owner only, ensuring full data control. Utilizing Crypto-controlled Data Sharing technology, the data owner can grant any third party data viewing rights of specific fields, while other fields remain as ciphertext. For example, one data owner encrypts their "identity information", "bank account information" and "balance information" into a ciphertext and upload it to FiMAX blockchain. If any other business party requests to view the "balance information", after evaluating the request as reasonable, the data owner can grant this party decryption rights of the "balance information" field. The authorized party can only view the "balance information", while still having no viewing access to other fields.

Without disclosing other important information, Crypto-controlled Data Sharing technology can realize accurate data sharing and meet specific business requirements. Data owners have full ownership and flexible control over their own data with no privacy concerns.

2. FiMAX Core greatly improves blockchain performance

FiMAX Core provides high performance blockchain infrastructure. Throughput and latency are two important indicators of system performance, and FiMAX core is able to achieve real-time (ultra-low latency) system response while realizing high TPS, facilitated by a number of innovative technologies independently developed by the FiMAX team. In addition, FiMAX also provides compatibility solutions to China Crypto issued by State Cryptography Administration of China (SCA), making it easy for enterprises that comply with China Crypto to integrate blockchain technology.

1) Smart block

FiMAX adopts a number of engineering optimization technologies such as customizable consensus mechanism, threaded optimization and architecture reconstruction, which greatly improves the throughput of a blockchain network under high concurrency. As a result, the throughput of FiMAX has not only matched but exceeded that of traditional databases under the same configuration.

On this basis, FiMAX is committed to addressing another bottleneck of blockchain performance - latency. Due to the special block structure of blockchain, one of the common approaches for improving throughput is to increase the block size. However, when system transaction volume is low, the design of large blocks often leads to high latency. In order to balance throughput and latency, the FiMAX Team independently developed Smart Block technology that adopts a block-less structure to break the dilemma between block size on block generation time. Without reducing throughput, the transaction latency of FiMAX was reduced to below 0.01 seconds, achieving real-time system responses almost solely affected by the network environment. Smart Block reconstructs the infrastructure of blockchain, so that the performance improvement can be obtained without any change to peripheral systems. It is a "silver bullet" for optimizing blockchain performance.

2) Go-lang China Crypto Accelerator

China Crypto is a series of commercial crypto standards formulated by the State Cryptography Administration of China. It is widely used for encrypting data related to sensitive internal information, administrative affairs and economic information. However, the design of China Crypto is very complicated. Traditional software implementations achieve extremely low efficiency, and users often encounter declining transaction speeds when accessing a blockchain system, thus having to upgrade hardware to meet business needs. In order to comply with China Crypto while lowering overhead costs on hardware, FiMAX has developed Go-lang China Crypto Accelerator technology by making in-depth optimization according to the characteristics of China Crypto and X86 Intel CPU instructions, which enables China Crypto to be efficiently implemented on Ping An FiMAX Blockchain System while not reducing system throughput. In test environment (8-core 2.3Ghz CPU, 16G RAM), FiMAX has achieved more than 10,000 TPS and real-time response on single chain under China Crypto environment; system throughput can be multiplied with increased configuration.

3. FiMAX Concord provides an integrated and exportable blockchain management system.

FiMAX Concord is the easy-to-use management module of FiMAX. It is an integrated set of blockchain management modules designed by FiMAX Team in the process of implementing blockchain technology and in combination with customer's needs. It helps customers achieve rapid deployment and convenient management of a blockchain network and solves the problems of high technological barriers and complicated operation of blockchain technology in practical application. FiMAX Concord has brought about an improvement in experience for users of blockchain, just like the visual experience transition from DOS to Windows.

1) Node management

FiMAX Concord has a convenient node management function that can realize rapid on-premise node deployment. In order to lower the threshold of local node management, Concord provides Organization Administrators with a friendly user interface, which includes functions such as node initialization, node start, node stop and channel joining. It provides real-time monitoring window for key nodes and helps operation and maintenance personnel to accurately detect abnormalities.

2) China Crypto Certificate Authority

Concord integrates complex network creation and management, access mechanism, consensus mechanism, verification mechanism, CA docking and certificate management mechanism into a simplest operation interface presented to the network administrator, enabling the latter to remotely control the network outside FiMAX. Concord has also built a set of exportable CA system according to China Crypto Standards. The blockchain network management system can be deployed on-premises and has been put into production.

3) Blockchain Explorer

The blockchain explorer designed by FiMAX is in line with actual business process. When granted with access, it can intuitively display the business-related information recorded on chain. Meanwhile, data APIs are exposed to users, who can then integrate relevant data into their own business systems by invoking API, thus realizing visualization of data on the chain.

4. FiMAX Sparrow supports comprehensive blockchain interoperations

FiMAX Sparrow is the middle layer of blockchain that interacts with the application layer. Through various APIs, it provides business entities with a secure, efficient and fast solution for access to the bottom layer of the blockchain system. Meanwhile, Sparrow develops and designs cross-chain interactive functions to realize interactive operation of different blockchain systems. In contrast to the “3C” in FiMAX S3C that emphasizes technological realization, FiMAX Sparrow focuses on the combination of blockchain and actual application scenarios, and is committed to promoting and guiding industry standards, so as to drive mass adoption of blockchain technology.

1) Industry standard API

FiMAX Sparrow chooses to first focus on the trade finance industry. Relying on rich project construction experience, and incorporating the financial data standards proposed by ISO20022 and UN/EDIFACT standards issued by UN/CEFACT, FiMAX team defined a series of standard API highly reusable in trade finance industry, such as orders, invoices, financing, logistics and other related data structures, and this series of APIs will be continuously refined in practice. Apart from the trade finance industry, FiMAX Sparrow also provides a number of General APIs with attributes common used across different industries, so that business entities can conveniently invoke these APIs and develop applications. In addition, Sparrow will expand to other industrial applications and continuously define new sets of APIs with industrial attributes.

2) Cross-chain interoperability

Cross-chain technology is the key to realizing interconnection between blockchains. Most of the existing cross-chain technologies, such as side chain, relay and notary, are based on the principle of “multi-phase submission” in distributed databases, with high complexity, and often exceed the controllable range especially in the weak consistency scenario of blockchain.

FiMAX natively supports multi-phase commit. This function is implemented in the bottom layer of the blockchain system without the need to modify smart contracts. FiMAX Sparrow, as an intermediary for coordinating distributed transactions, supports complete distributed transaction management functions, including transaction creation, transaction execution, transaction commit, transaction rollback and other features. Meanwhile, by incorporating a push notification module to ensure message delivery, it guarantees the reachability of transaction processing results, meeting the demands of cross-chain interoperability in various business scenarios.

5. BNaaS (Blockchain-Network-as-a-Service) creates blockchain ecosystems

In order to realize simple and highly efficient docking of FiMAX, meet the different technological construction requirements of business entities, and dispel the concerns of customers about the distributed nature of blockchain, FiMAX Team has created an open BNaaS network ecosystem. Unlike traditional BaaS (Blockchain-as-a-Service) platforms, where a chain and its nodes are generated by an account system, BNaaS emphasizes multi-account system networking and introduces the concept of BNaaS Market Place, which enables users to not only independently create and publish new blockchain networks, but also join existing commercial blockchain networks through MarketPlace.

BNaaS platform provides complete FiMAX blockchain components for users to test FiMAX 3D ZKP and other technological modules online. Users can establish a brand-new consortium and blockchain network, apply an integrated certificate management system, and develop their own applications on FiMAX. After creating a network, users can also market it in MarketPlace.

If users wish to join an existing blockchain network, they can select a business network in MarketPlace that is in line with their business needs. BNaaS also supports rapid on-prem deployment of blockchain nodes.



Application Cases of Ping An Blockchain in the Financial Sector

OneConnect ("the Company"), the world's leading technology service platform covering the whole financial industrial chain, is an associate company of the Ping An Insurance (Group) Company of China, Ltd. ("Ping An Group"). As an important player practicing Ping An Group's "finance + technology" dual-drive strategy, OneConnect leverages AI, blockchain, cloud computing, biometrics and other leading technologies to provide financial institutions including those in banking, insurance, and investment sectors with end-to-end solutions such as smart marketing, products, risk management and operations. So far, OneConnect has successfully implemented blockchain technology in 14 business scenarios, including trade finance, Asset-backed Securities, supply chain finance and reinsurance.

In the scenario of trade finance, OneConnect created a number of international and influential blockchain trade finance networks, thus eliminating trade finance frauds, reducing financial risks and realizing cross-regional global interconnection. In the application scenario of Asset-backed Securities, OneConnect launched the ALFA Smart ABS Platform. By deploying nodes for different participants to synchronize information under crypto-controlled data sharing mechanism, the platform effectively solves the problem of information asymmetry, realizes credit penetration of underlying assets and improves the transaction rate of ABS products. In the scenario of supply chain finance, OneConnect has successfully developed a blockchain-based product EachLink to empower small and medium-sized banks, which is being used by Jiaxing Bank and other banks. OneConnect has also worked with Foton Motor Group to build the "Foton Finance ALL-Link System" to directly address the financing problems faced by upstream and downstream suppliers and dealers with the technological advantages of blockchain, striving to enhance the collaboration of the entire automobile industry chain. In the reinsurance scenario, OneConnect built Genesis reinsurance platform, using blockchain to record the life cycles of insurance assets, so as to realize the division, intelligent matching and delivery of policy shares on the chain and improve the liquidity of reinsurance products.

This chapter will expound on the three most representative application cases.



1. Hong Kong Monetary Authority uses blockchain to build international trade finance network

With the progress of trade globalization, the scale of international trade finance business is continuously expanding. Traditional trade finance business has a low informatization level and complicated business processes, resulting in low overall efficiency. Meanwhile, the data flow between enterprises and between banks are not transparent, generating risks of trade fraud and double financing.

Led by the Hong Kong Monetary Authority, seven (7) international banks in Hong Kong jointly initiated the establishment of eTradeConnect, an international trade finance network, which was designed, developed and deployed by OneConnect. In October 2018, the network was officially inaugurated, with twelve (12) international banks participating in it. The introduction of FIMAX blockchain can effectively address the contradiction between data privacy and data sharing, break down data silos and eliminate trade fraud. Meanwhile, with the leading 3D zero-knowledge proof technology, banks can verify the encrypted financing information, greatly reducing the risk of double financing. Besides, the information digitalization and process automation brought by the blockchain system can significantly improve process efficiency, and in the long run will be more conducive to increasing the success rate of financing and reducing the cost of financing.

The network is not a mere "platform", but a network built by linking each small trade finance platform of participants with blockchain technology. The network effect formed by the less centralized network can solve the problem that a single platform has where it cannot attract players of the same size to join.

In addition, the eTradeConnect network is not only limited to Hong Kong. Following an MoU signed with we.trade, a European trade finance network covering 14 European countries, they will jointly build an Asia-Europe economic and trade digital corridor to create a healthy, shared and risk-controllable global trade ecosystem.

2. Tianjin Port implements blockchain-based verification pilot project

There are many participants in cross-border trade and they span different jurisdictions, resulting in fragmented data and difficulties in verification. Regulatory agencies and financial institutions are unable to effectively verify the trade background and they rely too much on the materials submitted by the applicants, which brings audit risks; enterprises are facing the problem of high transaction costs due to high communication costs and inefficient process coordination with all parties.

Under the guidance of the "Invigorating the Customs Through Science and Technology" strategy of the General Administration of Customs of China, Ping An OneConnect has established the Tianjin Port Blockchain-based Verification Pilot Project, helping the customs and all participants in cross-border trade to achieve the goal of "Two Improvements and Two Controls"⁴. The network was officially inaugurated in April 2019, becoming the first blockchain-based cross-border trade service network in China.

Tianjin Port Blockchain-based Verification Pilot Project built a blockchain-based network linking all participants using FiMAX advanced cryptographic solution to realize data sharing under the premise of privacy protection, and thus breaks down the data silos in cross-border trade. Using 3D ZKP technology, the system can cross-check encrypted source data and generate important documents in customs clearance according to the verified information, thus reducing the operating costs and risks of all parties and constituting the infrastructure for trade facilitation.

Data connection and inter-verification can improve the authenticity and credibility of trade. Regulatory agencies can carry out risk stratification and differentiated treatment of import and export business according to information on blockchain, thus improving regulatory accuracy and examination efficiency. Financial institutions can also obtain credible data from multiple sources to better assess and control risks. For all kinds of quality enterprises, they can enjoy better customs clearance services and financial services, as well as enhance the business coordination of the whole process and achieve cost reduction and revenue increase.

3. Internet Finance Association of Small and Medium-sized Banks (IFAB) establishes IFAB trade finance network

As the world economy is recovering, China's trade finance sector is also expanding rapidly. The combined amount of accounts receivable, inventories and prepayments has totaled nearly 110 trillion yuan, but the huge financial potential has not been fully tapped into. Enterprises are facing difficulties in financing and low turnover efficiency in the supply chain. Over 40% of SMEs are facing difficulties in financing; their financing cost is 1.5-2 times that of large enterprises, and the financing shortage is nearly 12 trillion yuan. Small and medium-sized banks are also facing difficulties in risk control and finding quality enterprises.

In order to address the pain points of various participants in trade finance, OneConnect has drawn on its successful experience in the Hong Kong Monetary Authority and Tianjin Port projects, and worked with Internet Finance Association of Small and Medium-sized Banks (IFAB) to establish the blockchain-based IFAB trade finance network, which was launched in March 2019. IFAB trade finance network links up banks and small and medium-sized enterprises, aiming to help enterprises and banks to better carry out trade finance business through blockchain technology. As shown in the figure, the bank's own corporate customers can access IFAB network through the client-end of its corresponding Bank/Enterprise system. The corporate clients belong to the bank and are not shared among banks. New business users of IFAB trade finance network can access the network after enterprise authentication through MarketPlace. IFAB network can automatically help them match suitable banks according to their business characteristics and conditions, providing accurate financing push service to help them obtain better financing experience. Banks can also acquire customers in an efficient manner.

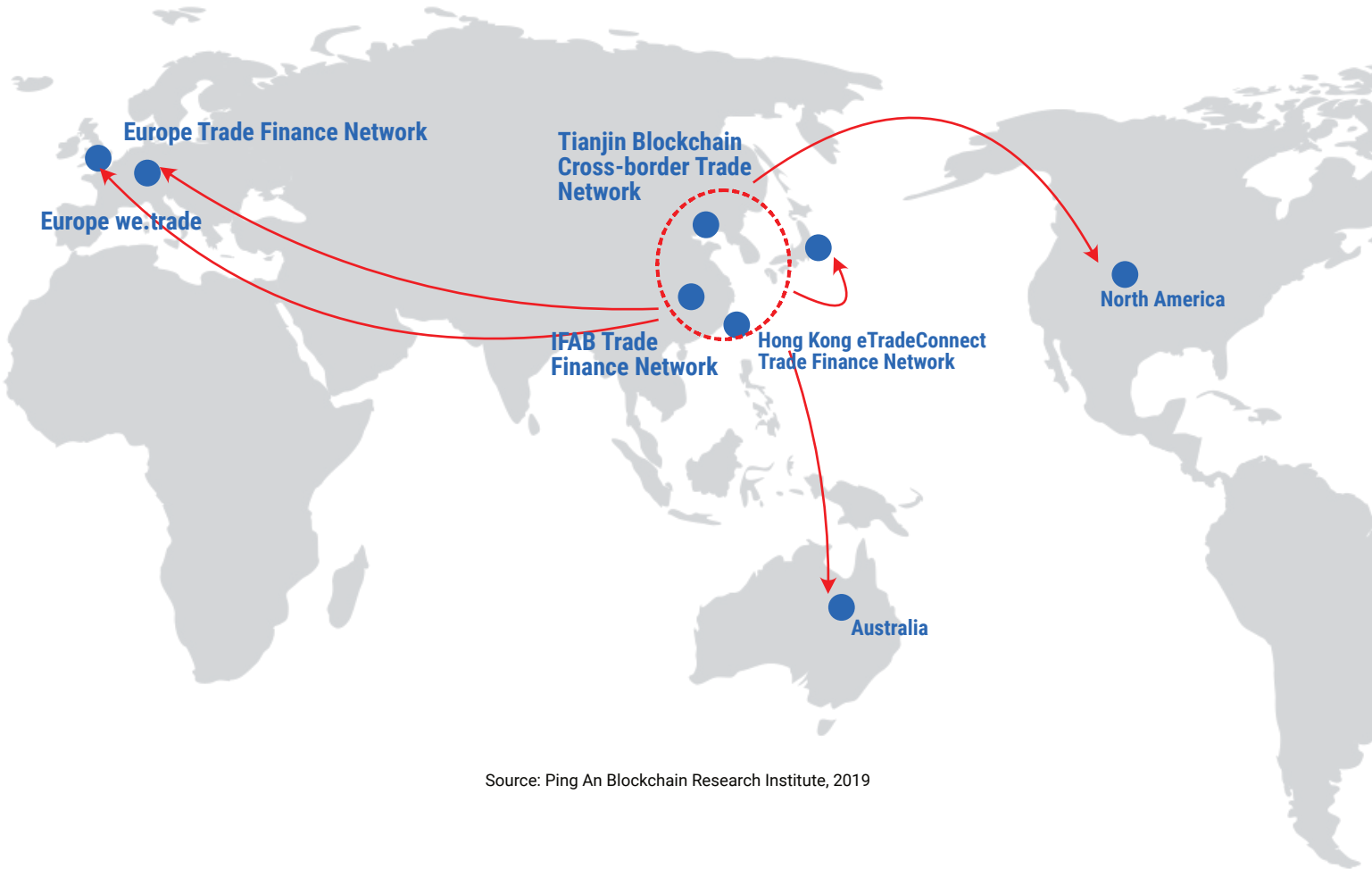
Figure 5 IFAB Trade Finance Network



IFAB network is built on the fully encrypted FiMAX architecture. All data are encrypted and then uploaded by the owners (banks or enterprises) to eliminate the risk of data disclosure. For each trade in the network, both parties of the transaction can jointly verify relevant information on the chain through crypto-controlled data sharing technology to ensure the authenticity of trade data. This not only provides effective vouchers for subsequent financing of enterprises, but also helps banks identify trade fraud and reduce risks. The system uses FiMAX's 3D zero-knowledge proof technology to enable banks to conduct over-financing verification on financing requests initiated against trade documents under full encryption of data, thus effectively preventing over-financing risks. IFAB trade finance network can improve financing efficiency and reduce financial risks, while ensuring the independence and privacy of user data to the greatest extent. In the blueprint of IFAB trade finance network construction, it plans to seamlessly integrate with the Asset-backed Securities (ABS) platform, so that the life cycle of original assets from generation, packaging to securitization is recorded on the blockchain, ensuring the authenticity and traceability of records, realizing the penetration of underlying credit assets, enabling banks to recover funds efficiently and at a low cost while reaping new business growth. It also enables enterprises to raise funds in a faster and more convenient manner and enhance overall competitiveness.

It is reasonable to assume that the three blockchain networks mentioned above, based on the same underlying framework, will interconnect with each other and gradually attract more networks and participants to join. In this way, data on the chain can span more sectors and regions and realize the integration of business flow, goods flow and capital flow. Diversified blockchain data will provide more comprehensive information sources and enable data cross-checking of more dimensions for chain-based business, further enhancing the value of blockchain application, and forming a large and self-improving blockchain ecosystem where participants' privacy and benefits are guaranteed.

Figure 6 Outlook: Global Blockchain Ecosystem



Source: Ping An Blockchain Research Institute, 2019

Recommendations for Action

IDC believes that we are in the early stage of blockchain-based industrial change. As more enterprises increase their investment in this technology and achieve the sharing and transparency of data and transaction records, the potential of blockchain can be further realized.

- **Recommendation 1: Clarifying the blockchain development strategy.** In the digital economy, the blockchain will greatly enhance the existing process, cut costs and reduce risks, help enterprises develop new services and improve capital mobility. Enterprises are advised to invest and participate in the application of blockchain technology as soon as possible, in order to establish their own blockchain development strategies. Small companies should track emerging technologies, learning about them and putting them into practice. Sector giants should actively make explorations and innovations, integrate industrial resources, and spearhead in the implementation of blockchain projects to gain competitive advantages in the new era.
- **Recommendation 2: Exploring blockchain application scenarios.** Overall, China's blockchain market is still in a very early development stage, with a small market scale. Most blockchain applications are still in the trial stage. Problems such as low transaction efficiency, insufficient demand for scenarios and single business model are commonly seen. More application scenarios have yet to be explored. All enterprises should strengthen their understanding of the technological capabilities of the business blockchain in target sectors, match them with business needs, and actively explore suitable blockchain application scenarios with their partners.
- **Recommendation 3: Selecting appropriate technological solutions and partners.** As a new technology, blockchain is in the explosive stage of innovation. Many new technologies and schemes have emerged at the adoption layer, service layer, protocol layer and infrastructure layer. Enterprises and organizations should clarify their requirements around performance, security, interoperability and other aspects of blockchain system, fully evaluate the advantages and disadvantages of various technological solutions, and select appropriate technological routes and partners in line with their own strengths and characteristics, so as to give full play to the value of blockchain.
- **Recommendation 4: Leveraging the power of ecosystems.** In the face of emerging technologies, ecosystems are as important as core intellectual property rights. Compared with other countries, the ecological characteristics of China's market are more obvious. The government, sector users and consumers are all important contributors to a digital ecosystem, bringing important stimulus into the ecosystem. All enterprises should pay full attention to this power and explore the application cases and business models of blockchain by forming strategic consensus, making contingency plans and conducting pilot projects, in order to realize the large-scale mature system development with blockchain.

About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications, and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

About PingAn Blockchain Research Institute

PingAn Blockchain Research Institute is established by PingAn Group and its subsidiary OneConnect in collaboration with Shanghai Jiao Tong University and Tsinghua University for the purpose of integrating the best resources of the industry, including "production, academia and research". Through the research and development of blockchain technology, it aims to help the industry establish technical standards, promote the application and exploration of blockchain in various industries, and attract the participation of high-quality enterprises, universities and industry associations by creating an ecosystem with the self-cultivation function in the blockchain industry, thus realizing the instant matching of "production, academic and research" resources on the basis of building the PingAn Blockchain brand.

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