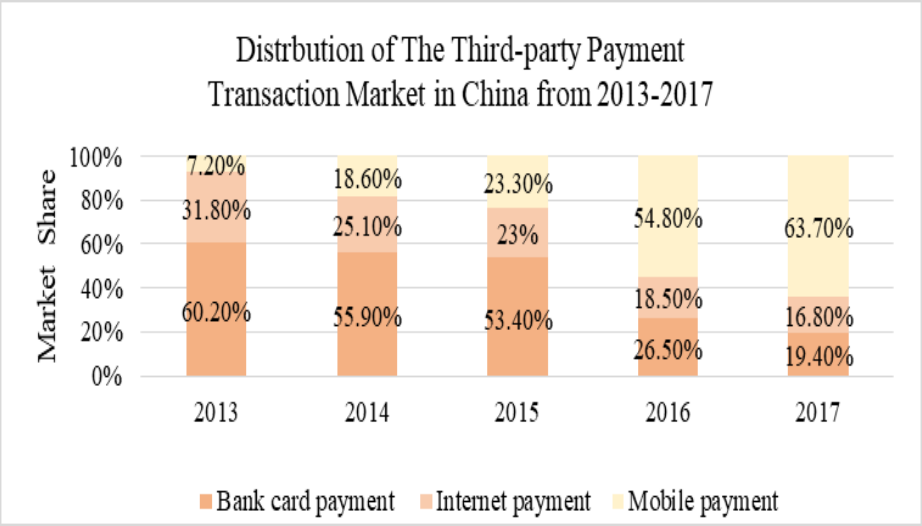
Chapter 2 Literature Review

2.1 Third-party Payment

Third-party payment (also call mobile payment) is based on the evolution of technologies such as internet technology, communication technology, biometric technology, and block chain (Eduardo Castelló Ferrer, 2017). China's third-party payment specifically refers to a third-party independent organization that has certain strength and credit guarantee. Generally, it provides a new payment model by means of cooperation with banks, providing transaction support tools and platforms, and realizing the transfer of funds. At present, the main medium for third-party payment is Internet-based payment and mobile-phone-based payment (Financial Action Task Force [FATF], 2013), as well as the relatively small volume of prepaid card payment and bank card business and the payment method is mainly based on scanning the QR code and NFC near-field payment, and biometric identification technology (face recognition, fingerprint identification, and iris recognition technologies.)

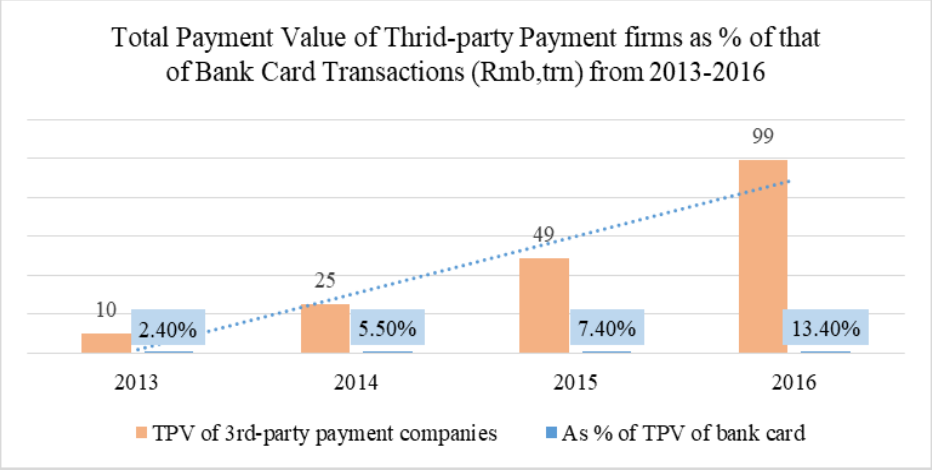
The Chart 1 below shows the distribution of China's third-party payment transaction market from 2013 to 2016 with an estimate for 2017, Chart 2 indicates total payment value (TPV) of third-party payment firms as percent of bank card transaction from 2013 to 2016. As of 2016, 54.8% of third-party payment transaction in China via mobile payment and total payment value (TPV) of third-party payment firms was 13.4% of that of bank card transactions.

Chart 1



Source: PBOC, WIND, iResearch

Chart 2

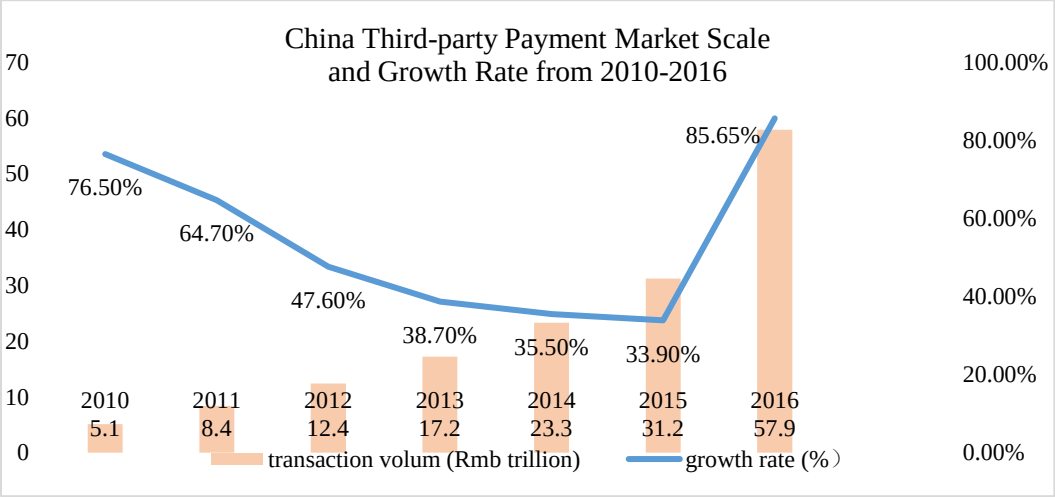


Source: PBOC, WIND, Goldman Sachs Global Investment Research

Chart 3 shows that from 2010 to 2011, China's third-party payment market has grown at an annual rate of more than 50% and has become a global leader. In 2013, third-party transactions successfully exceeded the base of 17 trillion yuan, reaching 17.2 trillion yuan, an increase of 38.71% year-on-year. In 2014, with the rapid growth of both mobile payment and online payment, China's

third-party payment transaction volume reached 23.3 trillion yuan, however, the growth rate has continue to decline. The total value of third-party payment in 2016 was 57.9 trillion yuan, an increase of 85.6%. The scale of mobile payment transactions was 38.6 trillion yuan, which was about 50 times that of the United States.

Chart 3



Source: Payment and Clearing Association of China

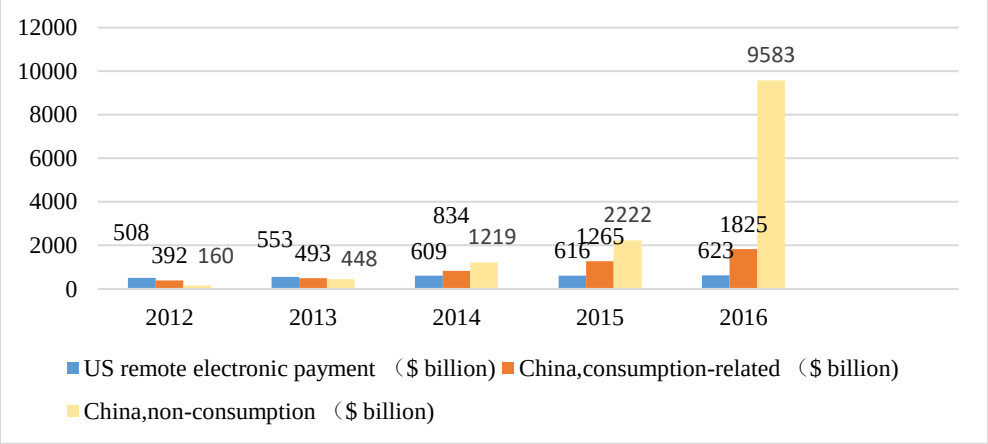
Mobile devices almost completely conquered the internet landscape in China. According to the China Internet Network Information Center (CNNIC) Data disclosure Statement, in 2016, 95.1% of Chinese Internet users access the Internet by using mobile devices.

In contrast, as the origin of Fintech, the development of US Fintech industry started relatively early, however, it has not really become a scale and mainly focus on a few scattered areas. 80% of e-commerce transactions in the United States today require payment through a computer terminal. At 2016, the amount of mobile payment in China has reached 70 times the size of the US counterpart, and consumption-related payments exceeded 8 times the size of American peers. China's third-party payment has expanded more than 74 times during the six years between 2010 and 2016. By 2016, the total payment value of third-party payment realized 11.4 trillion US dollars,

which third-party mobile payment accounted 75% of TPV, 16% came from consumer-related businesses and 56%from peer-to-peer (peer-to-peer) transfers.

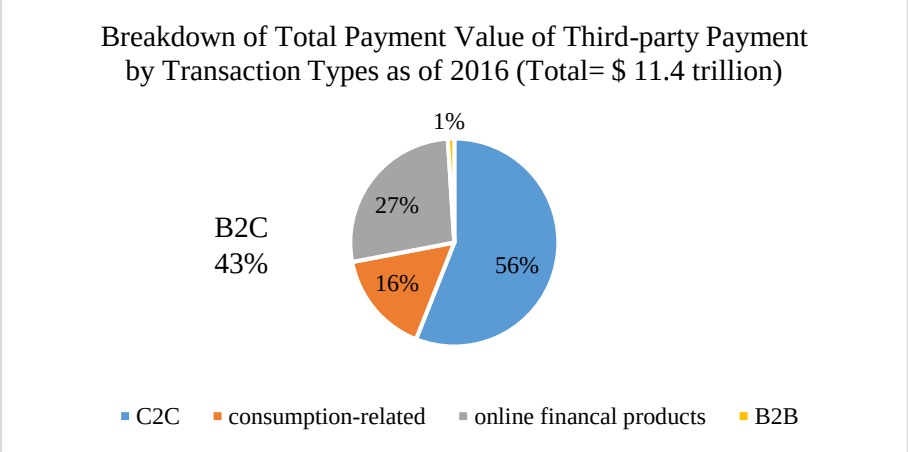
Chart 4

Total Payment Value of Third-party Payment China vs US from 2012-2016



Source: iResearch, Goldman Scans Global Investment Research

Chart 5



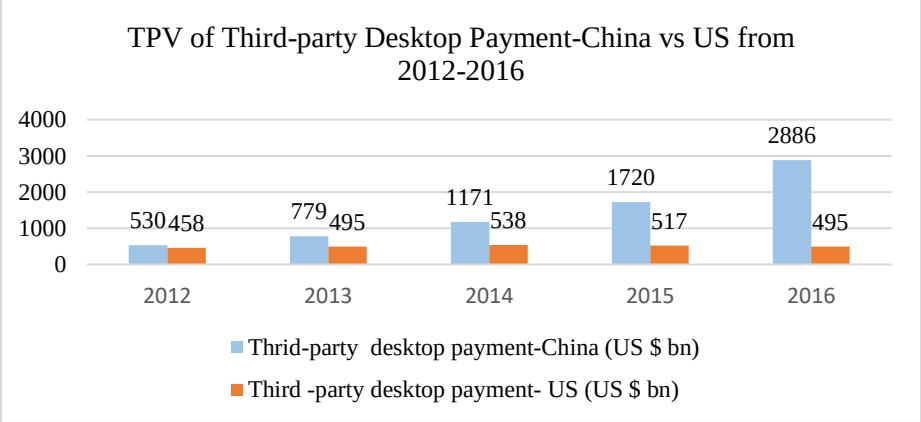
Source: iResearch, Nilson Report, Goldman Scans Global Investment Research

Note: no directly comparable data in the US, the remote payment data used from the Nilson Report

Third-party payment, especially third-party mobile payment, is one of the most prominent areas of China's Fintech. Results show on the Chart 4, the third party payment of third-party payment (via desktop and mobile payments) in China in 2016 to $11.4 trillion, while in the United States was $623 billion (in this article, the exchange rate USD/RMB = 6.9 flats in May, 2017). According to the results show on Chart 5, a great part of China payment value was P2P (C2C) transferred with fewer service charges, while the US $ 623 billion payment value may be mostly commercial rather than C2C,. However, even if only look at the consumption-related transaction, the value still large, reaching a new high of $155 billion in 2010 to $1825 billion in 2016 in China.

Chart 6 and Chart 7 shows the TPV of third-party payment through desktop and mobile of the US and China from 2012-2016. The speed and scale of China third-party payment (include third-party desktop payment and mobile payment) is faster than the US, especially third-party mobile payment and the popularity of it far exceeds the US.

Chart 6

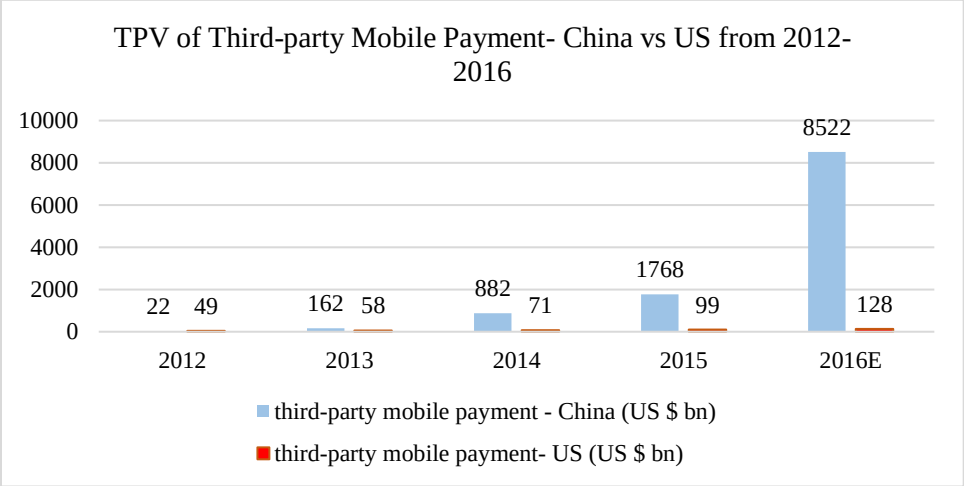


Source: Nilson Report, ComScore State of the US Online Retail Economy

Note: 1: The desktop TVP of the US was estimated based on the desktop payment mix in e-commerce.

2: The TVP of China was actual number. The breakdown was estimated based on iResearch

Chart 7



Source: iResearch, Nilson Report, ComScore State of the US Online Retail Economy.

Note: 1: The mobile TVP of the US was estimated based on the mobile payment mix in e-commerce.

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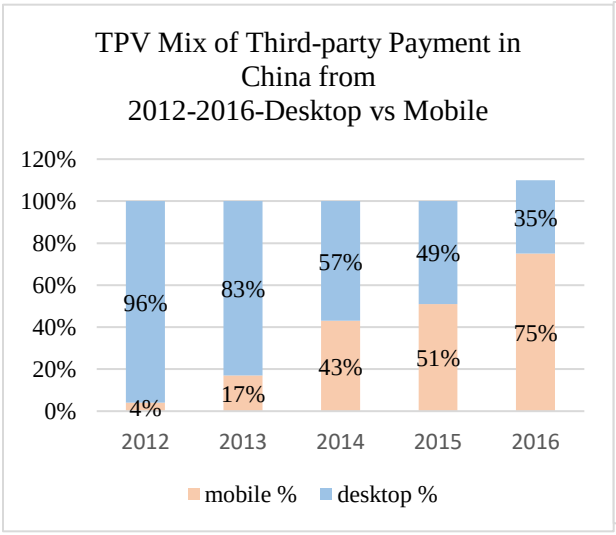
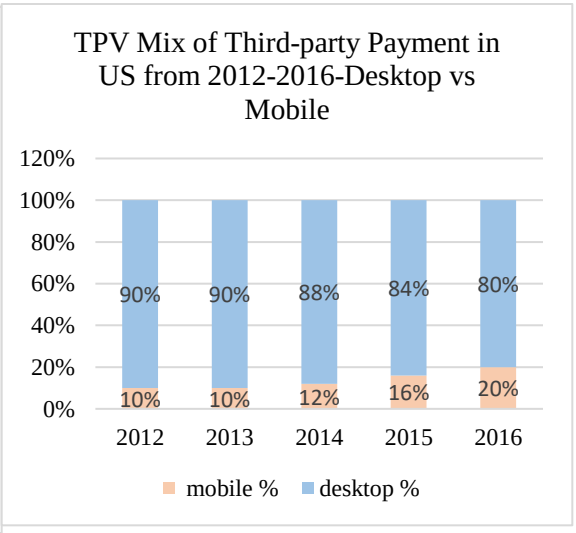
Chart 8



Source: iResearch

Chart 9



Source: ComScore State of the US Online Retail Economy

Chart 8 and Chart 9 shows the TPV mix of third-party mix (desktop & mobile) in China and the US from 2012-2016. As of 2016, third-party mobile payment accounted 75% of China total 3rd party payment value while that of US just 20% of the total and the third-party desktop payment accounted 35% of total 3rd party value while that of US was 80%.

US as a Fintech power, the above-mentioned situation in the US mobile payment industry was due to the strong bank card consumption habits and the complex market competitive environment, which hindered the effective development of US mobile payments from both demand and supply (Marianne Crowe, Marc Rysman, & Joanna Stavins, 2010). The inherent payment habits of consumers and merchants were hard to change. For the perfect payment system in the United States, consumers have also developed a strong credit card spending habit (Scott Schuh, Marianne Crowe & Joanna Stavins, 2006). Financial service companies have established strong market barriers in the personal payment sector through bank cards and personal cheque (Robert Weissbourd, 2002). At the same time, the market power of US mobile operators were not enough to promote the payment method based on NFC and other mobile technologies alone (Johannes Sang Un Chae, 2012), and initiated challenges to the traditional bank payment system. As a new form of payment, mobile payment is a difficult process for market penetration (Darin Contini, Marianne Crowe, Cynthia Merritt, Richard Oliver & Steve Mott, 2011).

In the United States, the mobile payment industry has not yet formed a dominant model (Jan Ondrus, Yves Pigneur, 2005). Operators, financial companies, merchants and third-party companies all wanted to control the mobile payment industry chain and share the development dividend of mobile payment (Coresight Research, 2016). In 2011, Google launched the Google Wallet offline NFC payment function in cooperation with Sprint. However, due to the lack of mobile devices and the blocking of rivals such as Verizon, Google Wallet has not been popularized since it was launched in two years, and the download volume was less than 30 million. In October

2012, Verizon, AT&T, and T-Mobile jointly developed their own Isis NFC payment to enter the NFC payment market and compete with Google Wallet.

In addition, NFC mobile payment has faced other forms of payment competition. Based on the huge user base accumulated by the Internet, PayPal remains the leader in mobile payment in North America (Reinhardt Krause, 2017). Squar, which was founded in 2009, has risen rapidly, creating an annual turnover of $6 billion in less than three years. In June 2012, retail terminals were also actively distributing mobile payments. MCX, a retailer alliance including Wal-Mart and Target, was deployed mobile payment business based on QR codes.

2.1.1 Case Analysis: Aliay and Tenpay

Chapter 1 has mentioned that in the China payment industry, “Winner- take- all” mind-set is becoming a trend among Fintech firms. The following analysis, two China payment giants will be taken as an example: Alipay and Tenpay.

Chart 10

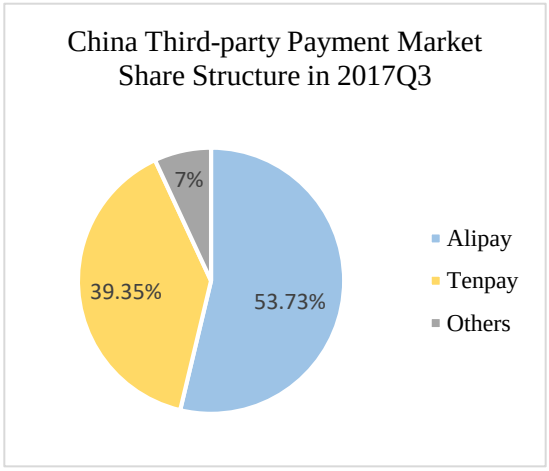


Chart 11

Third-party payment firms	Market share (%)
Epro	0.58%
Union mobile pay	1.04%
Lianlianpay	1.04%
Ping an pay	1.26%
Baidu wallet	0.21%
99bill	0.51%
others	2.28%

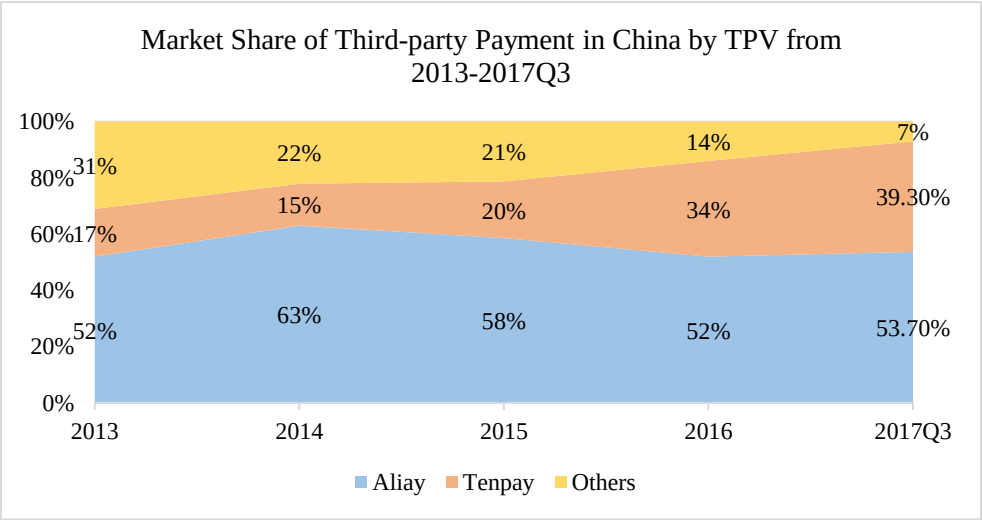
Source: iResearch

Alipay is a branch of ant finance that operates a third-party online payment platform. Alipay is China's largest third-party payment platform, with 520Mn active users every year. According to

a survey of Chinese third party pay markets, data show on the Chart 10 indicated thatAlipay accounted for 53.73% of China Mobile's market share by the third quarter of 2017. In addition to providing payment processing and hosting services for the Alibaba ecosystem, Alipay's mobile payment application is also an important entry point for its users to access Ant's suits, Alibaba and other services provided by its business partners.

Tenpay is a third-party payment platform for Tencent, which provides technical infrastructure support for WeChat Pay and QQ wallet. On December 2016, its mobile payment function has more than 600 million months active users and 600 million daily payment transactions. Tenpay's third-party payment market share was 39.35 % in 2017Q3 according to the data show on Chart 11, second only to Alipay, while the remaining market share occupied by other competitors was only about 7%.

Chart 12



Source: iResearch, Goldman Sachs Global Investment Research

Four years ago, Alipay firmly occupied the position of China’s third-party payment market, however, in 2014, WeChat opened the door to mobile payment through a red packet. In the face of WeChat, which has nearly 1 billion users and a daily average use of 9 hours of uhf APP, Alipay

began to struggle and its market share has declined since that, especially in mobile payment, as Tenpay entered the race, Chart 12 shows the changes of third-party market share from 2013-2017Q3.

2.1.2 Relevant Technologies Applied in Payment Sector

At present, the third-party payment market in China consists of scanning code payment and NFC (Near-Field Payment). Among them, Alipay and WeChat represent the camp of QR code payment. Unionpay and Apple pay represents the NFC payment camp. In the first quarter of 2017, the size of China's scanning code payment market exceeded 580 billion yuan, an increase of 606.8%, by the end of 2017, the payment of QR code was exceed 900 billion yuan market (iResearch, 2017).

As a wireless Communication technology, NFC is short for Near Field Communication. As early as 2006, with the promotion of Nokia, NFC technology has begun experimenting with mobile payment applications in China Yuetao Wu, Weizhou Zhou, 2014). Domestic operators have also begun to try NFC mobile payments. China Mobile has launched an "NFC-SIM card," which non NFC-enabled mobile phones also can implement NFC functionality. However, NFC's biggest development in recent years has undoubtedly come from Apple's support. In 2016, Apple Pay entered the Chinese market for the first time. The combination of NFC technology and Apple's mobile phone supported has enabled many Chinese users to truly experience the convenience of NFC (Tianyu M. Fang, 2018).

Biometrics is the use of computer operational capabilities and biostatistics methods to match the biometric samples to be identified with pre-stored human inherent biometric template to derive similarity value, and realize the purpose of identifying personal identification technology (Radhika V.Bhawani, 2009). It mainly includes fingerprint, face, vein, iris, voice pattern, palm print and other forms of biometric identification technology. Biometrics has been widely used in various fields of public security industry such as population information management, immigration control and criminal investigation (Anil K.Jain, Ajay Kumar, 2010). In recent years, biometrics technology has

also been gradually applied to such areas as customer authentication, remote account opening, and withdrawal without card, face payment, Treasury management and network lending (Jeanne Lee, 2016). The biggest difference between biometric payment and traditional payment is that the biometric payment eliminates the hardware environment such as bank cards, mobile phones, and cash, and directly associates with the account through biometrics (Jyotsana Goyal, 2013). Scanning biometrics directly at the time of payment to match with the biometrics registered in the cloud, and complete the payment after confirming the identity.

In March 2015, executive chairman of Alibaba Group Jack Ma released and demonstrated the face recognition payment authentication technology at the opening ceremony of the CeBIT exhibition in Germany. At the end of the same year, Ant Financial “brush face” certification was officially launched at Alipay and China Merchants Bank. Ant Financial's "brush face" payment was awarded as the top 10 breakthrough Technology in the world by MIT Technology Review in 2017.

In the Alipay ecosystem, users who use face recognition technology to access Alipay account for more than 150 million and the accuracy of biological recognition is 99.9%. In addition, notable achievements have realized in cloud computing and block-chain. The global storage and distribution network of Alibaba hybrid cloud has more than 5,000 CDN nodes, delayed in more than 20 countries and covering six continents. The block chain technology applies to the Alipay treasure donation platform. In the area of artificial intelligence, the intelligent customer service ratio reaches 97.5%, the intelligent problem solving rate was 78%, which was higher than 75% of manual settlement rate and the manual intervention rate of return freight insurance is less than 10% (iReserch, 2017).

2.2 Cloud Computing

Cloud computing is an information technology (IT) paradigm that enables ubiquitous access to shared pools of configurable system resources and higher-level services that can be rapidly provisioned with minimal management effort, often over the Internet. Cloud computing relies on sharing of resources to achieve coherence and economies of scale, similar to a public utility. Cloud computing is a business implementation based on parallel processing, distributed computing and grid computing (Naidila Sadashiv, Dilip Kumar, 2011). The basic principle of its implementation is to divide the functions of computing into different computers so that computing can be completely separated from the local computer or server. In this way, the operation of the cloud computing is very similar to the Internet network, which enables the enterprise to automatically adjust the application according to the demand, and accessing the distributed storage system or computer required by the demand (Fred Waldner, 2010).

In the 20th century, Oracle and amazon came out with prototype products and services for cloud computing. However, cloud Computing was first introduced by Google CEO Eric Schmidt in 2006. Elastic Compute Cloud (EC2) service was introduced by Amazon and widely speeded since March 2006, which eventually became the name that defined the current wave of information technology revolution. After more than a decade of development, cloud computing has gradually moved from the conceptual phase to the practicing stage.

In 2016, 98% of the 29 million global IT workloads was completed through traditional IT and only 2% by the cloud computing (Cisco, 2016). However, by 2016, the global IT workload has increased to 160 million, of which the distribution ratio of traditional IT, public cloud[1], and private cloud[2] has reached 73%, 15%, and 12%. IT Workloads carried on the cloud has accounted for more

[1] Public cloud: Public cloud is the most common way to deploy cloud computing. Public cloud resources (such as servers and storage space) are owned and operated by third-party cloud service providers. These resources are provided through the Internet.
[2] Private cloud: Private cloud refers to the cloud computing resources used by an enterprise or organization.

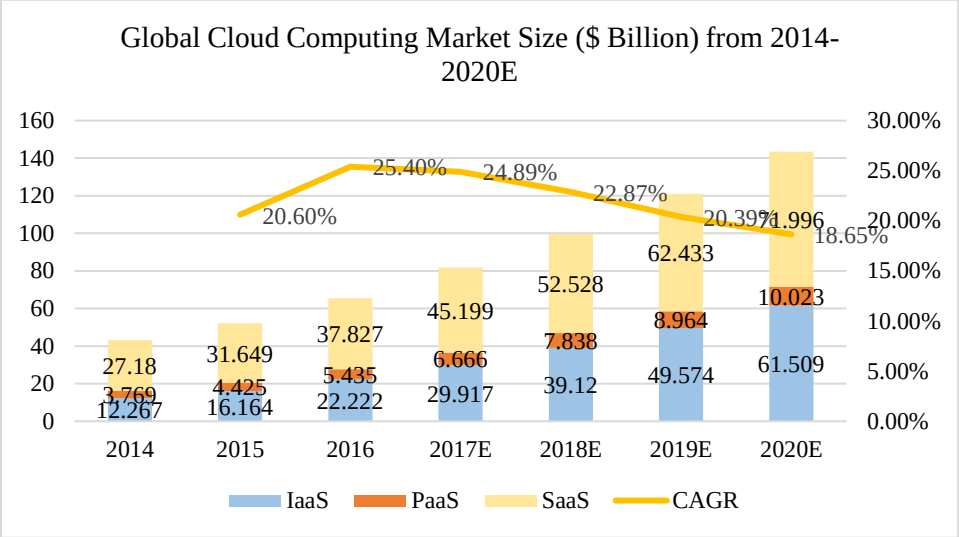
than a quarter of the whole. Cloud services can reduce the IT construction and operating costs of innovative startups of Internet companies and help companies form a sustainable business model, thereby reducing operational risks (Michael Ewens, Ramana Nanda, Matthew Rhodes-Kropf, 2015). According to the statistical data disclosed in a Cloud Computing white book by Ministry of Industry and Information Technology of China (2016), about 2% of the top 500,000 websites in the world use services provided by public cloud service providers, of which 80% of them use Amazon and Rackspace cloud services. More than 90% of new Internet companies in the United States use cloud services.

2.2.1 The Current Development of Cloud Computing

The overall global cloud computing market continues to grow. The Chart 13 below shows the global cloud computing market scale from 2014-2017 with estimate data from 2017-2020. In 2016, the typical cloud service market represented by IaaS[3] , PaaS[4] , and SaaS[5] reached US$65.48 billion, a CAGR[6] of 25.4%, and is expected to reach US$143.53 billion by 2020, with a compound annual growth rate of 21.7%.

[3] IaaS: IaaS refers to infrastructure as a service. Instead of buying hardware, the user rents out the cloud computing provider's infrastructure, deploys its own OS (operation system), and performs its own calculations. The users here are generally commercial organizations and not end consumers. The most famous provider of IaaS is Amazon's AWS
[4] PaaS: PaaS refers to platform as a service. It is a service for software developers, and cloud computing platforms provide hardware, OS, programming languages, development libraries, and deployment tools to help software developers develop software services faster, such as Google's GAE.
[5] SaaS: SaaS refers to software as a service. Instead of installing software, users can use software services, such as Google Docs, with a standard browser.
[6] CAGR: CAGR means compound annual growth rate, refers to the annual growth rate of an investment in a given period.

Chart 13



Source: Gartner

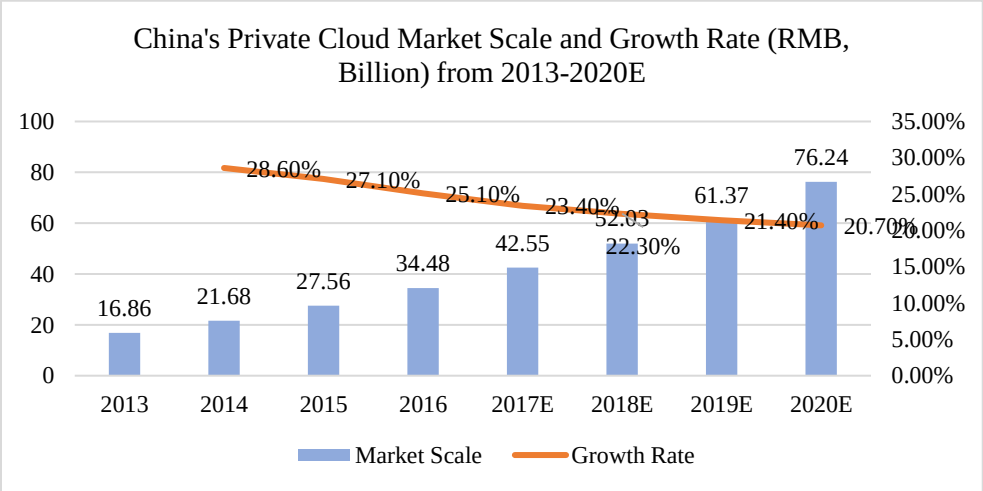
Note: data from 2017-2020 is estimated based on previous market data and carry out fine tune.

The United States occupies a solid leadership position in the global cloud computing market (Luca Millefanti, 2016). As the "first mover" of cloud computing, North America still occupies a leading position in the market (Suresh Siva Ram Malladi, 2014). In 2016, the US cloud computing market accounted for 54.1% of the global market share, with a growth rate of 19.8%. It is expected to continue to grow at a rate of over 15% in the next few years. From the perspective of service providers, Amazon’s AWS revenue reached USD 12.2 billion in 2016, a growth rate of over 54%, which data center located in the United States, Europe, Brazil, Singapore, Japan, and Australia, serving 190 countries and regions worldwide. Microsoft as an “attacker” of cloud computing, Azure cloud services growth rate during the same period increased by 93%, 1.7 times that of the AWS cloud services. At the same time, Microsoft's huge investment in cloud computing data centers has enabled Microsoft to have 38 data centers worldwide (CAICT, 2017).

-Development of China's cloud computing market.

China's cloud computing market generally maintains a high growth trend. The overall market size of cloud computing in China reached 514.9 billion yuan, and the overall growth rate was 35.9% in 2016, higher than the global average. Among them, the private cloud market was 34.48 billion yuan, with an annual growth rate of 25.1% (Chart 14). According to China Cloud Computing White Paper (2016), it was expected that the growth rate would still reach 23.4% in 2017, and the market size would reach about 42.5 billion RMB.

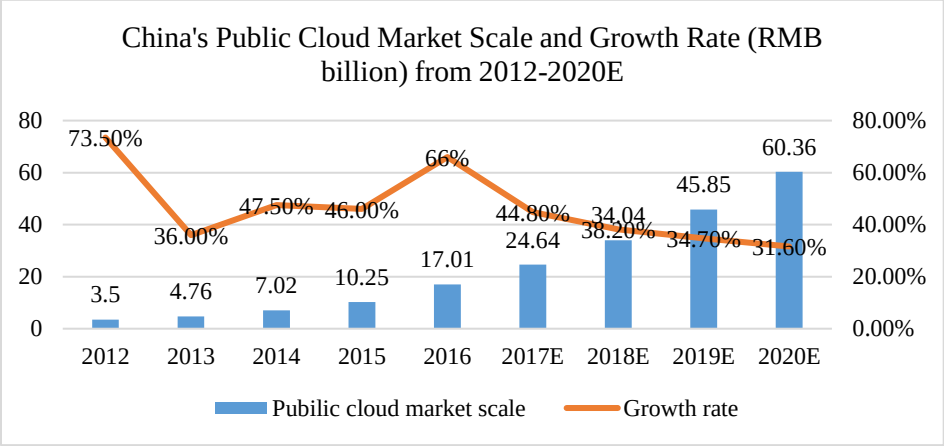
Chart 14



Source: China Academy of Information and Communication Technology.

In 2016, the overall scale of China's public cloud service market was approximately RMB 17.01 billion, a 66.0% increase from 2015 (Chart 15). It is expected that the public cloud market in China will maintain rapid growth from 2017 to 2020, and the market size will reach RMB 60.36 billion by 2020 based on the market valuation forecast 2016.

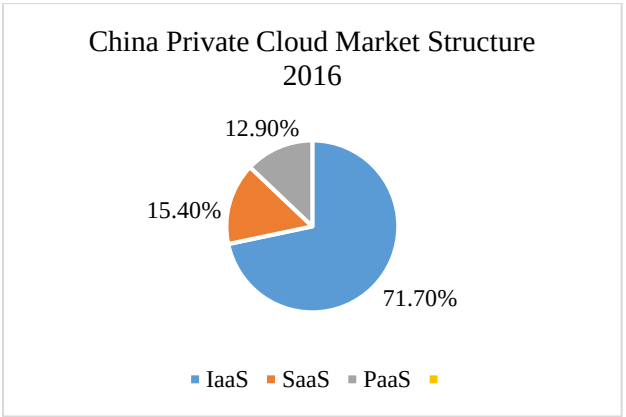
Chart 15



Source: China Academy of Information and Communication Technology.

The IaaS (hardware market) was still dominant in China's private cloud market (Leigh Ann Ragland, Joseph McReynolds, Matthew Southerland &James Mulvenon, 2013). Results show on the Chart 16 indicate that the hardware market in the private cloud market was RMB 24.72 billion, accounting for 71.7%, the SaaS (software market) was 5.31 RMB billion, and the PaaS (service market) was RMB 4.45 billion, occupied 15.4% and 12.9% of market share respectively in 2016 (Chart 16).

Chart 16



Source: China Academy of Information and Communication Technology.

According to the survey results by CAICT (2018), a large increase in the proportion of enterprises deploying private clouds in the form of separate procurement software and services, open source software (OSS[7]) is chosen by enterprises to deploy their private clouds more than 80% (Agatha Poon, 2013). OpenStack[8] has become the mainstream cloud resource management platform, and stronger security has become the most important reason for companies to use private cloud (Rob Shiveley, Krish Raghuram, 2015). The main application scenario on private cloud is enterprise internal IT system (David Linthicum, 2010). The obvious effects of enterprise deployment on private cloud include the improvement of IT operation efficiency, the reduction of IT cost and the reduction of IT operation and maintenance workload (Norman Dee, 2017).Those factors will further increase investment in the private cloud sector.

2.2.2 The Value of Cloud Computing in the Financial Sector

- Effectively reduce the IT cost of financial institutions.

Indeed, one of the benefits of the cloud, especially in the short term, is lower costs (Accenture, 2010). In terms of performance, cloud computing virtualizes physical IT equipment in an IT capability resource pool through virtualization technology and to meet the needs of financial institutions for computing power and storage with the ability of the entire resource pool (Sudhakar. K, Vinay Kumar.G, Sudha Rani. L, 2014). Through the cloud operating system, load balancing of IT equipment can be achieved (Minakshi Berwal, Chander Kant, 2015), the use efficiency of the unit IT equipment can be improved, and the cost of the unit information can be reduced. As a result, cloud computing architecture is far more cost-effective than the traditional financial architecture of mainframes and minicomputers as infrastructure. Accenture, for example, estimates its own IT

[7] Open source software is a kind of computer software whose source code can be accessed arbitrarily. The copyright holder of such software retains part of the rights under the software agreement and allows users to learn, modify and enhance the quality of the software.

[8] OpenStack is a free and open-source software platform for cloud computing initiated by NASA and Rackspace, mostly deployed as infrastructure-as-a-service, whereby virtual servers and other resources are made available to customers.

organization could save up to 50 percent of its hosting costs annually by transferring most of its applications to infrastructure clouds (Accenture, 2010).

-Increase speed and agility

Ecosystem connectivity is another business enabler powered by cloud computing. Using cloud services, it is easier to collaborate with partners and customers, which can lead to improvements in productivity and increased innovation. Cloud-based platforms can bring together disparate groups of people who can collaborate and share resources, information and processes. The ability to respond to rapidly changing customer needs is a key competitive differentiator. Like companies in other industries, banks are continuously seeking ways to improve their agility and adjust to market demands. By enabling businesses to rapidly adjust processes, products and services to meet the changing needs of the market, cloud computing can facilitate rapid prototyping and innovation, which helps speed time to market. (Bruce Berriman, Ewa Deelman, Gideon Juve, Mats Rynge, &Jens-S. Vöckler. 2012).

-Top guessing capacity

Cloud computing eliminates speculation about the capacity of infrastructure for financial institutions (Kathleen Jungck, Syed (Shawon) M. Rahman, 2011). When financial companies make decisions before they deploy their applications, they usually take into account the price of new resources and the capacity to handle them. With cloud computing, these problems disappear, such as processing capacity, financial institutions can access the capacity as much or as little as they want, and they can scale and shrink proportionally in just a few minutes.

- Higher degree of automatically operation and maintenance

At present, all the mainstream cloud computing operating systems is equipped with monitoring modules. The cloud computing operating system manages the servers, storage and

network devices within the financial enterprise through a unified platform (Michael Hogan, Fang Liu, Annie Sokol & Jin Tong, 2011). Though the centralized management and control of the equipment can significantly improve the management ability of the enterprise to manage IT equipment and realize lean management. In addition, the tag technology can accurately locate the failure of the physical equipment. The troubleshooting can be realized quickly through equipment field replaceable. On the contrary, financial enterprises cannot maintain by themselves in case of equipment failure under traditional financial architecture.

2.2.3 Cloud Computing Applied in China's Financial Industry

Fintech itself is a dynamic combination of financial services and technology sector advantages, with emphasis on the technology-focused start-ups and emerging market participants which have innovated the products and services currently provided by the traditional financial services industry. China is one of the fastest growing markets for cloud computing in the world and has expanded into many areas such as manufacturing, finance, government affairs, medical care, and education (CAICT, 2017). At present, China's traditional financial institutions use cloud computing technology mainly adopts two deployment models: private cloud and industry cloud. However, the acceptance of public cloud relatively lags behind that of other industries, which is closely related to the highly regulated financial sector.

The private cloud deployed by financial institutions is mainly used for storing and running core business systems, and stores important sensitive data (Bogdan Nedelcu, Madalina-Elena Stefanet, Ioan Florentin Tamasescu, Smaranda Elena Tintoiu, Alin Vezeanu, 2015). Financial cloud deployments are generally constructed by purchasing hardware products, infrastructures, and solutions. In the process of using, the outsourcing operation, maintenance, or automatic operation and maintenance are implemented. The deployment of industrial clouds by financial institutions is mainly through cooperation among financial institutions in the field of infrastructure, and through the sharing of resources, a number of technical public services such as public infrastructure, public

interfaces, and public applications are formed in the financial industry (Sharma Archana, 2012). The industry cloud deployed by financial intuitions is mainly used for data processing and services for external customers of financial institutions, or provides resource sharing services for financial institutions and their vertical institutions in certain regions.

Large financial institutions with strong technical strength and economic base try to launch a new IT system by deploying private clouds, transforming themselves from a traditional centralized IT architecture to a distributed cloud computing architecture (Hrishikesh (Rishi) Trivedi, 2013). Due to relatively weak technological capabilities, small and medium-sized financial institutions generally prefer to choose an industry cloud service platform (Katharina Candel Haug, Tobias Kretschmer &Thomas Strobel, 2016).

At present, the use of cloud computing technology by financial institutions usually adopts an implementation path that starts from the peripheral system and gradually migrates. Nonfinancial assistance business systems have a low level of security, and system problems do not lead to significant business risks. Financial institutions generally try to apply the related cloud services to the auxiliary systems such as channel system, customer marketing system and operation management (Mircea Georgescu, Victor Jeflea, 2013). In this way, the flexibility of system management is improved, and the operating cost is reduced, and the relevant user experience is greatly improve.

2.2.4 Cloud Computing Application Case in China's Financial Industry

In 2009, Alibaba set up its cloud sector, known as Ali Cloud, to solve the problem of cloud services not allowed to be provided by foreign cloud providers by in mainland China. As a start-up for cloud providers, China's manufacturers and retail giants have almost been driven by it, shifting to the Ali Cloud.

The development of “Ali Financial Cloud” is part of the sustainable development of Ant Financial Services. Ant Financial apparently needs to have a future-oriented core banking system, thereby, they apply for MyBank license to develop its core banking system by itself instead of looking for external suppliers. After that, Ali Finance has decided to sell its cloud-based solutions to other banks. At present, more than 40 companies applying the Ali Financial cloud, which includes banks, payment providers, and even peer-to-peer platforms.

Ali Financial Cloud advocates reducing costs and increasing flexibility. Ali Finance has its own risk management system, digital customer relationship. Compared with other financial companies, it has almost everything, and the cost is lower, is a complete ecological chain. Ali Financing Cloud can also be used to make up the final gap, and "solve" the financial containment problem, which has been China's efforts for decades. Clearly, cloud computing is a relentless technology.

2.3 Big Data

Big data is a term applied to data sets whose size or type is beyond the ability of traditional relational databases to capture, manage, and process the data with low-latency. And it has one or more of the following characteristics – high volume, high velocity, or high variety. Big data comes from sensors, devices, video/audio, networks, log files, transactional applications, web, and social media - much of it generated in real time and in a very large scale. Big data is larger, more complex data sets, especially from new data sources. These data sets are so voluminous that traditional data processing software just can’t manage them. However, these massive volumes of data can be used to address business problems you wouldn’t have been able to tackle before (Oracle, n.d.).

With the explosive growth of global production data, the traditional data processing technology has been unable to cope with new challenges, the development of the information processing technology to make data value can be better mining and utilization. As a trend of

emerging technologies, big data have rapidly developed in all areas of the world (Hsinchun Chen, Roger H. L. Chiang & Veda C. Storey, 2012). Its core ideas are mainly two points: more extensive and in-depth digitization, and interconnection and interoperability of data within the entire society. "More extensive and in-depth digitalization" is not equivalent to the electronic paper document in the traditional sense. It refers to the habits, strategies, and models for companies to use data to guide business in the era of big data and a kind of decision-making thinking and process. The final result is to drive the enterprise to improve the innovation ability and enhance the efficiency of enterprise production, and competitiveness. "Interconnection and interoperability of data within the entire society" means that enterprises now facing is not only the internal data interconnection problems but data interconnection issues across the entire society.

2.3.1 The Application Value of Big Data in Finance

-Improve decision-making efficiency

Big data analysis can help financial institutions achieve the fact - centered business approach (CAICT, 2018b). Based on big data, financial institutions are gradually transitioning from static phenomena analysis and forecasting to making dynamic decision-making suggestions aim at different scenarios to respond more accurately to market changes.

-Strengthen data asset management ability

The large use of traditional databases by financial institutions leads to higher costs and insufficient analytical capacity for structured data storage (Frank Hayes, Mark Sykes, Puneet Suppal &Marc Linster, 2016). Through the construction of the big data underlying platform, it is possible to replace traditional databases in some scenes, and to achieve multi-source data storage analyzing of texts, pictures, videos, effectively improving the ability of financial structure data asset management (Amazon, 2018).

-Realize accurate marketing services

Under the impact of the Internet financial model, the operation mode of the whole financial industry faces restructuring, industry competition is intensifying, and the demand for data-based refined operations and product innovation is increasingly pressing. Financial institutions can better identify customers' needs, create better customer experiences and enhance comprehensive competitiveness by utilizing of big data.

-Enhance the ability of risk control management.

Big data technology can help financial institutions conduct a full-scale analysis of customer-related information, identify suspicious information and illegal operations, strengthen the ability to predict and prevent risks, lead to more efficient and reliable risk management under the condition of using less risk control personnel (Amazon, 2018).

2.3.2 Characteristic of Financial Big Data

The business of financial institutions requires that big data platforms have the capabilities to calculate in real time. At present, the most commonly used big data application scenarios in financial institutions require real-time computing support for precision marketing, real-time risk control, trade warning and anti-fraud services (Oracle.2015). The big data analysis platform can cover existing customers and some high-quality potential customers of financial companies, and carry out portrait and real-time dynamic monitoring of customers to build active, efficient and intelligent marketing and risk management control systems (Oracle.2015).

To achieve the data-driven, technology platform needs to be customized by financial enterprises. First of all, financial companies should conduct top-level design[9], combine technology and business, and apply technology to every scene of the company's value chain. Secondly, financial

[9]Top-level design: Its original meaning in engineering is to consider the various levels and elements of the project as a whole, to govern the overall situation, and to seek solutions at the highest level.

firms need an overhaul of the financial system. In order to achieve the convergence of data, it is necessary to integrate the data originally stored in hundreds of information systems, redesign and build an architecture for data collection, storage, and transmission. Finally, financial big data need more perfect security measures. Leakage and tampering of financial data may cause systemic financial risks and even endanger social stability. (Xiao Liang, 2016). Partial data such as user authentication and payment authorization information for financial transactions requires full process encryption.

2.3.3 Subversive Changes in the Financial Industry Driven by Big Data

The financial industry itself does not have similar physical production and logistics processes, which is itself a collection of data production, processing, warehousing and transmission. Whether it is a commercial bank, a securities company or an insurance company, their business trading system operates a huge amount of transaction data every day (Daniel. D. Gutierrez, n.d.). Not only that, there is a huge amount of historical data behind each individual as a support for analysis and decision-making. Therefore, for the financial industry, the influence exerted by big data cannot be ignored.

The changes brought by big data to the financial industry are reflected in the following two aspects: 1) Precision marketing: big data changes the information structure, and financial institutions introduce more individualized services through the collection and analysis of customer data. 2) Risk Management: Big Data changes the risk management model, and cloud computing promotes the most accurate and lowest-cost risk measurement. This also means a further improvement of operational efficiency and performance.

Driven by big data, the future financial industry will further shift from "extensive management" to "delicacy management", from "profit-centered" to "customer-centric" transformation, and from "mortgage culture" to "comprehensive risk management system". At the

same time, the development of big data will also promote the continuous emergence of various new businesses such as internet finance and mobile finance. Many technology-led Internet start-up companies will also participate in the finance industry to share the gluttonous feast of big data.

2.3.4 The Application Cases of Big Data in the Financial Field

Case: Risk Control of Ali Finance under Big Data Era

In recent years, Chinese internet companies have begun to enter the financial industry on a large scale. “Internet finance” has become a hot topic in major media reports. Among the emergence of Internet finance companies, Alibaba Group’s Alibaba Finance is the most compelling one. From Alipay to Ali Micro-Finance, to Yu Eao, which is popular among the people, Ali Financial has gradually touched the traditional financial sector and made traditional commercial banks feel the crisis. However, Ali Finance can reach a strong position today depends on its strong platform foundation and the support of big data. Alibaba always focuses on the e-commerce platform and continuously expands new businesses, which in turn strengthens the consolidation of the core value of the platform. With the development of the platform, the scale of customers and user agglutinant has increased, and its business innovation and outward expansion capabilities have been further improved. In July 2012, Tmall and Alibaba Cloud and Wannet jointly launched the “Cloud.tmall.com” to provide data cloud services for Tmall, Taobao, e-commerce and e-commerce service providers. Whether it is C2C's Taobao, or B2C's Tmall, or B2B's Alibaba, it has brought a very large number of potential customers and massive customer transaction data. It is on the basis of this massive amount of data that Alibaba has been able to sublimate its financial services with big data.

Through the support of the platform and big data, Ali Finance can easily understand the information and credit situations of loan customers and effectively control risks. In the data analysis model, Ali Financial will fine-tune various weights in real time to make the data analysis more

accurate to ensure that the bad debt rate will not rise. Take Ali Micro-Finance as an example. Before loans, Ali Micro-Finance can utilize the company's e-commerce business data and combine tripartite certification information to judge the company's operating status, credit conditions and solvency. During the loan process, risk monitoring can be made in advance through Alipay, Alibaba Cloud, and the future logistics system that monitors the corporate information flow, logistics, and capital flow. Alibaba will timely adjust user credit ratings based on real-time information. Account transactions, fluctuations in orders, changes in Alipay's funds, etc., will all lead to the adjustment of the user's credit rating. Once it breaks through the “red line”, Ali Micro- Finance will require the company to repay early which will be the first to withdraw funds in various loan channels and effectively reduce the non-performing loan ratio. After the loan, Alibaba Finance will further monitor the company’s business operations and deepen the credit evaluation. Default customers and online shops will be restricted or shut down, and other network customers will be notified of their potential risks.

The quality of online financial customers is uneven, and financial needs are also different. It is impossible to reduce risks through traditional commercial bank loan models such as real estate mortgages. Hence, a big data platform required to better tap potential demand, conduct accurate credit and achieve effective risk control. The advantage of Internet companies is that they have accumulated a large amount of data. Whether it is Alibaba, Tencent, or Baidu, they have stored thousands of customers' data on consumer behavior and preferences. By analyzing these data, the enterprise can judge the credit of the borrower to facilitate the transaction and reduce the transaction risk.

2.4 Block Chain

A block-chain, originally block chain, is a continuously growing list of records, called blocks, which are linked and secured using cryptography. Each block typically contains a cryptographic hash of the previous block, a timestamp and transaction data. By design, a block-

chain is inherently resistant to modification of the data. It is "an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way". For use as a distributed ledger, a block-chain is typically managed by a peer-to-peer network collectively adhering to a protocol for inter-node communication and validating new blocks. Once recorded, the data in any given block cannot be altered retroactively without the alteration of all subsequent blocks, which requires collusion of the network majority.

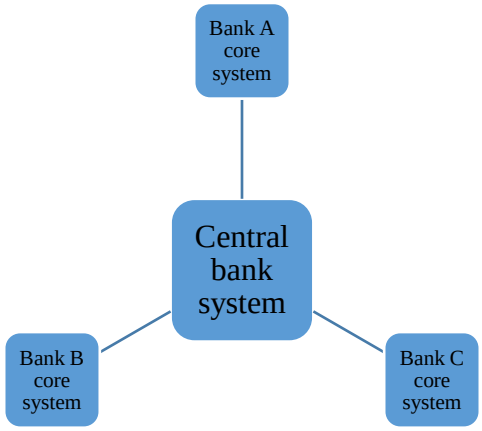
When it comes to the block chain, Bitcoin must first come to mind. From a technical point of view, Bitcoin's system consists of three layers: Underlying technology – block chain, Middle Links – Protocols, Upper Level – Currency (Mitch Steves, 2018). The upper layer of the currency here refers to Bitcoin, and the middle layer is the protocol, which is the block chain-based fund transfer system. The underlying technology is a block chain, which is a decentralized, distributed recording of an open and transparent transaction record ledger whose transaction data is shared across the entire network. The “miners” are responsible for the records and supervision by the entire network.

This solution is to allow any node participating in the system generate a data "password" for verifying the validity of its information and linking to the next database block through a series of data blocks (each data block contains data for all information exchanged by the system within a certain period of time) associated using a cryptographic method. Bitcoin is a global electronic currency that can be traded and is the most successful application of block chain technology (Marco Iansiti, Karim R. Lakhani, 2017). Currently, banks and other institutions are paying more attention to the block chain technology behind Bitcoin.

Block chain is a decentralized public ledger, which is the digitalization of all encrypted currency transactions. As the growing "completed" blocks are recorded and added to it in chronological order, it allows market participants to keep track digital currency transactions without central record preservation.

The evolution of block chain is from 1.0 to 2.0 to 3.0. Block chain 1.0 is a digital currency application represented by Bitcoin and its scenario includes currency functions such as payment and circulation (Narayanan, 2018). Block chain 2.0 is a combination of digital currency and smart contracts, and it optimizes the use of a wider range of scenarios and processes in the financial sector. Block chain 3.0 goes beyond the financial sector to provide decentralized solutions for various industries such as automated procurement, intelligent IOT applications, supply chain automation management, virtual asset transfer, and property registration.

2.4.1 Analysis of Block Chain Characteristics



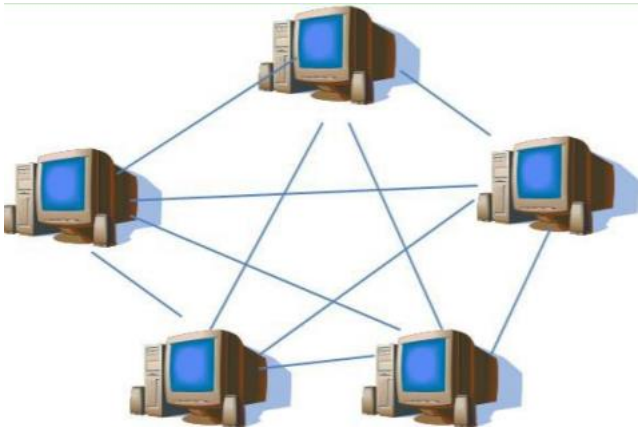
-The Characteristics of Traditional Payment Models - Centralization

The Picture above is a data exchange diagram of a traditional bank payment service. When Bank A's customers conduct intra-bank transfer transactions through outlets, online banking, and mobile phones, the information is transmitted to the data center of the headquarter to complete the registration of information and transfer of funds. The customer's funds, accounts, and other information are all based on trust in A's core banking system server. From the perspective of bank A, this is a typical centralized mode between head office and branches. The server of bank A core system is the central node. In the same way, when bank A's customers transfer funds to bank B across banks, they need to go through the information transmission path of the core system of bank

A-central bank system-bank B core system. From the overall process, the central bank becomes the center of the transaction. This centralized model is the basic mode of financial transactions in China and even in the world.

-The Characteristics of Block Chain Payment Model

Unlike the traditional centralized model, block chain is a typical decentralized model. Each computer host is an equal node. Each node in the system can interact directly without a central node. At the same time, the transaction information of any two nodes is encrypted and transmitted to the entire network (Ian Pattison, 2017). All nodes record all transaction information of the system with an encrypted block storage manner and in time series, thereby forming a new decentralized mode.



In general, block chain technology contains four main features. The first one is decentralization. In the block chain payment model, there is no central core system and central payment and settlement organization. Information directly exchange between nodes, and any node damage will not be affect the entire network operation. Under this payment model, transaction efficiency, low costs and business continuity can be achieved. For instant, during the Greek financial crisis, the supervisory authority announced that the per capita daily withdrawal was limited to 60 Euros. However, in Athens, Bitcoin ATM has adopted a decentralized model and are not subject to regulatory restrictions, residents were free to withdraw funds and not limited by quota restrictions.

The second characteristic is trustless. Unlike traditional trust models based on government credit or laws and regulations, the block chain payment mode is an open source algorithm, which make the system operating rules transparent. In this mode, data exchange between each node does not require mutual trust and can be anonymous. Simultaneously, each transaction will be recorded in real time to prevent data from being controlled and tampered (Ian Pattison, 2017), which can effectively avoid the violation behavior of the trust subject.

The third feature is collective maintenance. A huge computing power requires to be supported the financial systems. From the block chain itself, the computing power of a single machine may not be high, however, computing power can be greatly enhanced through a distributed peer-to-peer model. As of now, the overall computing capacity of bitcoin mining machines has exceeded 9 times the sum of computing power of top 500 large-scale servers worldwide. This model is similar to the core system architecture concept of China online banking financial cloud.

The last feature is the security database. A single node may be modified by violence, however, since the transaction data is distributed to all nodes of the entire network, the data modification of a single node is not approved by the entire network. Theoretically, data cannot be tampered with as long as it does not control more than 50% of the computing power of the entire system and the more nodes involved in the system, the stronger the computing power and the higher the data security.

2.4.2 The Status of China's Block Chain Development

China’s block chain ranked 9th in the business models of the China top 50 companies (KPMG, 2017), by utilizing the block-chain technology, 11-12 billion dollars can be saved in global capital markets on an annual basis. Block chain technology is no stranger to Chinese investors, bitcoin volume is now exchanged in and out of the Chinese yuan has exceeded 80% of all. However, when it comes to its app in financial sectors, block chain start-up companies still in an experimental

stage. Purpose of boosting R&D and deployment of block chain applied, several consortiums have been set to speed up the block chain technology applied in finance, commerce, public services and other industries in China, such as China Ledger Alliance, and Financial Block Chain Shenzhen Consortium (Xingnan Wang& Rui Huang, 2017).

Judging from the application of block chain, China's block chain market structure will be dominated by block chain 2.0 applications and supplemented by block chain 3.0 applications in the coming years. The financial transactions and asset management in the financial sector by the application of block chain 2.0 should be the most mainstream application scenarios in the Chinese block chain market in the next few years. However, at present, due to complex scenarios and regulatory issues in the financial sector, many business scenarios that block chains cannot be further innovated. The block chain 3.0 which represented by data certification has achieved a breakthrough at this stage due to its simple application scenario and lack of government supervision.

Currently, a total of 77 start-up companies and companies related to the block chain nationwide. From the application perspective, there are 24 companies engaged in the research and application of the underlying block chain platform, 12 companies involved in digital assets and credits, digital certificates, 8 companies contribute to creditworthy businesses, and 6 companies are engaged in data security. In addition, there are companies engaged in charity medical care, energy extraction, digital currency and advertising, and smart wearable devices.

2.4.3 The Financial Application Scenario Interpretation of Block Chain

-Identity: Knowing who you’re dealing with

For banks and financial institutions, ensuring compliance with customer (KYC) compliance is an important step to prevent inappropriate and illegal use of funds and services (Jo Lang, 2017). Banks have been studying how to share customer information with partners in a safe way, and block chain-based solutions are a clear contender. Password protection can help maintain information

security, the ability to share continuously updated records with many parties can be realized, and the management process can be simplified by reducing the duplication of unnecessary information and requests.

-Payments: Speeding time to settlement

Though digital payments have become more common, sending money from one individual to another isn't always a simple endeavor. Traditionally, it's been hard for those involved in a transaction to trust that they will receive their payment. Intermediary financial institutions like clearing houses, regulators and other banks offer certainty, but they also slow down the process. If a payment crosses borders and exchanges in currency are involved, it could take days or weeks for clearing and settlement to occur because of inefficiencies in reconciling records on separate ledgers from intermediaries. By design, block-chain provides certainty because participants can view the same ledger of transactions that is updated through consensus and made immutable through cryptography. In the long term, this can make it possible for individuals and corporations to transact more directly, making payments simpler, faster and more secure.

-Trade finance: Reducing friction in global markets

The friction of global markets has made the process of financing and trading complete long and complex (Jo Lang, 2017). Friction in global markets makes obtaining financing and completing trades a lengthy and complex process. Following traditional practices, which include various activities such as lending, issuing letters of credit, factoring and insuring the parties, it can take days up to weeks to complete a single transaction! Paper documents have to be sent back and forth to be validated and reconciled, and in the interim, capital gets tied up and business slows. By using a shared version of the truth on block-chain, trade partners can interact with greater trust, increasing the efficiency with which companies can access funding as well as saving time and costs throughout the trade process.

-Supply chain finance: More optimized Process

Under the traditional supply chain finance model, multi-tier suppliers are faced with the problem of financial difficulty, which is due to: 1) information asymmetry; 2) credit cannot be delivered; 3) payment settlement cannot be completed based on the agreement; 4) commercial ticket cannot follow split payment terms. For multi-party supply chain finance, block chains rely on core technologies such as distributed ledgers, encrypted ledgers, and smart contracts to provide a good solution to the above problems. The block-chain registers the goods on the ledger as transactions to determine the parties involved in the production chain management, as well as the product's origin, date, price, quality, and other relevant information. Neither party will not have ownership of the ledger, nor will it be able to manipulate the data for private gain, and the transaction is encrypted and has an immutable nature, thereby the ledger will not be compromised in the whole process. In addition, the supply chain finance based on block-chain technology will significantly reduce manual intervention and digitize the current process of paperwork. All participating parties can use a decentralized document-sharing and pay automatically when the scheduled time and results are reached, greatly improving efficiency and reducing the potential for errors caused by manual transactions.

2.4.4 Analysis on Application Cases of Block-chain in Financial Sector

Block Chain ABS Investment Bank: JD ABS Cloud Platform

In March 2017, JD Finance announced that its asset cloud factory underlying asset management system based on block chain technology has been officially launched. In fact, JD Finance announced the launch of the "JD ABS[10] Cloud Platform" as early as the third quarter of 2016, however, the initial release of underlying system was not implemented by block chains.

[10] ABS refers to Asset-Backed Security, It is a bond or a bill that is issued on the basis of a loan agreement with a bank, credit card companies, or other credit provider, or accounts receivable as a guarantee.

During the two years from 2015 to 2017, the distribution of JD IOU note[11] assets exceeded 10 billion yuan. JD.com started from its own experience in issuing ABS and began to actively build "ABS cloud platform" to help other Internet companies to issue ABS assets.

Asset Cloud Factory is one of the three major businesses of JD Company's "ABS Cloud Platform." The core of capital intermediary business of asset cloud factory is to provide liquidity and risk management services to customers by creating financial products and acting as counterparties, and to reduce the threshold for issuing ABS for consumer financial service companies and the issuance costs. In a typical business scenario of the asset cloud factory, JD Finance, as the funder, joins with the cooperative consumer financial service companies to participate in the risk control, borrowing, and repayment of each asset, and is responsible for the full-process management of structured issuance after the formation of asset packages. Since the process of formation of the underlying asset package often involves multiple financial institutions such as the asset side, the capital side, and the SPV (special purpose vehicle), all participating parties have their own business systems, with large transaction volumes, high transaction frequency, and inter-agency information. Therefore, some problems such as accuracy of information transmitted and reconciliation settlement may exist. Meanwhile, the problem of confidence in the authenticity of the quality of the underlying asset is also a pain point in the industry.

Block chain technology makes it possible for the asset cloud factory to implement decentralized protocols, and can securely store transaction data, ensure that information cannot be forged and falsified, and smart contracts can be automatically executed without the need for review by any centralized agency. By using of block chain technology enables all market participants can participate in the ABS transaction process, jointly maintain a set of transaction book data, real-time

[11] JD IOU note is a new payment method of "consume first, pay later" launched by JD.com. It uses an IOU note for payment on JD.com website and can enjoy up to 30 days of deferred payment or up to 24 installments. The method is the industry's first Internet consumer financial product

control and verify the contents of the ledger, and maintain the authenticity and integrity of the data book.

In this way, the transparency and accountability of the asset-backed security can be improved, the authenticity of the underlying asset data of the consumer financial service companies can be guaranteed, and realizing the asset fidelity of consumer financial service companies, thereby increasing institutional investor confidence and reducing financing costs. JD block chain technology is jointly developed by JD Finance and its investment company, Goldenstand, and it is also an application of block chain technology in commercial environments. In addition to JD, many Chinese companies are also actively developing and applying block chain technology and applying it to the financial sector. Companies like WeBank, Tencent, and Alibaba have developed their own block chain technology and used it in their own businesses to achieve relative successes.

2.5 Artificial Intelligence

Artificial intelligence (AI, also machine intelligence, MI) is intelligence demonstrated by machines, in contrast to the natural intelligence (NI) displayed by humans and other animals. In computer science AI research is defined as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals. Colloquially, the term "artificial intelligence" is applied when a machine mimics "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving

Artificial intelligence (AI) is the process of simulating human intelligence through machines, especially computer systems. These processes include learning, reasoning and self-correction. Special applications of artificial intelligence include expert systems, speech recognition and machine vision. Since the 1950s, through the three waves of technological revolutions, the understanding of artificial intelligence among academics and industry has been divergent. The

diversified development of technology and commerce has led to varies understand of definition, motivation and form of expression of artificial intelligence.

2.5.1 What Does Artificial Intelligence Do

Artificial intelligence obtains two capabilities: "fast processing" and "self-learning". Artificial intelligence enables quick processing of learning, decision making and actions. The speed of computers handling and communicate information, parallel computing and linear computing is faster than humans. In addition, the computer can continuously iterate and optimize the positive cycle of "test-verify-learning". For instant: the traffic in the city is complicated, and there is a complex connection between every intersection and road section. In Ali ET artificial intelligence dispatch traffic application, the robot needs to process and learn the massive historical information data of thousands of sections to obtain the all-day traffic model of the road section, and then combines the intelligent video information (including vehicle identification, vehicle speed identification, etc.) returned from each intersection of the city to make a global, real-time analysis (BCG, 2016). This process poses greater challenges to data processing capabilities in terms of scale, complexity, and real-time performance.

Artificial intelligence can be more flexible and learn to manage knowledge autonomously and support the systematic management of "production-storage-application-update" of knowledge. For example, in Taobao and Tmall, there are nearly 50,000 hotline calls every day. These massive amounts of voice data are self-learned by artificial intelligence robots, thereby the robots obtain the ability to "listen" and "understand" knowledge, which can be applied to various industries and scenes related to voice interaction such as smart customer service voice interactions, internet car voice commands. In some specific scenarios, such as court trial shorthand, some new data will be generated and new knowledge adapted to this scene. These knowledge and data are also used to update the knowledge base of speech recognition and are quickly used by other applications. This is also the source of knowledge that Ali ET can defeat the world's shorthand runner-up (BCG, 2016).

How to make AI master a good knowledge management is an important part of systematic project. “Double 11” is a global consumer shopping carnival initiated by Taobao Tmall. In 2015, it set a world record of 140,000 orders a second. The huge volume of orders has also brought about the peak of user problem consulting services. Alibaba's algorithm engineers have raised the time-validity for automatic update of the knowledge base to minutes in the industry for the first time through the analysis and prediction of massive issues, enabling intelligent resolution rate to achieve up to 94% in this scenario.

2.5.2 The Impacts Brought by AI

The progress of artificial intelligence is catalyzed by the basic layer of cloud computing and big data (Feng Liu, Yong Shi & Peijia Li, 2018).The breakthrough in algorithm brought about by deep learning gives rise to a wave of artificial intelligence, which greatly improves the classification accuracy of complex tasks, consequently, promotes the rapid development of computer vision, robot learning, natural language processing, robotics, and speech recognition (Javier Andreu Perez, Fani Deligianni, Daniele Ravi & GuangZhong Yang, 2018). Artificial intelligence will bring great changes in the future where its impact will be far greater than the Internet's transformation of various industries. It will completely change people in all fields and generate more value, make a lot of repetitive work now being replaced, people can be freed from labor-intensive work and release manpower to do more valuable things. In the financial sector, there are mainly the following aspects:

- More active financial service model

Finance belongs to the service industry and is engaged in the business of value exchange between people and people. Before large-scale application of Internet technology, financial institutions needed to invest a lot of manpower and material resources for customer relationship maintenance and exchange, found customer needs to obtain financial business value. For an instant, the medium for banks and customers to establish relationships was mainly in bank outlets. Through

face-to-face communication between customers and bank staffs, customer's needs can be quickly met, and even through some of the details of conversations and observations to excavate potential needs. Through a period of communication, customers and bank staff have established a deep relationship that led to increasing degrees of customer reliance on bank personnel, called customer stickiness. Once the stickiness exists, customers rarely compare the financial services recommended by the bank staff, such as when purchasing wealth management products, they would not compare the profitability of multiple banks.

In the Internet era, the rapid development of Internet technology and Internet finance enterprises have prompted financial institutions to vigorously carry out the system construction work. The emergence of online banking and APP has reduced the cost of banking services to customers. Regardless of whether it is a client or a web page, standardized function templates are adopted. Customers need to learn how to use them, and find the desired financial services among many menu functions. The communication between customers and financial institutions is unidirectional. It makes the "cost of customer demand" shift to the customer from the financial institution, that is, while facilitating the financial institution, the customer needs to find and meet their own financial needs by themselves by browsing function menu, which also causes the bank to lose the opportunity to create more financial value.

No matter how to optimize the function menu, customers always have to pay "demand costs". In this process, customers' financial professional degree is passively enhanced. They will actively compare which financial institutions provide the best services and the most efficient service, and customers' dependence on financial institutions continues to decrease, and may be sought by other peers or even Internet finance companies. For example, banks have been greatly impacted by third-party payment agencies over the past few years, whether in payment sector or other C-side financial services. Bank's innovation flexibility and policy supervision standards being inferior, and individual users were circled by internet financial institutions on a large scale.

The rapid development of artificial intelligence has enabled robots to simulate human functions to a large extent, and has achieved humanized services and personalized service. This will exert a profound impact on the high-end financial service value chain. Artificial intelligence will become an important factor in determining the bank's communication with customers and discovering financial needs of customers.

It will also bring a new round of revolution in financial products, service channels, service methods, risk management, credit financing, and investment decisions. Artificial intelligence technology can be used at the front-end to serve customers, supporting decision-making in credit granting, various types of financial transactions and financial analysis at middle-ground, and used in the background for risk prevention. It will drastically change the existing financial landscape and make financial services (Banking, insurance, wealth management, lending, investment, etc.) more personalized and intelligent.

- Financial big data processing capacity greatly improved

The financial industry is closely related to other industries and has precipitated a large amount of useful or useless data, including massive scales of financial transactions, customer information, market analysis, risk control, investment consultants and other information (BCG, 2016), simultaneously, a large amount of data exists in an unstructured form, such as the customer's identity card scanning information, which occupies valuable storage resources, however, cannot be converted into analytical data for analysis, makes the processing of financial big data face great challenges. Through the use of intelligent deep learning systems, robots can continuously improve or even exceed human knowledge answering capabilities, especially in the handling of complex data such as risk management and transactions (Darrell M. West, 2015). The application of artificial intelligence will significantly reduce labor costs and enhance financial risk control and business processing capabilities.

2.5.3 Application Scenario of Artificial Intelligence in Financial Field

At present, the scope of artificial intelligence technology applied in the financial field mainly focuses on smart customer service, intelligent investment advice, intelligent risk control, intelligent investment research, and intelligent marketing.

-Intelligent customer service

Intelligent customer service mainly uses voice technology, natural language understanding and knowledge map as the technical basis to master customer needs, by automatically acquitting customer features and knowledge bases to help customer service solve customer problems quickly. The intelligent customer service system adopts the natural language processing technology to extract the customer's intention and build an understanding and reply system of the customer service robot through the knowledge map (Coveo Solutions Inc., n.d.) Intelligent customer service interacts with users in multiple channels through text or voice, providing customers with more convenient and personalized services, and further enhancing the user experience while reducing the pressure on manual services and operating costs.

- Intelligent investment advice

Intelligent investment advice, also known as robotic investment advice, is based on investors' risk preferences, financial status and financial management goals, using intelligent algorithms and portfolio theory to provide users with intelligent investment management services (CAICT, 2018b). Intelligent investment advice is a standardized data model based on robot learning algorithms and modern asset portfolio optimization theory which applied the network platform and artificial intelligence technology to provide customers with personalized financial consulting services (Jonathan Walter Lam, 2016). Traditional investment advisers need to stand in the perspective of investors to help investors to conduct portfolio management that meets their risk preference characteristics and adapts to the market performance in a specific period. The application

value of intelligent investment advice is to replace or partially replace expensive financial consultants' manual service, to standardize and batch investment advisory services, reduce service costs, wealth management fees and investment thresholds, and achieve more widespread investment services.

- Intelligent risk control

The application of knowledge mapping, deep learning and other technologies in the field of credit management and anti-fraud integrate structured and unstructured big data from different sources (Deloitte, 2016). By analyzing the connected data, such as upstream and downstream companies, partners, competitors, parent and subsidiary companies, and investment, and applying knowledge mapping technologies to monitor the inconsistencies in the large-scale system and identify possible fraud points. In the area of credit risk management, associated knowledge maps can use the credit evaluation model established by "big data + artificial intelligence technology" to accurately depict user's portraits, conduct comprehensive assessment of users, and improve risk management and control capabilities.

- Intelligent investment research

The traditional investment research business needs to collect a large amount of data to conduct data analysis and report writing, and investment research personnel need to spend a lot of time to collect and process data every day. Intelligent investment research is an intelligent integration of data, information, and decision-making based on big data, robot learning, and knowledge mapping technology, which realizes intelligent association between data, forms a document for use by analysts and investors, assists decision-making, and even automatically generates research report (Salla Paajanen, 2017).

- Intelligent marketing

Artificial intelligence can accurately target user needs through user portraits and big data models to achieve accurate marketing. Based on quantifiable data, intelligent marketing utilizes technologies such as big data, robot learning and computing frameworks to analyze consumer consumption patterns and characteristics of the individual, so as to divide customer groups, thereby, accurately seek out target customers and conduct accurate marketing and personalized recommendations (Financial Stability Board [FSB], 2017). Compared with the traditional marketing model, intelligent marketing obtains the characteristics of strong timeliness, high accuracy, high relevance, higher cost performance, and strong personalization.

2.5.4 Application Cases of AI Applied in Financial Field

Case: Alibaba

Google, IBM and other international giants have penetrated artificial intelligence technology into all aspects of various products. On the whole, China financial industry has gradually begun to apply artificial intelligence technology. With the promotion of policy and investment in the artificial intelligence industry, it is expected that the widely used of AI will soon come.

Alibaba's Ant Financial Services Group organizes a special team of scientists specializing in cutting-edge research in the field of artificial intelligence such as robot learning and deep learning, and conducts a series of innovations and applications under the business scenarios of Ant Financial Services Group, including microfinance, insurance, credit investigation, intelligent investment advice, customer service and other fields.

According to the statistics released by Ant Financial Services Group, the use of robot learning has reduced the fictitious trading rate by nearly 10 times in the Ant Check Later (A

consumer credit product)) and microfinance business of MYbank[12], and developed an OCR system based on deep learning for Alipay's document verification system, which reduced the document verification time from 1 day to 1 second and increased the passing rate by 30%. Taking intelligent customer service as an example, during 2015 “Double 11”, 95% of the remote customer service of Ant Financial was completed by big data intelligent robot, and automatic speech recognition was realized 100% at the same time. Artificial intelligence comes into play when users enter "my customer service" through Alipay. "My customer service" can automatically "guess" several points that the user may have in question, and this part is a common problem for all users. More accurate is that these are personalized questions based on variables such as user services, duration, and behavior. In a communication, automatic answers are given through deep learning and semantic analysis. The accuracy of the problem recognition model has been greatly improved in the past time, in the business such as Ant Check Later, the accuracy of the robot answer is increased from 67% to more than 80%.

[12] MYbank is China's first core system based on cloud computing architecture, launched by ant financial as a major shareholder.