

## Case Analysis of the Planning of Information Technology Architecture Construction of Regional Banks in China

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**Abstract** — with the economic globalization, the banking industry is facing increasingly fierce and complicated competition environment in its development. All banks put forward higher requirements on information technology in aspect of responding to market changes rapidly and supporting and guiding business innovation. This paper studied the strategic planning of information technology of regional banks and the safeguard strategies for its successful implementation, in order to help the regional banking institutions in China construct more flexible information technology system based on the mainstream technologies and mature solutions and thus improved the core competitiveness of regional banks. The research was carried out mainly through literature research and case analysis. It first summarized and reviewed the current situation and development trend of the information technology construction in regional banks and then analyzed the universal problems existing in the information technology field of commercial banks. Finally, with the information technology construction project of CCB in C city as an example, a series of contents related to information technology of regional banks were introduced. Analysis results show that regional city commercial banks should advance the information work according to their actual situations. They must adhere to planning first and improve the design capacity of the top level to carefully work out a scientific and comprehensive IT architecture solution and then develop a practical and prospective IT planning on this basis. This paper provides some reference to the information technology construction of regional banks in China.

**Keywords** - *Bank Information Technology; Strategic Planning; Implementation Strategy*

### I. INTRODUCTION

At present, China's banking industry is facing pressures from different aspects, such as creating maximum profits for shareholders, complying with the provisions of the regulatory authorities, adapting to the changes in the global competition environment, meeting higher customer requirements, etc., which forces it to promote the information technology platform to the strategic development measure. How to shorten the gap between regional banks and advanced banks at home and abroad, comprehensively strengthen the subtle management and perfect the risk control mechanism has become the priority in the information technology platform architecture of banks.

Compared with foreign advanced Banks, there is still very great disparity on information technology security, financial service improvement and management system construction in our regional banks. Those banks have more or less defects in information technology construction, have no unified strategic planning for information technology construction, pay more attention to the realization of business functions than the stability, reliability and security, have certain on cognition of system support and business development and fail to well coordinate and improve the consistency among business model, process improvement and system development. It is precisely the problems in those fields that put China's regional Banks at a

disadvantage in response to market competition and market risks.

With the continuous changes of the demands of the target market, the one who can well and fast meet customers' demands can finally win the customers and obtain the initiative to sustainable development. In order to better meet customers' demands, regional banks should improve the level of management decision and develop new suitable products and services faster and better than their competitors, which is the enterprise core competence with information technology as the support. Now, improving operation management and promoting business innovation capacity through speeding up the construction of new-generation information technology platform has become an urgent problem for the regional bank management, information technology management department and related business departments to solve.

### II. LITERATURE REVIEW

At present, many commercial banks are working on improving the core competitiveness of business development, which puts forward higher requirement on information technology. There are also a large number of research achievements. In aspect of the bank information technology construction, the research mainly focuses on

strategic planning, overall application architecture, data architecture, security architecture, basic hardware environment, etc. The achievements are as follows:

According to statistics of the American bank reconstruction expert Paul, H. Allen (1994) [1], from 1980 to 1996, there were 13 big banks implementing the reconstruction plan in the United States in a year on average; the redesigned business process of the bank after full use of information technology made the average rates of return on assets and capital increase from 1% and 14% to 1.5% and 20% on average, respectively, and the average ratio of cost to benefit dropped from 63% to 50% ~55%. Information technology plays an important role in the construction process of foreign information technology platforms, because they realize the importance of combining information technology and banking business, make full use of information technology to develop various new products and financial services and realize the effective integration of information technology and bank operation through implementing the business process reengineering. Zhang Li and Wei Hongqin (2012) [2] pointed out that the United States and other developed countries have paid attention to constructing the systematic and standardized basic platform at the beginning. They have set up the unified authentication and digital identification center, developed the uniform interface standard for connecting the network of all banks and realized the intercommunication and information sharing among banks, so as to lay a solid foundation for the subsequent informatization and management. Ge Zhaoqiang (2010) [3] said foreign banks attached great importance to the management of information resources, regarded them as a strategic resource and fully utilized them. Perfect customer relationship management (CRM) system is a very good example of information resources development and utilization. At present, among 100 major banks in the United States, 71 have implemented or are implementing the projects related to CRM. The internationally famous survey organ Gartner Group lists data mining and artificial intelligence as the first among five key technologies with far reaching influence on the industry in next 3 to 5 years in senior technology investigation report and the parallel processing system and data mining as the first and second among ten emerging technologies of the focal point of investment in next 5 years. N.Venkatraman (1999) [4] put forward that the banks could truly know 20% of customers who brought 80% of profits through scientific CRM, so as to provide them with personalized high-quality services. Foreign banks attach great importance to collecting and perfecting customer information and other financial information, making full data mining, service adjustment and innovation and designing high value-added and personalized financial products, which is undoubtedly the core of modern bank management. In the view of modern management, Zhang Chenghu (2011) [5] proposed that any work which played the role of back-office support without producing turnover should be outsourced in all enterprises. In the 1990s, the US banks had abandoned the idea of developing the application software independently but outsourced part or all of information technology to the

integrated service companies outside the banks. For example, Morgan Bank and Chase Bank carried out the outsourcing cooperation with CSC and First Data, respectively. Implementing information technology outsourcing can make those banks receive the professional services from the information service organizations. The information service organizations can provide the banks with the most effective information technology operation and the banks can focus on market development and customer services.

Relevant literature research has important guiding significance to China's commercial banks in how to promote the design and implementation of their own information technology strategic planning. With small assets scale and business scale and weak talent and technology reserve capacity, regional city commercial banks have their own characteristics in constructing the strategic system of information technology. This paper reviews the construction situation and development trend of information technology in commercial banks in Section 2 and dissects the problems existing in information technology construction in the banking industry at present in Section 3. Then, with CCB in C city as an example, it analyzes the architecture planning and construction of the information technology system from business architecture, data architecture, application architecture, infrastructure and management architecture from the perspective of regional banks and introduces the overall implementation path and current achievements of this bank in information technology planning in details. In the fourth section, it puts forward the directional suggestions on how to do a good job in information technology planning and implementation and how to avoid problems in the practice for regional banks.

### III. CASE STUDY

In the face of the shock of Internet finance and acceleration of the experience economy era, China's banking industry has changed its strategy from technology support to technology leading. The application of some innovative models, such as mobile payment, Internet finance and cloud computing, is now in the ascendant. It becomes more and more a trend of leading and driving business innovation by information technology for banks. Information technology has changed from the role of support and safeguard to an important part of the bank value creation. At the same time, however, the rapid development of the Internet technology application and the emergence of new modes like Internet finance produce a challenge to the technology innovation system of commercial banks. The impact on city commercial banks is greater. On the one hand, the important role and encourage prospect of information technology and the prospect drive us to make a lot of investment continuously; on the other hand, due to various reasons, the so-called "IT black hole" emerges: a lot of investment fails to establish the corresponding competitive advantage; on the contrary, it makes our weaknesses and contradictions more and more obvious.

The first is the contradiction between rapidly changing business environment and lagged response of information technology of city commercial banks. In an ever-changing business environment, banks must make fast and flexible response to customers' needs. However, at present, the information technology level of city commercial banks is limited to repair the system passively, which is far from that of large modern banks.

The second is the contradiction between the scale effect of information technology and the small scale of city commercial banks. In essence, information technology belongs to the capital intensive new and high-tech industry with high investment and high yield, so its scale effect is very obvious. Some professionals have analyzed four difficulties of city commercial banks, one of which is that the construction cost of the IT system exceeds the bearing ability of a single city commercial bank<sup>1</sup>.

The third is the contradiction between the high requirement of banks' information technology on the specialization degree and the low professional service level of the technology company. Obviously, relying only on technology outsourcing cannot effectively break the technical bottlenecks of city commercial banks. Moreover, as the core resource of the bank, once the information is put into others, it means huge potential risks.

The fourth is that it is more and more difficult for decision makers to identify the technical demands rightly and judge which technical investment is necessary, appropriate and valuable.

On the uneven road to the development of information technology, more than 130 regional banks in China carry out hard explorations. Next, the paper will introduce the practice of cshme.com in top level architecture, IT planning and construction, in order to analyze the development path and direction of information technology construction of regional banks.

#### Management Information System Construction Practice of CCB in C City

Founded in 1997, CCB in C city is the first joint-stock commercial bank in the province. Now it has 101 net spots and has basically completed the organization distribution in the local province. By the end of 2015, its total assets were about 280 billion yuan; its general deposits totaled 200 billion yuan; its balance sheet credit amounted to 150 billion yuan; and its total profits were 4 billion yuan. Various structural indexes have achieved the level of listed banks. In addition, it has maintained more than 25% of growth for ten consecutive years; its total assets ranked No.395 in the global banking industry in 2015; its comprehensive strength has listed among top 500 in the service industry and among top 100 in the financial industry of China. Various structural indexes have been basically above the average level of the national shareholding commercial banks. The company is perfectly managed. It has basically met the listing requirements and is gearing up to promote the listing.

The acceleration of networking and interest rate marketization makes the competition between commercial

banks more and more fierce, leading to the increasing competitive and professional levels. From the perspective of information technology, the competition between banks has gradually turned from the front stage to the middle and back stage. Deep competition is carried out in process control and reengineering, resource use efficiency and other aspects. Technology leading is gradually becoming the core strategy of banks. CCB in C city fully recognized the importance of information technology, so it has officially launched the three-year plan of designing and implementing information technology development at the end of 2014. The basic framework is as follows:

#### (1) Business Architecture Planning

Business architecture defines the target business environment logic of CCB in C city. Its purpose is to provide a rule and framework for the definition of specific business requirements and functions. It defines the general background and terms of the target environment to assist the business and IT teams to discuss business requirements and related problems.

Both traditional and new banking businesses take customer and account as the basic elements of two businesses. The value added between customer and account develops 5 business sectors as the means of contract, namely, assets, liabilities, payment, funds and value added. In each sector, it customizes rules and procedure to form business products as the value commitment. The price of each product is fixed according to the risk and service cost. In addition, it promotes the interaction between customer and account through various ways of service (net spot, teller, telephone banking, ATM, POS, online banking, etc.)

New business has changed from the previous single customer management to the 1+N customer base management formed by core customers. It makes private, small and individual enterprises form the three-in-one network finance, reduces the operation cost through operation streamlining and business self-support and cooperate with interest rate marketization to realize the financial service with customer profit maximization. The role of banks also changes from the organization managing the funds to the platform helping management and from the traditional amount and position authorization to credit/risk authorization, so as to speed up the approval.

In short, innovative financial products are to combine traditional products to form new high-value products. New business architecture design will be reconstructed based on the model of product factory to rapidly customize products and combine and produce innovative products.

Target business architecture includes: operating model definition, business ability and specification and broad business principles and rules. The business architecture consists of 7 major skills and 5 business perspectives.

7 major skills include: channel (way of service), customer (information and relationship), product factory (deposits and loans), finance management (accounting and general ledger), risk management (all process), process management (back stage center) and quantitative management (large data analysis). Those 7 major skills represent the core competence which is necessary and must

be mastered in order to successfully participating in market competition.

5 business perspectives include assets business, liabilities business, fund business, payment services and value-added service, which subdivide the bank products and services into several logical categories from the perspective of customers. It refers to the supporting ability which should be mastered to support various products and services.

TABLE. 1 BUSINESS ARCHITECTURE OF CCB IN C CITY

Retail clients	Enterprise	Third party	Cooperative agency	Other financial institutions
Customer information		Financial product		
Customer relationship		Pricing		Accounting treatment
		Risk		
		Service mode		

(2) Data Architecture Planning

In terms of business support, with the transformation of future business towards front end, remote networking and self support, most business data will be dominated by unstructured data (The traditional business process is driven by sheet and authorization. Customers fill out a large number of sheets, sign or seal them for authorization. New business has changed to take multimedia as the basis. Take remote account opening as an example. Now customers submit unstructured data like face and scanned documents to the bank rather than various sheets.). Polymorphous data is the foundation of future development. It should meet not only the basic structured and unstructured data but also no-format information from various information channels (such as justice, social network, taxation, web page, weibo, ect.) to form the real big data platform, support the strategy information of management, customer information of the bank and detailed information of unlimited customers in all directions, fully support batch to directional sales information, information required by different business departments, supervision submission information, judicial inquiry and process transformation, and provide the information service for business system and business personnel as well as the indefinite information query service for the external, so as to realize where there is a bank there is the customer information.

In data management, CCB in C city develops its own data standard and model, standardizes the management of source data of all business systems and external source data and isolates the difficulty of difference in data accuracy caused by the source data caliber problem. Through standardization, it forms the data application architecture and data application factor to promote the data application products rapidly.

The overall architecture contains three layers, namely, basis, theme and application from bottom to top. The functions of the basis layer include external interface providing, data extraction from source system, standardization, purification and indefinite storage. The function of the theme layer is data differentiation after purification, in order to provide high-speed storage and

access for data application (level2 high-speed storage). The functions of the application layer include being responsible for the results and forms of the data, providing delivery interface (such as supervision submission, governor overview, department statements, business analysis, history inquiry, judicial access and user). Three layers of the data architecture are clearly defined. In terms of the basic platform technology, it adopts Hadoop ecosystem which is widely used globally and characterized by very low cost and mature and stable technology.

(3) Application Architecture Planning

The relationship between business architecture and application architecture is as follows: the latter serves the former and is derived from the former. On the basis of business architecture, the application architecture which can flexibly support the business architecture is designed by combining the requirements of business ideas and the transformation projects in the whole bank.

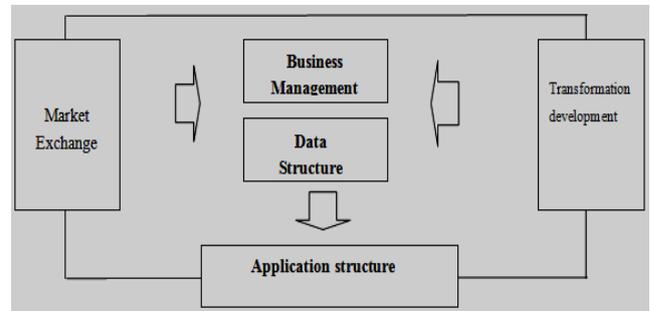


Fig.1 relationship among business architecture, data architecture and application architecture of CCB in C city market changes

- 1).Development mode change from scale operation to scope operation
- 2).Organization form change from physical net spot orientation to network orientation
- 3).Business marketing change from scattering to concentration
- 4).Electronic financial transaction and financial electronic transaction channel
- 5).Making the data become the important factor for improving the productivity, reducing risks and increasing customers.
- 6).Transformation development with customer satisfaction as the main force for marketing
- 7).Management transformation from departmental bank to process bank
- 8).Net spot transformation from the cashier type to the selling type
- 9).Personnel transformation from business operation to customer operation

Application architecture

The new architecture consists of two main parts, namely, customer and account. All customer-related managements and services shall be the responsibility of the customer layer and all account-related affairs shall be the responsibility of the account layer. The customer layer provides 360-degree customer service and multiple ways of access. It drives the

trading route with the customer information. The account layer is in charge of core products, all account operations, statements and supervision. The whole architecture consists of multi-accounting and multi-bus-management application groups, in which each business line can extend horizontally. Only the data are associated with the process. There is no mutual interference between systems. Finally, the highly flexible business system group without core is formed.

(4) Infrastructure Planning

The new infrastructure combines the development results of software and hardware technologies in the industry to reduce the project construction cost to the greatest extent on the basis of guaranteeing the technical advancement and reliability. It is characterized to be high flexibility, reliability and low cost.

The technology cost is mainly composed of three parts: hardware, software and service. Hardware cost consists of hardware device and hardware architecture. At present, CCB in C city mainly depends on the equipments with IBM, HP, EMC and other minicomputers and storage as the core. Special equipments are expensive with high management and maintenance costs. However, with the rapid development of technology, cheap server with x86 has had enough processing capacity to replace the special equipments. Software cost refers to operating system, middleware, database and software tools. At present, it gives priority to the closed special software. Due to the large amount of maintenance and service support costs brought by special equipments and software, cshme.com now uses the standard IOE architecture. It cannot master the technology but has to reply highly on the manufacturer. In addition, it is difficult to quickly and accurately identify the fault when problems occur.

The plan will use the server with x86 architecture as the hardware core and forms the highly flexible, reliable and low-cost basic platform to replace special equipments in the way of no-sharing cluster mode. It will also replace the special software with open software platform.#

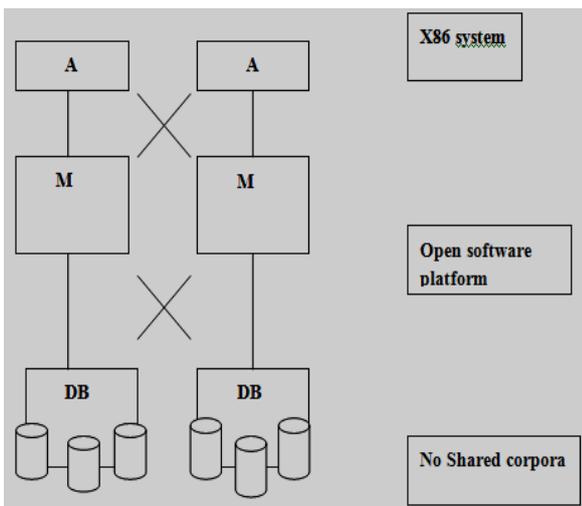


Fig.2 infrastructure mode of CCB in C city

In next 3 years, it will apply new system architecture to reduce the cost and gradually replace original systems in the principle of new construction going first.

Target infrastructure will greatly take advantage of Internet and mobile phone network everywhere and adopt the low-cost infrastructure to improve the overall efficiency and reduce the operating costs. New infrastructure takes the customer as the driving point, refers to the Internet mode in construction and leans towards Internet and mobile phone network in network design. It realizes service self-support and process front end with the integrated front platform and manages all accounts with the unified customer management platform as the core and the background providing the accounting service. The multi-node platform promotes the mutual complementation and standby among multiple centers. The private cloud platform provides the data management service.

Network Architecture

With the leaning of future business towards Internet and mobile devices, Internet and mobile phone network will greatly replace the traditional special network. With the advantages of rapid deployment and business region restriction, they lay a foundation for the banking service at all times and all places.

Disaster Recovery Architecture

The disaster recovery architecture will replace the present primary-spare relation architecture of two centers with mutual complementation and standby among multiple centers. The multi-center mutual complementation and standby architecture can not only effectively eliminate the single center risk, but also share pressures by all centers. Especially for the new Internet finance, its business may suddenly soars to be 100 times more than the usual in some periods (such as Single’s day, Spring Festival...).

(5) Management Architecture Planning

Risk Management Architecture

Risk management will manage four risks comprehensively, including operation risk, IT risk, information security risk and business process risk for system implementation.

IT Service Management

In order to promote the achievements of the architecture planning, C Bank forms a planning team with a bank as the team leader and the related department heads as the members. It also employs an information technology doctor with international experience as the technical director. Information technology of CCB in C city is managed by two departments with different special functions. It establishes a special IT planning department, responsible for collecting and summarizing the department needs, developing the annual project needs and submitting them to the information technology management committee for approval. As the business system production factory, the information technology department is responsible for developing the projects which have been approved by IT planning department, controlling the quality, going into production and managing operation and maintenance. In next 3 years, it will develop a series of project management processes and drive the work of two departments with the process bank

mode. As for inter-departmental communication, it needs to establish the regular meeting mechanism to collect business requirements and problems, project problems and schedule, etc.

In terms of personnel management planning, it needs to change the current model in which the business system relies mainly on the outsourcing company. It is because the business department is short of the technology knowledge and the technology department is short of the business knowledge, which leads to the over-dependence on the third party company or on the application of others in the same industry. At present, the work of technology workers should cover the whole technology process from basic technology R&D, system development, testing, production, operation, management to problem management, but the department is badly understaffed. In next 3 years, it needs to change the management mode by concentrating the technology workers on need management, new-generation business system project management, operation, maintenance and other work supporting business development and strengthening the training of business analysts, system architects (infrastructure and application architecture), data architects and other professional talents.

#### Overall Implementation Path and Practice Achievements in 2015

During 2015 and 2017, CCB in C city will adhere to the implementation route of innovation & development, reinforcement & stability. Innovation & development is divided into 3 stages. In 2015, it will focus on the leap of customers' experience, improve customers' experience on the bank services and promote the architecture of the technology construction in the background to adapt to the new business ability and reduce the costs. In 2016, it will drive the business reform with technology and especially improve the coverage of business self support and background greatly. In the background technology optimization, it should achieve the multi-accounting and multi-bus model framework. In 2017, it will construct the business driven by technology, work on the personalized bank and realize the system factory with rapid response in the background technology. The information technology planning has been implementing well in 2015. The specific achievements are as follows:

##### 1). Wisdom Hall APP

At present, wisdom hall supports social security card issue, contract signing for opening an account, risk rating and other transactions. CCB in C city has installed nearly 100 computers, which brings great convenience for customers to handle business and good experience for the front line staffs. First of all, it is easy to carry. The staff can go out of the counter and come to the customer's house to handle business. As long as the device can be connected to the Internet, there is no limitation on the service place. Secondly, the staffs neither need to remember the annoying transaction code, nor work overtime for training the new functions like traditional counter system. When using Wisdom Hall, the staff can find the required function rapidly after opening the APP and then handle business skillfully without any learning cost. Thirdly, the humanized user

experience design eliminates all unnecessary language input. It takes nearly 10 min for a customer to sign a contract for opening an account, but now it needs only dozens of seconds. Fourthly, it reduces the distance between customers and workers. In the past, there is a layer of cold glass between customers and workers. Now they can handle business shoulder to shoulder or face to face, which creates a good atmosphere for counter marketing. Fifthly, it reduces the cost. A teller needs tens of thousands of yuan, but the cost of Wisdom Hall ipad needs only 2,000 to 3,000 yuan. In the future, more transactions will be released in Wisdom Hall APP, including the marketing function required by the customer manager.

##### 2). Mobile OA

Mobile OA first launches the governor billboard on which the governors of the branches can see various important indicators under jurisdiction at any time and any place through ipad. It provides both the graphical interface with good experience and full, accurate and detailed data, which is a strong support for strategic decisions and work deployment. It will launch new office process. Users only need to refer to the flow chart for transfer rather than modifying the system for special processes.

##### 3). Online Financial Products

Customer experience improvement is mainly embodied in the most complete assets view of customers, rapid capita flow and assets appreciation. Through the multi-channel communication of one channel registration and all channels sharing, it realizes the access to all assets view of customers and all bills in all channels. Fast capita flow provides the fast and convenient payment experience for customers and realizes the order mode of once transaction and lifetime contract in payment of water, water, electricity and gas, withdraws without card, fines and confiscations by traffic police, social security and other businesses. Because of the experience improvement of the Internet channel and the more rich products, the number of network customers of CCB in C city is increasing rapidly.

The implementation and preliminary achievements of the information technology planning in the first year has basically achieved the expected technical goal and reduced the costs of IT development, operation and maintenance at the same time (about 30% down) at the same time. The guiding role of information technology on promoting business development and strategic transformation has gradually revealed. Meanwhile, related research results also reflect the front end and scientific nature of information technology planning of CCB in C city. Research and Practice on the Application Delivery Platform in Small and Medium-sized Commercial Banks based on the independent and controllable technology of the bank has won the second prize of the information technology risk management research from CBRC, which is the highest award of city commercial banks in this field at present. Its state cryptography financial IC card pilot project has passed the check and acceptance of related national department. It is the first city commercial bank mastering the state cryptography technology.

## IV. RESULTS OF ANALYSIS AND DISCUSSION

It can be seen from above case analysis that CCB in C city ensures the effectiveness of the technology planning and application from several aspects:

First of all, it adheres to the principle of practicality and effectiveness in technology planning. CCB in C city have organized the business backbones of different specialties to discuss the technical needs and make decisions for many times. It also strengthens the training on the application of new system and strictly limits the data entry time into each new system and establishes the technology contact system among all departments and branches. More importantly, after building the new technology architecture and improving its functions, it rapidly optimizes the accurate marketing and service, improves the customer winning capacity and customer experience, which brings the revolutionary change to the operation and development concept of the whole bank.

Secondly, in the past, all banks invested a large amount of technology and human inputs to establish the independent and closed IT systems in the process of IT governance, which not only produced a large number of inefficient investments and redundant construction, but also became the unbearable burden in cost management, especially for small and medium-sized banks. CCB in C city draws the lessons from them and introduces new information technology management concept to realize the low-cost updating of IT technology.

At the same time, it refers to the successful experience of advanced banks in the field of information technology business outsourcing and cooperates with professional development companies to break through its own bottleneck and shortcomings in technology development.

Finally, it strengthens the communication with regional banks which have similar business characteristics and market orientation and different business scopes in region to greatly increase the success rate of technology communication between city commercial banks through market means of paid transaction.

## V. CONCLUSION

With the intensity of competition in the banking industry and the increase of types of banking services, informationization of banks has gradually become an important factor for them to increase their own competitiveness. Many small and medium-sized banks in China took stop-gap measures in IT construction and had no comprehensive understanding and planning of the overall IT architecture in the past, which caused the confusion and disorder of the IT architecture, complicated technologies, lack of correlation between information and high management cost. This paper hopes to guide many small and medium-sized banks in overall informationization through case analysis of the information technology strategic planning of CCB in C city.

The paper carries out analysis mainly through literature research and case analysis. It reviews the research achievements of experts and scholars at home and abroad in the related research field and provides the constructive suggestions on how to construct their own information technology system for small and medium-sized banks from the perspective of a regional city commercial bank in China:

(1) Regional city commercial banks should ensure the scientific, forward-looking and applicable nature of the planning in the overall planning process.

(2) IT architecture design and overall planning of regional city commercial banks should adhere to the concept of opening and asset-light operation to reduce the IT cost.

(3) In order to solve the technology bottleneck, regional city commercial banks should not only break through the resource limitation and focus on training and managing the core capacity but also insist on depending themselves and master the research process, core contents and intellectual property of outsourcing technologies through scientific top level architecture design and overall IT planning, so as to grasp the initiative of technology development.

(4) Regional banks must establish the cooperation union or communication and sharing mechanism of information technology. It's feasible to found the intermediary organs similar to clearing center and bank network by the bank supervision institution to coordinate and guide regional banks.

Due to the work experience, this paper is based on the practice of the author in regional banks. The relevant concepts and knowledge collected in work are only suitable for regional banks with strong similarity, but the concepts, strategies and practice of state-owned banks, joint-stock banks and advanced banks in informationization are limited. Thus, the paper has little in-depth analysis and needs improvements in objectiveness and comprehensiveness.

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