Research on Operational Risk Management Based on Bank Information Management System

Xiaofei Tang

Science & Technology University of Liaoning, Liaoning, Anshan, 114001, China.

Tangxiaofei@163.Com

Abstract

In view of the single function of risk management system, combined with computer and network technology, a new bank information risk management system and corresponding risk supervision system based on operational risk management theory are established. The problem of risk management in the operation process of bank information system is discussed in detail. The design principles of the risk management system in the bank information system are determined. A complete solution is put forward for the preparation and planning process of the system, the development environment and the selection of the development tools. According to the characteristics of the risk management system, a number of key technologies (components, COM/DCOM/ActiveX, multi-layer distributed applications) based on computer and network are applied synthetically. Three components based distributed risk management system framework is designed. They are distributed risk management system based on Windows, distributed risk management system based on Web, and distributed risk monitoring system based on Java and XML. The system has good security and practicability.

Keywords

Risk Management, Risk Management Systems, Banking Information Systems, Multi-tier Distributed Applications, Compo-nents.

1. Introduction

As a kind of special interest-seeking enterprise, commercial banks aim at operating financial assets and financial liabilities. It should have a good quality and strategic planning. In this way, enterprises can develop healthily and establish a solid foundation for the sound operation of the national economy. With the ever-changing business environment of commercial banks, especially the impact of financial liberalization and integration in the world, the risks of commercial banks are constantly increasing. Risk management is an important part of business management (Ratnovski, 2013). Therefore, with the deepening of the financial system reform and the development of the financial market, foreign commercial banks have landed in the Chinese financial market. It has become an urgent task to establish a systematic and scientific risk management system in the information management system of commercial banks in China.

At present, the risk management and control of commercial banks in China is only limited to the fragmented research of risk types, risk sources and risk control, while the theoretical system and model have not been studied thoroughly and systematically. Its main object of study is only a certain aspect of the risk of commercial banks. The methods used are mostly qualitative or simple proportional analysis (Belkhir, 2013). In addition, the development of risk management system is just beginning to adapt to the method of risk management. Its main function is to realize some simple proportional control through the computer system. In order to establish a comprehensive and systematic risk management

system for commercial banks and control all kinds of risks, the risk management in the bank information management system is taken as the research object.

2. Methodology

2.1 Risk measurement standard for commercial banks

Risk measurement originally came from the need to manage securities and portfolio. Now it has been extended to manage assets risk in other fields (Giovannoni, 2016). After reviewing the latest development of risk measurement, the risk measurement standards in the risk management system of commercial banks are discussed. Two new standards for measuring the risk and capital adequacy ratio of commercial banks are introduced, namely Value-at-risk (VaR) and Capital-at-Risk (CaR).

The measure of risk is the quantitative analysis of the risk. The number of values is used to describe the degree of risk. The risk measurement standard is the basis of risk management and control (Handorf, 2015). There are not many types of assets in the early days. Therefore, the risk measurement process and the standard are relatively simple. With the continuous development of the financial market, new financial instruments are constantly emerging. The tradable asset structure becomes more and more complex. The limitations of traditional risk measurement standards are becoming more and more obvious. Some more efficient approaches have gradually come into the field of risk measurement (Mansurov, 2013). In the practice of risk management, there are a variety of measures to measure the risk. Their overall objectives are to measure the degree of change in the income or market value of a financial asset under the conditions of the market environment (such as interest rates, etc.). It can be divided into three categories: sensitivity, variance / mean variance and lower end risk.

The relationship between them is shown in Figure 1.

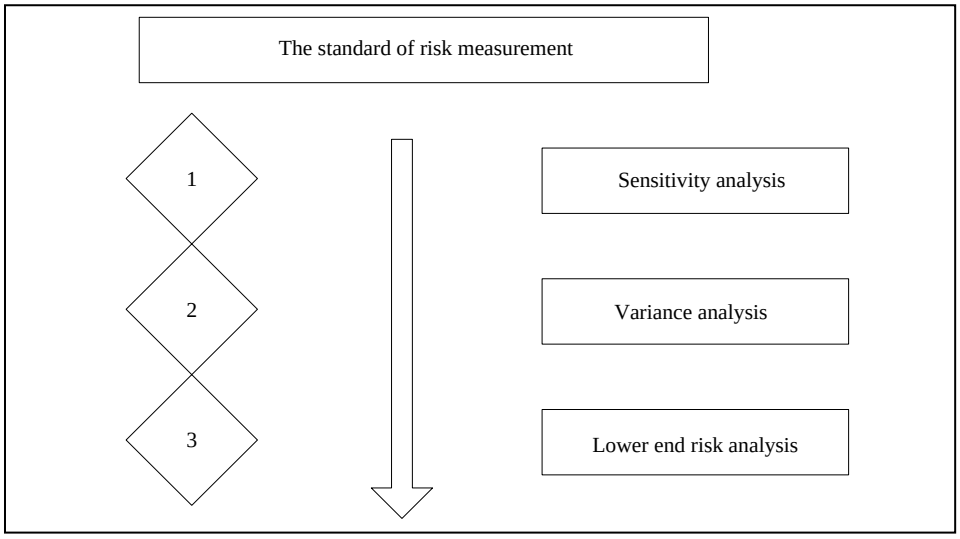

Figure 1. Risk measurement standard

The risk value vaR is defined as the maximum number of possible losses under a given tolerance α. Mathematically, it can be expressed as:

$$VaR = \max \Pr ob(\Delta X < -v) \le \alpha \tag{1}$$

This concept is similar to the concept of single side test used in probability theory and mathematical statistics. In mathematical statistics, the above tolerances correspond to the confidence level 1-α. Whereas, assuming that the distribution of data has a normal distribution with a mean value of 0, the confidence interval is often expressed as a multiple of the variance, that is, VaR can be expressed as a multiple of the variance. Then,

$$VaR = k * \sigma(X) \tag{2}$$

The venture capital CaR is to apply the VaR method to the asset domain. Its value is the capital needed to absorb potential risks under a given risk tolerance (Valipour &Vahed, 2017). Bank capital, CaR, tolerance and the probability of bankruptcy are directly linked. Tolerance determines the relationship between CaR and volatility. If the bank's capital is less than CaR, the probability of the bank's bankruptcy will be greater than tolerance. If bank capital is exactly the same as CaR, bankruptcy probability and tolerance are the same. If bank capital is greater than CaR, bank bankruptcy is less than tolerance. In general, there is a non-linear change in bank CaR and bankruptcy (Penny, 2013). This can be described as a simple normal distribution. The relationship between CaR value and bankruptcy rate is shown in Figure 2.

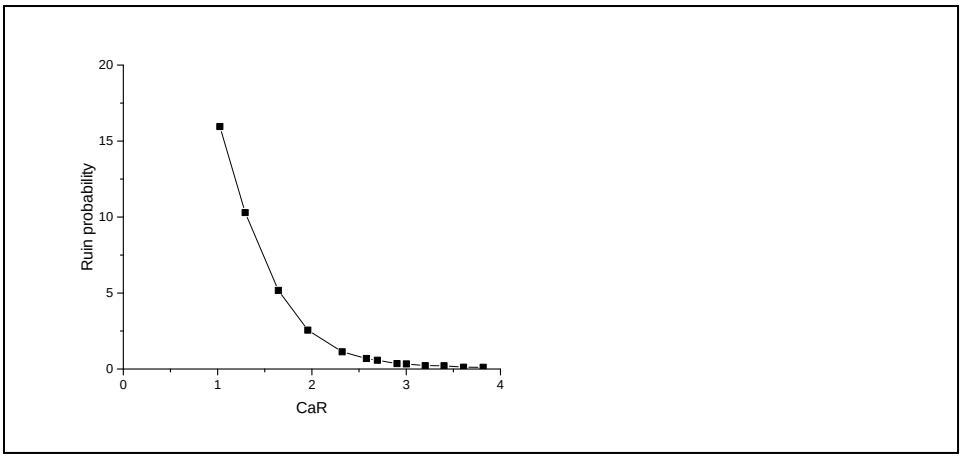

Figure 2. Relationship between CaR and bankruptcy rate

2.2 Development preparation and planning of risk management system

The development process of the financial risk management information system is a process of joint efforts by a multi domain expert. It includes financial theory research experts, quantitative analysis experts, application system developers, system integrators, and end-users (including analysts, traders and ordinary customers). At the same time, it is also a continuous and perfect process with feedback (Wei, Sha, & Yan, 2014). The whole development process is shown in Figure 3.

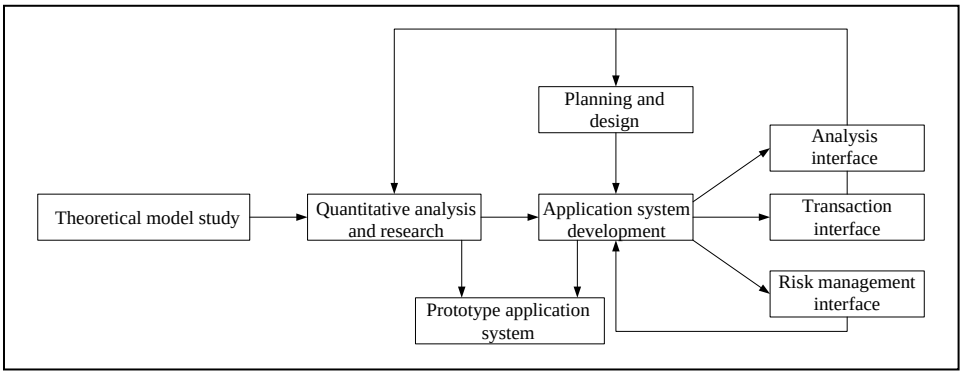

Figure 3. The development process of the financial service management information system

2.3 Design of distributed risk management system based on component

The application system of three layers' structure is developed under the windows platform. Many of the features of COM/DCOM make it the first choice. It provides great flexibility for developers, simplifies the process of upgrading and maintenance of the system, and is beneficial to the reuse of the code. According to the comprehensive analysis of the allocation and efficiency of the risk management system, COM or DCOM technology is selected. If COM technology is used, both the user layer and the application logic layer of the risk management system are configured on the local machine. The data service layer is mainly deployed on the database server. This configuration is simple and can make full use of the client's computing power. The system has better response speed. However, it is

not very convenient to maintain and upgrade. If DCOM technology is used, both the business logic layer and the data service layer are deployed on the server. The centralized management of these components can greatly reduce the workload of installation, maintenance, and upgrade (Huang, Huang, Ju, He, &Li, 2013). The body system structure of the two modes is roughly the same. In Figure 4, the two patterns are marked together, and they are separated by only one bold line. In practical application and development, one of them can be chosen according to the needs or two modes are applied at the same time.

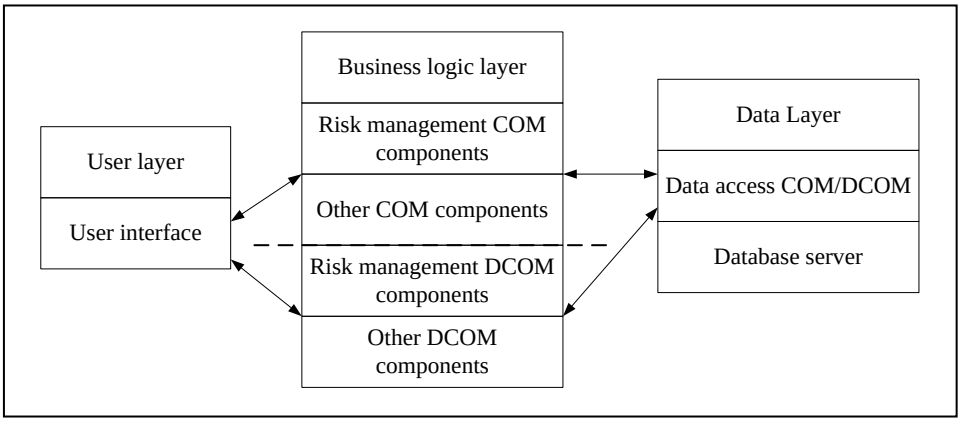

Figure 4. Structure diagram of risk management system based on WindowCOMD/COM

The weakness of Web applications severely limits the development of a stable, efficient and secure business application on the Web. With the development of inetnert technology, Web development technology continues to mature. By expanding Web server capabilities such as rapid development capabilities, transaction processing capabilities, session and state management capabilities, and scalability and security, a multi-tier web-based application development model was developed (Dawoud, 2013). For a Web-based risk management system, it is similar to the Windows-based COM / DCOM multi-tier risk management system, except that the client now uses a standard browser. The COM / DCOM components such as risk management are deployed on the application server. It takes full advantage of the features provided by the application server such as transaction processing and session management. The overall structure of the system is shown in Figure 5.

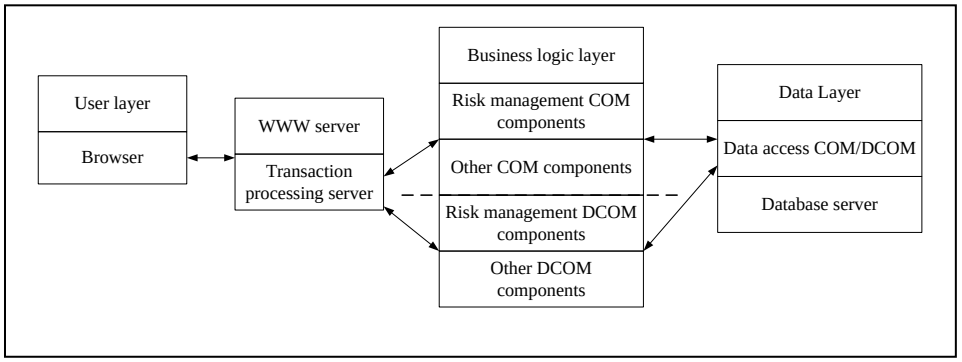

Figure 5. Architecture of a three-tier web-based risk management system

2.4 Banking risk supervision system based on XML and Java

In the overall design of risk supervision system, the most important task is to realize the transmission of risk analysis information collection from commercial bank to central bank risk analysis database. Because of many reasons, the vast majority of commercial banks have carried out unified planning and design from the general bank to the information systems of each branch. However, the design of information systems between different commercial banks is not standard. The running platform is not necessarily the same. In this way, the following two problems need to be solved. The first is information exchange between different systems and even different platforms. In this respect, XML

can play its specialty. The second is the design of application components that can run under different systems or even different platforms. This is the chance of the Java language.

For the design of the basic information structure of the central bank's comprehensive risk supervision, XML grammar is used to express these information as structured text, which is the foundation of risk supervision system. It should include the basic information needed for all risk regulation. The work can be provided by the people's Bank of China to specify the specific contents of all kinds of basic information. It is expressed in the XML grammar for use by commercial banks. The Java component mainly completes the parsing of XML documents and gets the basic information set of financial risk supervision. The basic risk analysis method and model are called, and the financial risk to be supervised is calculated on the basis of the basic information set. The analysis results are presented to the supervisor and the analysis results are processed to assist the supervision and decision-making.

The supervision system has the characteristics of fast finding, flexible tracking, high accuracy, timely handling, no need of manual intervention and active work. It has a unique role in assisting financial supervision, reducing the intensity of supervision and improving the efficiency of work.

3. Results and discussion

In the process of implementing the system, the client uses Windows 9x, Windows NT 4 or Windows 2000. The server uses Windows NT 4.0. The database server adopts SQL Server 7.0, and uses Windows application programming language Visual Basic 6.0.

The first is the installation of the database server and the establishment of data tables. In SQL Server, the database is almost the center of all implementation and management efforts. When the system is installed, the system creates four system tables: the master database, the model database, the tempdb database, and the msdb database. After the system is installed, SQL Server provides SQL tools to verify the system's installation. On this basis, the database of the financial risk management system is created. The create database command is used to create it.

The second is the creation of the application logic layer and the creation of business logic components, such as financial analysis. The financial function library is encapsulated into an ActiveX component. Then, it is compiled into a dynamic link library riskcom.dll. The DLL file is distributed on all machines that require this function. The creation and configuration of the application server for the financial analysis business has been completed.

The last one is the design of the user layer, which mainly includes the following three aspects. The first is to connect the database. The second is to instantiate financial analysis components and invoke financial analysis functions. Third is the presentation of the analysis results or the necessary maintenance of the database.

With the idea of component software design as the policy, and based on ActlveX technology, the three-layer client / server solution is applied. It has the following advantages. Application logical centralization is shared by all users on the server, which makes the maintenance and update of the system easy. When the transaction logic changes, it is only necessary to update the corresponding application logic components on the server. After that, the new transaction processing logic components can be used by all customers. The difficulty of controlling and updating the version of the client application version is avoided. In the application logic layer, developers use Visual Basic, Visual C++ and other common development tools to develop reusable binary components instead of writing stored procedures directly on data servers. These components can be mirrored on multiple machines running simultaneously, thus sharing the burden of multi-user. Application components can share the connection with the database. The database server no longer maintains a connection for every active user, thus reducing the burden on the database server and improving system performance. Security management can be authorized to the user based on components. Customers no longer direct access to the database, thus improving the security of the system.

4. Conclusion

The risk management and control of commercial banks and the development of the risk management system have been studied. A new bank information risk management system based on the operation risk management theory and the corresponding risk supervision system have been established. Three components based distributed risk management system framework is designed. They are distributed risk management system based on Windows, distributed risk management system based on Web, and distributed risk monitoring system based on Java and XML. In the concrete implementation of the system, it shows that the system has good security and practicability. It has a certain reference significance to the development of the risk management system in the commercial bank information management system.

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Avoid the stilted expression, “One of us (R. B. G.) thanks...” Instead, try “R. B. G. thanks”. Do NOT put sponsor acknowledgements in the unnumbered footnote on the first page, but at here.

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