

A Model for Detecting Bankruptcy in Nigerian Banks Using Capital Ratio and Liquidity Ratio

Dr. Okeke Ogochukwu C¹., Okonkwo Esther Nneka² (M.Sc.), Ezenwegbu Nnamdi Chimaobi³

^{1,2,3}*Department of Computer Science, Chukwuemeka Odumegwu Ojukwu University, Uli, Anambra State, Nigeria*

I. INTRODUCTION

1.1 Background of the Study

The global economic crisis of 2008 had serious detrimental effect on the economy of the world, and was seriously felt by all most especially the financial market. Since then, many people lost confidence on the stock market. Financial sector is the most important sector in the whole world since without the financial sector, it is impossible to carry out any serious business transactions. The experiences of stock market on financial institutions due to bankruptcy have remained an indelible mark in the minds of both operators and the public. Olaniyi (2007) described bankruptcy as a situation in which a sizeable proportion of financial institutions have liabilities exceeding the market value of their assets which may lead to runs and other portfolio shifts and eventual collapse of the financial system. In the case of banks, it is a situation which occurs when a fairly reasonable proportion of banks in the financial system are unable to meet their obligations to their customers, their owners and the economy as a result of weaknesses in their financial, operational and managerial capabilities which render them either illiquid and or insolvent (CBN, 1997). Bankruptcy is an early indication of a failing bank. Prolonged bankruptcy often results to bank failure. How then could banks detect bankruptcy early enough in order to avert eventual failures?

The ability to detect bankruptcy is critical for many users of financial statements. Such users include banks, investors, credit rating agencies, underwriters, auditors and regulators. During a period of financial and economic crisis, the importance of using a model to detect bankruptcy and flag warning signs as early as possible becomes increasingly important. Thus, for example, it is important for institutional investors who are buying corporate bonds of banks to know the risk of bankruptcy inherent in the said bonds, both prior and subsequent to their purchase. Financial institutions and academic researchers utilize potential bankruptcy detection models to assess distress risk. However, these models for detection of potential bankruptcy are not efficient as the banks keep having failures. Potential bankruptcy detection models are more generally known as measures of financial distress. How efficient and reliable the model becomes the worry of

every one such that there needs to be more research to develop a reliable and efficient model that can sanitize the banking sector and keep it sound.

Following the promulgation of Banking Ordinance of 1952, era of banking without special regulation came to an end. In spite of this ordinance, Nigeria experienced series of bank failures between the periods of 1952 to 1958. Uzoaga (1981) observed that only 4 out of 25 indigenous banks established during this period survived while 21 others went under. The pre-CBN bank failures were attributed to absence of regulation and control. With the promulgation of the Central Bank Act of 1958, the banking business came under the regulation and control of the CBN. Despite the establishment of CBN and its responsibilities to foster monetary stability and a sound financial system, symptoms of distress in Nigerian financial system was first officially pointed out by the World Bank Team that examined the financial sector shortly before the NDIC (Nigeria Deposit Insurance Corporation) Decree 22 of 1988 took off in February 1989. The period of 1994 to 2003 saw another round of bank failure culminating in a good number of banks having their licences withdrawn by the CBN and liquidated by the NDIC.

A cursory look at this development suggests that the banking sector in Nigeria had been operating in an unsafe and unhealthy manner, thus, exposing the fragility of the system and further erosion of public confidence. The belief that the reforms of 2004/2005 would usher in a new era of banking in Nigeria, especially in the area of enhanced capital base/shareholder's funds, turned out to be a mirage. This was revealed from the sector in late 2009 when the ugly situation of a huge sum of non-performing loans for which provisions were not made in different balance sheets of the banks culminated to capital erosion of 9 out of 24 banks in the country. This portends great danger to the system and requires drastic approach to be embarked upon, not only by the CBN, but also by the practitioners and the academia alike, as the financial sector is the engine hub of any nation. In line with the popular saying that prevention is better than cure, the Central Bank developed a system tagged CA (using capital adequacy ratio) to determine the financial health status of banks in Nigeria for a necessary reform. This system, from the point of view of continued

bankruptcy or failures in our financial industry without early detection seemingly, is inadequate, especially as has been argued by several experts (Ukah, 2007; Okigbo, 2003). This study is therefore advocating for a new model which will not only measure the financial health of these banks but would be able to detect potential bankruptcy and call for necessary action in order to checkmate the situation or prevent failures.

1.2 Statement of the Problem

When analyzing the state of health of banks in Nigeria, the following problems were found:

- a) Capital and liquidity ratio which are useful tool for identifying banks with deteriorating financial condition are not currently employed in ascertaining bank health in Nigeria.
- b) Frequent bank distress occurs because the model used to monitor bank status does not provide real-time feedback. The checks are done periodically. Therefore, the time interval gives room for missing information about a bank that is near danger.
- c) The model developed by CBN called CA which uses capital adequacy ratio to monitor the status of the bank is not adequate since other factors such as liquidity ratio, ownership structure, ineffective or weak internal control system and poor management system, could be used to monitor the activities of the bank.
- d) Evidently, there is no consensus on any given model for detection of potential bankruptcy in Nigerian banks. Again, having a perfect system that could detect potential bankruptcy or failure in banks is not enough.

1.3 Aim and Objectives of the Study

The aim of this study is to develop a computer model for the detection of potential bankruptcy in banks. The computer model would be expected to give on the spot bank's health status on real time bases as transactions are carried out. The early indication of the bank's financial condition would enable the management to take precautions early enough in order to avert the potential bankruptcy while it would help the public and potential investors to look before they limp. This aim will be achieved with the following listed objectives:

- a) To include among others, asset quality and liquidity ratio as factors that help to determine bank failures.
- b) This study therefore, sets to solve this problem by developing a model for detecting potential bankruptcy in financial organizations.
- c) To determine the appropriate financial ratios that would impact negatively on a bank's financial status.
- d) To provide a model using the financial ratios to determine the financial strength/status of the bank.

- e) To provide real time financial status information to the management and other statutory bodies.

1.4 Significance of the Study

This study is of much significance because having gone through records, it has been noticed that CBN utilizes capital adequacy ratio to detect and prevent bankruptcy in different banks but these banks do not have inbuilt automated system that automatically notifies them when this ratio is below expectation. Hence, the new model is of much significance first to the banks because, it will be installed in each of these banks so that they could monitor themselves. The system is such that it will be used to monitor the banks periodically: weekly, monthly and yearly basis in order to detect early bankruptcy signal.

Also, the monitoring authorities (CBN and NDIC) will benefit from this study since their periodic checks on banks which may not be timely can now be augmented with efficient, flexible, automated and timely operated system that would eschew the manual rigours.

The government will equally benefit as the system will enable her build a sound and viable economy. Similarly, other organizations, both public and private could mimic this model to design and develop their own models that will enable them monitor their organizational financial viability.

1.5 Scope of the Study

This study detects potential bankruptcy in Nigerian banks. It is limited to the use of appropriate financial ratios to detect potential bankruptcy in bank.

1.6 Definition of Terms

Model: A model is a representation of the construction and working of some system of interest. A model is similar to but simpler than the system it represents.

Capital Adequacy Ratio: Capital adequacy ratio (CAR), also called Capital to Risk (Weighted) Assets Ratio (CRAR), is a ratio of a bank's capital to its risk. National regulators track a bank's CAR to ensure that it can absorb a reasonable amount of loss and complies with statutory Capital requirements.

Liquidity Ratio: Liquidity ratio is a class of financial metrics that is used to determine a company's ability to pay off its short-term debts obligations. Generally, the higher the value of the ratio, the larger the margin of safety that the company possesses to cover short-term debts. Liquidity ratio, expresses a company's ability to repay short-term creditors out of its total cash. The liquidity ratio is the result of dividing the total cash by short-term borrowings. It shows the number of times short-term liabilities are covered by cash. If the value is greater than 1.00, it means fully covered.

Financial Institutions: Basically, the term financial institutions encompasses several economic setups which provide financial services to its members or clients. This includes various deposit taking institutions such as banks and credit unions, as well as non-banking institutions such as insurance companies, investment funds, brokers, etc. Most of these financial institutions are regulated by the government. The most important function of these financial institutions is to channelize funds between lenders and borrowers indirectly.

Bank: A bank is a financial institution in itself - a deposit taking financial institution to be precise. As with most of the other institutions listed above, even banks acts as financial intermediaries. Basically, banks allow consumers deposit money in savings accounts and lend the same money in form of various loans. Banks are among the most strictly regulated financial institutions in any economy. While the basic concept of a bank is same in all the countries, the restrictions on these banks may differ from one country to another.

II. LITERATURE REVIEW

2.1 The Concept of Financial Crisis

The term financial crisis is applied broadly to a variety of situations in which some financial institutions or assets suddenly lose a large part of their value. In the 19th and early 20th centuries, many financial crises were associated with banking panics, and many recessions coincided with these panics. Other situations that are often called financial crises include stock market crashes and the bursting of other financial bubbles, currency crises, and sovereign defaults (Kindleberger & Aliber, 2005; Laeven & Valencia, 2008).

Some economic theories explained financial crises. World Systems Theory explained the dangers and perils which leading industrial nations will be facing at the end of the long economic cycle which began after the oil crisis in 1973. Coordination games, a mathematical approach to modelling financial crises, have emphasized that there is often positive feedback between market participants' decisions (Krugman, 2008). Positive feedback implies that there may be dramatic changes in asset values in response to small changes in economic fundamentals, Minsky's theorized that financial fragility is a typical feature of any capitalist economy and financial fragility levels move together with the business cycle, but the Herding and Learning models explained that asset purchases by a few agents encourage others to buy too, not because the true value of the asset increases when many buy (which is called "strategic complementarity"), but because investors come to believe the true asset value is high when they observe others buying (Avery & Zemsky, 1998; Chari & Kehoe, 2004; Cipriani & Guarino, 2008).

2.2 Causes of Financial Crisis

There are four major factors accountable for bank distress that finally lead to bank failure and each of the factors is reviewed below.

a) Lack of Disclosure and Transparency: Disclosure and transparency are the key pillars of a corporate governance framework, because they provide all the stakeholders with information with which to judge whether their interest are being represented or not. For the transparency to be meaningful, information should be accessible, timely relevant and qualitative. Lack of transparency undermines the ethics of good corporate governance and prospect for effective contingency plan for managing systemic distress.

It is obvious, that lack of transparency and disclosure of information deter efforts as to ascertain how many financial and economic activities are been mismanaged, therefore contributing to an increase in the proportion of economic and financial crimes in the banking industries in Nigeria. Trust and fiduciary principle, which are the cornerstone of banking industry have been jettisoned as banks now engaged in all manner of malpractice, such as the deliberated conciliation of correct records. This forms the bedrock of the supervisory oversight by the system, thus distortions will necessarily result, passing of wrong information to the regulatory authorities. The information which should have been a helping hand to take adequate measures to prevent further bank distress/failure are distorted, thereby rendering regulatory authority handicapped until the bank will hit the irreversible point of total collapse.

Imala (2004) opined that the issue of disclosure and transparency have to be taken serious in this new dispensation because lack of transparency and disclosure have been a recurring problem in the financial industry in Nigeria. Unless its improved upon, otherwise it is a waste of effort of the supervisory authorizes in trying to implement the new accord, which would have been of great assistance in laying a solid foundation to avert bank failure in Nigeria.

b) Inadequate Capital: Ogundina (1999) argues that capital in any business whether bank or company serves as a means by which losses may be absorbed. Capital serves as a shock absorber to withstand any form of abnormal losses not covered by current earnings patterns. Unfortunately, a good number of banks are grossly undercapitalized. This situation of inadequate capital could partly be attributed to the fact that many of these banks were established with very little capital. This problem of inadequate capital is worsened by the huge amount of non-performing loan of some of these banks. Therefore for any bank to maintain its solvency, it has to maintain adequate capital to meet up with its financial obligations, operate profitably and contribute to promoting a sound financial system. CBN

therefore, prescribes minimum capital, which stipulates that at least 50 percent of the component of bank's capital shall comprise paid-up capital and reserves. Every bank shall also maintain a ratio not less than one is to ten (1:10) between its adjusted capital funds and its total credit. When any bank capital falls below the prescribed ratio, it is an indication that the bank is heading for distress. Inability to meet stipulated higher minimum capital requirement means that the banks is unhealthy.

c) Huge Amount of Non Performing Loan: Ogundina (1999) observes that the Nigeria financial system over the years have been under severe stress as a result of large amount of non-performing loans.

This is when it is extremely difficult or impossible to recover a substantial part of the loan which is part of the capital from debtors. Based on this research, it have been observed that many owners and bank directors abuse or misused their privileged position or breach their fiduciary duties by engaging in self-serving activities. The abuses include granting of in-secured credit facilities to owners, directors and related companies which in some cases were in excess of their bank's lending limits invocation of the provision of the law.

d) Staff Involvement: Bank staff are overwhelming involved in bank failures. They engaged themselves in all sort of banking malpractices (such as forgery, embezzlement, defalcation, theft, manipulation of vouchers, etc.) that wreck the bank. Anyanwu (2010) opined that the principal causes of bank failure are dishonest and or inept bank managers even to the level of the board members especially those that were appointed by way of political considerations. For instance, what happened recently in Spring Bank, where some directors led by the managing directors have taken unauthorized insider loans running into billions of Naira. The CBN disbanded the board and appointed an interim management board, is a clear example. Some of the sources of banking malpractices engaged by the staff of the bank are highlighted below.

- Forgeries: This is the fraudulent copying and use of customer's signature to draw money from the customer's account without prior notification/consent of the customer. This research has shown that most of such forgeries are masterminded by internal staff or by outsider who act in collusion with employees of the bank who usually are the ones to release the specimen signature being forged.

- Defalcation: This is the embezzlement of money that is held in trusts on behalf of customer by a banker, where such fraud is committed, it is neatly perpetrated and it takes a longer time to uncover it. It is mostly uncovered during reconciliation of customer's bank account. Bankers also collude with customers agent when he steals notes

from money meant to be paid to unsuspecting customer/client and pay the money into customer agent account.

- Money Laundering: This is deceitful act of legitimizing money got from criminal activity by saving them in the bank account of the criminal or by helping them to transfer it to foreign bank account or investing it in legitimate business.

- Manipulation of Vouches: This is when a banker substitute or involved in conversion of entries of one account to another account being used to commit the fraud. It thrives well in a banking system saddled with inadequate checks and balances.

- Unofficial Borrowing: This is when bank staff borrowed from the bank informally. Such borrowings are done in exchange of the staff post dated cheque or IOU or even nothing. These unofficial borrowings at times ran into millions of naira though might be replaced but without any interest attached to it or may resort to other means of balancing the cash without ever having to replace the sum of money collected.

2.3 Indices for Measuring Bank Failures

Bank failure includes technical and legal insolvency. Insolvency here means negative net worth or inability to meet current obligations as they fall due; even if the bank's total assets exceed its total liabilities. When a firm or either a bank is liquidated for its inability to meet its obligations to creditors, it has clearly and unambiguously "failed". But in a situation where a bank's financial condition results in shareholders' funds being completely or largely wiped out, it is appropriate to view this as failure even if legal action is not taken to liquidate the bank. The worldwide definition of distressed (or insolvent) bank is one whose classified assets exceed 100 percent of shareholders' funds. Banks in Nigeria are often assessed to be insolvent or a problem bank using either CA rating scheme or LR rating scheme.

2.3.1 The CA rating scheme

The CA rating scheme utilizes one ratio (Capital Adequacy ratio) to monitor the health of the bank. The bank supervisory authorities stipulated a bench mark for this ratio, and if any bank goes below the bench mark, such bank is marked unhealthy and can fail at any time.

2.3.2 Liquidity in Banks

Bank liquidity can be determined by the level of liquid assets it has. Such liquid assets like cash and other short term funds can be employed in meeting the banks daily transaction needs, and precautionary needs against unforeseen demand for cash, and the CBN liquidity ratio requirements. It must be emphasized that bank assets need

not be so much in liquid form to enable it invest optimally in income earning assets for profits.

CBN (1997) retains 30% of total deposit liabilities as the statutory minimum liquidity ratio requirement for both commercial and merchant banks. In CBN (1996) monetary and credit guidelines, "the share of Treasury bills and Treasury Certificates in each banks liquid assets shall continue to be a minimum of 10% of the bank's total deposit liabilities (Anyanwu, 2010). A bank's net placement with discount houses shall continue to count as part of the bank's liquid assets for the purpose of meeting the statutory liquidity ratio.

The LR rating scheme utilizes one ratio (Liquidity ratio) to monitor the health of the bank. The bank supervisory authorities stipulated a bench mark for this ratio, and if any bank goes below the bench mark, such bank is marked unhealthy and can fail at any time.

2.4 Implications of Banking Crisis

According to Ekundayo (1994), banking crisis where it occurs could result in serious economic disequilibrium and distortion which if not well managed could portend doom and even lead to economic depression. The economic distress fostered by the collapse of the payments system, at some time in history, on the big economies like USA, Britain and Japan were instructive. Those economies witnessed recession consequent upon the failure of their payments system. The resolution options adopted however minimized the impact of the crisis in those jurisdictions. Bank failures are therefore made relatively painless while public confidence in the system has continued to be engendered and sustained in these economies.

Anyanwu (2010) stated that in the specific instance of Nigeria, the country had witnessed two painful eras of bank failures: The pre-1950s when 21 out of the 25 indigenous banks folded up. The distressed syndrome also resurfaced in the late 80s such that by December 1995, 60 out of 115 banks in operation were known to be distressed. It is now common knowledge that many of those that could not be salvaged were later closed down by the CBN. Between 1994 and 2002 a total of 33 banks were closed down. This excludes Rims and Savannah as the action of the Regulatory Authorities in respect of them is being challenged in the courts.

The experience of the last era has been largely unsavory. The means of livelihood of thousands were suddenly cut off, contractual obligations running into hundreds of millions of Naira between the banks and their creditors were frustrated, not to mention the thousands of jobs that were directly or indirectly lost. Such was the painful experience of bank failures. In fact, it took the systematic and pragmatic disposal of the failed banks by the Regulatory Authorities to forestall the contagion effect it

could have had on the healthy institutions (Anyanwu, 2010).

While any legal entity could fail, bank failure on the contrary is an issue because of the financial intermediation role of banks which makes failure in the sector something of great concern both to the depositors, investing public, operators, Regulatory Authorities and government. Apart from the yield offered by banks to depositors, another important reason why funds are kept with banks is safety consideration for which distress or bank failure is an aberration to such depositors.

Bank distress leads to loss of confidence which could jeopardize the intermediating roles of banks. The consequential dearth of investible funds could truncate economic growth and development. It is therefore expedient to adopt a resolution strategy that will help to ensure a stable banking system and engender public confidence in the industry.

2.5 Empirical Review of Related Research

Most authors have researched into financial ratios that can be used to detect bankruptcy such as Olaleka and Adeyinka (2013) studied the effect of capital adequacy on profitability of deposit-taking banks in Nigeria. They used primary data collected by questionnaires and published financial statement of banks from 2006 - 2010. Their findings for the primary data analysis revealed a non-significant relationship but the secondary data analysis showed a positive and significant relationship between capital adequacy and profitability of bank. This implies that capital adequacy plays a key role in the determination of profitability. They also discovered that capitalization and profitability are indicators of bank risk management efficiency.

Aspal and Nazneen (2014) studied on determinants of capital adequacy ratio in Indian Private Sector Banks. The study examines whether specific bank performance factors particularly Loan, Asset Quality, Management Efficiency, Liquidity and Sensitivity have an impact on capital adequacy requirements among private sector banks of India. The study highlighted the impact of some risks such as credit (loan), liquidity and sensitivity on the capital adequacy of Indian Private Sector Banks. They used Multiple linear regression analysis to analysed secondary data from the annual reports of relevant banks for a period of 5 years (2008-2012), which is the most recent data available on banking sector immediate after 2007 global financial crisis. The results highlighted that capital adequacy ratio is negatively correlated with proxy variables of lending (loans), asset quality and management efficiency. However, liquidity and sensitivity are positively correlated. The regression results have revealed that Loans, Management Efficiency, Liquidity and Sensitivity have statistically significant influence on the

capital adequacy of private sector banks. However, the independent variable asset quality has negligible influence on capital adequacy of Indian private sector banks.

Ikpefan (2013) investigates the impact of bank capital adequacy ratios, management and performance in the Nigerian commercial bank (1986 - 2006). The study used a cross sectional and time series of bank data obtained from Central Bank of Nigeria (CBN) and Annual Report and Financial statements of the sampled banks. The formulated models were estimated using ordinary least square regression method. He found out that adequate capital adequacy can serve as a veritable stimulant in strengthening the performance of Nigerian commercial banks and also heighten the confidence of customers especially in this era of global economic meltdown that has taken its toll in the Nigerian financial system.

Olagunju et al (2011) in their study on liquidity management and commercial banks' profitability in Nigeria examined the empirical evidence of the degree to which effective liquidity management affects profitability in commercial banks and how commercial banks can enhance their liquidity and profitability positions. They used both qualitative and quantitative methods of research. The data obtained from the Primary and Secondary sources were analyzed through collection, sorting and grouping of the data in tables of percentages and frequency distribution. The formulated hypotheses were statistically tested through Pearson correlation data analysis. Findings indicate that there is significant relationship between liquidity and profitability. That means profitability in commercial banks is significantly influenced by liquidity and vice versa. The study concluded that for the success of operations and survival, commercial banks should not compromise efficient and effective liquidity management. Finally the study recommends: The Central Bank should be encourage maintaining a flexible Minimum Monetary Policy [MMP] or discount rate so as to enable the commercial banks take advantage of the alternative measures of meeting the unexpected withdrawal demands

Adeyeye et al (2012) studied on liquidity management and commercial banks' profitability in Nigeria. Their analysis of the regression model indicates that the measures of profitability, liquidity, credit risk and capital adequacy are the key predictive financial ratios. In other words, differences in profitability, liquidity, credit risk (asset quality) and capital adequacy (sustenance) are found to be the major distinguishing characteristics between the non-failed (healthy) and failed banks. However, variables for management quality and other bank characteristics like economic conditions and staff productivity are potentially not important predictors of financial problems in Nigerian banks but might make a difference for the group of banks that are facing difficulties.

2.6 Summary of the Related Studies

Analysis of related studies has shown that financial ratios are vital in detecting bank failure. Capital adequacy and Liquidity are strong financial ratios that drive the performance of banks. The two ratios have been emphasized by several studies as being able to drive the strength and performance of banks. Presently, no model has been developed to use these two financial ratios jointly to detect potential bankruptcy. Also, detection models in existence have not been built into the daily transactions of the banks for real time detection.

Against this backdrop, this present study is set out to develop an enhanced computer model for detection of potential bankruptcy in banks. This model will be incorporated into the daily transactions of the bank to detect potential bankruptcy on a real time basis. More so, this model will utilize two financial ratios (capital adequacy and liquidity ratios) to strongly detect potential bankruptcy.

III. SYSTEM ANALYSIS AND RESULTS

3.1 Analysis of the Existing System

The analysis of the present system points out ways and methods by which regulatory authorities carry out supervisory functions in banks as at present. Supervisory authorities carry out their functions through bank examinations. Bank examination may be defined as the examination of the books and records of a bank for the purpose of ascertaining that the affairs of the bank are being conducted in a safe and sound manner with respect to: adequacy of capital, asset quality, board and management, earnings, liquidity, adequacy of internal controls, adequacy of accounting system and record keeping as well as compliance with both the individual banks' internal policies and prudential regulations. To accomplish the task of examining banks, bank examiners use both off-site and on-site supervision to carry out their supervisory functions.

3.1.1 Ratios Used by the Supervisory Authorities in Monitoring the Banks Under the Existing System

In the existing system, the supervisory authorities use either capital adequacy ratio or Liquidity ratio (but not both at the same time) to monitor the activities of the bank. These ratios have been assigned minimum rating as bench mark by the supervisory authorities thus:

$$CA = \frac{T1 + T2}{a} \geq 1 \dots \dots \dots 3.1$$

Where:

CA = Capital Adequacy

T1 = Tier 1 capital, which is the summation of: Paid up capital or Capital base, Statutory reserve and Disclosed

free reserve subtracted from the summation of: Equity investment, Intangible assets and Current/brought forward losses.

T2 = Tier 2 capital, which is the summation of: Undisclosed reserve, General loss reserve and Hybrid debts.

a = Risk Weighted Asset, which is the total assets owned by the organization.

$$LR = \frac{\text{Liquid asset}}{\text{Short term liability}} \geq 25 \dots \dots \dots 3.2$$

Where:

LR = Liquidity ratio

Liquid asset = The total working capital or cash available at the bank from day to day transactions; and

Short term liabilities = The demand from the working capital, which is mainly made up of daily withdrawals from the bank.

3.1.2 Advantages and Disadvantages of the Existing System

The existing system whereby banks and banking activities are monitored by supervisory authorities (CBN and NDIC) in order to detect or predict potential bankruptcy has both advantages and disadvantages. The advantages include:

1. The major advantage of the existing system is that it does not involve much cost as individual banks do not have installed automated system to monitor itself instead the CBN does the monitoring periodically.

The disadvantages include:

1. The supervisory activities of the CBN have not been very effective in checking distress within the banking system as some information may be hidden from the CBN by the individual banks.
2. Because the monitoring as stated is done on periodic basis, most times, it becomes medicine after death as things may have gone wrong before the detection of the bankruptcy.
3. It may be difficult for a bank to start early enough to take necessary actions like pumping more money into the system, curtailing loans, and such like since they are not monitored day in day out.

3.2 Analysis of the New System

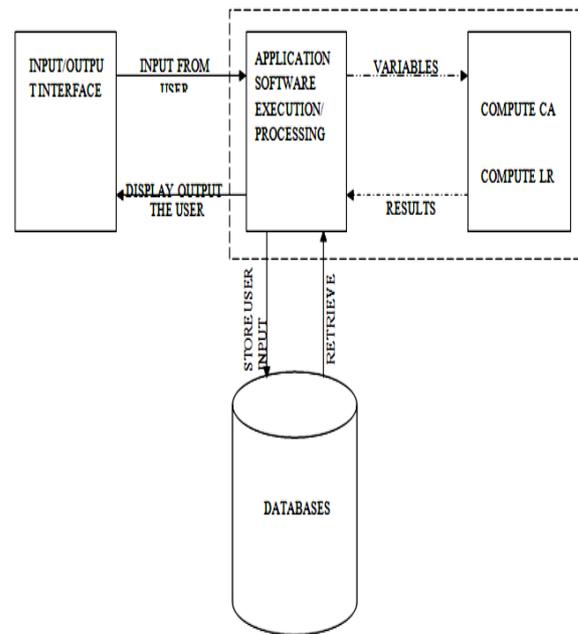


Fig. 3.1: model of the new system.

Description

The user or Bankers type input information to the input/output control form. The information is stored in the database table. Such information as customer account information, deposits, withdrawals (daily transaction), information about bank's special account and reserve or loans. The application sends the necessary information to the database and retrieves other information that will be needed for computation of Capital Adequacy (CA) and Liquidity Ratio (LR) ie. the CALR model. The result of the computation is then used to generate or establish the status of the bank and then displayed back to the input/output interface.

Computation of CALR-

The variables for CA (Capital Adequacy) are grouped into 3 viz:

1. Tier 1 capital
2. Tier 2 capital
3. Risk weighted assets.

Tier 1 capital is the summation of: Paid up capital or Capital base, Statutory reserve and Disclosed free reserve subtracted from the summation of: Equity investment, Intangible assets and Current/brought forward losses.

Tier 2 capital is the summation of: Undisclosed reserve, General loss reserve and Hybrid debts. While Risk Weighted Asset is the total assets owned by the organization.

Therefore,

$$CA = \frac{\text{Tier1} + \text{Tier2}}{\text{Risk weighted asset}}$$

Tier 1 = (Paid up capital + Statutory reserve + Disclosed free reserve) – (Equity investment + Intangible assets + Current and b/f losses)

Tier 2 = Undisclosed reserve + General loss reserve + Hybrid debt.

The values of these variables are retrieved from the sum of the amount from each database table representing each of the variables.

Computation of LR- Liquidity Ratio

$$LA = \frac{\text{Liquid asset}}{\text{Short term liability}}$$

Where:

Liquid asset is the total working capital or cash available at the bank from day to day transactions; and

Short term liabilities are the demand for the working capital, which is mainly made up of daily withdrawals from the bank.

Therefore, the Liquid Asset is represented by the total deposits available in the bank while short term liabilities are represented by the total withdrawals from the bank.

The LR variables are retrieved from a database table of daily transactions of deposits and withdrawals.

$$LR = \frac{\text{Liquid asset}}{\text{short term liabilities}} = \frac{\text{total deposit}}{\text{total withdrawals}}$$

3.2.1 Advantages and Disadvantages of the New System

The advantages of the new system are:

1. The system will help management and individual investors to be able to monitor the health of banks before they invest their money in them.
2. The system will give timely signal to the management of banks when their liquidity and/or capital adequacy ratios of the bank go beyond acceptable level. This will make the bank to take necessary actions on time to avoid bankruptcy.
3. The system will be of benefit to the monitoring authorities such that they may not need to monitor the banks again since they are adequately regulated on weekly basis.
4. The new system will restore confidence of investors as they can use it to determine the status of a given bank before investing their money on it.
5. The new system will equally eliminate the need for huge lumps of paper that are needed to be examined by authorities of the CBN and NDIC.

The new system will have one identified disadvantage which will be the cost of installation of the system.

3.3 Justification of the New System

Worldwide, the banking business is highly regulated. This is because of the pivotal position the financial industry occupies in most economies. The new system is justified for the following reasons:

- Proper bank regulation assures stability of the system and protection against systemic risk and collapse hence protection of depositors' money and maintenance of public confidence in the system.
- The new system, which is an efficient system, it is believed, will help the government restore the nation's economy from the past failures it has suffered; it will equally restore the confidence of investors, hence, ensuring safe and sound banking practice.
- The new system will provide on the spot check of the financial health status of the bank using bank transactions.
- It is obvious that the new system has both advantages and disadvantage, but the advantages far outweigh the disadvantages thereby justifying the new system.

3.4 High Level Model of the New System

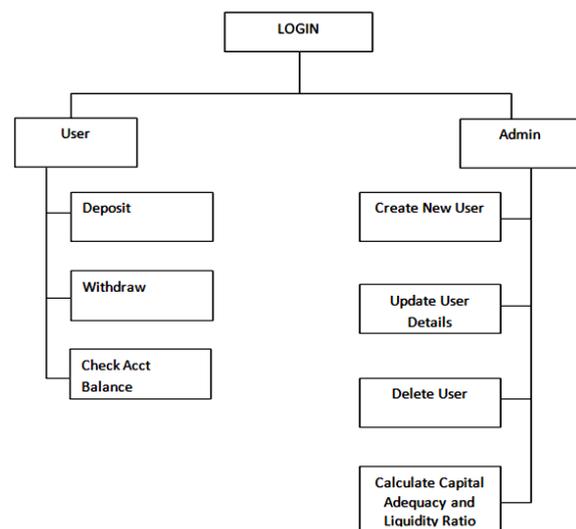


Figure 3.2: High Level Model of the New System

IV. SUMMARY AND CONCLUSION

Review of Achievement

The detection model system was tested and found to achieve the following:

1. The design detects when a bank is well funded, not adequately funded and underfunded;
2. The model calculates the liquidity and capital adequacy ratios of banks using their banks daily transactions;
3. The model alerts the bank management and or the shareholders and intending investors on their financial status using capital adequacy and liquidity of the bank.

Areas of Application

The new system can be applied in the bank and can equally be modified to be used in the following areas:

- 1) Business Organizations.
- 2) Any institution that deals with financial transactions.

Suggestions for Further Research

It is suggested that this study be repeated using loan portfolio (Non-performing loans) as input variables to detect bankruptcy in financial institutions in Nigeria.

Contribution to the Body of Knowledge

This work focuses on the design of a computer model for bankruptcy detection in banks using Fidelity Bank Plc. as a study. Before now, CBN and NDIC were the two monitoring agents for Nigerian banks. Individual intending to invest in banks do not have system to monitor these banks to know their health status. Also, existing models have utilized different financial ratios other than CALR rating system which this model utilizes to detect bank failures. This study has been a challenge in that area. Having seen what Nigerian banks are passing through in the recent time, this study will go a long way to remedy the situation and restore confidence of the masses when deciding on where to invest their hard earned money.

Recommendations

This study is a worthwhile study to be embarked upon in this country. It is recommended that Nigerian banks use the program developed in this work to boost their banking activities in order to eliminate the issue of bankruptcy thereby fostering confidence again in their numerous customers and the Nigerian citizens at large. The government should encourage researchers who embark on this kind of project by sponsoring them.

Conclusion

The significance of this system cannot be overemphasized. It has been tested and found to be reliable. This system can be used by banks in Nigeria. The system without doubt, is beneficial. If the system is deployed in Nigerian banks today, the management of the bank could utilize it to avert bankruptcy. This they can do by taking several steps as soon as they notice that the bank is seriously depreciating. The steps to be taken can come in different directions such as: withdrawal of loans and credits when the need be, selling more shares in order to pump money into the bank, etc. More so, individuals can repose their confidence on the integrity of Nigerian banks since the banks can buckle up to their services and render much more services without being bankrupt or going under.

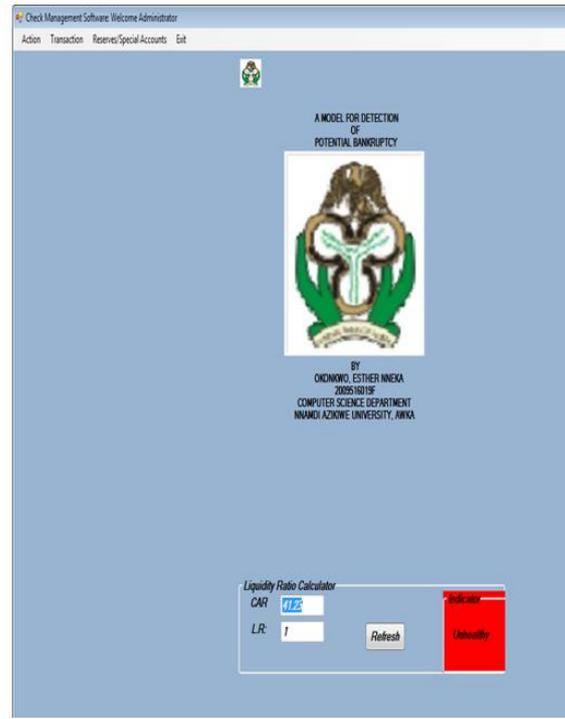
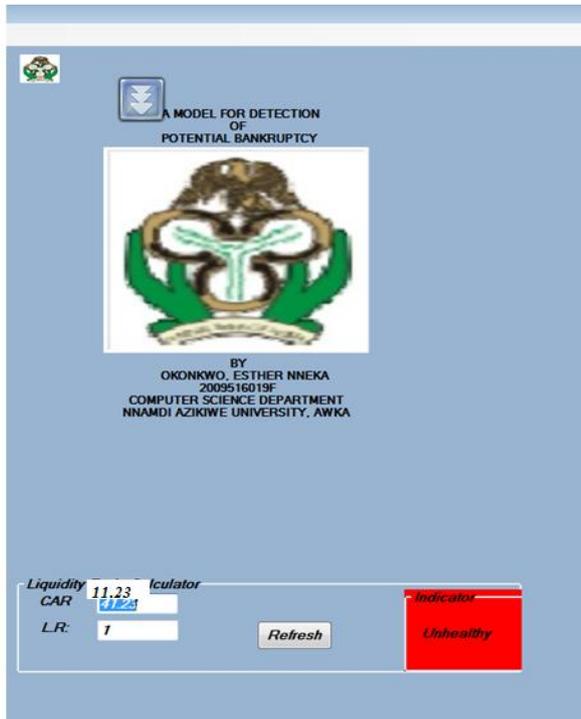
REFERENCES

- [1] Adeyeye, P. O.; Fajembola, O. D.; Olopete, M. O. & Adedeji D. B. (2012). Predicting Bank Failure in Nigeria using Principal Component Analysis and D-Score Model. *Research Journal of Finance and Accounting*, Vol. 3, No 8; 159-170.
- [2] Amamchukwu C.O. (2011) Capital Ratio as Predictors or Distress, *Glid Journal Inc. (USA)*, 106, pp. 673-787.
- [3] Anyanwu, C.M. (2010). An Overview of Current Banking Sector Reforms and the Real Sector of the Nigerian Economy. *Central Bank of Nigeria Economic and Financial Review Volume 48/4 December 2010*.
- [4] Asikhia Olalekan and Sokefun Adeyinka (2013) Capital Adequacy and Banks' Profitability: An Empirical Evidence from Nigeria, *American International Journal of Contemporary Research*, Vol. 3 No. 10; 87-93.
- [5] Avery, C. & Zemsky, P. (1998). 'Multidimensional Uncertainty and Herd Behavior in Financial Markets'. *American Economic Review* 88, pp. 724-748.
- [6] Blum, M. (1974). 'Failing Company Discriminant Analysis'. *Journal of Accounting Research*, Spring, 1974, 1-25.
- [7] Boyd, J.H. & Prescott, E. (1986). "Financial Intermediary Coalitions", *Journal of Economic Theory*, 38, pp. 211-232.
- [8] Breuer, A.; King, N.Y. & Wilford, D. (2009). "The Role of Early Warning Models in the Identification of Problem Banks: Evidence from Nigeria". *Nigeria Financial Review*, Vol. 6 No. 1 pp. 29-43.
- [9] Brownbridge, M. (1998). The Causes of Financial Distress in Local Banks in Africa and Implications for Prudential Policy, *United Nations Conference on Trade and Development (UNCTAD) Discussion Papers No. 132 (UNCTAD/OSG/DP/132)*.
- [10] Carlin, W. & Mayer, C. (2003). 'Finance, Investment, and Growth', *Journal of Financial Economics*, 69, 191-226.
- [11] Central Bank of Nigeria (1995). *Banking Supervision Annual Report*, Abuja.
- [12] Central Bank of Nigeria (1997). *Guidelines and Incentives on consolidation in the Nigerian Banking System*. Abuja: CBN publishing.
- [13] Central Bank of Nigeria (2002). *Central Bank of Nigeria Annual Reports and Statement of Accounts (2002)*.
- [14] Chari, V., and Kehoe, P. (2004). 'Financial Crises as Herds: Overturning the Critiques'. *Journal of Economic Theory* 119, pp. 128-150.
- [15] Čihák, P.; Walmsley, J. & Allen F. (2009) "Are The Causes of Bank Distress Changing. Can Researchers keep up?" *Federal Reserve Bank of St Louis Review*, 8(1). Pp 57-80.
- [16] Cipriani, M., and Guarino, A. (2008). 'Herd Behavior and Contagion in Financial Markets'. *The B.E. Journal of Theoretical Economics* 8(1) (Contributions), Article 24, pp. 1-54.
- [17] Delong J.B. (1991). 'Did J. P. Morgan's Men Add Value?: An Economist's Perspective on Financial Capitalism', in Peter Temin, ed., *Inside the Business Enterprise: Historical Perspectives on the Use of Information* (Chicago, IL: University of Chicago Press for NBER), pp. 205-36.
- [18] Diamond, D.W. (1995). 'Liquidity, Banks, and Markets', *University of Chicago CRSP Working Paper*. December 1995.
- [19] Ekundayo, J.O. (1994). 'The Future of the Banking Industry in Nigeria'. *Lagos: Central Bank of Nigeria Economic and Financial Review*. Vol. 32 (3): 344-355.
- [20] Geršl, A. and Seidler, J. (2010). 'Conservative Stress Testing: The Role of Regular Verification'. *IES Working Paper 12/2010*. IES FSV. Charles University.

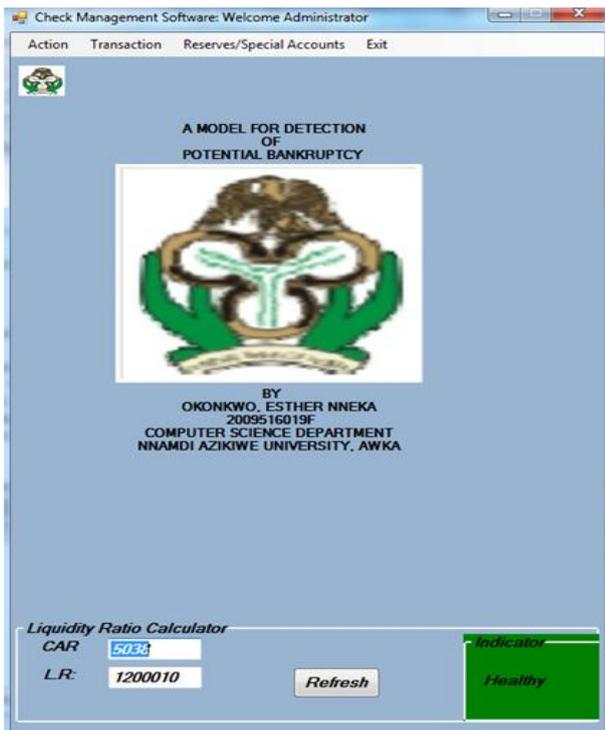
- [21] Greenwood, J. and Jovanovich, B. (1990). 'Financial Development, Growth, and the Distribution of Income'. *Journal of Political Economy*, University of Chicago Press, vol. 98(5), pages 1076-1107, October.
- [22] Gunther J. W. & Moore R.R. (2002). "Early Warning Models in Real Time. <http://www.dal.frb.org>. Retrieved October 10, 2012".
- [23] Haldane (2009). Small Lesson from a Big Crisis. Remarks at the Federal Reserve Bank of Chicago 45th Annual Conference. 'Reforming Financial Regulation' 8 May 2009. Retrieved on 13th May, 2012 from <http://www.bankofengland.co.uk/publications/speeches/2009/speech397.pdf>
- [24] Ikpefan, O.A. (2013) Capital adequacy, management and performance in the Nigerian commercial bank (1986 - 2006). *African Journal of Business Management*, Vol. 7 (30); 2938-2950.
- [25] Imala, O.I. (2004). The Experience of Banking Supervision in Financial Sector Surveillance Bullion. A publication of the Central Bank of Nigeria, 28 (1), pp. 49-53.
- [26] Kindleberger C.P. & Aliber, R. (2005). *Manias, Panics, and Crashes: A History of Financial Crises*, 5th ed. London: Wiley, ISBN 0471467146.
- [27] Krugman, P. (2008). 'The widening gyre', *New York Times*, Oct. 27, 2008.
- [28] Laeven, L., and Valencia, F. (2008). 'Systemic banking crises: a new database' *International Monetary Fund Working Paper 08/224*.
- [29] Lee, S.C.; Berger, A.N. & Ebhodaghe, J.U. (2005). *Financial Deepening in Economic Development*. London: Oxford University Press.
- [30] McGough (1974). *Managing Financial Risk*. New York: Harper Business.
- [31] NDIC (1995). *Annual Reports, Nigeria Deposit Insurance Corporation, Abuja*.
- [32] Oboh, G. A. T. (2005). *Selected Essays on Contemporary Issues in the Nigerian Banking System*. Ibadan: University Press.
- [33] Ogbunka, U.M. (2003). *Walking Ahead of Bank Distress. The Secrets of Safeguarding Your Money in Banks*. Lagos: Rhema Enterprises, pp. 19-26.
- [34] Ogundina, A. (1999). *The Nigerian Banking and Financial Environment*. Ibadan: Immaculate Press, pp. 138-151.
- [35] Okigbo, P. (2003). "Financial Institutions in Distress: Causes and Remedies", Working Paper of the Economic Development Institute of the World Bank, September, pp. 1-34.
- [36] Olagunju, A.; Olanrewaju, A. ; Olabode, D. & Oluwayinka, S. (2011). *Liquidity Management and Commercial Banks' Profitability in Nigeria*. *Research Journal of Finance and Accounting*, Vol. 2, No 7/8; 24-39.
- [37] Olaniyi T.A. (2007). "Bankruptcy prediction through financial strength Analysis: A study of Trade Bank Plc.", *Advance in Management, Business Administration Department University of Ilorin, Ilorin*. Vol.5 No. 1 pp105 - 110.
- [38] Oluajakaiye, P. (1995). *Short Run Macroeconomic Effects Of Bank Lending Rates In Nigeria 1987-1991*, AERC Research Paper, 34 Nairobi Kenya.
- [39] Onyeiwu, C. & Aliemeka, G. (2010). "Financial Ratio and State of Result of Nigeria Bank". *Advance in Management, Business Administration Department University of Ilorin, Ilorin*. Vol.5 No. 1 pp. 225 -250.
- [40] Parvesh Kumar Aspal, Afroze Nazneen. An empirical analysis of capital adequacy in the Indian private sector banks. *American Journal of Research Communication*, 2014, 2(11): 28-42 accessed on Tuesday 2/5/14 @ www.usa-journals.com.
- [41] Semra, K. & Ayhan, K. (2008). An Analysis of the Effect of Financial Ratios on Financial Situation of Turkish Enterprises Resulting from their Annual Operations, *International Research Journal of Finance and Economics*, Vol. 19 pp. 139-149.
- [42] Sharda, R. & Wilson, R. L. (1996). *Neural Network Experiments In Business Failure Forecasting: Predictive Performance Measurement Issues*. *International Journal of Computational Intelligence and Organization* 1, 107-117.
- [43] Sirri, E.R. & Tufano, P. (1995). 'The economics of pooling', in eds D.B. Crane et al (2009). 'The global financial system, a functional perspective'. New York: Harvard Business School Press.
- [44] Ukah, A. (2007). "The Role of Early Warning Models in Identification of Problem Banks: Evidence from Nigeria" *Nigerian Financial Review*, Vol. 6, No. 1, 29 -40.
- [45] Umoh (1999). *Comparing Financial Systems*. Cambridge, Massachusetts: MIT Press.
- [46] Umunnachila, A.I. (1996). *Bank Failures in Nigeria: History, Causes and Remedies*. Lagos, Nigeria: Foundation Publishers.
- [47] Uremadu, S.O. (2012). *Bank Capital Structure, Liquidity and Profitability Evidence from the Nigerian Banking System*. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, Volume 2, Issue 1; 98-113 ISSN: 2225-8329.
- [48] Uzoaga, S.N. (1995). "The role of capital in financial institutions". *Journal of Banking and Finance*, Vol. 19, pp.393-430.
- [49] Wilson, R. L. & Sharda. R. (1994). *Bankruptcy Prediction Using Neural Network. Decision Support System*, In Trippi R & Turban E (eds) (1996). *Neural Networks in Finance and Investing: Using artificial intelligence to improve real-world performance*. London: IRWIN Professional Publishing, 367-394.

SAMPLE OUTPUTS

A. Sample Output Showing Unhealthy State



B. Sample Output Showing Healthy State



C. Sample Output Showing Unhealthy State