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Loan Fraud Detection And IT-Based Combat Strategies

Ifeyinwa Ajah

Lecturer, Computer Science Department, Ebonyi State University, Abakaliki. Nigeria

Postal Address: 4 Hon. Nwazuku Close Milefifty, P. O.Box 490. Abakaliki, Ebonyi State

Email: ifyajah@yahoo.com

Ajah Ifeyinwa is a lecturer in the Department of Computer Science, Ebonyi State University (EBSU), Nigeria. Her areas of interest are Internet operations, networking, website development, design and development of ICT based system to support business process in industries .

Chibueze Inyama

Professor of Computer in the Department of Electronic & Computer Engineering, Nnamdi Azikiwe Federal University, Awka. Nigeria

Postal Address: Department of Electronic & Computer Engineering, Nnamdi Azikiwe Federal University, Awka. Nigeria

Email: drhcinyama@gmail.com

Prof. Inyama Hyacinth Chibueze is a seasoned computer scientist and engineer, with a wealth of experience in both industry and academics. He is a senior lecturer in the Department of Electronic & Computer Engineering, Nnamdi Azikiwe Federal University, Awka. Nigeria. His current research interest is using IT in solving human problems in industries with focus on Artificial Intelligent.

Abstract

Loan portfolio problems have historically been the major cause of bank losses because of inherent risk of possible loan losses (credit risk). The study of Bank Loan Fraud Detection and IT-Based Combat Strategies in Nigeria which focused on analyzing the loan assessment system was carried out purposely to overcome the challenges of high incidence of Non- Performing Loan (NPL) that are currently being experienced as a result of lack of good decision making mechanisms in disbursing loans. NPL has led to failures of some banks in the past, contributed to shareholders losing their investment in the banks and inaccessibility of bank loans to the public. Information Technology (IT) is a critical component in creating value in banking industries. It provides decision makers with an efficient means to store, calculate, and report information about risk, profitability, collateral analysis, and precedent conditions for loan. This results in a quicker response for client and efficient

identification of appropriate risk controls to enable the financial institution realize a profit. In this paper we discussed the values of various applications of information technology in mitigating the problems of loan fraud in Nigeria financial Institutions.

Keywords: information sharing; Artificial Neural Networks (ANN); Credit Scoring (CS); Biometrics; Intelligent Agents; Global Positioning System (GPS); Digital Nervous System (DNS); research study; Nigeria

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INTRODUCTION

Evidence from various previous researches reveal that IT has contributed immensely in mitigating the problems of NPL for banks that implemented it. In loan processing, IT can be applied to find an appropriate solution to the borrower's need for funds, with proper assessment of risk and the inclusion of sufficient control systems to ensure repayment. When a loan customer is unable to independently raise capital for a new venture, the customer depends on the loan officer to organize a loan. This dependency begins with the construction of the network of dependent activities shown in figure 1.

Credit loans constitute a cornerstone of the banking industry. As such, it is one of the greatest sources of risk to a bank's safety and soundness. The major risk that a bank faces is the probability of a customer's default. An experienced credit manager should be able to make the right judgment of the probability of default for different types of customers. To have effective managerial control over the credit department requires fast, accurate and real-time information that must be processed in a fair and objective manner.

Banks have begun to see the need to build credit risk management (CRM) groups that are tasked with a wide array of responsibilities, including governance over the credit lifecycle, ensuring proper risk distribution and sourcing channels, motivating improved portfolio-wide risk metrics, as well as increasing risk-adjusted performance. These CRM groups often establish risk tolerances for concentrations, stress-limits, and capital requirements – usually at the industry, market and business unit level. CRM groups are in regular contact with a wide array of risk management networks, both internal and external to the bank. Such direct connection to risk markets allows the bank to ensure that deal terms are consistent with the market's expectation, thereby enhancing risk-pricing and increasing enterprise risk awareness. Furthermore, a challenge for today's commercial banks is their ability to understand large amounts of information and reveal useful knowledge to improve decision-making. Modern bank managers are flooded with data. The sustainability of their banks depends on their capabilities to sift through large volumes of data, to extract useful knowledge and apply this knowledge in their decisions [1]. An intelligent information system that is based on artificial intelligence will provide managers with added value information, to reduce the uncertainty of the decision outcome and to enhance banking service quality. Thus, the application of new technologies can give a bank a competitive advantage and lead to a higher performance.

Financial institutions can avoid high incidence of non performing loan, and costly loan write-offs when a thorough background investigation is conducted at the start of the loan review process. Bankruptcies, defaulted loans, and aliases are flags that require further investigation. The performance of loan contracts in good standing guarantees profitability and stability of a bank. Screening the customer's financial history and financial background is a very significant factor before any credit decision is taken and it is a key process in reducing credit risk. Loan approval will be given

to good applicants with low credit risk, whereas high risk applications will be rejected [2]. Therefore, banks should control credit management thoroughly and quickly adopt automated Credit risk management system that will collect borrower’s credit information from multiple databases and uses a score card to process this data according to the bank’s screening criteria. The score aids risk managers by highlighting areas that require further review. Moreover banking loan decisions require the use of huge and various data and substantial processing time to be able to serve a large number of variables and a variety of different cases related to different customers. The application of the new technologies can give banks a competitive advantage and lead to high loan performance.

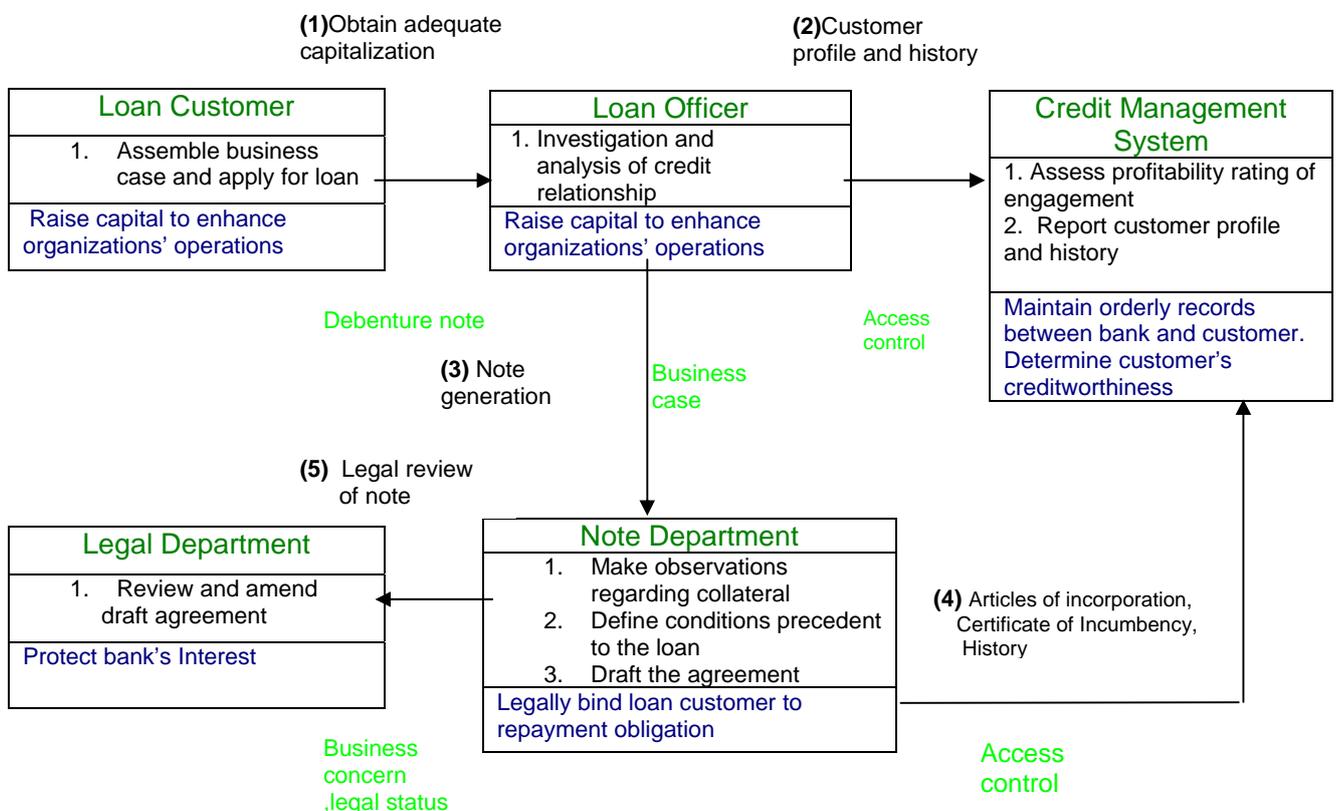


Figure 1: DND for Loan Department

PROBLEMS WITH NIGERIAN BANK CREDIT RISK MANAGEMENT SYSTEM (CRMS)

It is evident from our investigations that one of the causes of bad loans was a combination of too much money in the possession of banks. The too much money in their hands was as a result of Banking consolidation by the former CBN governor, Prof Soludo which made them go from N2 billion of shareholders fund to N25 billion and then on to N100 billion of share capital. Moreover, there was a candy held that any one that got to N100 billion will be able to manage the Nigeria’s external reserve . The drive to meet the target made banks grow tremendously in terms of capital base and assets without a corresponding growth in their risk management and compliance IT system; People were

given untenable targets for mobilizing profits, mobilizing deposits and in the process they threw caution to the winds and got very careless.[3].

Furthermore, lack of standard national system of identification, lack of central database that will promote information sharing among banks about clients' past indebtedness, the system's inability to detect fake collaterals and the use of same collateral in accessing multiple loans have contributed immensely to the problem of loan fraud in the country. We also discovered that Credit Risk Management System [CRMS] introduced by the Central Bank of Nigeria (CBN) in the late 1980s and early 1990s failed to address the problem of rising non-performing credit portfolios in banks which extensively led to the financial distress in the banking sector. It does not provide substantial credit history on a borrower that will adequately guide a lender in taking intelligent decision on whom to grant a loan and in most cases banks do not report bad loans to CBN in the bid to protect their customers. This encourages multiple lending. Multiple-bank lending can affect credit market performance by generating a contractual externality between lenders, as each banks lending may increase the default risk for the others [4].

In spite of the increase in consumer loans defaults and competition in the banking market, most of the commercial banks in Nigeria rely on loan officers to make credit decisions. There are some cases where the customers either through personal contacts or through friends know loan officers, which might affect their evaluation capabilities. There are cases where customers need a loan badly, but they might not be worthy of a loan because their application does not meet the required criteria. Their interaction with loan officers will enhance their other qualifications and they will be able to get the loan. That means the human touch in the service industry has a special flavor that might enhance its growth in some cases. Applying Information Technology in loan evaluation will reduce any bias or emotional intention that can distort the decision process. Hence, the time spent in loan processing will be reduced and this will enhance the quality of customer service. On the other hand, it is important to note here that the use of IT in credit risk management will not eliminate the human interaction but it is proposed to enhance the decision process. Furthermore, a loan officer's credit decision or recommendation for loan worthiness is subjective. After some experience, these officers develop their own experiential knowledge or intuition to judge the worthiness of a loan decision. Given the absence of objectivity, such judgment is biased, ambiguous, nonlinear and humans have limited capabilities to discover useful relationships or patterns from a large volume of historical data [5]. The problem underlying many such financial disasters was best summed up by the economist Henry Kaufmann in *Business Week*: "... these (financial) problems reflect inadequate monitoring and supervision."

The solution to these problems is development of a *comprehensive IT system*, which should have the ability to capture all key customer data, risk management and transactions. The information technologies required include Digital Nervous System, Biometrics, and Global, Positioning System, Artificial Neural Networks, Intelligent agent and Data mining Techniques. The value offered by the aforementioned technologies are discussed in this work.

This paper focuses on the identification and application of an enabling tool for evaluating credit applications to support loan decisions

INFORMATION TECHNOLOGIES FOR EFFECTIVE LOAN MANAGEMENT SYSTEM

BIOMETRICS IN IDENTITY

There has been an international move towards the introduction of biometrics into identity and travel documents. The International Civil Aviation Organization (ICAO) has recommended that all countries adopt biometric passports, and the United States has made it a requirement for entering the US under the visa waiver programme. Biometric border control systems have been established in the United States and the United Arab Emirates, and the EU is introducing biometric visas. However, it should be

noted that, internationally, the only requirement for biometric passports is a digital photograph. Biometrics can be applied in the design of a National Identity Card. Lack of standard National Identity Number is a great challenge facing financial institutions in Nigeria and the Nation as a whole. This has also posed a great challenge for the three credit bureau recently licensed late 2009 to operate in Nigeria. The problem has hindered their performance a great deal. People assume multiple identities and as a result perpetuate all kinds of fraud with ease. This problem of identity is worsened by unavailability of a centralized database that can record people's personal history. This grants opportunity to fraudsters to quote different addresses at various transactions without being detected. A customer uses the same collateral to obtain loan from different banks when he already had a bad loan with another bank. Biometrics can as well be extended to business registration by the Corporate Affairs Commission as this will help in tracking down the use of same collateral in obtaining multiple loans.

National Identity Card is a personal identification document. In the UK, it is linked to a database known as the National Identity Register (NIR), Many of the concerns focused on the databases which underlie the identity cards rather than the cards themselves. The Identity Cards Act 2006 specified fifty categories of information that the National Identity Register can hold on each citizen, including up to 10 fingerprints, digitised facial scan and iris scan, current and past UK and overseas places of residence of all residents of the UK throughout their lives and indices to other Government databases (including National Insurance Number [6]. — which would allow them to be connected. The legislation on this resident register also said that any further information can be added.

To achieve efficiency and performance in the system the following requirements should be met.

Legal requirements

ID card applicants would have been required to fulfill certain functions:

- Attend in person to have their iris scan recorded at the government approved Identity Service's Office.
- Promptly inform the police or Identity Service if a card is lost or damaged, and apply for a new card.
- Promptly inform the Identity Service of any change of address.
- Promptly inform the Identity Service of any prescribed change of circumstances affecting the information recorded about them in the Register.

Failure faces a strict penalty.

National Identity Register

Key to the ID Card scheme must be a centralized computer database such as the National Identity Register (NIR). To identify someone it would not be necessary to check their card, since identity could be determined by taking a biometric scan and matching it against a database entry.

Identity Registration Number (IRN)

One entry on the NIR is the Identity Registration Number. A unique identifier is needed as a primary key for the database. IRN enables data sharing amongst police databases (including the Police DNA database), legal databases, and even corporate databases (including bank and travel operators).

Loan

Any borrower without the Identity Registration Number will be refused access to loan in any bank in Nigeria. In order words IRN remains the numbers one requirement for accessing any type of loan.

Penalties

Failure to inform the Government of a change of address, name, or other personal details as well as use of false or multiple ID number will attract a huge fine.

THE DIGITAL NERVOUS SYSTEM (DNS)

A DNS would enhance the efficiency and effectiveness of lending business processes of Nigerian Banks by supplying “accurate, immediate, and rich” information to different parts of the Bank, and maximize “the insight and collaboration made possible.” It ensures getting the right information to the right people at the right time. This approach leverages the power of the Internet to make data flow faster and more cost-effective than ever before.

DNS can also improve business operations by allowing a smooth, quick coordination of internal business activities such as budgeting, scheduling, inventory, and others. It offers the following advantages;

- It allows faster flow of information among a company and its business partners, resulting in timely and more effective decision-making.
- It allows employees to quickly obtain, store and share necessary information, thus improving internal organizational planning and administration.
- It enables the company to immediately respond to customer feedback, thus promoting better customer service and greater customer satisfaction.
- Digital processes help to improve the competitive position of a company in target markets through faster, accurate and reliable information sharing.
- It is environmentally friendly

ARTIFICIAL NEURAL NETWORKS (ANNs) IN LOAN APPLICATION EVALUATION

Artificial neural networks have been fruitfully used in a variety of business fields including marketing, accounting, management information systems and production management [7]. Most of the studies have used neural networks for predicting future stock behavior, financial crises, bankruptcy, exchange rate and detecting credit card fraud. Furthermore, researchers have used neural networks in modeling market response collective behavior, telecommunication and real estate evaluations. According to “The Guardian” (September 9, 2004), “Credit card fraud losses in the UK fell for the first time in nearly a decade last year, by more than 5% to 402.4m [British pounds], according to research by the Association of Payment Clearing Services (Apacs). The fall has put a spotlight on the increasing use of neural networks that have the ability to detect fraudulent behaviour by analysing transactions and alerting staff to suspicious activity. As commercial applications of research into artificial intelligence, these systems give the impression of mimicking human abilities for recognising unusual activity. Karina Purang, a financial analyst at Datamonitor in London, says the use of neural networks are very important to banks trying to reduce fraud, and are becoming standard across the card industry to detect unusual spending patterns.’

ANNs are also used for analyzing relations among economic and financial phenomena, forecasting, generating time series, optimization and decision making [8].

Artificial intelligence technologies have proven to be a fruitful investment in the banking industry, such as neural networks, for their ability to assist in improving the quality of credit decisions to reduce credit risk [9]. Thus, artificial neural networks with their capabilities of capturing nonlinear and complex relationships are considered promising techniques in classification problems [10; 11]. Neural networks promise to be a breakthrough in areas where a traditional computer system and statistical methods have difficulty to support the decision making process in today's complex business environment. Neural networks have been used in building intelligent information systems that mimic the way humans think. They are suitable for modeling business logical outcomes where variables give unstable signs and interact in a complex non-linear way [12]. A decision support tool to classify loan applications into good or bad has been designed [13]. The experimental results showed that Multi-Layer Feed-Forward (MLFF) neural network is an effective tool in classifying loan applications at a high accuracy level and will not eliminate the human interaction. His research findings correspond with the research by [5], [14] and [1] which indicate that neural networks are a successful technology that can be used in loan application evaluations.

INTELLIGENT AGENT

The concept of "agent" has become important in artificial intelligence, computer science, and e-commerce [15, 16]. Agents are used to denote a software-based computer system that possesses the following properties: autonomy (agents operate without the direct intervention of humans); social ability (agents communicate with other agents); reactivity (agents perceive their environment and respond in a timely fashion to changes that occur in it); proactivity (agents do not simply act in response to their environment, they are able to exhibit goal directed behavior by taking the initiative); mobility (agents are able to travel through computer networks). In general, an agent on one computer may create another agent on another computer for execution.

Agents may also transport from computer to computer during execution and may carry accumulated knowledge and data with them. There has been a recent accretion of approaches for building multiagent systems for Internet applications [17]. Multiagent systems are generally computational systems in which several semiautonomous agents interact to perform some set of tasks or satisfy a set of goals [18]. Researchers have proposed to design and develop numerous intelligent agent-based systems to support business processes. Lightweight intelligent agents have been introduced into financial monitoring systems [19]. The intelligent agents provide an effective means for systematic monitoring of financial transactions in the corporate world, to detect and report any abnormal financial transactions that may signify a high risk, fraud, and other financial inconsistencies. A multiple classifier system (embedded in a multiple intelligent agent system) is proposed to predict the financial health of a company [20]. In his model, each individual agent (classifier) makes a prediction on the likelihood of credit risk based on only partial information of the company. Each of the agents is an expert, but has limited knowledge (represented by features) about the company. The decisions of all agents are combined together to form a final credit risk prediction.

A novel workflow monitoring approach, in which various intelligent agents work together to perform flexible monitoring tasks in an autonomous and collaborative way has been proposed [21]. By using customized monitoring plan and proactive monitoring process, the workflow monitoring activities can be executed flexibly and efficiently. The application of intelligent agents for such flexible, adaptive and collaborative workflow monitoring is investigated through an intelligent monitoring system in securities trading. Barr et al. proposed using an intelligent agent for business data monitoring [22]. In the prototype system, intelligent agents will intermediate on behalf of business analysts by being able to perform limitless, error-free routine calculations and interpretations rapidly to the precise requirements of business managers. A multiagent system for the supervision of dynamic systems by using a temporal scenario recognition approach has also been proposed [23]. The supervision is performed by a society of agents where an agent is considered a watching process responsible for a subset of

possible scenarios of the way the system functions.

DATA MINING

Data mining is becoming a strategically important area for many business organizations including the banking sector. It is a process of analyzing the data from various perspectives and summarizing it into valuable information. Data mining assists the banks to look for hidden pattern in a group and discover unknown relationship in the data. It can also be applied in credit risk management and fraud detection. In credit risk management, banks provide loan to its customers by verifying the various details relating to the loan such as amount of loan, lending rate, repayment period, type of property mortgaged, demography, income and credit history of the borrower. Customers with bank for longer periods, with high income groups are likely to get loans very easily. Even though, banks are cautious while providing loan, there are chances for loan defaults by customers. Data mining technique can help to distinguish borrowers who repay loans promptly from those who do not. It also helps to predict when the borrower is at default, whether providing loan to a particular customer will result in bad loans etc. The data mining tool will compile all data bank-wide and construct several new rules to detect fraud. When combined with reporting tools, it will enable managers and CBN to spot irregularities at a glance. They can immediately recognize any case that may need further investigation. It also flags the branch where these problems occur.

Bank executives by using data mining technique can also analyze the behavior and reliability of the customers while selling credit cards too. It also helps to analyze whether the customer will make prompt or delay payment if the credit cards are sold to them. Sometimes the given demographics and transaction history of the customers are likely to defraud the bank. Data mining technique helps to analyze such patterns and transactions that lead to fraud. Banks record all installment loans on a central mainframe system. These files contain all the essential information pertaining to a loan. That includes characteristics such as identity of loaner and borrower, location of the bank/ branch where the loan was issued and changes that were made to the loan. This data is the cornerstone from which the search for any irregularities in the loan process begins.

With data mining, a thorough profiling and ranking of banks with respect to loan fraud risk can be achieved. To accomplish this, the large data cube on the mainframe will be used to gather all the relevant information. Then, the miner will be used to search for new fraud detection rules. There are specific sets of instructions the bank personnel must comply with and conditions for granting loan. Example of one such rule is whether a loan has been issued without complying to the CBN loan qualification guidelines. There is need to ascertain if clients have loans at other banks before they can confidently be granted loans. Another rule serves to determine whether the pay back account really belongs to the credit owner. The real power of the data mining tool lies in the fact that it has ability to connect data we believed was uncorrelated, and construct new rules. Fraud rule results are converted into risk scores and then displayed by the reporting application. The reporting application gathers all the information from the rules and transforms these absolute numbers in percentages and relative scores. This data is then combined to create total risk scores for each bank countrywide. The higher this score, the more likely irregularities occurred at that specific bank. The reporting tool allows the user to choose from an extensive array of graphs to plot these risk scores. "That way, we can instantly spot where irregularities occur, determine whether these are intentional or not, and take appropriate action in case of fraud. With the reporting tool, inspectors can pin-point very specific internal fraud irregularities. Inspections can now be carried out in much less time with increased accuracy and efficiency.

GRAPHICAL INFORMATION SYSTEM (GIS)

Global Positioning System (GPS) can be incorporated in a GIS. It can be used to read and record the coordinates of landed / housing properties used as collaterals obtained by a loan officer or bank approved property value. This will guard against use of fake collateral in obtaining facility.

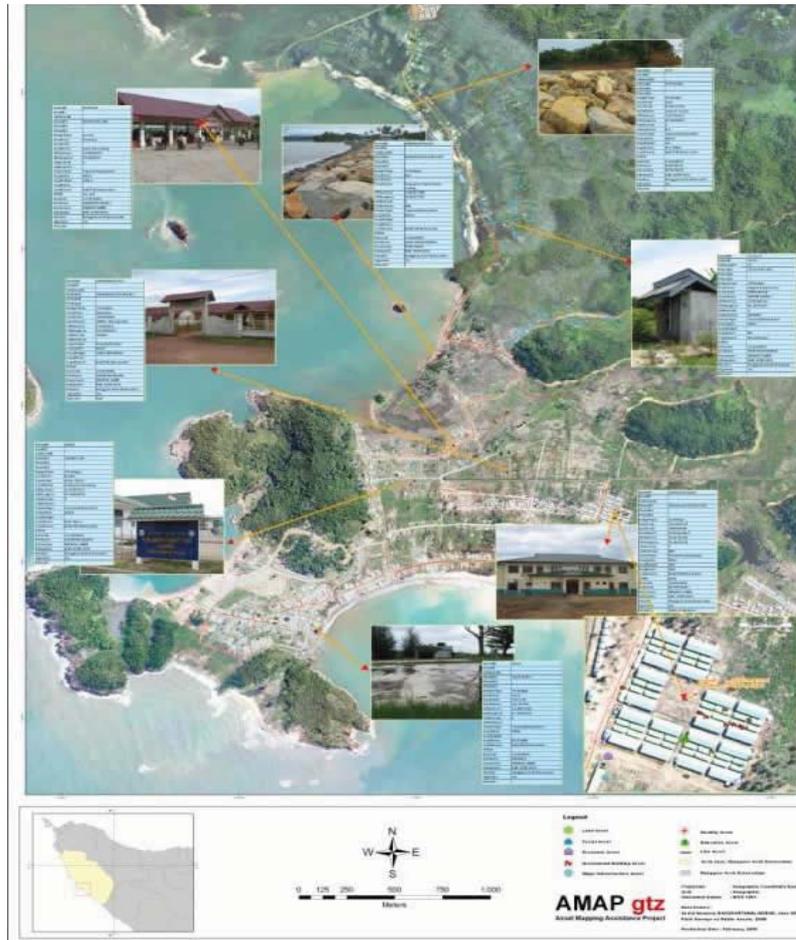


FIGURE 2: SAMPLE OF FIXED PUBLIC ASSET MAPPING AND MANAGEMENT INFORMATION SYSTEM IN CALANG, ACEH JAYA Australian Government Overseas Aid Program FI(AusAID) funded the Asset Mapping (GIS Best Practices Oct.2010)

The GIS-Based Title Registration and Microfinance to Alleviate Poverty project under way in the African nation of Ghana seeks to demonstrate the vital role that formalization of landownership can play in helping the poor take a crucial first step away from poverty. Focused on one of the poorest areas in the capital city of Accra, the pilot project is leveraging the latest geospatial technologies to create a land titling process and GIS-based land records system. Using GIS, the organizations made collecting, managing, and sharing information as timely as possible between many different stakeholders. Handheld mobile GPS devices were used to map the parcels in the field and the land registry database was created to manage the land surveying and mapping activities. The pilot is being conducted in close cooperation with the Ghana Ministry of Lands, Forestry and Mines (FIG2). The process involves surveying the school property with GPS-based mobile GIS equipment, creating a legal description of the land, and collecting property ownership information from the school operators and neighbors via personal interviews conducted by members of the local team. Each school owner has sought to become part of the land registration pilot and actively participated in the required procedures as part of the loan processing.[24]

In 2004, on the day after Christmas, a magnitude 9.1 earthquake in the Indian Ocean set off a devastating tsunami. From the beginning, GIS played an important role

in mapping the impact of the disaster, guiding emergency responders to the devastated areas, and coordinating the relief effort. Now the technology is being used in the process of rebuilding.[25].

3.1 THE NEW SYSTEM

The user applies for a loan by filling out a loan request, including information such as ID number, personal identifying information, and amount of loan requested. Figure 3.

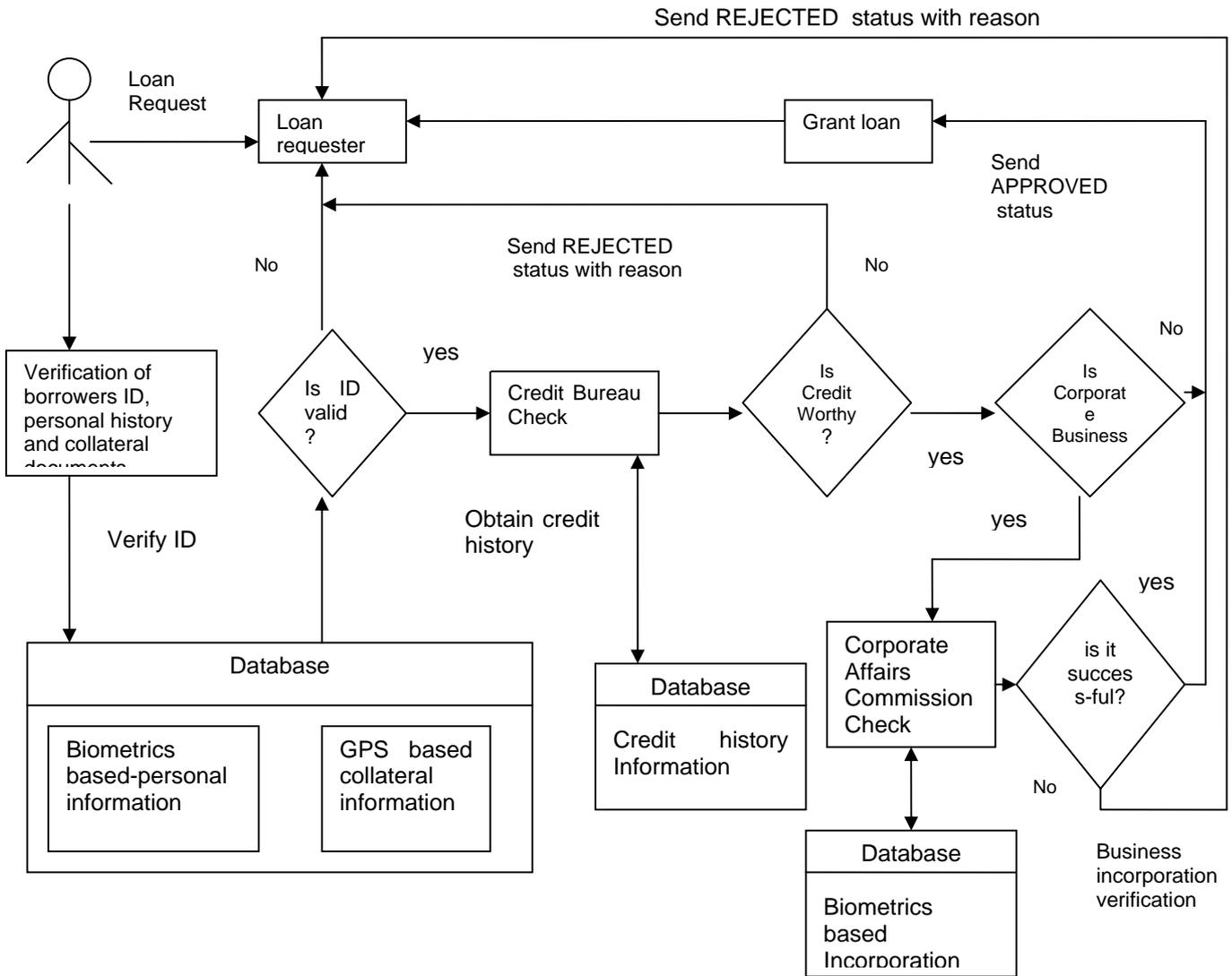


FIGURE 3: THE PROPOSED CREDIT-WORTHINESS SYSTEM

- When the loan request is received, the personal information and collateral details supplied by the user is sent to the CRMS to verify across an existing database the authenticity of the borrowers ID and personal history. If the ID is authentic, the applicant credit history is retrieved

from a credit bureau to know if the applicant is credit worthy. Approval is granted or rejected based on the information, the amount requested and the banks credit guidelines/policy for an individual applicant. For Corporate body, the incorporation details is obtained

- After certain formalities are fulfilled, a report, in the form of an offer letter, is generated and sent to the user for signing, confirming the approval and acceptance of the loan respectively.
- If the loan is rejected for some reason, then a report showing the reason for the rejection is generated and displayed.

CONCLUSION

Although the credit decision approval in the Nigerian banks has been subjective and it is up to the loan officer in most cases, banks can improve their credit analysis methods through the integration of the aforementioned technologies in building a standard credit risk management system. DNS technology will tie them to achieve a strong collaboration and high productivity. Besides, banks can customize the system according to their specific strategies. Pulling manual reports from the bureau into the credit assessment system is not sufficient. There is an urgent need for automation of CRMS. The first level of automation will be online bureau enquires to support automated credit. The bank's credit assessment system must make on-line calls to the bureau's system to obtain the required information and feed the score into the banks scorecard. The system needs to be a robust process that enables Banks to proactively manage facility portfolios in order to minimize losses and earn an acceptable level of return for shareholders. Central to this is a Comprehensive IT System, which should have the ability to capture all key customer data, risk management and transaction information. Our choice of DNS approach will enable us achieve robustness.

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