

A Frame Work for Customer Relationship Management in Nigerian Banks Using Data Analytics

¹Olatayo M. Olaniyan, ^{*2}Emeka Ojukwu and ³Cyril U. Ogude

Department of Computer Engineering, Federal University Oye Ekiti, Nigeria

Department of Computer Science, National Open University of Nigeria

Department of Computer Science, University of Lagos, Nigeria

{mosesolaniyan2001|ojukwu.emeka}@gmail.com|uogude@unilag.edu.ng

Abstract - One of the most crucial challenge that Nigeria banks have to face is in the jurisdiction of customers' satisfaction. Customers' satisfaction has become one most important factors of success in today's banking industry in Nigeria. Today Nigeria banks customer's increases every day, as it is essential for many Nigerian to have proper savings this modern day with a choice of banking with any bank of their choice; if the performance of bank falls short of their expectations, the very survival of such bank would be difficult. In this paper, a framework for customer relationship management for Nigeria banks using big data analytics approach was developed. Qualitative research was used to identify customer satisfaction through customer management system information publish annually. The data were collected from-complaint data for financial report 2017 from the Customer Relationship Management System for WEMA Bank Plc. The data were analyzed using excel and converted into CSV and ARFF file format respectively. In conclusion, Data were exported into WEKA for data analytics which then generated results. The formulated hypotheses are subjected to empirical test using Logistic regression and Machine learning. This new strategy provided solution of this problem identified.

Keywords: Big Data Analytics, Linear regression, Banking, Customer Satisfaction, Hypothesis

1 INTRODUCTION

Some organizations in Nigeria were using the supply-push strategy for their businesses which produces services with different requirements to customers. This strategy was found inefficient. Tito Phillips Jr. (2017), therefore the demand-pull strategy has been raised and focuses on producing services based on customer preferences. Consequently organizations shifted from being product centric to becoming customer centric. This is where the Customer Relationship Management (CRM) could play a role to accomplish the transformation. One major recent trend is the use of big data analytics approach to convert large volume of data obtained (from data descriptive to diagnosis to predictive and to prescriptive) into actionable information (decision).

Today in Nigeria, Customer Relationship Management still remains the synthesis of many existing principles from relationship marketing and the broader issue of customer-focused management. CRM systems provide the infrastructure that facilitates long-term relationship building with customers. Some examples of the functionality of CRM systems are sales force automation, data warehousing, data mining, decision support, and reporting tools. The purpose of this study is to explore the domain of the Big Data problem; particularly, to create a framework that helps to obtain actionable information to foster better Customer Relationship Management in Nigeria Banks using big data analytics approach. Since the data, technologies and methods are chosen; a testing scenario is created and deployed over this data. Finally, the achieved results will be discussed and some recommendations will be provided.

2 RELATED WORK

Consideration of Customer Relationship Management (CRM) started gaining popularity in 1990s. This is a process mediated by a set of information technologies that focuses on creating mutual exchanges with customers so that firms have an intimate knowledge of their needs, wants, and buying patterns. To create and manage more real relationship with their customers, businesses still prefer to adopt CRM, no matter what is the size of an organization. There are many scholars who have worked on Customer Relationship Management. An enhanced relationship with customers ultimately leads to greater loyalty, retention as well as profits. Further, the rapid growth of the internet and its associated technologies has greatly increased the opportunities for marketing and has transformed the way relationships between companies and their customers are managed.

Lu, et al... (2002) suggest that when implementing a CRM system, banking industry would normally focus on the customer-service system rather than on the overall strategies. Banks have their own way of managing their relationships with the customers. Therefore, what do these marketing managers in Nigeria banks, who are in the front lines of implementing CRM think it is? This study provides empirical proof to fill these research gaps in the extant literature.

Kenneth, et al... (2013) researched the impact of customer relationship management (CRM) on the Business Performance of Nigeria money deposit banks. The nomothetic methodology was adopted and forty copies of structured questionnaire were the primary data collection instrument which was distributed to ten money deposit banks in south-south zone of Nigeria. The hypotheses were tested by employing the Spearman Rank Correlation Coefficient (SRCC) statistical tool, statistical packages for social sciences (SPSS) software. The study revealed that a significant relationship exists

*Corresponding Author

between CRM & BPM Business process management. It was also discovered that amongst the dimensions of CRM, customer identification and retention impacts more significantly on business performance. The study therefore concludes that Nigerian money deposit banks should increase their customer identification and retention strategies since there is a proportionate impact on the performance level.

William (2016) investigated the role of customer relationship management strategy on competitiveness of commercial banks in Kenya. The study made use of a descriptive correlation research design and data were collected from 34 out of the target population of 43 registered banks in Kenya. Data analysis and interpretation was based on descriptive statistics as well as inferential statistics mainly linear regressions. The study found statistically significant positive linear relationships between CRM strategy and organizational competitiveness. It was found that organizational competitiveness is achieved through appropriate CRM strategy practices. The study therefore provided managers invaluable insights on how to effectively build their CRM strategy to give them a competitive advantage.

3 RESEARCH METHODOLOGY

The following techniques were adopted for this research.

- ❖ Association rule learning.
- ❖ Classification tree analysis.
- ❖ Genetic algorithms.
- ❖ Machine learning.
- ❖ Regression analysis.
- ❖ Sentiment analysis.
- ❖ Social network analysis.

3.1 RESEARCH TOOLS USE FOR BIG DATA ANALYTICS

There are various tools that can be used for data analytics in data science ranging from WEKA, SPSS, MATLAB, R, and Python. This research will consider using WEKA as data analytics tool.

3.2 REGRESSION ANALYSIS

At a basic level, regression analysis involves manipulating some independent variable (i.e. background music) to see how it influences a dependent variable (i.e. time spent in store). It describes how the value of a dependent variable changes when the independent variable is varied. It works best with continuous quantitative data like weight, speed or age. Regression analysis is being used to determine how to predict levels at which the customer satisfaction affects the gross income of the bank. In this research we adopted linear regression techniques. Logistic regression focuses on estimating the probability of an event occurring based on the previous data provided. It is used to cover a binary dependent variable that is where only two values, 0 and 1, represent outcomes.

3.3 RESEARCH QUESTIONS

- ❖ Does customer relationship management lead to increase banks customers’ satisfaction?

- ❖ What significant effect does customer relationship management have on banks market share?
- ❖ To what extent has customer relationship strategy translated into customer satisfaction?

3.4 RESEARCH HYPOTHESES

H₀: customer relationship management does not lead to increase in customer satisfactory

H₁: customer relationship management leads to increase in customer satisfactory

3.5 DESIGN COMPONENTS

The following are the design components used for this project:

- i. Input design
- ii. Output design

3.6 INPUT DESIGN

Based on the design of this computerized CRM system, the following data are needed to carry out the operations.

a) **Email details:** Data items to be captured include customer email, bank email and message.

Field	Data Type	Field Length
Customer Email	Text	33
Bank Email	Text	33
Message	Text	33

b) **Live Chat:** Allow the customers to interact.

Field	Data Type	Field Length
Customer Name	Text	20
Chat Message	Text	20

c) **Fraud details:** Data items to be captured include; Account name and complaint message.

Field	Data Type	Field Length
Account Name	Text	30
Message	Text	30

d) **Complaint:** Allow the customers to log complaint.

Field	Data Type	Field Length
Acct Name	Text	30
Acct No	Text	30
Message	Text	45

3.6.1 Database Design

The information on customer relationship management system is kept in a database and the records can be displayed on the monitor or by printing it out. Several outputs or reports can be generated from the input specification and these include:

❖ **Complaint**

← T →	AcctName	AcctNo	Message
📱 ✎ ✖	adeola adelakun	29282727272	My money was debited without m
🔍 🔥 ✓	ami adami	222222222	Last hour access to online b

Each of these symbols is linked with arrows to illustrate the flow direction of the process. The diagrammatic representation illustrates a solution steps to a given problem

3.7 HARDWARE COMPONENT

The hardware requirements include the following specifications.

- i. Minimum Pentium I processor or higher
- ii. Minimum 512MB RAM or higher
- iii. Minimum 1GB hard disk or higher
- iv. VGA color monitor
- v. Standard Mouse

3.8 SOFTWARE REQUIREMENTS

The following under listed software requirements are needed for effective functioning of the system:

- i. WampServer
- ii. MySQL
- iii. PHP
- iv. JavaScript
- v. HTML5 (Hypertext Markup Language)
- vi. CSS (Cascade Style Sheet)
- vii. Operating system: Windows XP, Vista or above

3.9 DATA ANALYSIS PRESENTATION OF RESULTS

Data collected during the research were analyzed. The data (Complaint data for Financial Report 2017) from the Customer Relationship Management System for WEMA Bank Plc were coded and fed into excel spread sheet then converted into CSV and ARFF file format respectively. The data were then exported into WEKA for data analytics. Furthermore, the formulated hypotheses are subjected to empirical test using Logistic regression and Machine learning.

Table 1. Customer Complaint for the year 2017, Wema Bank Plc, Nigeria

Month	Complaint Received (X)	Complaint Solved (Y)	Gross income	Satisfaction Prediction
January	5603	5580	19,287,233	Yes
February	4900	4853	48,870,107	Yes
March	5940	5888	13,225,994	No
April	7713	7630	284,977,836	Yes
May	8747	3000	12,949,273	No
June	10631	10526	382,694	No
July	14422	14332	52,289,916	Yes
August	14680	14007	58,381,728	Yes
September	15913	14691	10,127,394	No
October	12957	11969	8,900,980	No
November	20975	19683	48,870,107	Yes
December	21108	18719	10,045,873	No

(Source: WEMA Bank Plc. Financial Statements, April 2018)

3.9.1 Research Hypothesis

H₀: customer relationship management does not lead to increase in customer satisfactory

H₁: customer relationship management leads to increase in customer satisfactory

3.9.2 CSV Data Format

Data in excel format must be converted to CSV (Comma-Separated Value) then to ARFF (Attribute Relation File Format) format for data pre-processing as shown in Figure 1.

```

Wemafile - Notepad
File Edit Format View Help

% WemaBank Financial Report 2018
@Relation WemaDataSet
@attribute Month string
@attribute ReceivedComplaint real
@attribute ComplaintSolved real
@attribute GrossIncome real
@attribute Satisfaction {Yes,No}

@data
January,5603,5580,"19,287,233",Yes
February,4900,4853,"48,870,107",Yes
March,5940,5888,"13,225,994",No
April,7713,7630,"284,977,836",Yes
May,8747,3000,"12,949,273",No
June,10631,10526,"382,694",No
July,14422,14332,"52,289,916",Yes
August,14680,14007,"58,381,728",Yes
September,15913,14691,"10,127,394",No
October,12957,11969,"8,900,980",No
November,20975,19683,"48,870,107",Yes
December,21108,18719,"10,045,873",No
    
```

Fig. 1: CSV file for Data Pre-processing

3.9.3 Attribute Relation File Format (ARFF) Data Pre-processing

Figure 2 shows data in of format loaded into the WEKA for data analysis. This is the pre-processing state of data analysis.

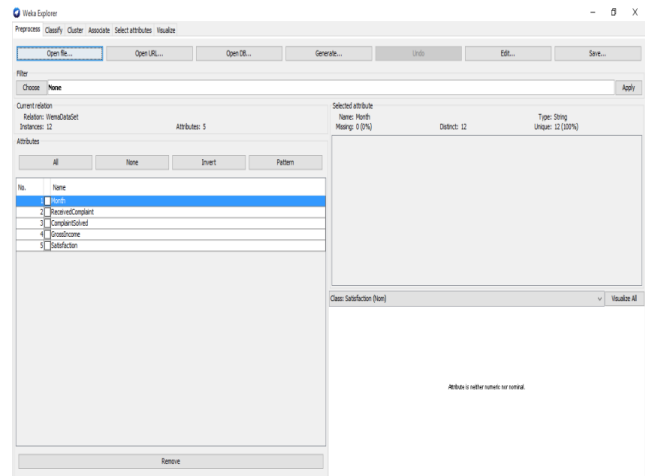


Fig. 2: Pre-processing stage of data analysis

3.9.4 Regression Analysis

The logistic regression can be understood simply as finding β that best fit.

$$y = \begin{cases} 1 & \beta_0 + \beta_1 x + \epsilon > 0 \\ 0 & \text{else} \end{cases}$$

β_0 = Complaint Received

β_1 = Complaint resolved

ϵ = error term

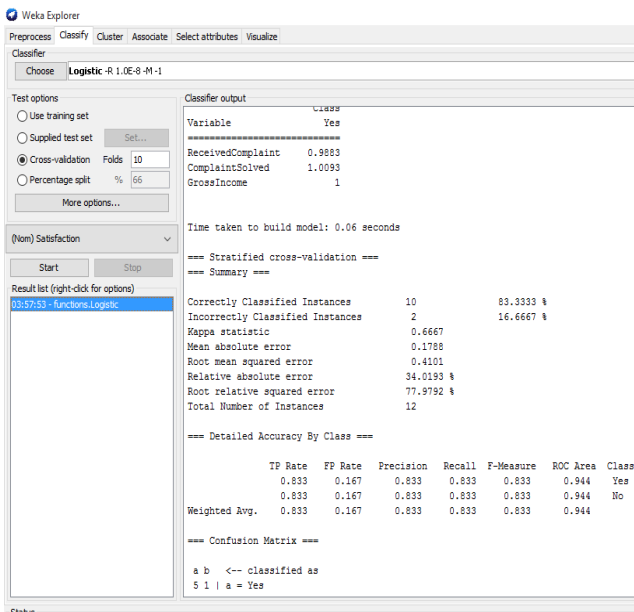


Fig. 3: Regression Analysis

At 10-fold cross validation, results show 83.333% prediction value with 10 instances classified correctly out of 12 instances supplied, this analysis shows that there is a strong relationship between the customer complaint received, complaint resolved and the gross income generated. This shows that H_0 will be rejected while H_1 hypothesis will be accepted.

3.9.5 Machine Learning

Support Vector Machine: Support Vector Machine (SVM) is a discriminative classifier formally defined by a separating hyper plane. In other words, given labeled training data (supervised learning) and the algorithm outputs an optimal hyper plane.

Simple Algorithm

candidateSV = {closest pair from opposite classes}
 While there are violating points do
 Find a violator
 candidateSV = candidateSV \cup violator
 if any $\alpha p < 0$ due to addition of c to S
 then candidateSV = candidateSV \setminus p repeat till all such points are pruned
 end if
 end while

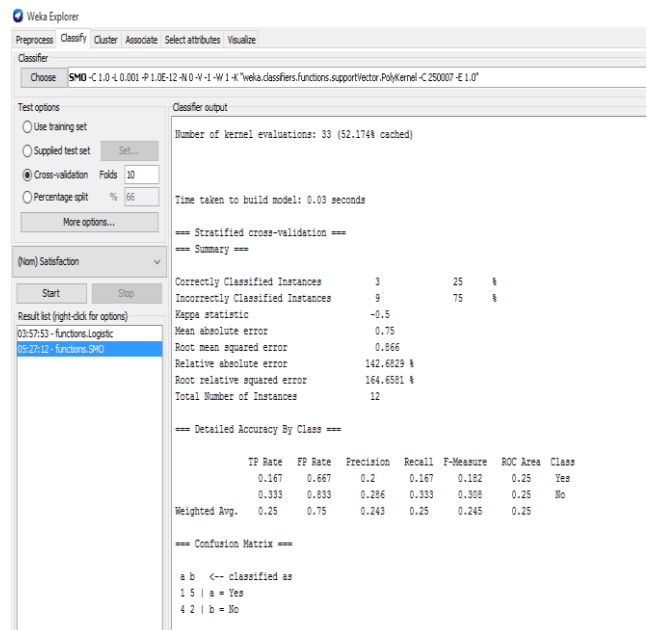


Fig. 4: Support Vector Machine output in WEKA

At 10-fold cross validation, results show 25% prediction value with 3 instances classified correctly out of 12 instances supplied, this analysis shows that there is no strong relationship between the customer complaint received, complaint resolved and the gross income generated. This shows that H_1 will be rejected while H_0 hypothesis will be accepted.

Artificial Neural Network (ANN): At 10-fold cross validation, results show 75% prediction value with 9 instances classified correctly out of 12 instances supplied, this analysis shows that there is a strong relationship between the customer complaint received, complaint resolved and the gross income generated. This shows that H_0 will be rejected while H_1 hypothesis will be accepted.

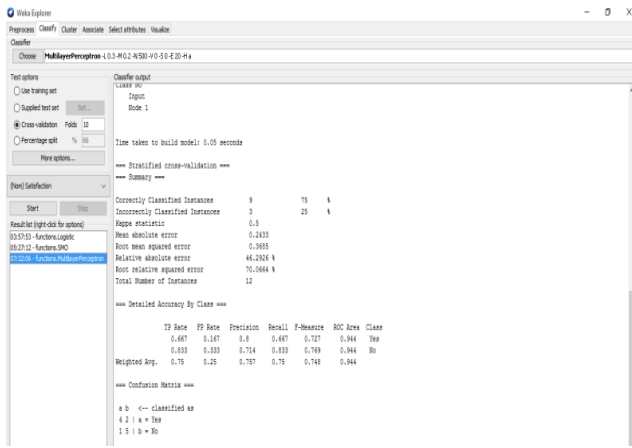


Fig. 5: ANN output in WEKA

3.9.6 Evaluation

In our analysis Logistic Regression, Support Vector Machine (SVM) and Artificial Neural Network shows 83.33%, 25% and 75% of predictive value respectively showing that there is strong relationship between customer satisfaction and customer relationship management system; therefore, the null hypothesis will be rejected and the alternative hypothesis will be accepted. Hence; better customer relationship management leads to increase in customer satisfactory.

3.9.7 Choice of Programming Language

Due to the nature of the processing that takes place in the proposed system, a programming language that will aid the creation of large database and acquiring information from the bank customers. HTML5, CSS, PHP, JavaScript and MYSQL are referred platform suitable for the application software development. For the big data analytics tool WEKA is used for the data analysis.

4 SYSTEM DEVELOPMENT

The model used in the CRM system is the waterfall model; it is a sequence of stages in which the output of each stage becomes the input for the next.

4.1 PROGRAM STRUCTURE

The function of each module in the program is described below;

- ❖ Telephone Access interface

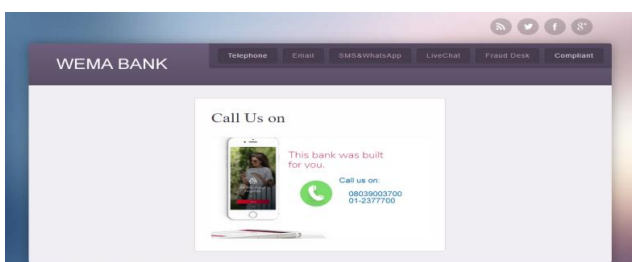


Fig. 6: Telephone Access page

❖ Email interface

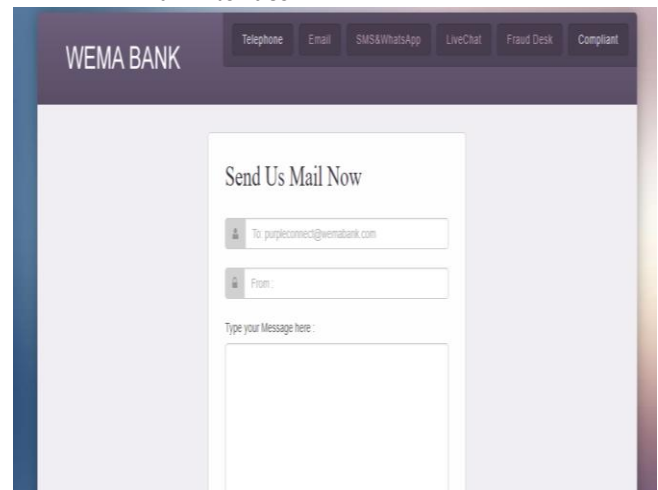


Fig.7: Contact us page

❖ Live chat interface

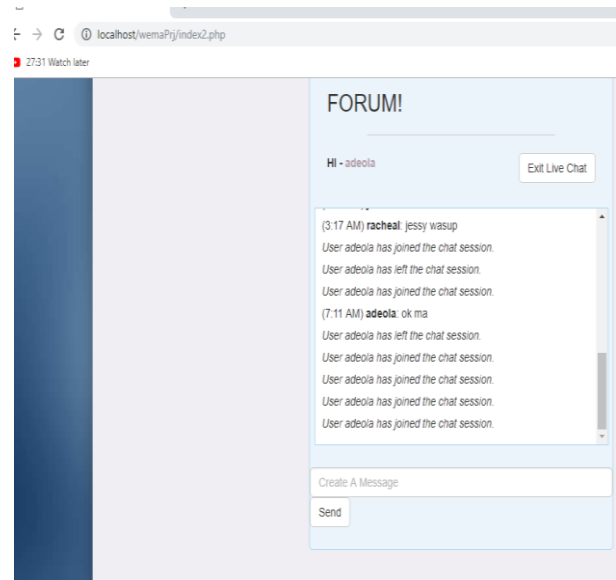


Fig. 8: Live chat page

5 CONCLUSION

In recent times, many businesses realize the importance of customer relationship management and its potential to help them acquire new customers, retain the existing ones and their life time value. This paper presents a scheme that uses big data analytics approach to determine customer satisfaction from data obtained from customer relationship management system. Customer Relationship Management (CRM) consists in processes and techniques used by a company to manage and improve interactions with current and future customers. Data mining techniques applied in CRM environments are evolving due to new technology developments in Big Data management and analytics. Management of customer complaints is centered on ensuring the customer is given utmost satisfaction that will reduce

customers churn. For instance, because of economic challenges a customer can cease to bank, or because of internally stimulated effort by banks when a customer ceases to be profitable. This paper presented the use of Big Data Analytics Approach to give the certain level of customer satisfaction in Wema Bank Plc.

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