

ABSTRACT

ZB Bank Digital Channels is a system that uses the internet as the delivery channel to conduct banking activity, for example, transferring funds, paying bills, viewing savings account balances, applying for loans and ordering ATM cards. This system targets the clients and various departments in the bank (Corporate banking, Retail banking, Treasury and Investment banking) and production of reports for all the levels of management. The purpose of this project was to come up with an efficient and effective ZB Bank Digital Channels system to meet clients' needs. This project was done in five main phases, which include Introduction, Planning, Analysis, Design and Implementation Phases. The introduction phase is an introduction of the research study and a historical background of the organization. The planning phase details the scheduling of the study and a feasibility study which was conducted to evaluate viability of the system. From the feasibility study, the project proved to be feasible. During the analysis phase, the researcher analyzed the weaknesses and strengths of the current or existing system and evaluated whether to develop, improve or outsource the software. User requirements were gathered using questionnaires, interviews and observations. After analysis phase, the design phase followed. A database was designed using MySQL Database management system, input forms, menus and output forms using diagrams to illustrate the major functionalities of the ZB Bank Digital Channels. The last phase was implementation, where the implementation of the proposed system and testing and maintenance were carried out continuously identifying and rectifying any errors. Parallel conversion was recommended when the project was implemented.

DECLARATION

I, Muguse Tony T. do hereby declare that I am the sole author of this project. I authorize the Midlands State University to lend this project to other institutions or individuals for the purpose of scholarly research.

Signature.....

Date

APPROVAL

This project entitled ZB Bank Digital Channels by Muguse Tony T. meets the regulations governing the award of the BSc Honours Information Systems of the Midlands State University, and is approved for its contribution to knowledge and literary presentation.

Supervisor: Mr. T. Tsokota

Signature..... **Date**

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DEDICATION

I dedicate this piece of work to my mother, Sabina Maripise who has supported me all my life and has believed in my abilities. Her love and inspiration brings out the best in me.

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LISTS OF ACRONYMS AND ABBREVIATIONS

ANSI-SPARC- American National Standards Institute Standards Planning and Requirements Committee

ATM- Automated Teller Machine

CASE- Computer-Aided Software Engineering

DBMS- Database Management System

DFD- Dataflow Diagram

ER- Entity Relationship

GB- Gigabyte

IT-Information Technology

JAD-Joint Application Development

LAN- Local Area Network

NPV- Net Present Value

PBP- Payback period

RAD- Rapid Application Development

RAM- Random Access Memory

ROI-Return on Investment

SDLC- Software Development Lifecycle

SQL-Structured Query Language

DC-Digital Channels

WAN-Wide Area Network

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Chapter 1: Introduction

1.1 Introduction

ZB BANK digital channels is an online system that seeks to give the bank a reduced work load within the branches through the integration of the activities undertaken within the banking hall as it is designed to allow most of the transaction at any given place and time without visiting the banking hall. This system will improve the image of the bank through offering an improved customer service rather than delays in the banking hall.

1.2 Background

Consumer behavior is changing partly because of more spare time. The way of use of financial services is characterized by individuality, mobility, independence of place and time, and flexibility. Financial transactions caused by purchases will more and more be carried out by non- and near-banks. These facts represent big challenges for providers of financial services. More and more the Internet is considered to be a "strategic weapon". Financial services companies are using the internet as a new distribution channel. The goals are:

- complex products may be offered in an equivalent quality with lower costs to more potential customers;
- There may be contacts from each place of earth at any time of day or night.

This means that financial institutions may enlarge their market area without building new offices or field services, respectively. Because of its image as an innovative corporation, better interacting possibilities, the usage of rationalization potentials, promotion of self-serviced as, the improvement of its competitive situation by development of core competencies together with the construction of market entry barriers, it may be possible to increase profits and market shares.

One way of exploiting rationalization potentials is the implementation of the entire transaction (from purchase to payment) under a common user interface. Information collected in operative databases of financial institutions allows them to act as information brokers. Offering special information in closed user groups may result in more intense customer commitment, as well as

customer bonding. Know-how that is built up by Internet presence. The use of digital coin-based money to completely settle transactions in the Internet is a new service provided by financial institutions.

1.2.1 Background of Organization.

ZB Financial Holdings dates back to the 1st of March 1888, when the Netherlands Bank and Credit Association of South Africa was formed in Amsterdam Holland under the Royal Charter granted by Prince William III of the Netherlands. Fifteen years later (1903), the bank changed its name to Netherlands Bank of South Africa before becoming a wholly owned South African company in 1969. This was due to a rapid increase in shareholding by the public over the prior years.

Netherlands Bank of South Africa (NEDBANK) extended its sphere of operations to the then Rhodesia (1951), when it opened its first branch in Salisbury. Here it became Rhodesian Banking Corporation (RHOBANK), where it acquired entire shareholdings in Syfrets Trust & Executors Limited (SYTRUST), Syfrets Nominees (Pvt) Ltd & Trustee Company of Central Africa (Pvt) Ltd. On 1 May 1974, Nerficho Limited changed its name to Syfrets Merchant Bank Ltd (SYBANK).

A year after acquiring independence, the Zimbabwean Government acquired 61% shareholding in the bank (26 February 1981), held at that time by Ned bank Limited South Africa. Subsequently it was considered appropriate to change the bank's name to Zimbabwe Banking Corporation Limited (1 June 1981) which was now popularly known as ZIMBANK. ZIMBANK later became a subsidiary of FINHOLD along with SYBANK and SCOTFIN. Finhold later merged with Intermarket in 2006 to form ZB Financial Holdings with ZB Bank, ZB Asset Management, and ZB Capital as subsidiaries.

On October 30 2006, the Group adopted a new monolithic brand and formally changed its name to ZB Financial Holdings Limited. This change was also meant to coincide with the merger with former Intermarket Holdings units, namely (Intermarket Banking corporation, Intermarket Building Society, Intermarket Reinsurance, Intermarket Life and Intermarket Bank Zambia), which units have since adopted the ZB brand. The name changes are illustrated in the comparison below.

1.2.5 ZBFH Core Values

ZBFH values are as follows:

- Reliability,
- Honesty and Integrity,
- Social Responsibility,
- It reflects our Zimbabwean heritage with a proudly Zimbabwean but international feel.

1.3 Problem Definition.

In Zimbabwe banking industries today, queuing has become the order of the day, customer's line up for hours waiting to withdraw, deposit money, pay bills and ordering cards. This creates a lot of problem to both customers as they waste their useful time in the banking hall, and also management of the bank as they run around to find solution to their problems.

The prevailing system has many manual activities which make the system to be more prone to errors and at the same time there will be duplication of activities hence making banking operations slow and unhealthy for business environment.

There is a problem of functions integration in the prevailing system. Some banking services are on separate systems that is to do a certain payment instead of using a single system the teller will have to switch to another system which is a bit time consuming.

Also there is a problem in resolving queries and responding to applications that is queries takes time to be resolved since there will be a lot of queries filed which need to be attended. On loan and card application the client might not know if it is approved or not.

1.4 Aim of the Study.

The major aim of this study is to integrate all the services offered by the bank's systems separately under one system that is the digital channels. By integrating these functions, it will be easy for the customers to do all their transaction under one system since he or she can transact at any time and

any place without delays in the banking hall. However, using the present system, the client should visit the banking hall for him or her to purchase ZESA prepaid token since it will be not offered on the current internet banking.

Also the client will able to apply for loans and at the same time tracking their loans without visiting the banking hall as compared to the prevailing manual system were the clients fills a form which will be then captured later and authorized with a different person which is a tedious procedure. In the case that the client loses his or her ATM card he or she will be able to block it to prevent someone from using it without the owner's permission as compared to the current system were the clients was supposed to visit the branch for his or her card to be deactivated.

1.5 Objectives of the Research Study.

The proposed system under consideration:

- i. To enable clients to order new ATM cards and cheque books online.
- ii. To enable the clients to receive a message notification when a transaction is made.
- iii. To enable the clients to block or unblock their cards if lost or stolen.
- iv. To enable clients to make funds transfers.
- v. To provide a system that allows the payments of bills
- vi. To enable clients to set regular dates for certain payments
- vii. To enable the clients to apply for loan and check on the response.

1.6 Instruments and Methods

- Operating system: Windows 7 or higher
Microsoft **Windows** or simply **Windows** is a metafamily of graphical operating systems developed, marketed, and sold by Microsoft. It consists of several families of operating systems, each of which cater to a certain sector of the computing industry with the OS typically associated with IBM PC compatible architecture.
- IDE: Visual Studio 2010 using C# (ASP.NET)
Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for Microsoft Windows, as well as web sites, web applications and web services.

- Database Server: MS SQL server 2010
SQL Server is Microsoft's relational database management system (RDBMS). It is a full-featured database primarily designed to compete against competitors Oracle Database (DB) and MySQL. Like all major RDBMS, SQL Server supports ANSISQL, the standard SQL language.
- Browser: Google Chrome Internet Explorer 8.0 or higher
Google Chrome is a freeware web browser developed by Google. It used the WebKit layout engine until version 27 and, with the exception of its iOS releases, from version 28 and beyond uses the WebKit fork Blink

1.7 Justification and Rationale of the Study

The project work will help in a good number of ways to ease the queuing system in the banks as the online banking system will help customers to achieve whatever they want to achieve without coming to the bank. Digital Channels allows the users to check their account information, statements and pay the bills instantly. Customer has to login into his account using the username and password, check the statement and fill the amount and authorize the payment and it will be posted instantly.

Due to the fact that the organization will be faced with many needs and limited resources, the management should best utilize the available resources. In this case the digital channels system helps the bank in reducing the costs such as labor, inventory and stationary since the clients can have access to their accounts reports if they are in need of them that is this will save the resources of ZB Bank since there will be no need to print the bank statements in the banking hall if the client request for them since he or she will be able to access them on the digital channels system.

Manual work on the part of the organization's staff is reduced since some of the activities like loan application, cheque book ordering and ATM card ordering will be done by the clients on the site the same time this will reduce errors of capturing clients details by the bank tellers, rather than using the current prevailing system were the clients fills some forms then submit them and wait for them to be captured and approved which might take a bit of a time and at the same time causing duplication of activities.

1.8 Conclusion

In the recent years there has been explosion of Internet based digital channels banking applications states that the emergence of new forms of technology has created highly competitive market conditions for bank providers.

However, the changed market conditions demand for banks to better understanding of consumers' needs motivated the author to focus greatly on the Digital Channels System. In stress that the success in Digital channels banking will be achieved with tailored financial products and services that fulfill customer' wants, preferences and quality expectations. Concedes that customer satisfaction is a key to success in Internet banking and ZB Bank will use different media to customize products and services to fit customers' specific needs in the future. Suggest that consumer perceptions of transaction security, transaction accuracy, user friendliness, and network speed are the critical factors for success in Digital Channels banking. From this perspective, Digital Channels banking includes many challenges for human computer interaction (HCI). This is highlighted in the next chapter which is the planning phase.

Chapter 2: Planning Phase

2.1 Introduction

According to Bennatan (2013) the planning phase is the time when the project team translates the initial vision or scope from the envisioning phase into practical plans on how to achieve it. In this phase the analyst created a functional specification, developed the solution architecture and design, and prepared cost estimates. In the software project lifecycle this is regarded as the second phase in coming up with a software product. The analyst created a set of plans to help guide the project team through the execution and closure phases of ZB Bank Digital Channel. The plans created during this phase helped the analyst to manage time, cost, quality, change, risk and issues.

2.2 Business Value

According to Kendall (2014) business values are the qualitative goals which the company strives to achieve in all its activities. The business values relate to the positive aspects expected that will go together with the implementation of the Digital Channels of the ZB Bank. These aspects are in relation to the incorporation of the system and generally the organizational as a whole's functionality. The analyst had an interactive session, during that session the shareholders established the need expected by the business and at the same time the functionality expected. Basically there are many business values which need to be taken into consideration but in this case the core business values are as follows:

- a. **Shareholder Value:** ZB Bank Digital Channels is of great importance to the organization's shareholders in that it allows effective and strategic decision making that maximize the expected value at the expense of reducing the costs of the organization and also it provides the shareholders relevant information that is they can be potential investors who wants to invest into the organization.
- b. **Customer Value:** Through the use of Digital Channels the clients will be able to communicate with the bank when they are having queries without physically visiting the bank thereby improving customer relations and saving customer time this is achieved by comprehensive information and updates which are received by clients about their accounts and transaction activities.

- c. **Employees' Value:** Reduction in workload to the employees due to the fact that there will be no hassle of capturing large numbers of clients' information since all the processes will be automated.
- d. **Managerial Value:** The proposed system is regarded as the best tool for managing risk which will allow frontline employees and middle managers to perform their superior performance on the value drivers that are influenced directly by them thereby improving the services offered to the clients by the bank. For public relations purposes the website will allow the clients to view other products which are offered by the financial institute, information regarding promotions offered by the institute and announcements information which need to be communicated by the bank, also the site will provide information such as interest rates, information regarding stock, exchange rates, the transaction fees and bank charges of the institute.
- e. **Organizational Values:** The proposed system should add value to the business by increasing the profits of the organization this should be achieved by the implementation of the new proposed system, that is there should be an increase in the number of transactions done through the Digital Channels, the system should also be used to announce important information which will help the clients to manage their accounts and at same time it will be easy for the organization to communicate with the clients.
- f. **Security Value:** The implementation of the Digital Channels System will assure ZB Bank that there will be no crimes committed related to clients' funds through fraudulent activities. Data control and integrity is ensured since the system will not allow unauthorized people to access the information and data.

2.3 Feasibility Study

According to Kerzner et al. (2015) a feasibility study is an evaluation and analysis of the potential of the proposed project which is based on extensive investigation and research to give full comfort to the decisions. The major objective of the analyst was to reveal the existing system's weaknesses and at the same time its strengths, threats and opportunities as accessible by the system operating environment, resources that are required to come up with the system and finally the projections for success of developing Digital Channels System.

The benefits of carrying out a Feasibility Study:

- It helps the organization to make informed decisions.
- Reduces resource wasting
- Helps the organization the record what is known about the project
- The probability of the project success will be high.
- It also helps the organization to make a rational decision on the financial budget of the project.

2.3.1 Technical Feasibility

According to Kerzner et al. (2015) technical feasibility is a measure of the practicality of a specific technical solution and the availability of technical resources and expertise. The system requirements of the project should be assessed that is the analyst will be looking at the software, hardware and other equipment required. While conducting a technical feasibility the analyst reviewed the following information systems (IS) infrastructure aspects required:

- To accommodate the proposed project, the systems and infrastructures should be capable to expand.
- Required systems security architecture has been well-defined thus making it appropriate for Digital Channels to be implemented.
- There is protection of data flows and databases from unlawful access.
- The bank has a sound process which ensures adequate control over the path between the website and the bank's internal networks or computer systems and the internal network is suitably protected from the external environment using appropriate firewall technology.

- The record for each customer transaction contains identification of the customer, the transaction number, the type of transaction, the transaction amount and other information of relevance.

Hardware and Software Requirements

The required hardware and software equipment's are shown in table 2.1.

Table 2.1: Hardware and Software

Quantity	Description	Availability
1	Patch Panel-24 Port	Yes
4	HP Probook 2305(Client Computer)	Yes
40	Tape drives	Yes
1	Dell PowerEdge (Database and Web Optimized Server)	Yes
7	30 meters UTP Cat 35 Fly Leads Patch Codes(RJ45)	Yes
3	3 Meg Ded Internet Link	Yes
1	Visual Studio 2013	Yes
1	MySQL 5.5 community	Yes

2.3.1.1 Technical Feasibility Overview

From the hardware and software requirements analysis above the analyst considered the project to be technically viable to proceed without any doubts since most of the required resources prevail within the organization.

2.3.2 Economic Feasibility

According to Kerzner et al. (2015) economic feasibility is a measure of the cost-effectiveness of a project or solution. Economic feasibility helps the organization to when assessing the viability, benefits and costs that are associated with the project before allocating the financial resources. Decision makers are helped to quantify and determine the economic benefits that are provided by the proposed system to the organization. Basically the economic feasibility involves the project cost and benefit analysis, in this case the benefits are compared to the costs and if the benefits outweighs the costs it will be viable for the system to be designed and implemented. The major objective of the analyst was to assess the costs of ZB Bank Digital Channels development that is to see if the return on investments is acceptable.

2.3.2.1 Cost Benefit Analysis

According to Davis et al. (2014) cost-benefit analysis is a metric that weighs the costs to be incurred as a result of the proposed system over the probable benefits of the system. Basically it is difficult to quantify benefits in monetary terms unlike costs which can be quantified in monetary terms, so for comparisons purposes appropriate estimation methods should be used to quantify benefits that is monetary values are assigned to benefits. It is not worthy for an organization to finance and undertake a projects in which its costs are more than its benefits in this case it is not viable for an organization to invest in the proposed system since the costs are outweighing the benefits. Two steps should be followed to engage the Cost Benefit Analysis which are as follows:

- To carry out a project first one should identify and estimate all the costs and benefits of the project.
- Common units should be attached to the costs and benefits for them to be comparable.

a. Costs

Costs refers to the money and resources that has been paid or given up to come up with the proposed system in this case it comprises of development costs and operational costs that are to be incurred during the system development, also the costs of maintaining and running the system will be included.

i. Development Costs: This refers to the expenses that are incurred during the system development only, they are estimated at the beginning of the project and these development costs comprises of:

- Stuff costs
- Material costs (Supply and equipment costs)
- Ongoing training
- Records migration and storage
- Software purchases

The operational costs are shown in table 2.2.

ii. Operational Costs: These refers to the costs or expenses which are going to be incurred by the ZB Bank for the day to day running of Digital Channels. These type of costs are classified in two categories that is fixed costs and variable costs. Fixed costs are those that incurred at regular intervals at a fixed charge that is they do not change with the rate of usage while variable costs which refers to those costs which are incurred to the proportional usage of the system for example, stationary software and hardware maintenance, magnetic tapes and floppy disks shown in table 2.3.

b. Benefits

Benefits refers to the quantifiable improvements that result from an outcome perceived as advantage by stakeholders. There are four benefit types of a project which are:

- **Cost saving** which is an action that will result in fulfillment of the objectives of the project at lower costs than the projected costs in this case operational and administrative costs are reduced for example a decrease in the size of the staff used to support the system.
- **Cost avoidance** which is an action that is taken to eliminate future costs that is it is achieved by operational and administrative costs elimination a good example of cost avoidance is that in order to handle administrative activity there will be no need to hire more staff.
- **Improved service level** which is the benefit of the new ways of doing things which is realized by improved service which will be offered by the system. For example, for a client to apply for a loan it takes him or her 10 minutes to apply using the system rather than hours spent when he or she physically visit the bank to apply for a loan.
- **Improved information** the organization will improve its decision making processes due to the accurate information which is provided by the system rather than doing things manually to come up with a decision. For example, the system will be able to generate reports of the number of people who applied for loans within a specific period of time which will help the organization to easily track the applications.

There are two types of benefits that is tangible and intangible benefits which are as follows:

i. ZB Bank Digital Channels Tangible Benefits

- Processes automation
- Efficiency is improved
- Expanded and retained client base
- Niche market acquisition
- Data security and integrity is improved
- Operation reduction
- Transformation from traditional market chain to modern market chain.

Tangible benefits are shown in table 2.4.

ii. ZB Bank Digital Channels Intangible Benefits

- Brand appreciation and recognition
- Employees' morale's are improved
- Utilization of assets is improved
- Realization of competitive advantage
- Consumer time saving
- Consumer loyalty is realized

Table 2.2: Development Costs

Description	Amount (US\$)
Patch Panel 24 Port	150
HP Probook 2305x4	2,000
40 Tape Drives	180
Dell PowerEdge	2,700
30m UTP CAT 35 Fly Leads patch codes RJ 45	220
Visual Studio, MySQL 5.5 Community	1,500
Total	<u>6,750</u>

Table 2.3: Operational Costs

Description	Amount (US\$)
Stationary	150
Hardware and software maintenance	2,000
Electricity	300
User training	1,500
Total	<u>3,950</u>

Table 2.4: Tangible Benefits

Description	Amount (US\$)
Increase customer base	3,500
Productivity increment	1,500
Reduction in stationary costs	100
Reduced overtime allowances	1,400
Labour Cost Reduction	5,000
Total	<u>11,500</u>

Detailed Cost Benefit Analysis (CBA)

Table 2.5: Costs Benefit Analysis

Costs and Benefits	Estimated Amount (US\$)	Total Amount (US\$)
Tangible Benefits	11,500	
Intangible Benefits	1,200	
Total Benefits		12,700
Development Costs	6,750	
Operational Costs	3,950	
Total Costs		(10,700)
Net Benefits		<u>2,000</u>

As shown on the table above it is feasible to undertake the project since the net benefits have a positive figure of \$2000 that is the total benefits are greater than the total costs.

2.3.2.2 Capital Investment Analysis

Capital investment refers to the amount of money invested into a business with expectations of recovering it back through cash inflows and earning in the future. According to Collier (2013) capital investments analysis refers to the comparison of the sum to be invested in a project with

the earnings expected over the investment period. There are basically three methods used of evaluating investments which are as follows:

- Return On Investment
- Payback Period
- Net Present Value

a. Return on Investments

According to Hughes et al. (2014) return on investment provide a way of comparing net profitability to the investment required. This is a method of analyzing the investment which is used analyze the future returns of capital investment in order to see the pattern of recovery and periodic investments earnings. From the analyst finding an acceptable return on investments must be between 10% to 20% as the notion that ROI must not be overstated or must not be high since the stakeholders will be expecting more return from the invested capital and at the time ROI should be understated or low since this will discourage the investors or stakeholders to fund the system proposed that is low ROI discourages the proposed system development. ROI formula is shown below:

$$\begin{aligned}\text{Return on Investments} &= \frac{\text{Net Benefits}}{\text{Total Costs}} \times 100 \\ &= \frac{2,000}{10,700} \times 100 \\ &= 18,7\%\end{aligned}$$

On project ranking and selection the analyst found return on investments to be the very useful method to use, taking into consideration the above calculation there was favorable net benefits of \$2,000 and also the ROI of (18, 7%) this proved that system is economically feasible to undertake. To proceed with the ZB Bank Digital Channel development the stakeholders needed to be convinced since there was rationalization of capital. However, time value of money was not taken into consideration by this method so the analysts used the Net Present Value (NPV) to overcome the time value for money weakness.

b. Payback Period

Hughes et al. (2014) defined payback period as the time the elapses between initial investment and the date when the investment is fully recovered. The organization will choose a project with the shortest payback period since its major objective is to realize a profit from the system in short space period of time. A favorable payback period is regarded as between one to four years because once the organization’s system reaches the payback period there will be no risk for a loss. The payback period formula and calculation is shown in table 2.6 below:

$$\text{Payback Period} = \frac{\text{Net Initial Investment}}{\text{Net Annual Cash Flow}}$$

Table 2.6: Payback Period

Year	Cash flow (US\$)	Balance (US\$)
0	(18,500)	(18,500)
1	7,960	(10,540)
2	17,750	7,210

Payback = 2 years 5 months

From the above calculations it is shown that for the organization to recover its initial capital invested on the project it needs 2 years 5 months which if favorable since it is a short payback period and from the time the organization recovers all its initial capital it is left with a profit of about \$7,210 which is expected by the management, but however the above do not take consideration the time value for money.

c. Net Present Value

According to Collier (2013) net present value of an investment discounts future cash flow to their present value and compares the present value of the future cash flow of the capital initially invested. NPV is the best method to use when deciding to proceed with the project or to drop it if its returns are not favorable in the future. Payments are made yearly and the starting year will be regarded as year 0 followed by year 1 and so on. This approach takes into consideration time value of money and the cost of borrowing that is if a project has a positive NPV and at the same time with at least 10% of the capital invested initially is regarded as favorable and it is intelligent to invest on such project. A project is regarded worthwhile if the net present value is positive on the other hand a project must be rejected if it has a negative net present value. Using a discount rate of 10%, a positive net present value above \$6,000 should be delivered which shows that the project is feasible and ZB Bank should accept it. The net present value formula is shown below:

Net Present Value = $\frac{\text{Annual Total Benefits}}{(1 + r)^n}$

$(1 + r)^n$

Where **r** = discount factor

n = number of years

Table 2.7: NPV (Net Present Value)

Year	Cash Flow (US\$)	Disc Factor (10%)	P Value (US\$)
0	(18,500)	1	(18,500)
1	7,960	0.9090	7,235
2	17,750	0.8260	14,661
3	9,500	0.6840	6,498

Net Present Value	<u>9,859</u>
--------------------------	---------------------

The project is feasible since there is a surplus net present value of \$9,859. The cash flows were discounted using the discounting factor of 10 %. It is considered economic feasible to develop the system since it exceeded the estimated figure of \$7,500 and at the same time with a positive net present value of \$9,859 that is the project is a true reflection of a worthy investment. Net present value was regarded by the analyst as the most important and useful method to evaluate an investment to come up with a conclusion that the development of the system will add value to the organization.

2.3.2.3 Economic Feasibility Overview

As of the methods used by the analyst above, a clear and sounding conclusion was drawn that ZB Bank Digital Channels is economically feasible since in the first 2 years 5 months the benefits outweighed the costs which is favorable to the organization. Also the cost benefit analysis and all other investment analysis techniques showed that system proposed was economically feasible.

2.3.3 Social Feasibility

According to Lewis et al. (2012) social feasibility refers to determination of whether a proposed project will be accepted by the people or not. The major goal of this type of feasibility study is to determine the effects of changes made by the proposed system to the clients, management and other employees within the bank that is how they are going to view the change and their attitude towards the new system. This study addresses the social beings of the proposed system and how the society is influenced by the proposed system. The following aspects should be taken into consideration for the project to be regarded as socially feasible:

- **Integration:** All social and organizational components should be organically blended to come up with a system which is greatly accepted by both the clients and the organization as a whole.

- **Communication:** Reviews and ideas should be communicated freely by the stakeholders to the system developer such that a product of high quality will be delivered so as to meet everyone's needs and wants.
- **Leadership:** For the project to yield the intended beneficiaries it is essential to have an effective and efficient leadership and management which is of a great benefit to the society.

2.3.3.1 Social Feasibility Overview

Basically the employees were in fear to lose their jobs but however the implementation of ZB Bank Digital Channels was not implemented to retrench other employees thereby making it socially feasible. Also the implementation of system did not change the social structure of the organization or compromised the organizational culture and morals.

2.3.4 Operational Feasibility

According to Kerzner et al. (2015) operational feasibility is a measure of how well a proposed system solves the problems, and it takes advantage of the opportunities identified during scope definition and how it satisfies the requirements identified in the requirements analysis phase of system development. This study defines the urgency of the problem and the acceptability of any solution that is if the system is developed will it be used which will include people oriented and social issues. Internal issues such as manpower problem, labour objections, manager resistance organizational conflicts and policies. This study heavily depends on available human resources for the project and it will assess whether employees and the clients will use the system when developed and at the same time implemented. Through operational feasibility the analyst reviewed the commitment and willingness of the development of the system.

2.3.4.1 Operational Feasibility Overview

As reflected by the sample conducted by the analyst above the project is feasible and the probability of success is high because all the stakeholders are in support of the ZB Bank Digital Channel development.

2.4 Risk Analysis

Kendall (2014) defined risk analysis as the process of analyzing and assessing the likelihood and impact of risks that can adversely affect the successful execution of a project and ranking of risks as well as determination of risk strategies. Risks were taken into consideration that is they were identified and evaluated as well as the counter measures (contingency plan) were put in place.

Associated Risks and Counter Measures

The introduction of Digital Channels causes risk challenges for the bank but however the developed system tries to impact risks related with the traditional banking. Associated risks are as follows:

- **Legal Risk:** This is the risk related to the earnings arising from non-conformance with the rules, regulations, standards and the law. Continues monitoring of the ZB Bank Digital Channels will to ensure compliance of the prevailing rules, regulations and laws.
- **Online Fraud Risk:** There is high risk with online transactions that is the bank must enforce great measures of the system to ensure that there is no unauthorized entry into the system for example phishing attacks, identity theft and hacking which will pose a serious risk to both the bank and the clients that might end up causing a loss to the bank. For this to be encountered the bank should continuously check and upgrade its firewall as well using tricky authentication ways which only known by the users.
- **Technology Risk:** This risk may cause system failure which may be associated with process error, malicious attacks, hardware failure and network challenges. Process and other components related to Digital Channels should be frequently checked and controlled.

2.5 Stakeholder Analysis

The development of the ZB Bank Digital Channels was regarded as the best investment done by the financial institution. Stakeholders refers to those people who are positively or negatively affected by the business operations. The analyst interviewed all the stakeholders of the organization which are as follows:

- **CEO and the board of directors:** The management supports and promised to fully fund the project as well as organizing the subordinates who will motivate others to support the system.
- **IT Management:** The IT management regarded the ZB Bank Digital Channels system to be the best innovative product to be in the organization and they are self-confident that they will be able implements and maintain the system well.
- **Finance Management:** The major objective of the finance department is to understand what the organization earns from the project that is they are more concerned with what is required to complete the system that is the financial resources required and at the same time the benefits which the organization will realize after the implementation of the system. After analyzing the cost benefit analysis, the finance management realized that the project benefits the organization.
- **Administrators (Transaction Controllers' and Personal Bankers):** These were the initiators of the project since they were tired of the traditional way of the banking processes which led them to clerical paper work as well as many errors during capturing clients' data. The administrators fully supported the system since they were looking forward for a new innovative system which will thereby reduce their workload.
- **Client End Users:** These people are the reason why this system was proposed. They fully supported the project since it will reduce their transport and communication costs by just visiting the bank system using internet. Once the system is implemented and the clients accepted it the clients will easily get used to it.

2.6 Work Plan

According to Davis et al. (2014) a work plan is a detailed accounting of how an individual or group proposes going about accomplishing a specific task, approaching a project or pitching a new business concept. It is sometimes known as work statement in which includes the project overview, accomplishment of individual tasks, and implementation costs projection and completion timelines for the project. The analyst used the Waterfall model for the project development and it is a widely used approach because it well document the project. It is easy to follow and the stages are defined clearly since it is a linear approach which ensures an explained written documentation of each

phase which can be used reference when system errors arise as well as on the system maintenance. Work plan shown in the table 2.8 below:

Table 2.8: Project Time Schedule Allocation

Phase	Start Date	Completion Date	Duration (Months)
Project Proposal	02/02/16	28/02/16	1
Planning	29/02/16	26/03/16	1
Analysis	27/03/16	25/04/16	1
Design	26/04/16	27/07/16	3
Testing and implementation	28/07/16	29/09/16	2
Evaluation	30/09/16	30/10/16	1
Documentation	02/02/16	30/10/16	9

Gantt chart

A Gantt chart is a horizontal bar chart which was developed by Henry L. Gantt in 1917 as a tool to control production. The analyst used a Gantt chart to illustrate the above project time allocation schedule in table 2.8 which will help in the planning, tracking of specific tasks and coordinating in the project. The Gantt chart is derived from Work Breakdown Structure (WBS) as shown in fig 2.2:

Phase	Duration (Months)								
	1	2	3	4	5	6	7	8	9
Project Proposal	■								
Planning		■							
Analysis			■						
Design				■	■	■			
Testing and implementation							■	■	
Evaluation									■
Documentation	■	■	■	■	■	■	■	■	■

Fig 2.1: Gantt chart

2.7 Conclusion

The system developer was in a position to proceed with the ZB Bank Digital Channels system development since the analyst looked deeper into various factors that might affect the project development for example the feasibility study (technical, economic, operational and social feasibility) which turned out to be favorable. At the same time this planning phase made the management and the end users to approve the project which increased the success rate of the project. The next phase will be the analysis phase in which the analyst will make a detailed analysis.

Chapter 3: Analysis Phase

3.1 Introduction

According to Bainey (2014) system analysis is a phase that outlines who is currently using the system, what data, how and where the data is being handled in the current system through the use of different gathering methodologies. Activities such as process modelling are taken into consideration that is the prevailing way of modeling the current processes. Systems analysis phase's major objective is to stress out the system specification and needs that need to be developed so as to meet end users' requirements. System analysis was used by the analyst to interpret facts from the gathered information, and at the same time using that same information to design the system effectively guided by the recommendations from the gathered information.

Banking systems are usually complex since it comprises of many modules that is to make system changes to it requires one to notices the effects of the implementation to the prevailing subsystems since it may lead to many problems rising thereby affecting the business operations. The following factors will be identified when undertaking systems analysis:

- Migration of data from the old system
- Cost of implementing the system
- Processes and roles to be undertaken by individuals
- Data processing and output needed

3.2 Information Gathering Methodologies

According to Walters et al. (2015) information gathering is an art and a science and the approach and manner in which information is gathered require persons with sensitivity, common sense, and knowledge of what and when to gather and what channels to use in securing information. Interviews, questioners and observations where undertaken by the analysts and these information gathering techniques were conducted to the people who are directly affected by the system within the organization that is the users of the system.

3.2.1 Interviews

According to Kendall et al. (2014) an interview is a face to face interpersonal situation in which a person called the interviewer asks a person being interviewed, questions designed to gather information about a problem. This is a traditional information gathering technique which is used to gather opinions, informal procedures, facts and goals. An interview between the analyst and the users of the system was conducted.

Before conducting the interview, the analyst came up with a list of the targeted people to be interviewed so as the order in which the people are going to be interviewed. The analyst planned and noted a number of questions which he was supposed to ask the users of the system. A number of individuals were interviewed independently that is the top and senior management, five different heads of departments (credits and loans, retail, treasury front office and investment banking), and finally the clients. This conducted interview was based on the traditional processes as well as how to improve them through ZB Bank Digital Channels use, work experience and finally the user's level of involvement to the system. The analyst used semi-structured way of interviewing such that the respondents will be able to express their point of view. During the interview the respondents had guided topics of the subject under consideration which will determine the ZB Bank Digital Channels system acceptance, but however there were some issues such as security features and control regulation of the system which were raised during the interview. The interviewee was free to discuss any issues concerning the proposed system. The interview took 20 minutes to 50 minutes and it was conducted using English Language. The analyst carefully questions asked to avoid wrong conclusion which might cause problems in the future. The interview checklist in **Appendix B** was used to conduct the interview.

Advantages of interviews

- **Development of relationship:** an interview develops a good relationship between the interviewer and the interviewee thereby improving both parties' co-operation and mutual understanding in this case in our Digital Channel research in which accurate and reliable information was gathered at the same time correct responses given increasing our system success rate this was achieved after the researcher and the interviewees build a mutual relationship and trust.

- **Collection of required primary information:** through conducting an interview new, primary and fresh information was collected which was greatly needed for the Digital Channels so as to come up with a system which is required by the banks' clients.
- **Captures behavior, emotions and thoughts of the users:** due to face to face interviews the interviewer will be able to capture the interviewee's behavior and emotions towards the proposed system that is the individuals affected by the implementation of that system that is those who are negatively affected by the proposed system will have a negative attitude towards the implementation of the system in this case the researcher communicated the benefits of the proposed system with the interviewees before contacting the interview.
- **Gathers vital facts about the prevailing problem:** through conducting an interview the analyst will be able to gather information about what is expected by the users, the problems which the users are facing by using the current system and how they want these problem to be presented on the proposed system so as to meet the users' needs and wants that is the analyst will be able to explore the actual reason causing the problem making it simple to overcome it thus the Digital channels will be there to solve those stated problems faced. The researcher gathered the problems that were affecting the clients and the management before conducting the interview so he or she had a guide of the questions to be asked.

Disadvantages of interviews

- **Time consuming:** in this situation there was misunderstanding and interpretation of response need to be done, interviews can be time consuming that is it may delay the implementation of the proposed system but however the researcher minimized the delays by setting a minimum time with each interviewee.
- **Interviewee biases:** bias responses are given by the interviewees if an adverse response is expected the interviewee will give a positive response in case they might be in fear of losing their jobs due to the implementation of the proposed system but however the researcher explained how the system will work in the prevailing work environment without affecting their jobs.

3.2.2 Questionnaires

According to Kendall et al. (2014) questionnaire refers to a tool that has a number of questions which individuals respond with the main objective to gather information of factors affecting the users. These questionnaires are sent to a number of individuals that is this document will be containing series of standard questions pertaining the system and are designed for statistical analysis.

To have a general picture of aspects affecting customers and employees' decisions whether to make use of the digital channels services the analyst used the questionnaires. It is believed that the analyst should design a large number of unbiased questionnaires which will cover a large sample size thereby increasing the chance of gathering accurate information that is 150 questionnaires where used and 15 of them were sent to the randomly selected ZB Bank branches nationwide and was completed by current system users which were selected at random. The analysis targeted the group between 17 to 50 years which are able to use the advanced system to be implemented by the bank. The researcher designed and used the following questionnaires:

- **Clients:** This was designed for clients and given to clients so that the analyst will be able to know what is expected from ZB Bank Digital Channels so as get improved services and products.
- **Branch Workers:** These questionnaires were designed for the transaction controller, personal bankers, loan officers and retail officers who are responsible for customer enquiries, stock trading and loan processing at the same time they are directly involved with system that is they should express the changes they expect to be in the proposed system which will give the analyst a clear understanding to the user requirements.
- **Management:** This questionnaire was designed for the managers (cooperate, retail, investments and credit and loans managers) and the top management as a whole to understand is expected from the management about ZB Bank Digital Channels in relation to the departments they are heading.

The analyst designed questionnaires which are brief, easy to understand and answer as well as user friendly. The questions asked were clear and arranged in a chronological order with clear instructions on the beginning of the questionnaires. Simple English and words were used in the

questionnaires to avoid misunderstanding by the respondents. The questionnaires are shown in **Appendix A**.

Advantages of questionnaires:

- It is useful and easy to gather information on a large population sample that was used to capture different users' views towards the system.
- It is a cheap method as compared to the interview method taking into consideration the available funds to be employed on the system.
- It is comfortable on the part of the respondents since they are guaranteed that their responses were going to be kept private and confidential
- Questionnaires gathers accurate information as compared to interviews since the respondents will be having plenty of time to answer the question asked.

Disadvantages of questionnaires:

- There can be different interpretation of the question therefore the respondent will answer on their own interpretation of the question thus wrongly answering the question.

3.2.3 Observations

According to Thayer (2013) observation refers to the systematic description of events, behaviors, and artifacts in the social setting chosen for study. This method enabled the researcher to study the people's actions through participating and observing in the activities under study this will allow the researcher to learn and be aware of the things that the participants failed or unwilling to discuss or answer in interviews and questionnaires.

During observation the researcher gained a clear understanding of the traditional banking operations that were carried out by the users. The researcher mastered all the steps involved in stock trading, loan application and balance enquiry jotting down each and every step's output. He also examined the bill payments slip, ATM cards application forms and bank transfers slips so as to get an understanding on the purpose of each and every items to be filled on the slip. By engaging on a direct observation to the traditional banking processes, activities and operations the researcher developed a holistic point of view on how the ZB Bank should be operating. **Appendix C** is the score sheet which was used by the observer.

Advantages of observations

- Observations gave the researcher a chance to gather information of what the informants were unwilling to share or discuss with the researcher thereby increasing the accuracy of the information gathered.
- It also provided access to the researcher check the time taken by different people to undertake a process for example balance enquiry, funds transfers, loan application and bill payments

Disdvantages of observations

- Opinions cannot be studied or gathered using observations
- It is difficult to know or understand why people behave in a certain way as they do
- It causes a Hawthorne Effect that is people work more efficiently during the day when they know they are being observed as compared to other normal working days.

3.2.4 Document Review Analysis

The analyst collected ZB Bank's magazines, annual reports, journals and policies to better understand the research findings in this analysis. In order to get relevant information from the collected documents which involves service brochures and banks' publications the researcher made personal visits and sometimes made telephone calls to the branch. Financial services and banking industry books were gathered to have an overview of the impact of technology and the financial industry. The analyst used information from the reports for argument supporting to come up with the system. FAQ (Frequently Asked Questions) web page of the bank was accessed to see various questions which were asked by the clients and at the same time to see services which are expected by the clients.

Advantages of document review analysis

- Easy to analyze and quantify the information obtained.
- Information gathered is a little bit biased.
- Does not interrupt organization and clients' business operations.

Disadvantages of document review analysis

- It is time consuming to go through all these documents.
- The data is restricted to what is already existing.
- It is difficult to get the right and required information.

3.3 Analysis of Current System

ZB Bank is a well-known financial institution that offers various financial services which includes transaction processing, receiving and keeping deposits, money issuing and finally issuing loans. However, it provides additional financial services for example stock broking and trading investments products. ZB Bank uses the traditional banking in processing most their transactions that is bill payment, withdrawals, deposits and funds transfer that is for a client to perform a transaction he or she must physically visit the bank and be served by the bank tellers. For a client to apply for a loan, pay bills, apply for cheque books and ATM cards there is need to fill the forms which need to be captured into the banking system and at the same time need to be verified for it to be approved.

Detailed description of the current system:

New clients: at the current moment when a client wants to open account with ZB Bank he or she is required to fill a form which requires personal details such as a copy of national ID card, proof of residence which can be in the form of utility bills slip and passport photo size to the Retail Officers who are responsible for accounts creation.

Bill payments: if clients want to pay bills such as telone, DSTV, nyaradzo and Edgar's they should physically visit the bank and the transaction will be processed manually which is a tedious process.

Loan application: the client manually fills the loan application form after that the loan officers checks the application forms to see if it is viable to give the loan to the client in this case the loan officer checks the amount which a client requires, client's salary and finally the collateral security in case the client fails to repay back the loan. Once the clients' requirements are met the loan will be approved but however for the clients to have confirmation of their loan application they visit the bank branch frequently to check if the loan is approved.

Customer transacting process and enquiry: for the clients to make enquiries they physically visit the ZB Bank where their queries will be answered so as to make some basic transactions the client goes to the bank branches in which their transactions will be done by the tellers.

ATM cards and cheque book application: any ZB Bank account holder has an honor to apply for a cheque book and an ATM card. However, for the clients to apply for this they visit the bank to fill some cheque book and ATM card application forms and those forms are captured into the system by the ATM custodian to order the cards. The client will be told the collection date of the cards or cheque book.

3.4 Process Analysis

According to Davis et al. (2014) process analysis is a step-by-step breakdown of the phases of a process, used to convey the inputs, outputs, and operations that take place during each phase. To understand how the process is done and operates the analyst uses the process analysis that is this analysis' major concern is to improve the processes by efficiency improvement and waste removal. To present the traditional banking practiced by ZB Bank the analyst used the activity diagram that is it represented inputs, processes and output of the prevailing system.

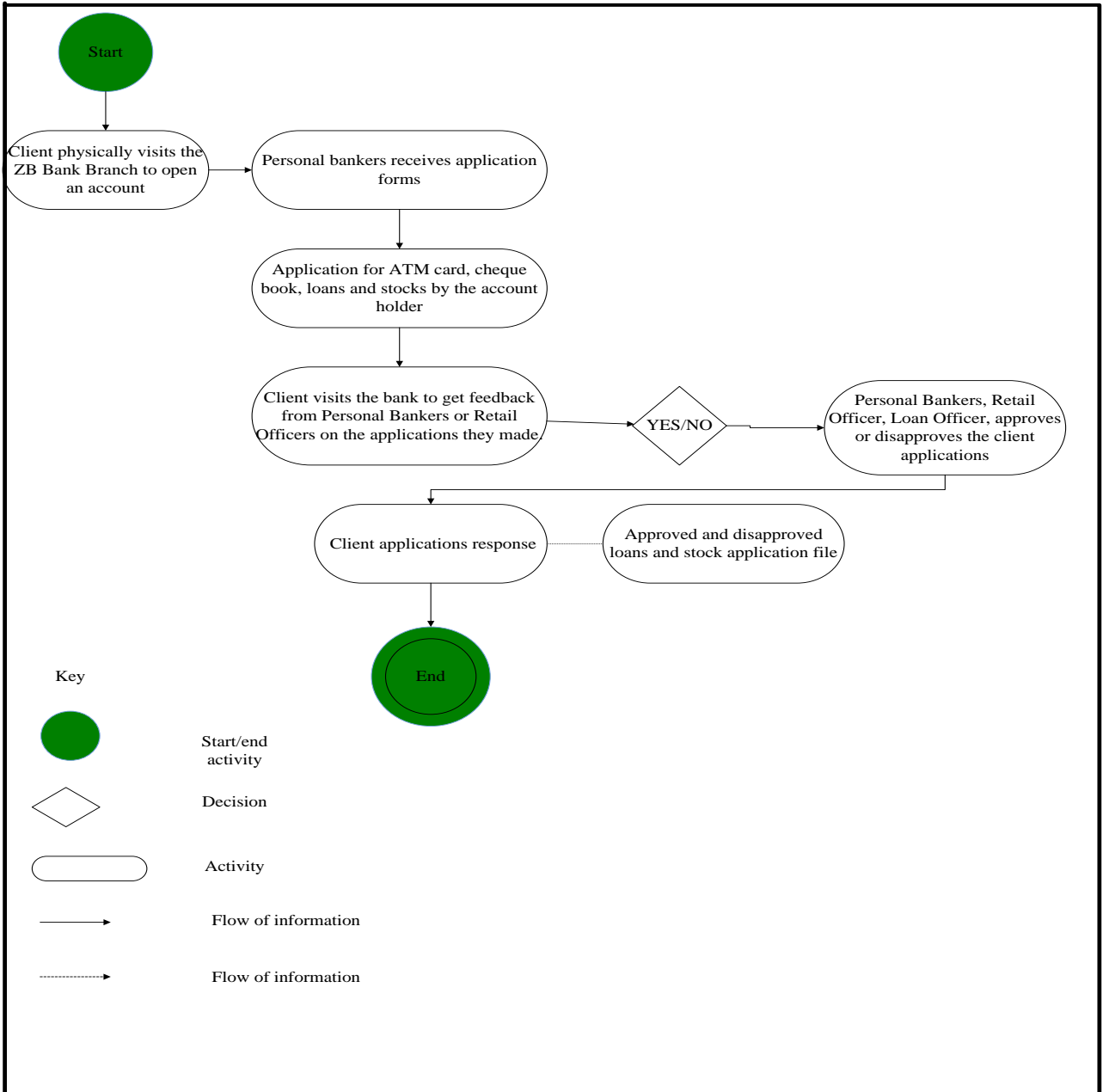


Fig 3.1 Current System Activity Diagram

3.5 Data Analysis

According to Garmus et al. (2015) data analysis comprises of a collection of methods to deal with data or information obtained through measurements, observations, surveys and experiments about a phenomenon of interest. However, it is also well known as the data evaluation process which uses logical and analytical reasoning to study each and every component of the provided data. The

major objectives of this analysis is to gather information as much as possible that is of paramount importance to the proposed system development.

3.5.1 Context Diagram

Context diagram refers to the highest level view of a system that is it is similar to a block diagram, showing a system as a whole and the relationship that it has with the external factors and entities. According to Garmus et al. (2015) context diagram refers to a data flow diagram showing data flows between a generalized application within the domain, the other entities and abstractions with which it communicates. Context Diagram is much concerned with the relationship between the system and the external entities so as the data and information which is exchanged within the system under consideration.

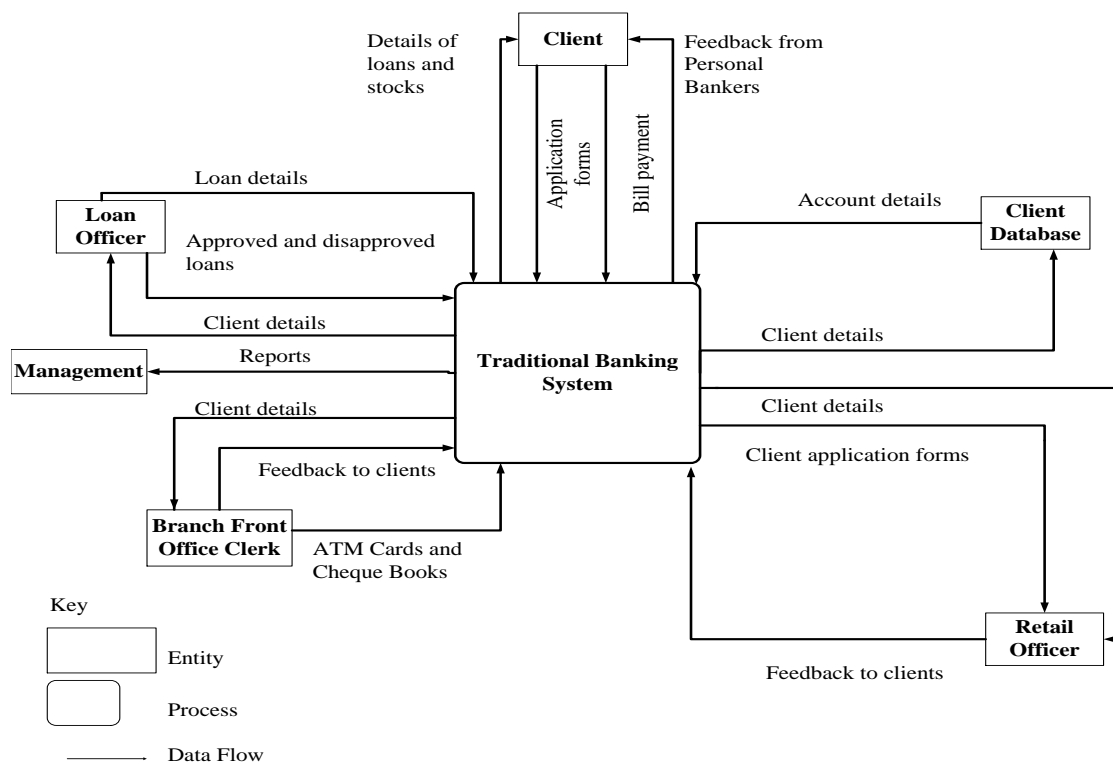


Fig 3.2 Current System Context Diagram

3.5.2 Data Flow Diagram

According to Garmus et al. (2015) a data flow diagram (DFD) is a graphical representation of the flow of data through an information system. It is a graphical manner of how data in the system is transformed by the system processes and at the same time it represents functions of the business. It makes use of the top down approach to show all functions levels of the system as shown in fig 3.4 below.

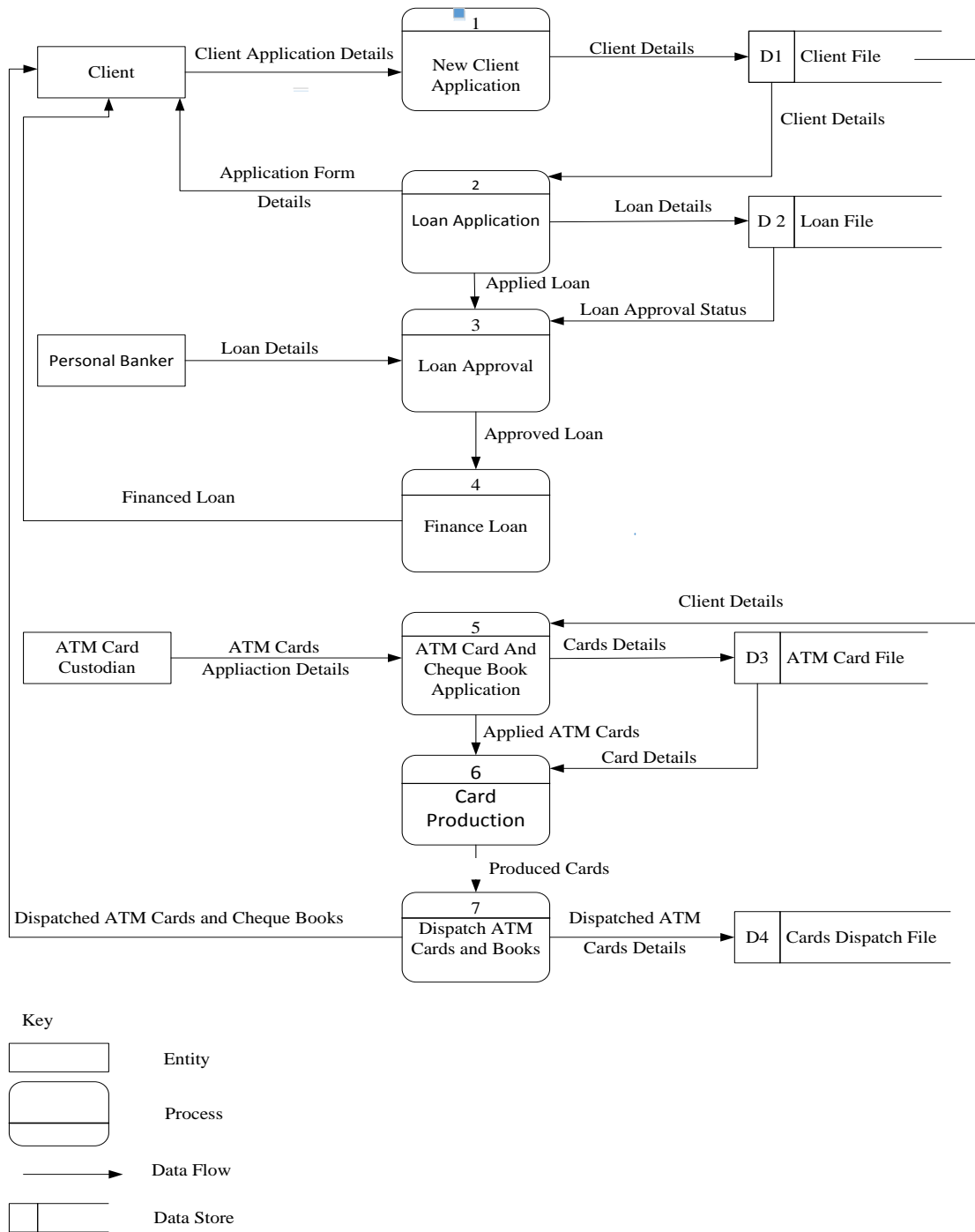


Fig 3.3: Data Flow Diagram of the Current System

3.6 Weaknesses of the Current System

The prevailing system comprised of weaknesses and are as follows:

- **Inaccuracy of data:** during capturing of data and filling of forms inaccuracy may occur that is information entered on forms cannot be validated. Also there might be the case that the wrong or invalid information was discovered later the client should physically visit the banking hall to rectify the errors.
- **Poor service is offered:** for the clients to be offered a service there is need to visit the bank physically, clients has to wait in queues up until it is his or her turn there by inconveniencing the clients since each and every transaction to be made there is need visit the bank's branch.
- **Time consuming:** captured data is sorted and stored in a certain structure using proper indexing for future referencing. There is the use of Microsoft excel to store customer's information there making it difficult to access the information when quickly required say a query need to be addressed there will be a slow response time since it takes long to retrieve the information.
- **Increase in costs:** an increase in the number of customers is followed by an increase in the bank costs because the number of form to be printed will also increase so as the transaction slips and storage files thereby increasing operational costs. Clients' costs are increased due to bus fares used to and from the bank to transact.
- **Communication is difficult:** communication between the bank and the client is difficult the only option is for the clients to visit the branch for their queries to be solved. The ZB Bank Digital Channels will be having a platform that facilitates communication between the bank employees and the clients.

3.7 Evaluation of Alternatives

The analyst concluded that it is viable to carry on with the system, making use of the feasibility study undertaken in the planning phase. Alternative evaluation helps us to select an alternative which is best and that yields ideal results. The alternatives comprise of:

- Outsourcing.
- Current system improvement.
- In-House Development.

3.7.1 Outsourcing

Pinkerton (2015) defined outsourcing as the process of assigning a company's business processes to an external agency in lieu of enhancing service quality, driving innovation or deriving benefits of lower labour costs. It encompasses purchasing an already designed software application package from a vendor. These type of application packages are not designed for specific company that is it will be a universal application that is used by most the companies and clients in this case the software application will be designed without specific requirements in this case the system will not be customized for ZB Bank. The analyst considered outsourcing as an alternative but however the following are reasons why ZB Bank should not outsource:

- The payback of an outsourced system is not certain which proved to be economically not feasible as shown by the calculations done above which shows a payback period of 2 years 5 months which is favorable to the bank.
- As reflected by the technical feasibility that was carried out it is not viable for the bank to outsource the system since it may lead to employment of some staff which have expertise in the use of the outsourced system there by causing the bank to incur additional costs and expenses for example salaries for the additional staff.
- Considering the operational feasibility, the alternative of outsourcing was considered not to be viable since for the outsourced system to be fully and completely implemented it may require many different upgrades of the prevailing systems and many different IT infrastructures which might not be prevailing in the organization to foster system integrations and smooth running of the outsourced system which might be against the contractor's will of the prevailing systems.

Purchasing an Off the Shelf software in not advisable since it might cause the organization to incur losses which is against the major objective of the bank of making profit thus making the Outsourcing alternative rejected.

3.7.2 Improvement of the Current System

To improve the current system, the analyst should identify weaknesses of the processes and improve them this implies that there will be no change in operations undertaken but the area of need will be the one to be improved. Various processes improvement on the traditional prevailing

banking system is a moderately cheap alternative in terms of operational and development cost but however it is associated with the following drawbacks which is the major reason why ZB Bank should not improve the current system:

- There will be time wasting by redesigning the current system however there is no guarantee that this improvement will meet the customer needs and wants.
- Operationally the improvement of the current system is not viable since it will not meet the international standards which might led to loss of some clients. The system may have problems which might be difficult to fix for instance the system performance. The current system might be having existing problems which might affect the improved system thereby producing undesirable results.
- Economically it is not viable to improve the current system since it was stressed out in the economic feasibility that funds for high operating costs were not available this high costs were due to extra employed employees to redesign the system. Also process changes from the system redesign is followed by training the workers on the new features added to the system thereby increasing the costs.

It is not viable to improve the current system since it may lead to the inheritance of the existing problems thereby causing problems in the future in this case it may increase the costs of the organization due to the increased in down time of the system. However, the analyst concluded that the improvement of the current system is not the best alternative based on the feasibility study done above.

3.7.3 In House Development

A customized ZB Bank system can be developed by the firm that is this system will be specifically developed for ZB Bank. All the current prevailing problems which were caused by the current system should be addressed by the proposed system to be developed that is the developed system should be developed according to what the clients and other users want so as to meet their expectations. The reasons why ZB Bank Digital Channels should be in-house developed are as follows:

- **Enhances employees' skills:** the ZB Bank development team will be greatly involved in the system development that is they will be using and sharing their different skills which

will allow them to learn from each other at the same time perfecting their skills thereby motivating them to deliver a system of high quality.

- **Client satisfaction and improvement in employees' self-confidence:** by developing the system in-house the team of developers will be having pride in their work due to the implementation of a system in which they were greatly involved. Also it will lead to high client satisfaction since the development team will be aware of what will be expected by the clients there by meeting the clients' goals at the same time high quality system will be delivered.
- **The system support will be easy and cheap to maintain:** the system is easy to support and cheap to maintain since after the system development a documentation is produced which will help the people to support the system with up to date and deep technical knowledge which is not possessed by most the managers. This document can help any person to maintain the system that is not only the system designer and developers can be able to maintain and support the system but rather anyone using that document which comprises of procedures and instructions of the system.
- **The firm will have a competitive advantage:** a competitive advantage will be realized by the bank because the internal development team will develop a unique system which comprises a system features that are differentiated from those of the competitor. Internal development team understand better the processes and industry there are working in that is when coming up with the system they will be much interested its clients' needs and meeting the bank's major objective of maximizing profit.

It is worthy for the bank to in-house develop the system since as shown by the analyst above the merit of in-house development is offsetting the associated demerits. By comparing the above alternatives, it is proved that it is far much better for the organization to in-house develop the system because it retains control of the development of products and it fosters a professionalism culture to staff.

3.8 Requirements Analysis

According to Thayer (2013) requirements analysis refers to the process of determining user expectations for a modified or new product. The requirements under consideration must be detailed, relevant and quantified. This analysis greatly involves the users of the system such that

expectations and conflict resolution required by the users are met before implementing the system to avoid delays. The major aim should be to implement a system that conforms to the client's needs and wants

3.8.1 Functional Requirements

According to Thayer (2013) functional requirements refers to things such as data manipulation, data processing, system calculations, user interaction with the system, user interface and other system functionalities that show the level of requirement satisfaction of the system. The following functions will be provided by ZB Bank Digital Channels:

- Check balance
- Transaction log (bank statement)
- Loan application, cheque book and ATM cards
- Payment of bills
- ATM card blocking
- Funds transfers
- Prepaid electricity purchase
- Privacy of data
- Authentication
- Validation and verification
- Generate reports

Use Case Diagram

The set of scenarios that describes interaction between the system and the user is referred to as the use case. According to Garmus et al. (2015) defined use case diagram as a diagram that is used to identify the primary elements and processes that forms the system. Processes are referred to as "use cases" while primary elements are referred to as "actors" that is use case diagrams shows the relationship between the use cases and the actors. The interaction between the actors and the uses case is shown in fig 3.5 below:

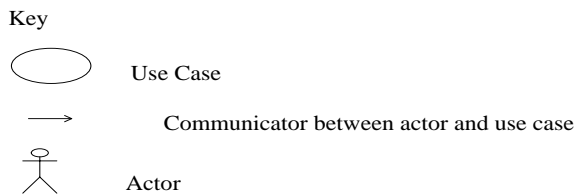


Fig 3.4: Use Case Diagram

3.8.2 Non-Functional Requirements

Thayer (2013) defined non- functional requirements as requirements indirectly concerned with functions that are delivered by the system. These requirements include the system properties that makes an efficient use of the system such as performance, security, response time and reliability however failure for the system to meet these non-functional requirements it means the system will be difficult to use or even unusable. Below are non-functional requirements that are needed on ZB Bank Digital Channels identified as security and performance requirements:

a) Security Requirements

- **Protection of account username and password:** user authentication is the first level to access the ZB Bank Digital Channels that is the user should enter correct username and password to have access with the system and at the same time the user should protect these credentials. Special types of characters should be used on the password to ensure high level of security.
- **Encryption:** server authentication is ensured by the system to protect the user passwords that is the password will be translated into an unreadable format.
- **Logout Tab:** the user should logout when he or she is done with using the system to avoid someone from accessing their accounts that is the session of the system will be end once the client logout.

b) Performance Requirements

- **Customer satisfaction increases:** the clients will be able to access the ZB Bank Digital Channels at any time of the day with little or no downtime period which makes it favorable for the clients to use.
- **Increase in products offered:** the implementation of ZB Bank Digital Channels will allow the bank to add new services on the system to be offered by the bank thereby increasing the bank product range through the use of the system.
- **Overall cost reduction:** the system will reduce the bank's overall costs that is it will reduce costs in the following way there will be no use of bank slips and forms used by the clients and also there will be reduction in the tellers employed since the clients will be having a self-service facility.

3.9 Conclusion

In this chapter the analyst was provided with an understanding of what is supposed to be done in this analysis phase that is a clear understanding of the current system works is fostered and at the same time it stresses out the issues and problems which must be addressed and overcome by the proposed system for it to be regarded as successful. The next stage is concerned on how the above problems can be tackled by the proposed system thus we proceed to the proposed system design phase in the following chapter 4.

Chapter 4: Design Phase

4.1 Introduction

Ulrich et al. (2014) defined design as an application process of various principles and techniques for the purpose of defining a system in sufficient details to allow its physical realization. In the development phase of a system design is regarded as the first step to come up with a system. As in the case of any systematic approach, this software too has undergone the best possible design phase fine tuning all efficiency, performance and accuracy levels.

4.2 System Design

According to Schach et al. (2015) system design refers to the process of defining the system architecture, modules, components, data and interfaces for specified requirements to be meet. This phase is much concerned on the conversion of the user oriented functional design into technical and computer oriented system design specifications in detail. This is the phase in which the system designer come up with a physical architecture of the system that is this where he or she translate the specifications produced during the requirements analysis of the system.

4.2.1 Overview of the Proposed System

Basically the following users will be making use of the proposed system management, staff and all the clients of the bank at the same time the proposed system should perform the following functions:

- a. Registration of clients
- b. Cheque books and ATM cards Application
- c. Allow application of loans
- d. Payments of bills
- e. Blocking and unblocking of lost and found ATM cards
- f. Transfers of funds
- g. Messages notification when a transaction is made

The use of a central database is facilitated thus allowing real time transactions and data capturing so as to allow the tellers to access the client information and details from any bank terminal

connected to the network or internet. The system will be validated such that there will be verification of data before saved to the database that is client details are verified first.

4.2.2 Context Diagram for the Proposed System

According to Pierce (2015) a context diagram is a data flow diagram that shows data flows between a generalized application within the domain and the other entities and abstractions with which it communicates. It focuses on the external entities relationships and the information exchanged between the entities and the system under consideration. The major goal of a context diagram is to identify the relationship between the users and the system so as the information which will be passed between the two parts.

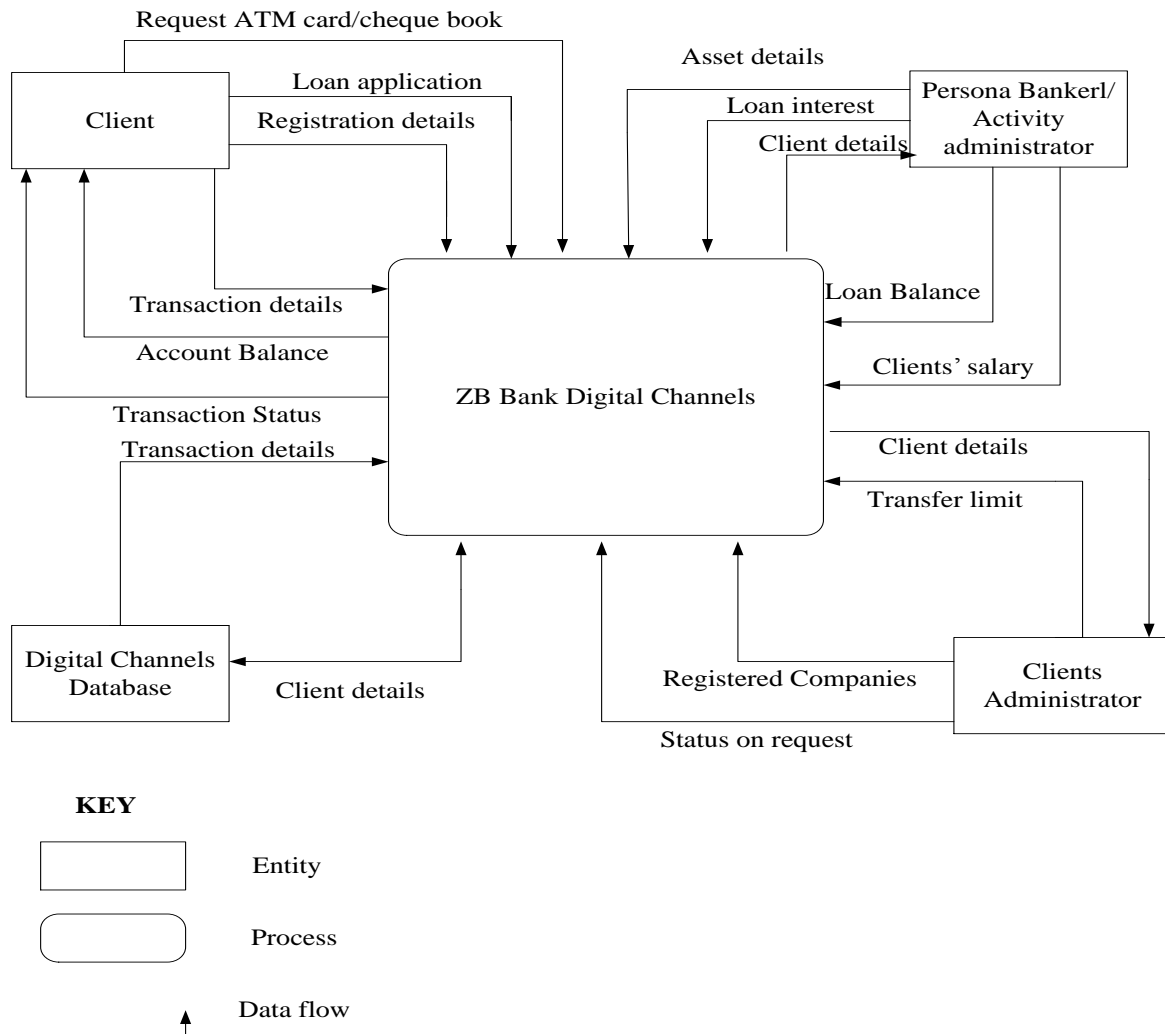


Fig 4.1: Context Diagram for the Proposed System

4.2.3 Data Flow Diagram for the Proposed System

Pierce (2015) defined a data flow diagram as drawing that shows how a system environment are interconnected that is the connection of the entities, processes and data. Data flows links the primary processes, sources, destinations and data stores also these are reflected by the data flow diagram. The elements of a data flow diagram lead directly into physical design, with processes suggesting programs and procedures, data flows suggesting composites, and data stores suggesting data entities, files, and databases. The data flow diagram of the proposed system is shown in the fig 4.2 below:

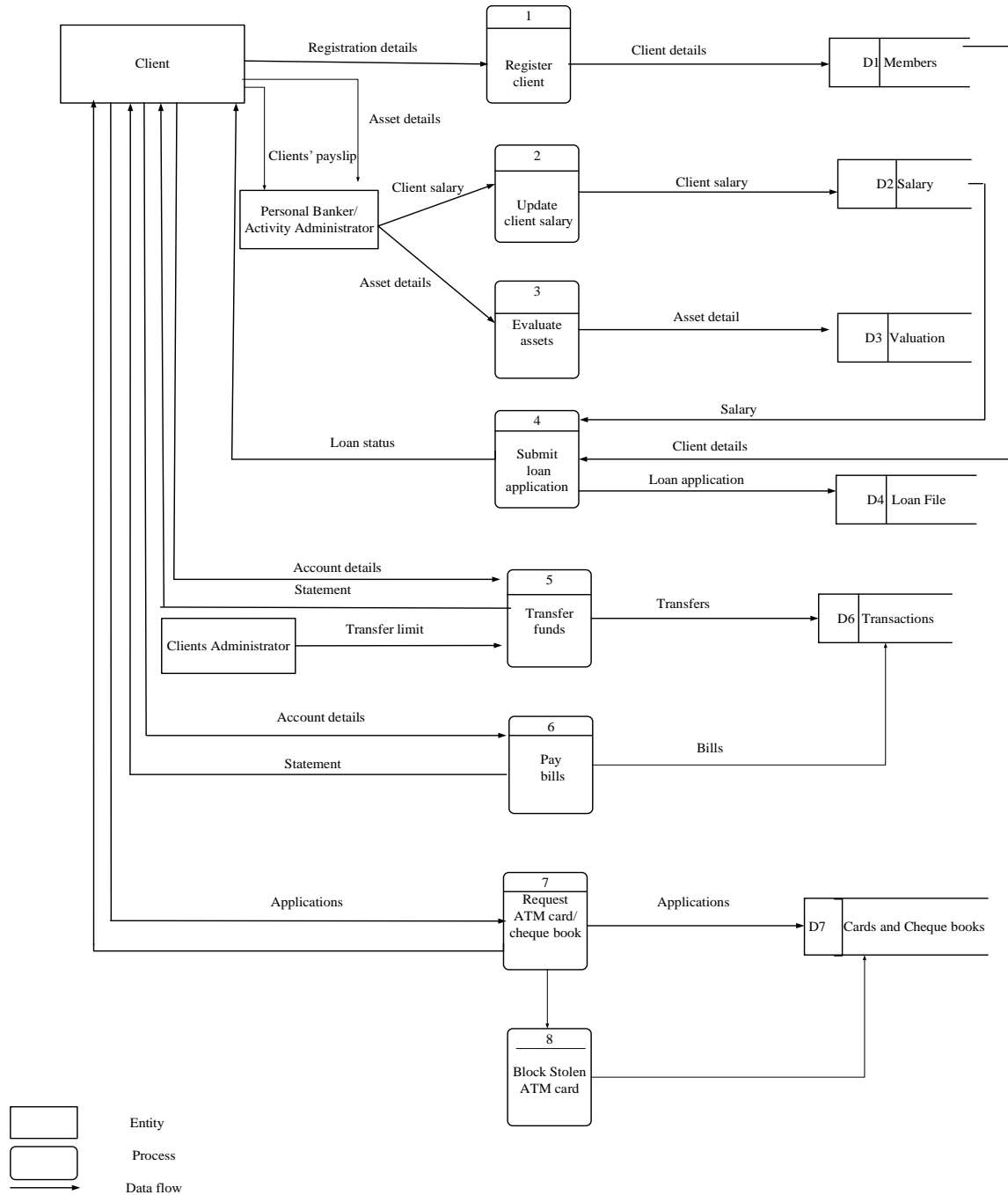


Fig 4.2 Proposed System Data Flow Diagram

4.3 Architectural Design

According to Ulrich (2014) architecture refers to the set of significant decisions about the organization of a software system, structural elements selection and required system interfaces so

as the behavior of the system. Communication between major systems components are also identified on the architecture design. Architecture design's major objective is the development of a modular program structure. In addition, it melds program structure and the database structure, defining interfaces that enable data to flow through the system.

In this system, three tier is going to be used for our architecture. The first three tier component is known as the presentation tier which is responsible for displaying information that is related to the services that are on the system that is where the user interface is. On this type of a tier that is where the clients are able to interact with the system through ZB Bank Digital Channels user interfaces. The clients are enabled to interact with the second tier in an intuitive and secure manner through the client component that is the first tier. For several types of clients to be supported Web Sphere Application Server must be used but however the clients cannot access the third tier services directly.

Application tier or layer which is the second tier process that is it is responsible for managing the application business logic and it have an access to the third tier services. It also known as the middle tier, it is pulled from the presentation tier that is its major responsibility is to control the application functionality. This is the layer where detailed processing is performed since clients' component will be accessing this layer simultaneously that is Apache Friend Server will handle these processes done on this layer.

Data tier which is the third tier in this case the data is kept separately of business logic or application servers. It is also known as the database server tier which persistently manages data and executes transactions services of the database. Fig 4.3 below shows the ZB Bank Digital Channels three tier client server application.

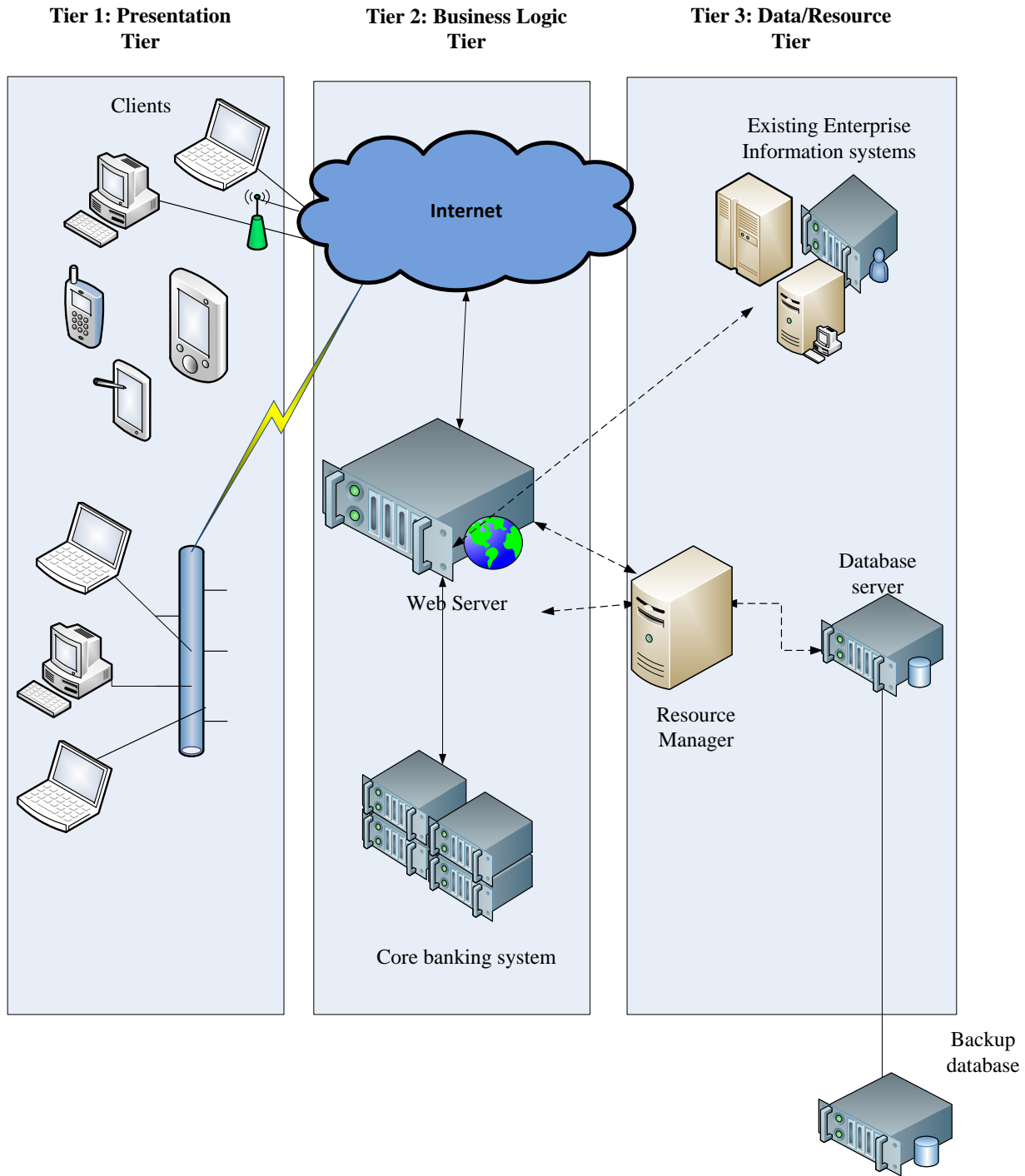


Fig 4.3: ZB Bank Digital Channels Three Tier Client Server Architecture

4.4 Physical Design

According to Schach (2013) physical design is concerned with the design of how the hardware and software components of the proposed system are going to be laid out and how are they going to be interacting. The actual processes of the system are related in this physical design that is the processes under consideration are input and output processes. The major emphasis will be on verifying on how data is captured up until it is produced as output. Hardware and software required have been met and available as stated earlier by the feasibility study above this means that that for the proposed system to work well we should use the required hardware and software without incurring other extra cost. Shown below in table 4.1 is the hardware and software specified and required for smooth running of the new system.

Table 4.1: Specified Hardware and Software

Quantity	Description	Availability
1	Patch Panel-24 Port	Yes
4	HP Probook 2305(Client Computer)	Yes
40	Tape drives	Yes
1	Dell PowerEdge (Database and Web Optimized Server)	Yes
7	30 meters UTP Cat 35 Fly Leads Patch Codes(RJ45)	Yes
3	3 Meg Ded Internet Link	Yes
1	Visual Studio 2013	Yes

1	MySQL 5.5 community	Yes
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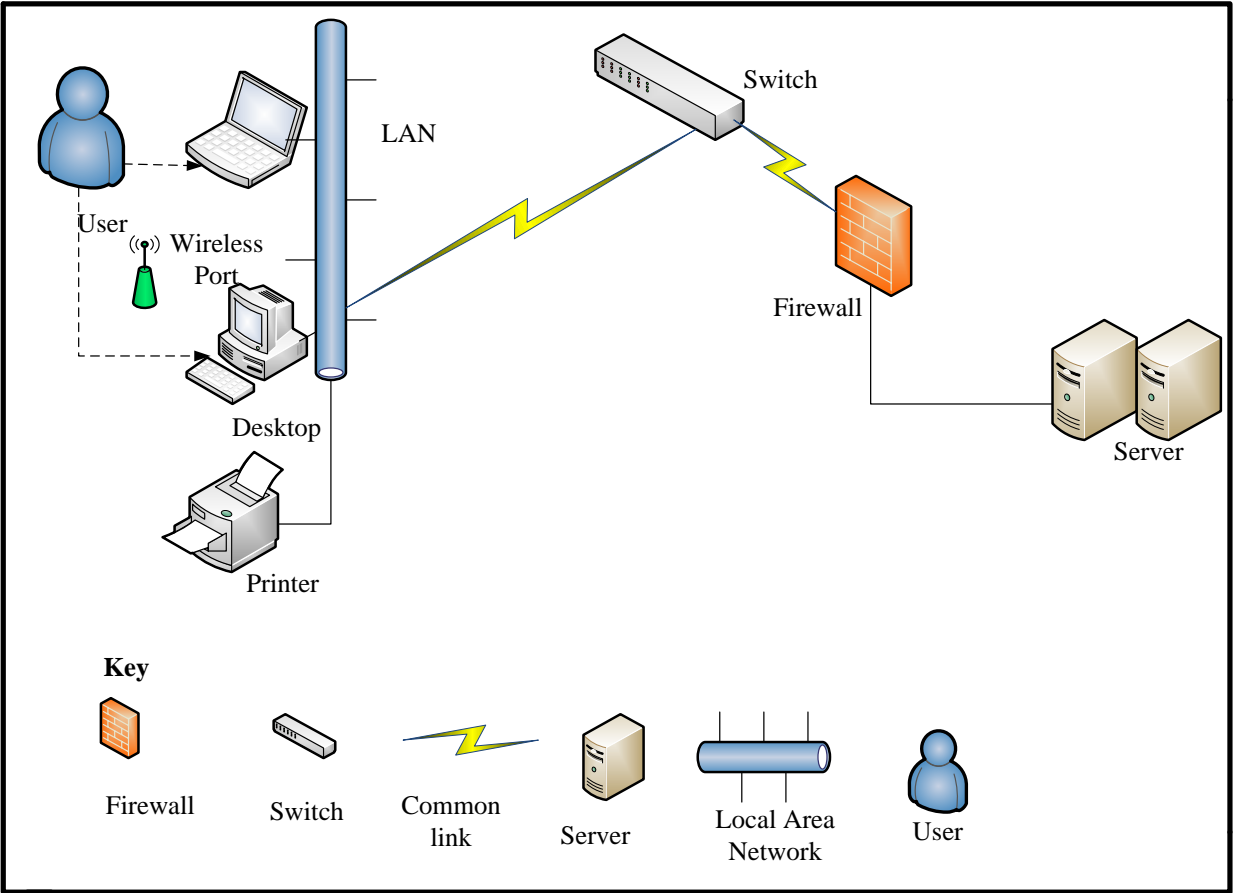


Fig 4.4: Proposed System Physical Design

Shown on the fig 4.4 above is the new system overall setup and physical design. One machine will be the application server in which the clients will be accessing this server through the LAN of the bank thus users’ workstations. This application server will be there to communicate with the database that is where all requirements and data manipulation takes place. To allow geographical dispersed clients to have access to the system the database is connected to the WAN making it easy for them to transact at any place and point in time.

4.5 Database Design

According to Wesley A (2005), database design is the process of creating a design that will support the enterprise’s mission statement and mission objectives for the required database system. A

database is a collection of interrelated data designed to meet the varied information needs of an organization.

4.5.1 Entity Relationship Diagrams

According to Conger (2014), entity relationship diagram refers to entities graphical representations and their associated relationships and it is used in computing. An entity relationship diagram is the preferred logical data model to model the proposed system because of its pictorial approach and that it is an accurate depiction of the entities and their relationships.

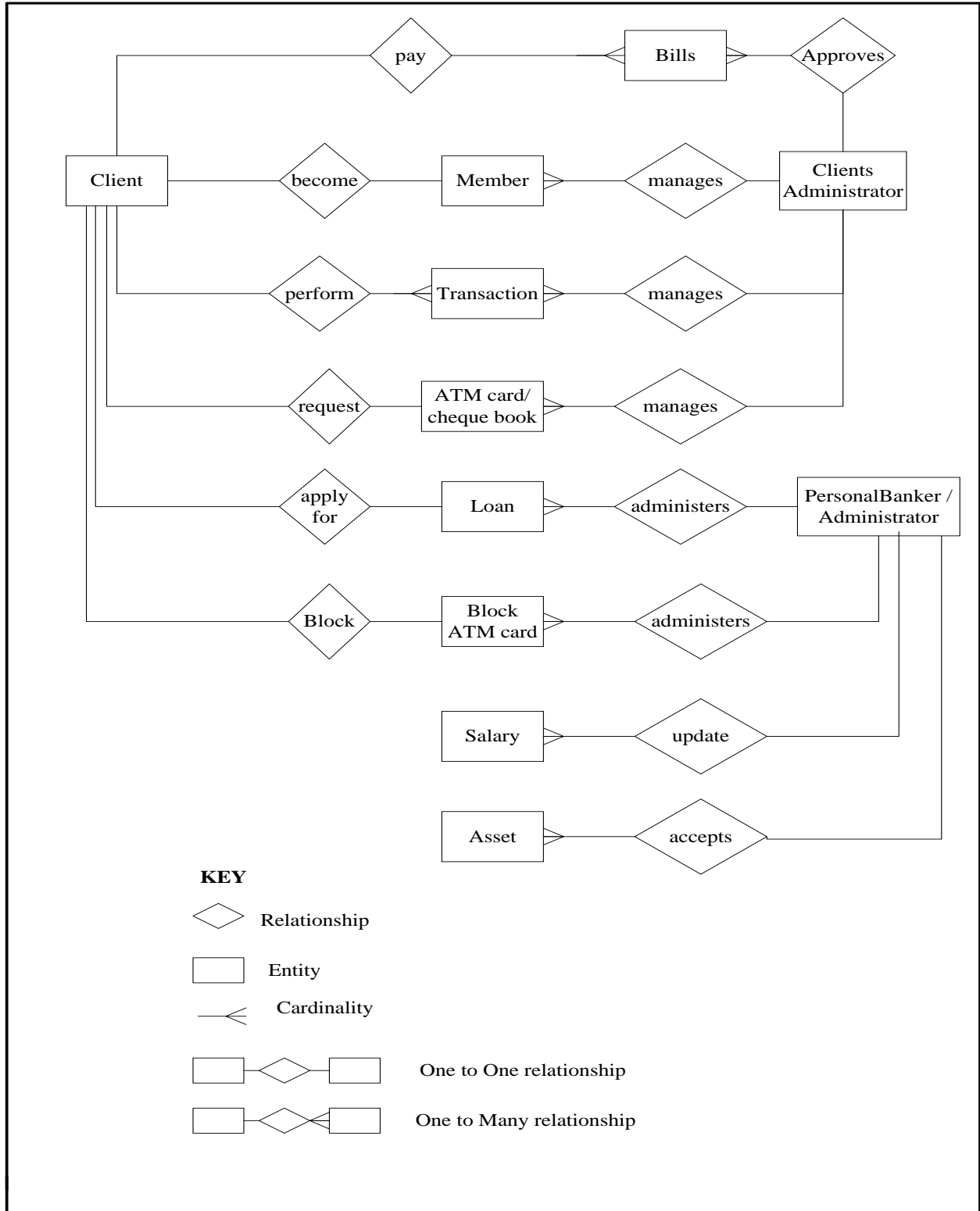
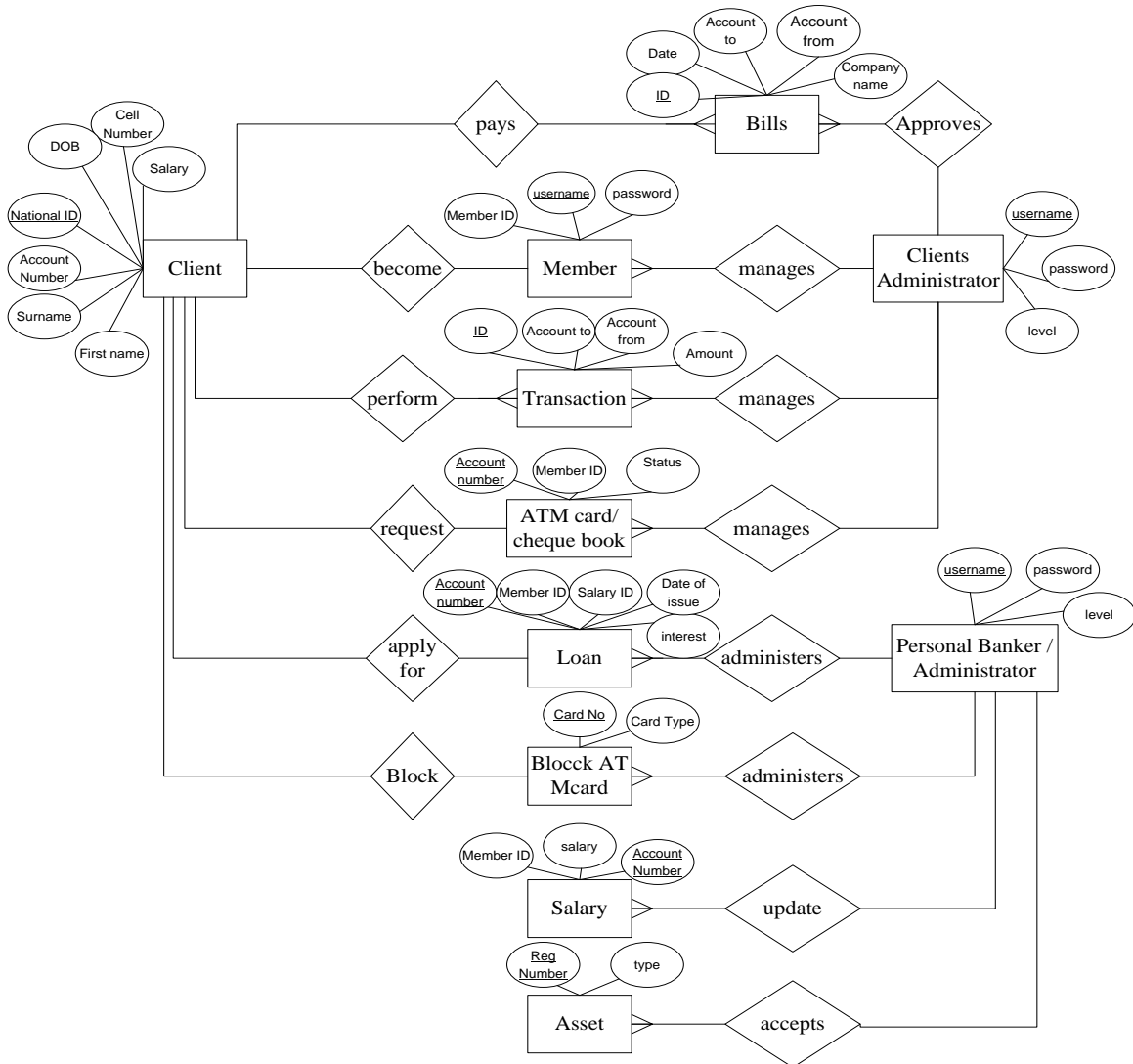


Fig 4.5: Proposed System Entity Relationship Diagram



KEY



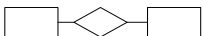
Relationship



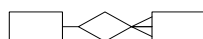
Entity



Cardinality



One to One relationship



One to Many relationship

Fig 4.6: Proposed System Enhanced Entity Relationship Diagram

4.6 Program Design

The designing of classes, functions and modules of the proposed system is involved in program design Ulrich et al (2014). In this phase functions, modules and classes design of the system proposed is taken into consideration. During the system design a structured methodology is adopted. This methodology is focused on the system break down into subsystem. Three diagrams are used to illustrate program design that is package diagram, class diagram and sequence diagram.

4.6.1 Package Diagram

Conger (2014), defined a package diagram as a system modular structure that shows the system modules breakdown and the modules interaction. To reduce complexity within ZB Bank Digital Channels classes are grouped into packages thus enabling an easy user understanding of the system proposed. Using the ZB Bank Digital Channels there is an online facility which will allow the clients to have access to their account information to achieve this the users should input the user credentials which will be verified before the user access the system. Once the user gain access to the system he or she will be able to transfer funds, pay bills and check accounts balances. Shown below in fig 4.10 is a proposed system package diagram.

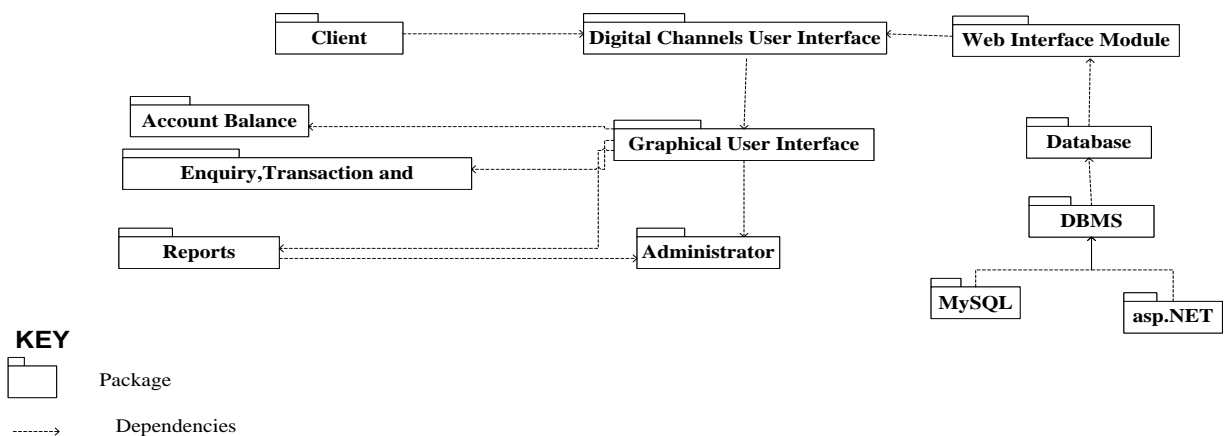


Fig 4.7: Proposed System Package Diagram

4.6.2 Class Diagram

According to Conger (2014), class diagrams refers to a static structure diagram type that describes the system structure by showing the classes of the system, attributes and the classes relationships. Class comprises of two main relationships that can exist between them that is association and inheritance. Relationship instances of each class are represented by an association that is a member of a second class is used by one class. Generalizations is another term used for inheritance that is it describes the major relationship of super class and subclass. Class diagram demonstrates the interaction of proposed system classes that is in terms of its behavior and expected states this can be illustrated as show in fig 4.11 below:

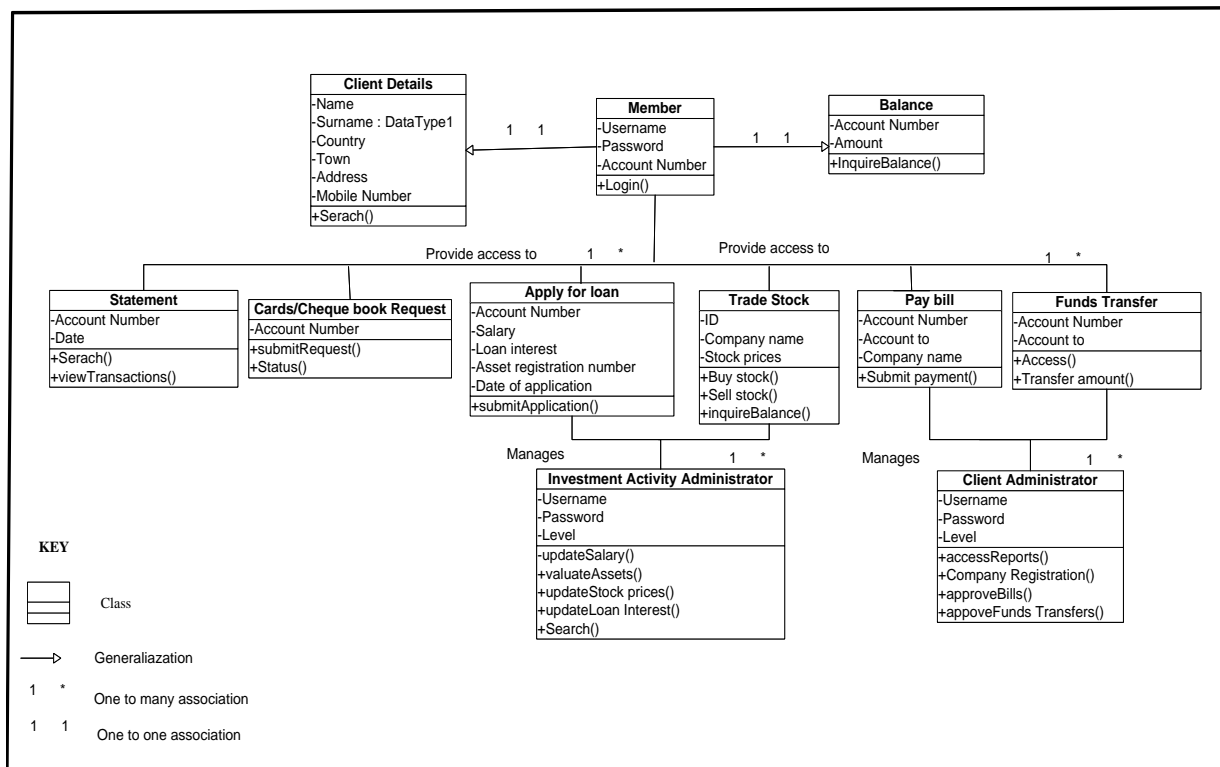


Fig 4.8: Proposed System Class Diagram

4.6.3 Sequence Diagram

Conger (2014) defined sequence diagram as a model of the flow of system logic in a visual manner which will enable one to validate and document logic. Analysis and design phases commonly uses the sequence diagram. The sequence diagram proposed system is shown in the fig 4.12 below:

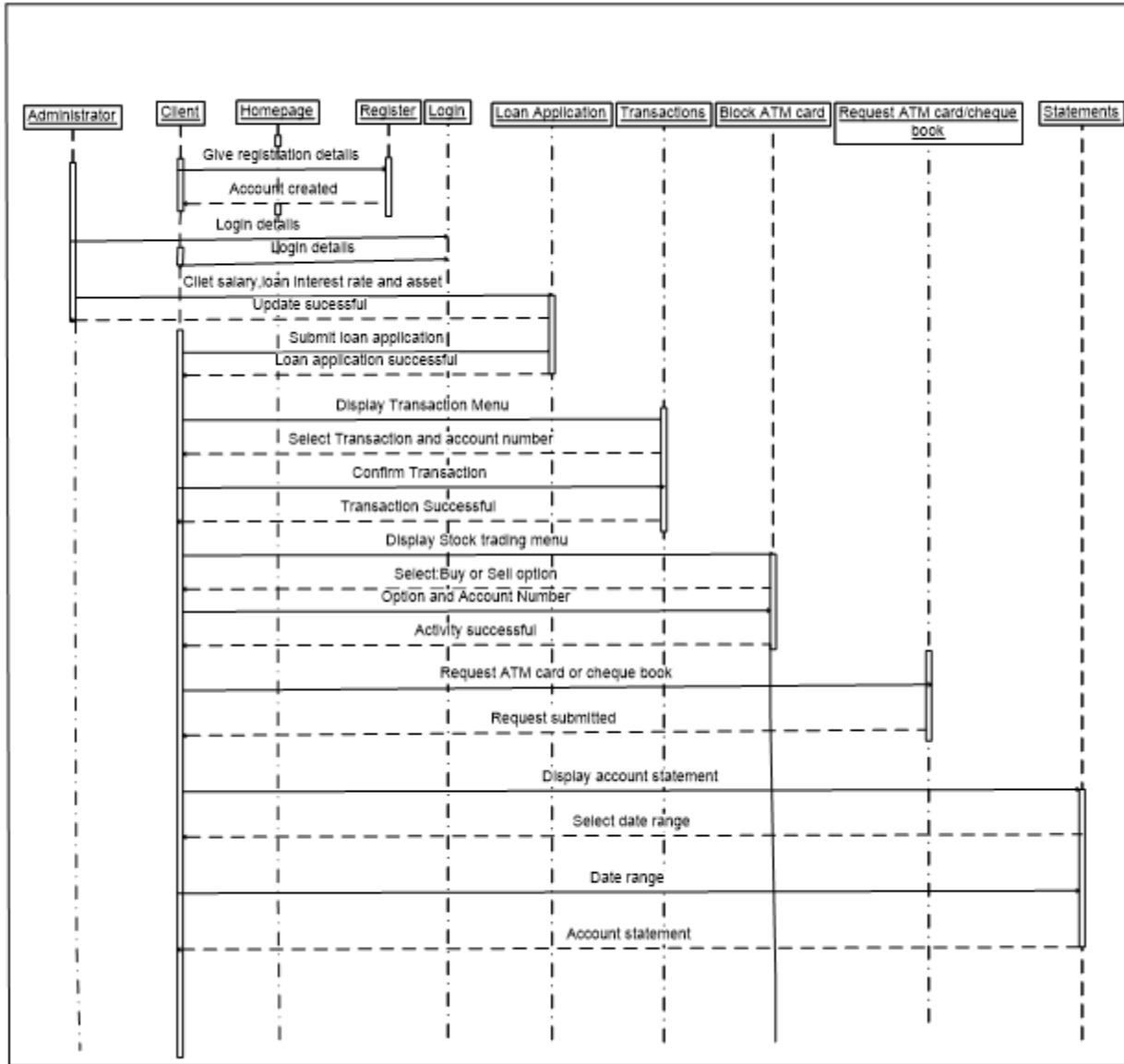


Fig 4.9: Proposed System Sequence Diagram

4.7 Interface Design

Maier et al (2000) defined interface design as the computer designs, machines, software applications, websites and mobile communication devices focusing on the user interaction and experience. This is where the interfaces design of ZB Bank Digital Channels is done thus forms and menus for data input into the system. In this case the input and output structure is outlined in this interface design.

4.7.1 Menu Design

The ZB Bank Digital Channels menu consist of user login interface in which the user should input the credentials to access the system. When the user credentials are verified the user will be redirected to a page where he or she proceed in doing his or her transactions and other activities.

4.7.1.1 Main Menu

The ZB Bank Digital Channels main menu comprises of the menu of banking services which are offered in the banking hall depending on the type of user how have logged in when it is the administrator his or her menu will be comprising the menu of supporting the Digital Channels clients.

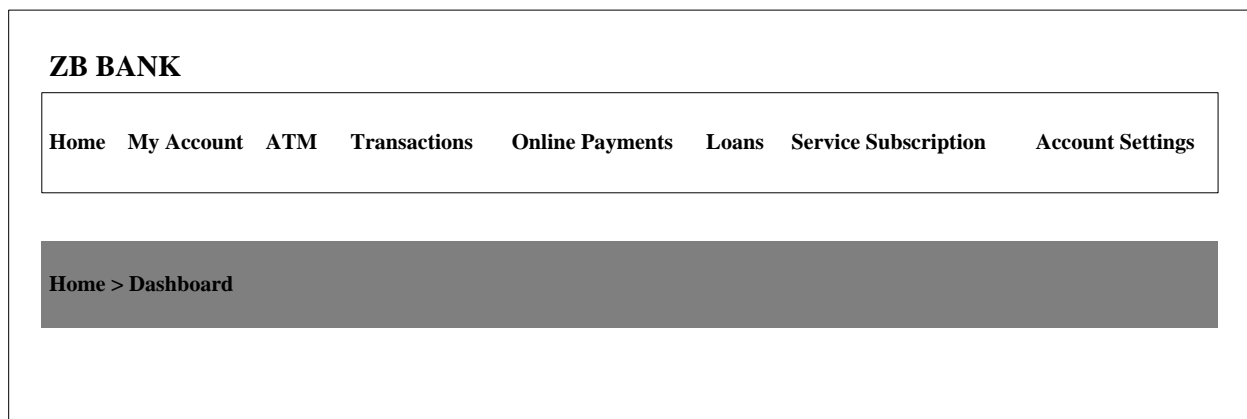


Fig 4.10: Client Main Menu

4.7.1.2 Sub-Menus

This refers to secondary menu that appears while one is holding the cursor over a main menu that is in this case say loan is the main menu while loan application and loan tracking are the secondary menu which falls under loans menu. This is shown as below in fig 4.11.

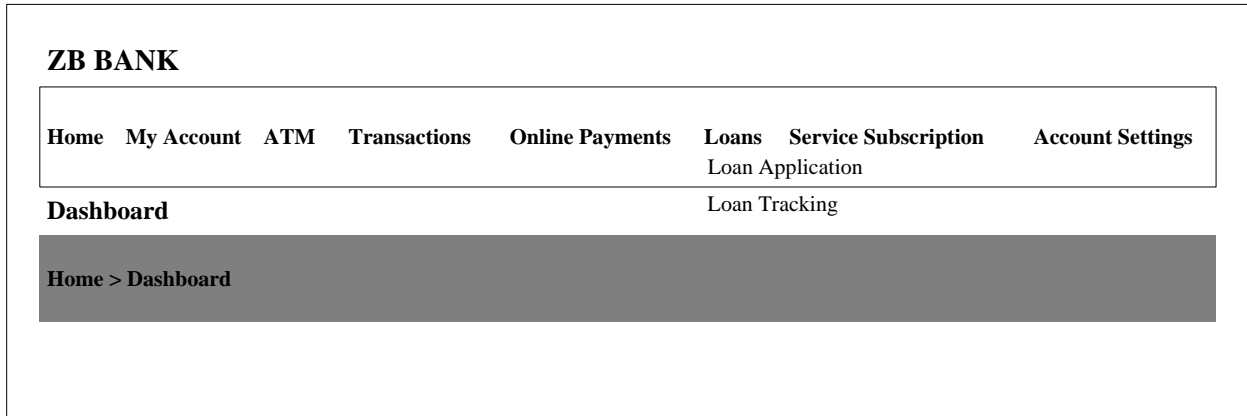


Fig 4.11: Loans Sub-menus

4.7.2 Input Design

According to Maier et al. (2000) input design refers to the conversion process of a user oriented description of input into a system. Validation of inputs, error avoidance and making the process simple is the major of the input design. The more the quality the system input have is the more the quality of system output. The major goal of the input design is creating input forms that are easy to fill the details and easy to follow. Shown below in fig 4.12 is a form that shows an input of creating a new user.

The screenshot shows the ZB BANK user registration form for an Administrator. The page title is "ZB BANK" and the user role is "Administrator". The navigation menu includes "Home", "Manage", and "Account Settings". Below the menu is a grey breadcrumb trail "Users Management" and "Home > Users". The main content area is titled "Add New User" and contains the following fields:

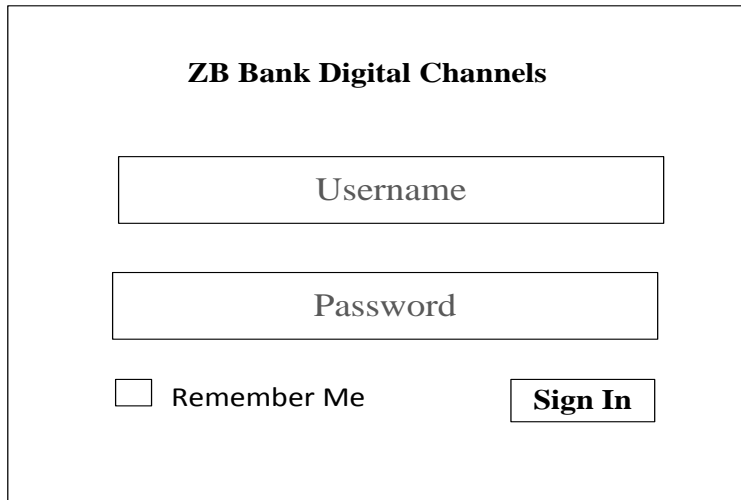
- Role
- First Name
- Last Name
- Account Number
- Account Type
- Username
- National ID
- Phone Number
- Email
- Physical Address
- Bank Branch
- Account Balance
- Password
- Confirm Password

At the bottom of the form is an "Add User" button.

Fig 4.12: User Registration Form

Login Form

This is the form which is used by the users to access the system once they are added into the system by the administrator that is the user should provide his or her username and password. The login form is shown in fig 4.16 as below.



The image shows a login form titled "ZB Bank Digital Channels". It contains two input fields: "Username" and "Password". Below the "Password" field, there is a checkbox labeled "Remember Me" and a "Sign In" button.

Fig 4.13: User Login Form

Loan Application Form

The client should fill in the details to apply for loan and he or she must also agree to the terms and conditions of the loan application as shown on the fig 4.14 below.

ZB BANK
Tony M

Home My Account ATM Transactions Online Payments Loans Service Subscriptions Account Settings

Loan Application
Home > Loan Application

Add New User

Account Number	523445676548
Max Loan Request (\$USD)	3228.00
Monthly Income	<input type="text"/>
Monthly Eexpense	<input type="text"/>
Loan Request	<input type="text"/>
Loan Payment Period (Months)	<input type="text"/>
Annual Interest (%)	35.32%
Collateral Security (*.pdf or *.doc)	<input type="button" value="Choose File"/>
Select Currency	<input type="text"/>
Physical Address	<input type="text"/>

I agree to the terms & conditions

Fig 4.14: Loan Application Form.

4.7.2 Output Design

Information should be clearly presented to meet end users' requirements and this is regarded high quality output. Maier et al. (2000) regarded this as the important source of information to be used by the users. A clear and intelligent design of output helps the management and the clients in decision making. Output design is much focused on how the information is displayed and also how the hard copy of the output is produced. Shown below in fig 4.19 is the mini statement output.

ZB BANK		Tony M
Home My Account ATM Transactions Online Payments Loans Service Subscriptions Account Settings		
My Account		Home > My Account
My Account Details Account Number 523445676548 Branch West End Account Balance 710.00 Physical Address 1863 4 th Close Mobile Number +263772616162		
Date	Description	\$USD
	Balance b/d	10.00
30-Aug-2016 11:44	Deposit	1000.00
31-Aug-2016 12:44	Bill Payment	(200.00)
06-Sept-2016 04:47	Bill Payment	(50.00)
27-Sept-2016 22:47	Bank Transfer	(50.00)
29-Sept-2016	Balance b/d	(710.00)

Fig 4.15: Client Mini Statement

4.8 Pseudo Code

Stephen et al (2013) defined pseudo code as a description of a computer programming algorithm that uses the structural conventions of programming languages, but omits detailed subroutines or language-specific syntax and the code cannot be compiled into an executable program. This is a rough draft of the code which must be inserted and converted into real system using a specific language of programming. The major purpose of this program is to make people easily understand the procedures which will be undertaken to come up with a real code of the system.

User Login Module

```
// Responsible for authenticating user details and thus controlling access to the system
```

```
{
```

Accept Username, Password

Repeat

{

Select username and password from users table.

Where username and password match those entered.

}

If a match is found, Then

{

Direct user to Client Page

}

Else

{

Display error message notifying user of failure during login process

}

} // Close User Login Module

Client ATM Orders Module

// ATM orders made (ATM cards and Cheque books)

{

Fill the order details

Repeat

{

Capture the order details into the order table

Edit old order details;

Enter other details;

Store data in order table;

```
}//close capture details function
```

```
If orders saved, Then
```

```
{
```

```
    Direct user to Order History
```

```
}
```

```
Else
```

```
{
```

```
    Display an error message notifying the client of failure during order process
```

```
}
```

```
}
```

Bank Transfers Module

```
//Transfer funds from one account to another account
```

```
{
```

```
Repeat
```

```
{
```

```
    Enter the account number into the transfers table
```

```
    Where the account number matches with the one that is in transfer table
```

```
}
```

```
Until an account number match found
```

```
If no match, Then
```

```
{
```

```
    Display account number found
```

```
}
```

```
Else
```

```
{
```


Transfer funds to another account

}

}//Close transfer module

Bill payments

Input account number

{

If valid account number

{

Enter amount

}

If sufficient balance

{

Pay Bills

Else

{

Insufficient balance

Else

{

invalid account number

}

}

4.9 Security design

Security design is the idea of engineering software so that it continues to function correctly under malicious attack. Most technologists acknowledge this undertaking's importance, but they need some help in how to overcome it. The researcher will make use of the username and passwords

that will prevent anyone from accessing the system at any given time and period. There is also mac address logging of every machine that accesses the system along with a camera function to take snapshots of system users.

4.9.1 Physical Security

According to the Field (2001) on physical security it defines physical security as the measures that an organization takes to make sure that no unauthorized access to system facilities, resources and hardware are granted through the use of physical barriers.

In terms of CRM they already have a very secure biometric control system to access points and also cameras in the data Centre. In light of this the researcher can conclude that the system 24 along with its supporting hardware will be safe from any intrusion although the same cannot be said about the equipment that will be sent out to polling stations.

4.9.2 Network Security

DeCapite, (2013) defines network security as the process through which an organization takes preventive intrusion measures through the use of networking infrastructure. For CRM to effectively secure the system from network hackers or tapping of data they can make use of encryption during transmission. The system will automatically cipher data into an unreadable format during transmission so help protect it. Network security will also be achieved through the use of passwords when gaining access to the system

4.9.3 Operational Security

According to the United States Defense department, Operations Security also known by its acronym OPSEC, is defined as the procedure through which an organization or individual protect their confidential information from intrusion. Many authors point out that in order to come up with an effective operation security policy one has to think like the enemy.

The researcher will make use of various operation security techniques in the relaying system to make sure election results are kept from public and intruders until a formal declaration of results is made. These will include for example validations to make sure in the event of a misconfiguration

or wrong server credentials the system should not allow any relaying of results until proper authentication is established.

4.10 Conclusion

In this design phase, all the required designing was carried out that is it was major focusing on the designing of inputs, processes and outputs of the system modules and functionality. The design phase helps in the coding of the system as well as the designing of activities flow of the system proposed. The next chapter will be the implementation phase that is this phase will be making reference from the design phase since this where most of the design of the system is done.

Chapter 5: Implementation Phase

5.1 Introduction

Watts et al. (2015) defined implementation phase as a process of addressing personal, administration and personnel issues. This is the last phase which follows after the design phase of the system. This phase involves training all personnel within the organization, the physical system installation and procedure documentation. The major implementation phase purpose is to enable the users to make use of the new information system that is introduced within the organization so as to deploy it in all the organization.

5.2 Coding

Stephen et al. (2013) defined coding as a phase in which the source code is input by the developers into the computer after that it is compiled to produce the final software product. ASP.NET C# programming language and MySQL database was used by the developer to come up with the ZB Bank Digital Channels. All the data in the database dictionary was mapped, and conceptualized and attributes were put in tables they fall into. A code that is written well reduces maintenance and testing effort thus the developer commented the code on each and every module improving the clarity and making the code easy to understand.

5.3 Testing

Somerville (2015) defined testing as an evaluation process of an application or a system in order to check if the user requirements are met so as to check if there are errors within the system. Errors and defects of the system are identified during the testing phase and they are rectified to come up with an error free system. For a business to understand and appreciate a system implementation risk an independent view of the software should be provided. The testing methodology is undertaken in different ways depending on the software application but however the following aspects should be covered:

- Exception handling evaluation
- Design specification deviation detection
- Validation of the system forms and modules

- Insecure programming practices identification

5.3.1 Testing Model

The V- model is a SDLC model on which processes execution takes place in V shaped and sequential manner and it is also referred to as the validation and verification model. Unit testing is used to test module implementation, integration testing is used to test the system design, system testing is used to test the system specification and the requirements are verified using the acceptance testing. The V-model is shown on the fig 5.1 below

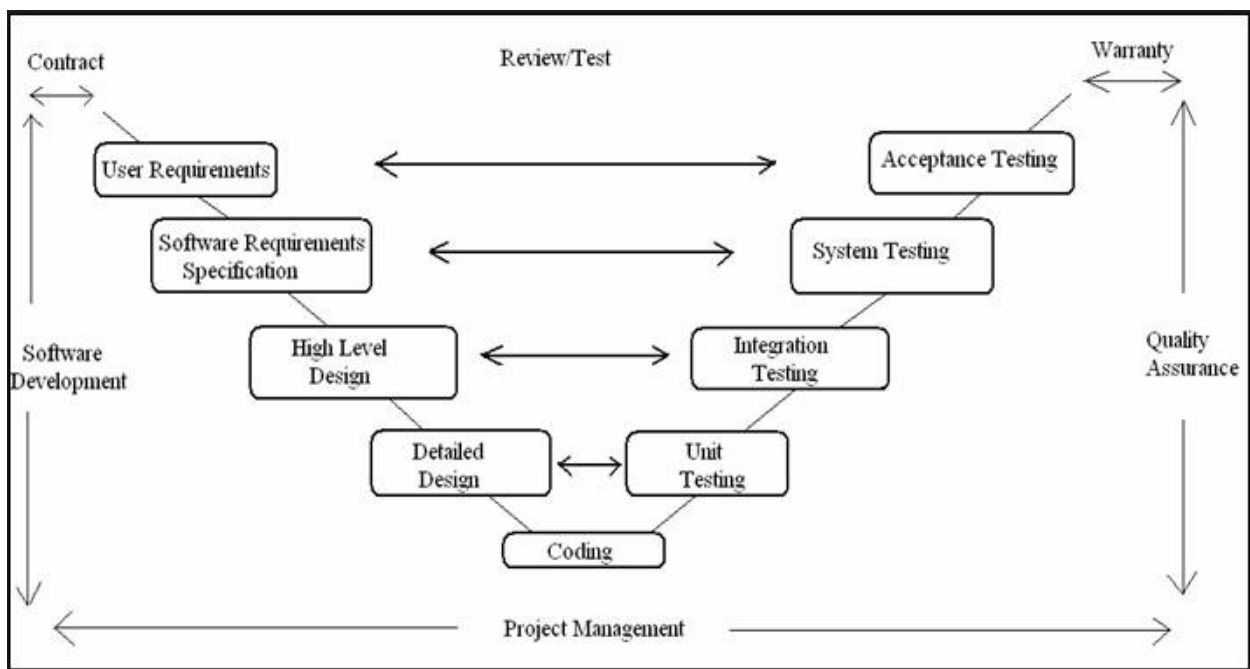


Fig 5.1: V-model

5.3.2 Testing Methods

Three methods of testing were used by the developer namely black box, white box and defect testing.

a. Black Box Testing

Glenford et al. (2013) defined black box testing as a testing that neglects the system's internal mechanism and it focuses greatly on the generated outputs after an input and conditions have been executed that is it can also be referred to as the functional testing.

Using the black box testing method the source code is not accessed by the software tester that is the source code is regarded as the black box which the tester cannot view what is inside that box. The application functionality is the one which is performed and considered using this method of testing thus end users are the one who performs these actions. The major objective of the developer when using the black box testing is to check if there are interfaces which have errors, initialization errors and performance error on the ZB Bank Digital Channels system.

b. White Box Testing

Glenford et al. (2013) defined white box testing as testing method that takes into consideration the internal components of the system that is this method is a technique used to verify the developer's code by the engineers that is white box is used to examine whether the code is working as expected. The code is keep running with foreordained input and checks to ensure that the code produces foreordained output. Unit testing, integration testing and system testing are three types of white box testing utilized by the developer.

c. Defect Testing

To identify the defects within the system the developer used defect testing and this exercise was done before the implementation of the system so that the defects will be uncovered and sorted before delivering the final software product. It is involved with four processes that is test case, test data, test results and test reports.

5.3.3 Testing Levels

To improve the quality of programming testing, and to deliver a more incorporated testing approach relevant over many different projects, the testing procedure is abstracted to various levels. These levels are most appropriate for the V-model and the Waterfall Model since the levels relate directly to the distinctive stages in the Waterfall model. The developer adopted the following testing levels:

- Unit testing
- Integration testing
- System testing
- Acceptance testing

a. Unit Testing

According to Whitten (2015) unit testing centers on verification exertion on the littlest unit of the software module segment. This testing level is white box oriented and multiple components can be tested in parallel. The ZB Bank Digital Channels developer did the unit testing using the loan application module and the results were as follows, the system produced an error if the client have an amount owing he she cannot apply for another loan up until he or she repays all the amount owing.

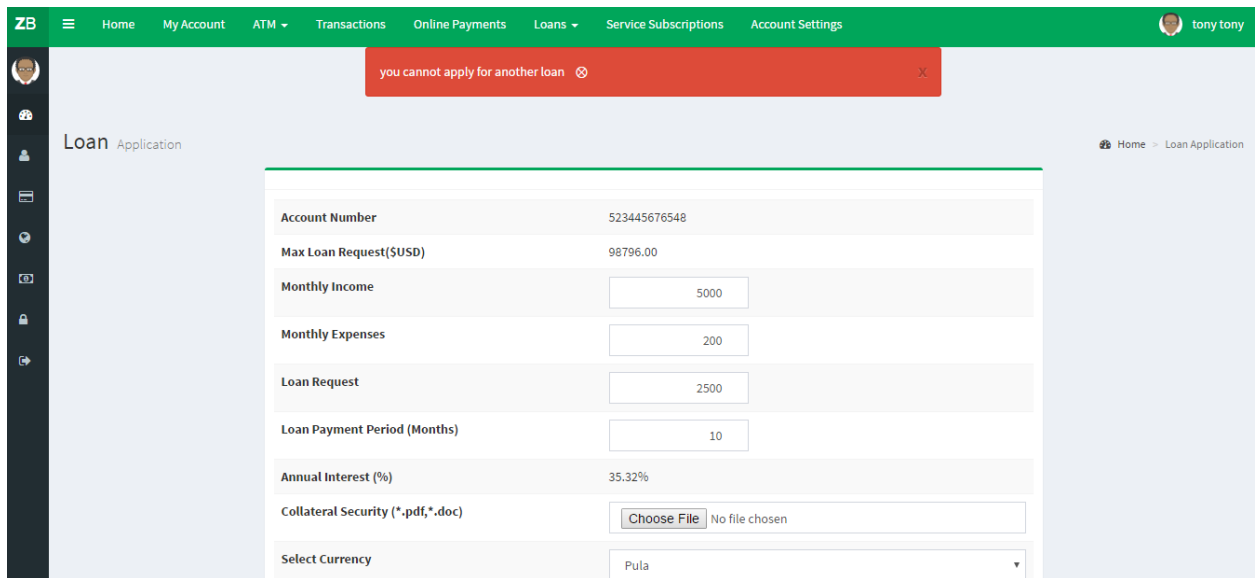


Fig 5.2: Unit Testing

b. Integration Testing

According to Shelly et al. (2005) integration testing refers to a process of individually testing the system modules. It is a precise method for developing the system structure while in the meantime leading tests to reveal errors related with interfacing. A complete and reliable unit tests set was assumed at the commencement of integration testing. Utilizing both white and black box testing methods, when the code is integrated to become a large code base the developer of the system verifies units working together. The system developer of ZB Bank Digital Channels did unit testing and the tried parts of the unit were then combined to assess if the segments collaborated well. Loan and deposit modules were tested if they interact with each other that is if the client salary is deposited into the account the loan module should deduct the monthly installments before the client withdraws his or her funds. The tests were

carried out to all other modules such as online payments, transfers and ATM and these modules interacted with each other well.

c. System Testing

System testing starts after finishing of integration testing that is after every one of the interfaces have been tested between numerous modules and the entire system is tested to be sure that all modules together effectively as one system, Whitten (2015). There is a number of sub types of system testing that the developer may or may not use depending on tested application which are as follows:

- Usability testing
- Compatibility testing
- Configuration testing
- Security testing

Executable files were created for the developer to test and see if the ZB Bank Digital Channels is performing the expected functions. The following functions was facilitated by the Digital Channels funds transfers, bill payments, loan application, client registration and ATM, and cheque book request.

d. Acceptance Testing

Whitten (2015) defined acceptance testing as a formal testing that is carried out to verify if the developed product meets the specifications, requirements and stipulated standards of the clients. Acceptance testing falls under the black box testing methodology where the system's internal coding is of less interest to the system users but however the major worry of the user will be their specified requirements and the system functionality. The acceptance testing comprises of:

- Alpha and beta testing
- Operational testing.

The users ran tests on the system that was delivered to them and the tests were based on the functionality which they expected hence the conclusion of the tests was that the ZB Bank Digital Channels was accepted.

5.3.4 Validation and Verification

Validation is intended to ensure a system results in a system that meets the operational needs of the user. For a new development flow or verification flow, validation procedures may involve modeling either flow and using simulations to predict faults or gaps that might lead to invalid or incomplete verification or development of a system. A set of validation requirements as defined by the user, specifications, and regulations may then be used as a basis for qualifying a development flow or verification flow for a system. The login form in fig 5.3 shows the login form validation.



Fig 5.3: Validation

Verification is intended to check that a system meets a set of design specifications. In the development phase, verification procedures involve performing special tests to model or simulate a portion, or the entirety, of a system then performing a review or analysis of the modeling results. In the post-development phase, verification procedures involve regularly repeating tests devised specifically to ensure that the system continues to meet the initial design requirements, specifications, and regulations as time progresses. It is a process that is used to evaluate whether a system complies with regulations as shown in fig 5.4.

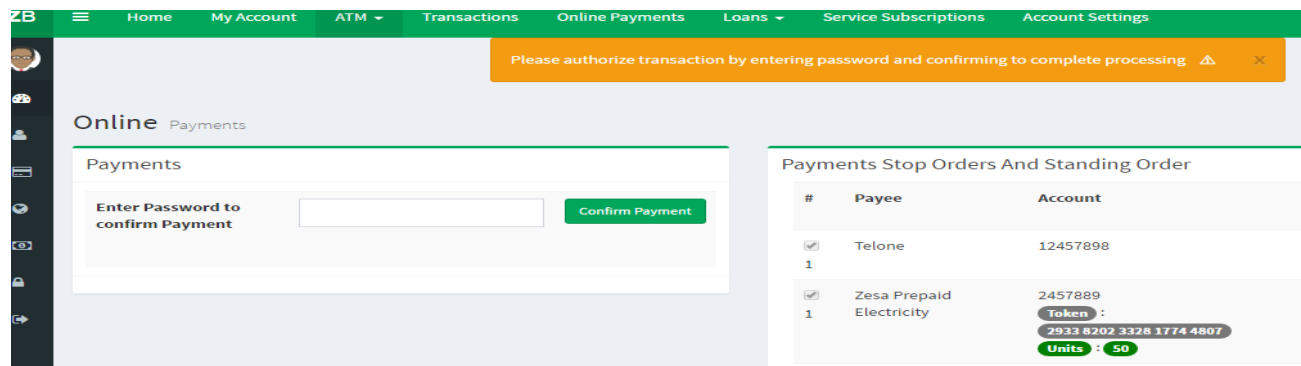


Fig 5.4: Verification

Defect Testing

The system defects were discovered by the developer using the defect testing. This activity was undertaken to make sure that the errors were uncovered before going any further with the system implementation. Below is a fig that shows the defect testing process:

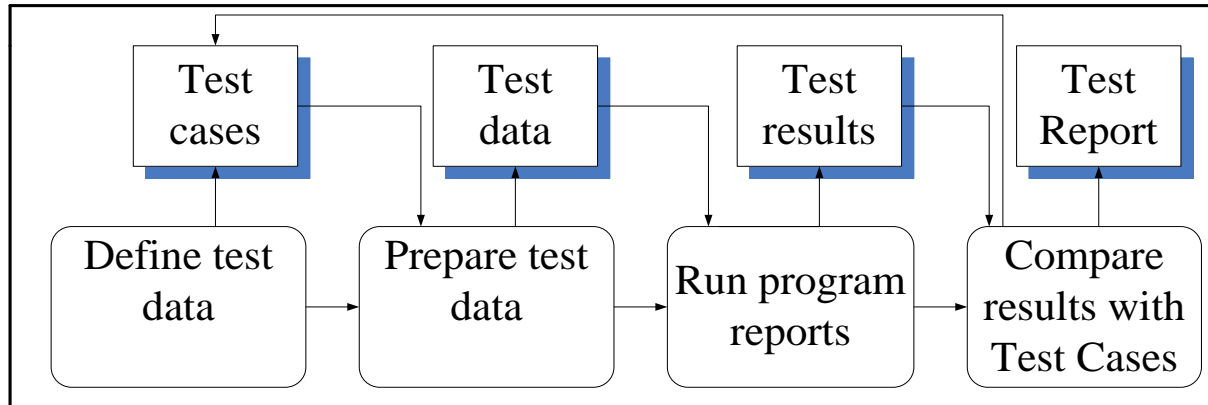


Fig 5.5: Defect Testing Process

5.3.4 Performance and Objective Evaluation

The entire system was tested against the objectives to make sure that the system meets the users' objectives that were offered on the proposal phase. To show the effectiveness of the testing the system screenshots and the results messages displayed were attached on the figs below:

Objective1: Order ATM Card

The screenshot shows the 'ATM Orders' page of a web application. The top navigation bar is green and contains links for Home, My Account, ATM, Transactions, Online Payments, Loans, Service Subscriptions, and Account Settings. The user's name 'tony tony' is visible in the top right corner. The main content area is divided into two sections. On the left, there is a form for placing an order with fields for Order Type (a dropdown menu), Account Number (523445676548), Details (a text input field with 'User Full name' as a placeholder), Collection Branch (a dropdown menu), and Card Type (only for cards) (a dropdown menu). A green button labeled 'Order Card/Cheque Book' is at the bottom of the form. On the right, there is an 'Order History' table with the following data:

#	Date	Order Type	Collection Branch	Status	(options)
1	8/30/2016 10:33:21 PM	ATM Card	Main Centre	processed	edit View
2	8/30/2016 11:02:21 PM	Cheque Book	West End	processed	edit View
3	9/6/2016 4:41:45 PM	Cheque Book	Main Centre	processed	edit View
4	9/25/2016 1:24:31 PM	ATM Card	First Street	declined	edit View
5	9/25/2016 1:25:01 PM	Cheque Book	West End	pending	edit View
6	9/29/2016 11:31:36 PM	ATM Card	Main Centre	processed	edit View

Fig 5.4: ATM Orders

Objective 2: Allow clients to receive SMS notification after a transaction is done

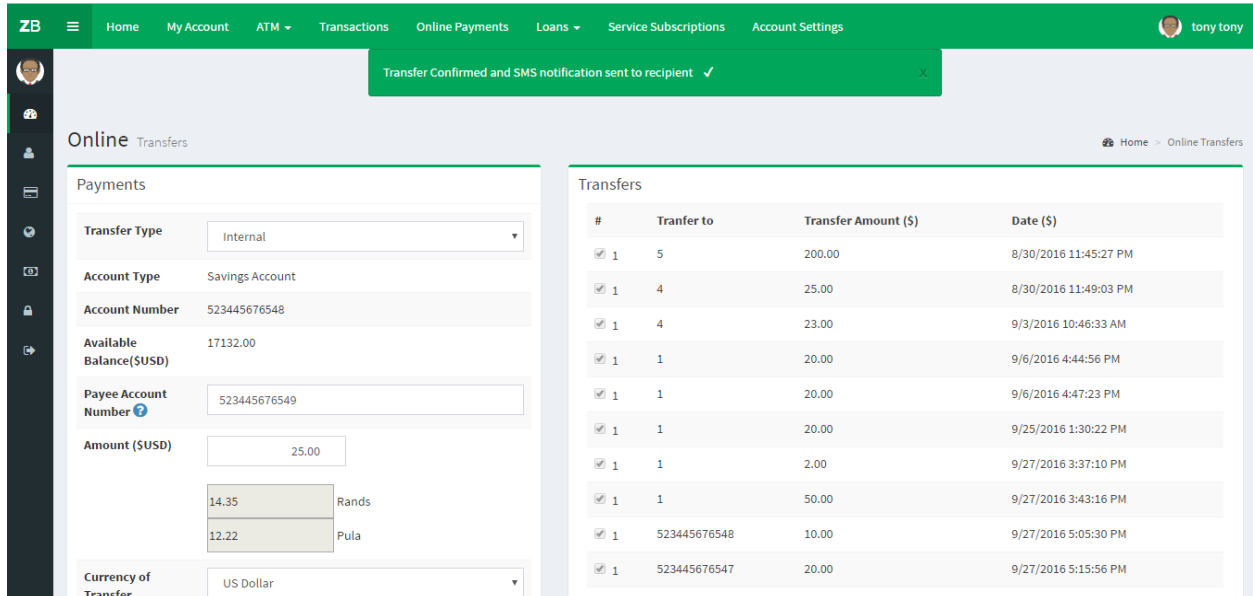


Fig 5.7: SMS notification

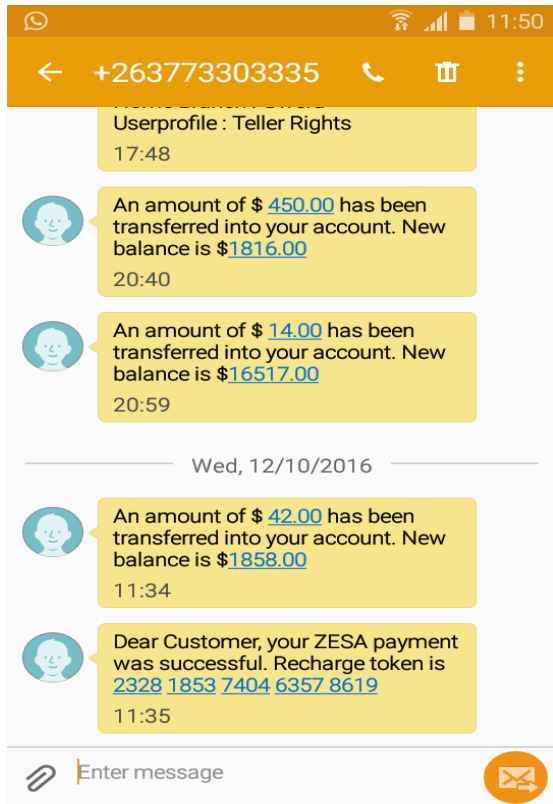


Fig 5.8: Phone Message

Objective 3: Enable clients to block their ATM cards when lost or stolen

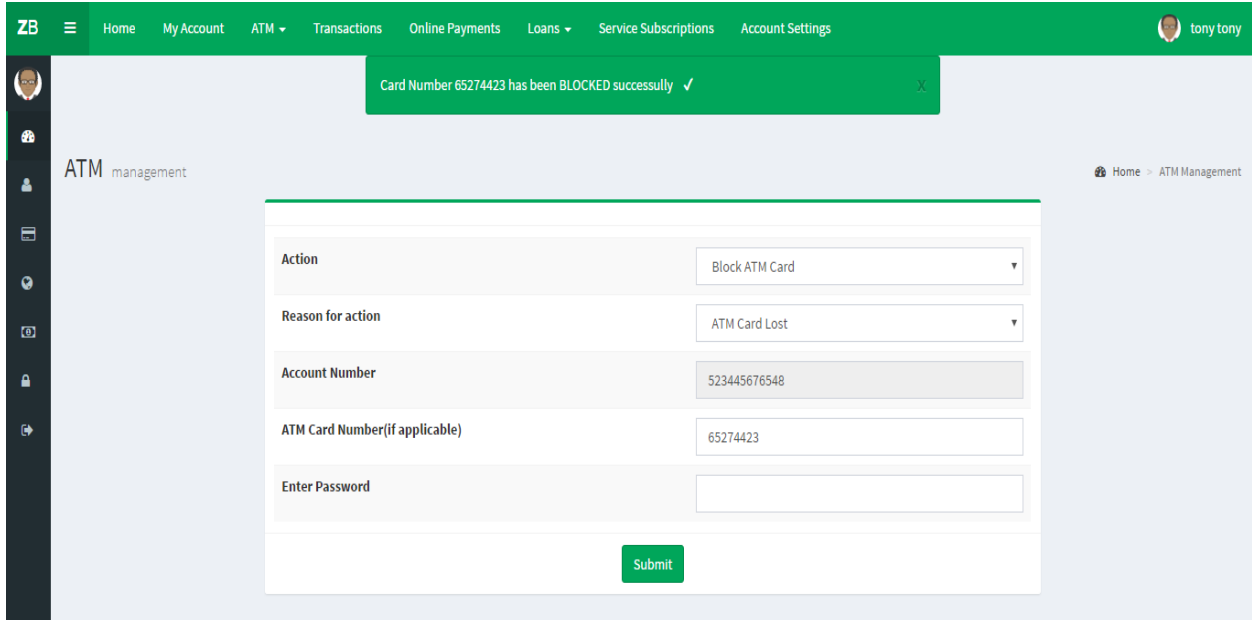


Fig 5.9: Block ATM card

Objective 4: Bank Funds Transfers

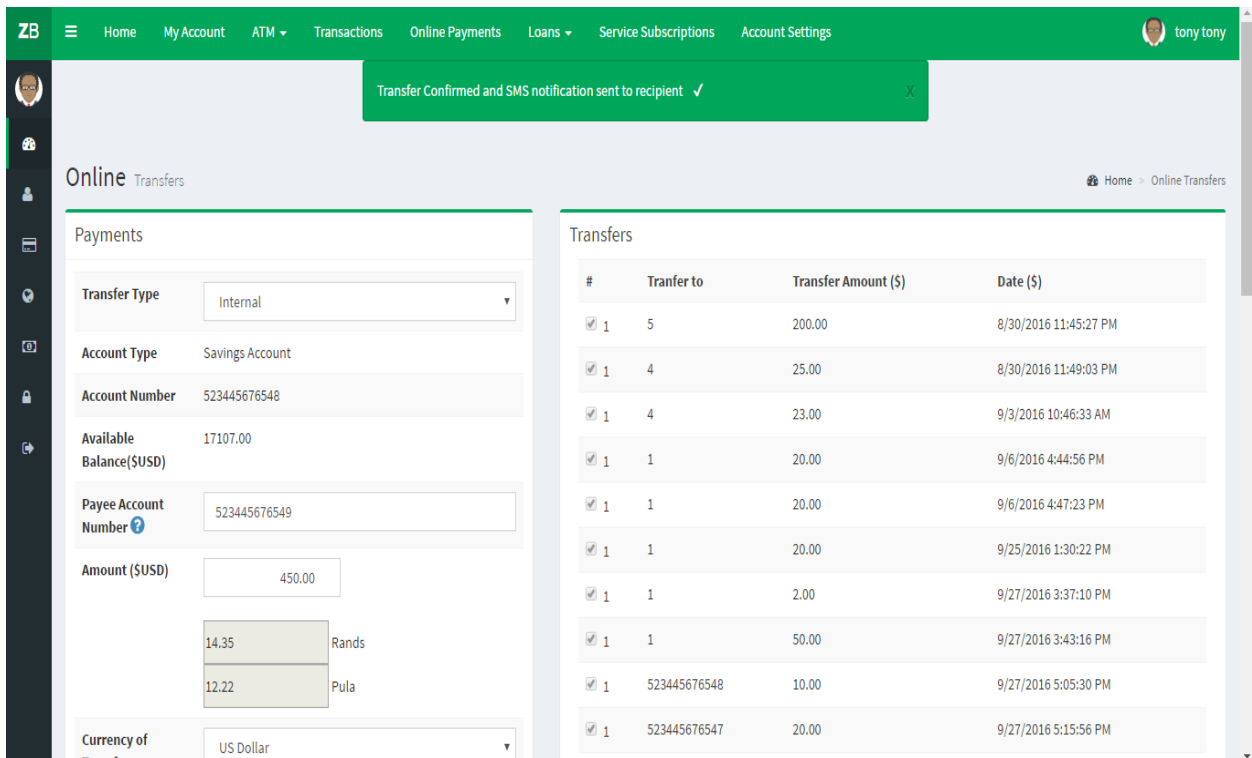


Fig 5.10: Internal Funds Transfers

5.4 Installation

Software installation refers to a system installation process and supplemental of required applications to support the developed system. The installation process include configuration testing, development and production configuration. The ZB Bank Digital Channels was installed by the developer as stipulated in the documentation. This process involves software and facility installation where the facility installation involves setting up of the office space, servers and computers at the 21 Natal, ZB Bank's head office. The SQL software server was installed as the database installation and this is the DBMS (database management system) which is used by the system, it was installed on the central server which all other terminals can access.

5.4.1 Steps for Software Installation

- Install SQL server
- Install workbench on the server
- Configure IIS
- Type the URL <http://localhost:1031/Default.aspx>
- Run the script of the installation setup

5.4.2 User Training

According to Laplante et al. (2013) training refers a process of teaching the entire system users on how to use the new system's features and functions. Ongoing and cutover training must be taken into consideration when engaging on a training process. Ongoing training is concerned with the turnover occurrence that is full training is recommended to all the new users of the system while cutover training is much concerned on the mapping old procedures of doing things into the new procedures. Training is of paramount importance to the system success because it heavily depends on the usage and operation rate of the system. Training was conducted to the following users:

- a. Client administrators- this was a training conducted to show the administrators how to approve the clients' transaction and orderings so as the overall system operations.

- b. IT administrator- this was a training to show the IT administrators on how to rectify system errors, backup and troubleshooting when there are issues affecting the system as well as report generation.
- c. Managers- Managers were taught how generate reports and how to approve loans of the clients as well as controlling the exchange rates of the bank.
- d. Personal bankers- they were trained to create clients, adding services and approving the client orders.

5.4.3 Conversion

According to Shelly (2005) conversion refers to a system replacement process in which the old system will be replaced by the new system after user training and operational environment has been established. The major aim of this was gain acceptance by the users of the system. Basically there are four methods of conversion that can be employed for new system installation which are direct, pilot, phase and parallel conversion.

- a. Direct Conversion

This refers to a conversion method that totally remove the old system with the new system taking over as a replacement that is the old system will be stopped while the new system will be the one working, Shelly (2005). The new system will be installed across all departments within the organization while the old system will be turned off. Direct changeover is a quick transition that is it is quickly installed into an organization if the old system will be having many problems or if it does not exist at all.

Direct conversion evaluation: Though direct changeover have many advantages favorable ZB Bank is not able to employ this conversion method since these two system that is the old and new system are totally different which makes it risk since the users need to learn how to use the new proposed system. Also there is need for data migration from the old to the new system which is impossible if the bank employs this method of conversion since the old system will be turned off once the new system has been implemented.

- b. Pilot Conversion

Laplante et al. (2013) defined pilot conversion as a method in which a single location or department that is the pilot site is installed the new system for certain period of time before it is introduced or installed to other organizational parts. This allows the organization to test the new system in such a way that it won't cause any harm or disturb the organizational business activity. Pilot conversion gives a room for error detection and rectification before the system is introduced to the whole organization as well getting feedback on any area which needs to be sorted to meet the user requirements.

Pilot conversion evaluation: It is difficult to employ pilot conversion in this situation. Confusion is fostered in the pilot site of which system to be used for a certain purpose and normally there are high chances of system failure when pilot method is used since the data is lost in the new system. Pilot conversion delays the implementation of the new system since the system will be under tests in the pilot site and the system will be improved. Finally it gives the IS systems support staff extra burden since they will be support and maintaining two systems that are likely doing the same task.

c. Phased Conversion

According to Laplante et al. (2013) in this phased conversion a new IS (information system) is separated into several modules and the organization will be using the system one module at a time that is all the users will be introduced to that one module at the same period. However this method takes time for the whole system to be implemented but the users will be learning the system step by step thereby helping to overcome the resistance to change by the users.

Phase conversion evaluation: The time required for the implementation of the whole system is the major constrain of ZB Bank employing this conversion method since a step by step module replacement of the current system implementation needs a long time. This type of conversion method is relatively expensive as compared to other conversion methods such as direct conversion thereby making it difficult to use.

d. Parallel Conversion

Shelly (2005) defined parallel conversion as a method in which the old and the new system will fully operate simultaneously within the organization for a certain period of time. With this method the users will be making use of both systems up until they are fully understanding the new system as well as if the new system is operating properly without

facing any challenges then the old system will be terminated. Parallel conversion allows ZB Bank to compare the effectiveness of both systems so as to fully migrate the user data to the new system. Once the ZB Bank Digital Channels fails it will be viable for the bank to continue using the old system since it was kept running in parallel with the new system without any data loss.

Parallel conversion evaluation: Parallel conversion was the ideal method used to implement ZB Bank Digital Channels. Both systems were kept running for a certain period of time thus giving the bank a room to make comparisons and viable decision of which system is efficiently and effectively performing well.

5.5 Maintenance

Somerville (2015) defined maintenance as the software product modification to correct the software faults, add other functions and for performance improvement after the product has been delivered this is done to make sure that the software product is adapting to the prevailing dynamic technological environment. Continuously system maintenance should be undertake such that the software product will continue to satisfy the users of the system. This is an ongoing process that takes into consideration upgrading and updating the ZB Bank Digital Channels. There are basically four strategies of maintenance which are as follows:

- Corrective Maintenance
- Adaptive Maintenance
- Perfective Maintenance
- Preventive Maintenance

5.5.1 Perfective Maintenance

According to Shelly et al (2005) perfective maintenance refers to software modification that is done to increase performance. When perfective maintenance is done the changes done might be of new functionality been provided to the users or it can be a reverse engineering which is responsible for maintenance documentation creation that is the document might be existing or might not be previously existing. A good example is that the clients might request that the ZB Bank Digital Channels must be added a financial calculator to help them do their investments decision. The

major objective of the perfective maintenance is for system enhancement by improving reliability, maintainability and efficiency.

5.5.2 Preventive Maintenance

Shelly et al (2005) defined preventive maintenance as the system modification required by identifying possible errors and correct the faults that are in the system before they affect the system as a whole. The system developer will be checking for errors and updating the system before they come out in other words this is usually done to prevent future problems or errors of the system. Preventive maintenance is important even with all the testing since it may not be possible to test few things before the software can actually be implemented.

5.5.3 Corrective Maintenance

According to Whitten et al (2015) corrective maintenance refers to the changes made because of the software product actual errors which may cause the software product not to meet the user requirements. Incorrect implementation causes coding errors of logic design detailed and source code logic incorrect use. Investigations should be lunched once the errors are identified such that the cause of the error will be rectified. A correction is made once the errors are noticed that is it is a damage control activity which waits for the errors to noticed then corrective measures are taken to fix the errors such errors are documented such that if the same issue happens in the future there will be reference.

5.5.4 Adaptive Maintenance

According to Whitten et al. (2013) adaptive maintenance refers to as the modification of a software product performed after delivery necessary to accommodate a changing environment and dynamic business environment. When using adaptive maintenance the changes made to the system will those say there was change in the client requirements, new interfaces of the system requested and finally there are new requirements of hardware. As the system exist in an ever changing technology and business environment there is need for the system to be changed frequently such that it will meet the user change in requirements.

System maintenance overview: The system developer viewed it as it is worthwhile to maintain the ZB Bank Digital Channels using all the above maintenance type since each type of maintenance will contribute greatly to the system performance. Even if the hardware is upgraded the ZB Bank Digital Channels is usable without facing any challenges.

5.6 Conclusion

The new system was successfully implemented and accepted by the user without facing any challenges, they did not face problems of using system since the interfaces are user friendly. The system project was a success since all the system requirements and objectives were met though there were some problems that the developer come across during the system development the system was well budgeted for and planned. The developer greatly benefited from this project and the organization will be able to realize profits through employing the new system. The parallel conversion recommended and employed so that the users will familiarize with the new system before the old one is terminated while all the maintenance methods were recommended to cover all different circumstances that may occur in the future.

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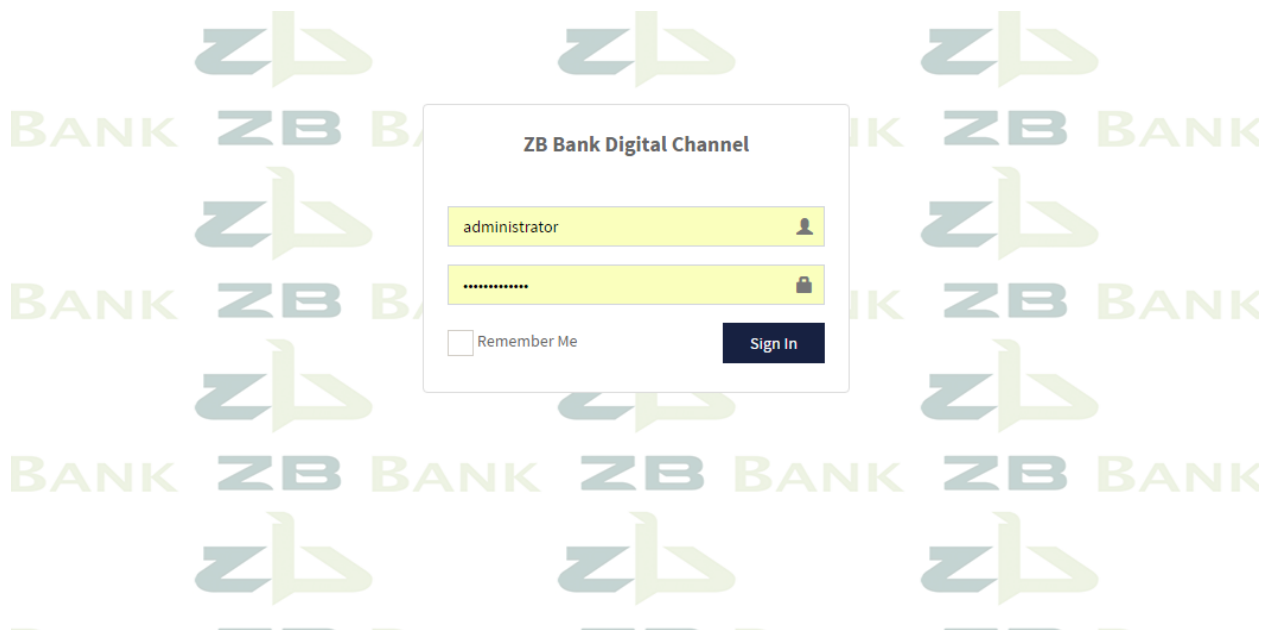
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APPENDIX A: USER MANUAL

The user manual is designed to equip the users with the necessary knowledge of the operating system without any problems. Within the user manual step on how to operate the system will be revealed to the user for them not encounter some challenges as they navigate through the system. This is important to the users of the system as it guides him or her on how to use the system. It informs him or her on what to do in cases where the system reacts in an unusual manner.

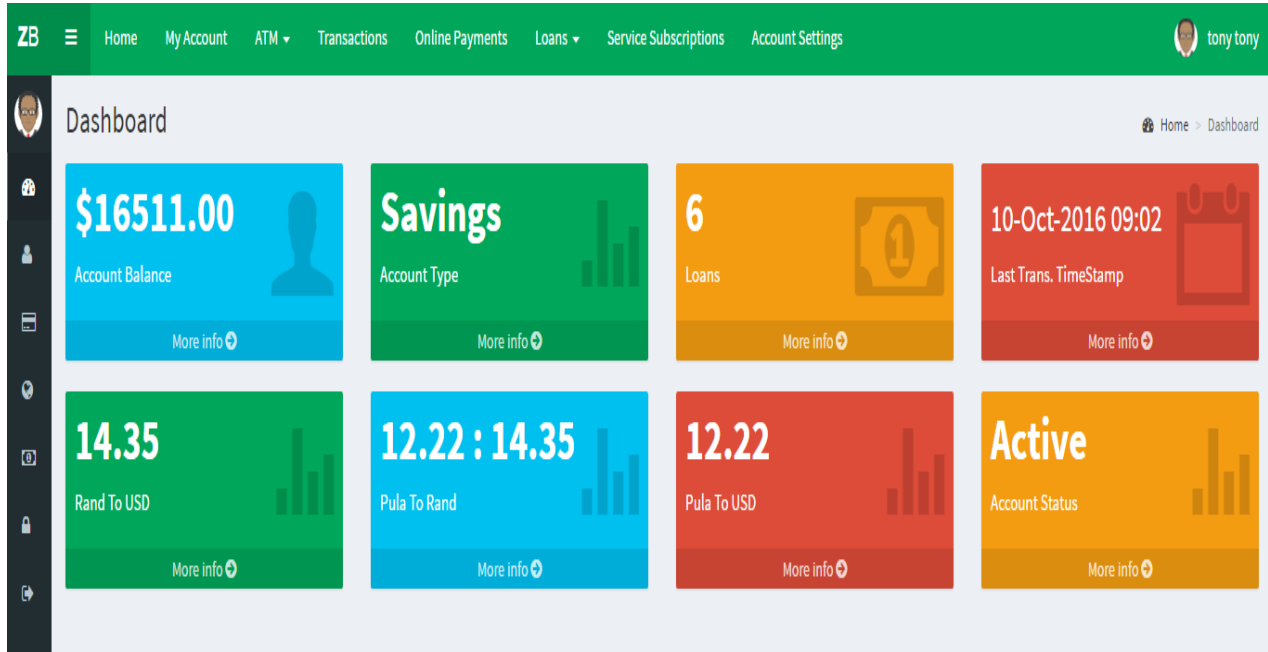
Main Menu

To gain access to the system every user should be authenticated. When the user types the website's URL in the browser, the login page is displayed. The login page is shown below. Depending on the user access level when adding the user the user is directed to the respective subsystem the User Home, or the Administrator Home. The user should input username and password on the form shown below to access the system.

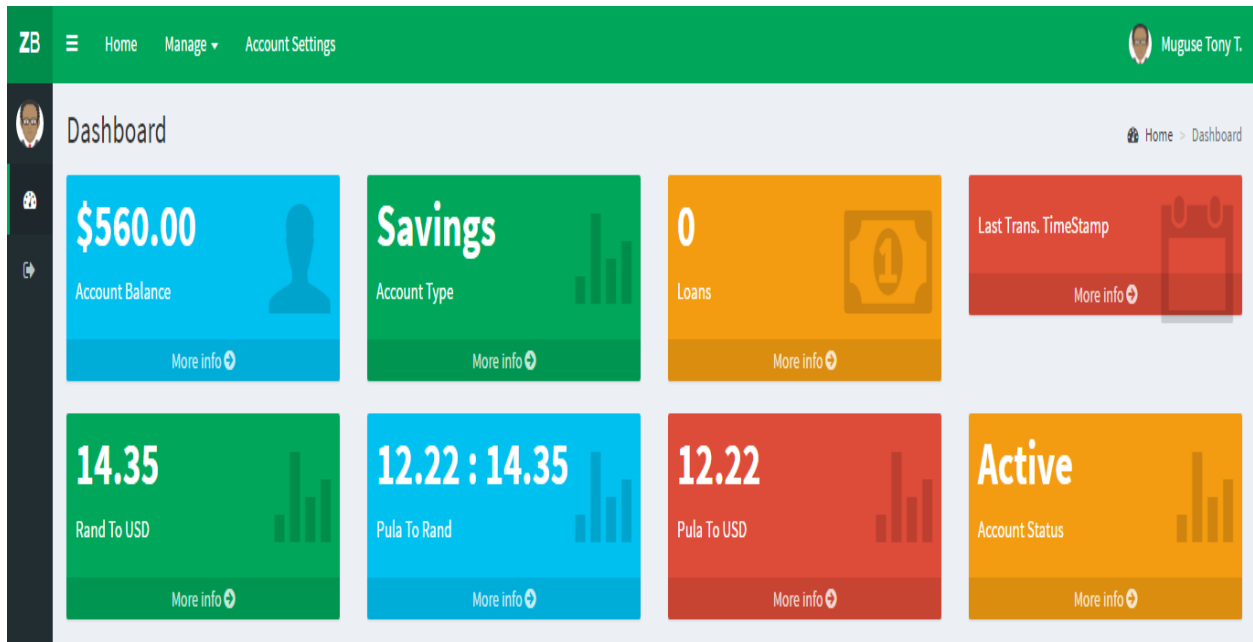


User Home

If the user logs into the system as a member, then the user is directed to the page with the User Home. The user will be able to view his or her balance, exchange rate and loan available. The menu is shown below:



Administration Home - If the user log into the system as an Administrator, the user is directed to the page with the Administrator menu, the Administrator Home shown below:



New User Registration

This page allows a client to enter his or her personal details, creating a username, password and auto generate the account number. Upon clicking the submit button, the new user's account is created and the new user becomes a member. The administrator should input the user details to add a user as shown below.

The screenshot shows the 'Users Management' page. On the left is the 'Add New User' form with fields for Role / Account Type Access, First Name, Last Name, Account Number (Auto Generated), Account Type, Username, National ID, Date of Birth, Gender (Female/Male), and Phone Number. On the right is a table titled 'Users in system' listing existing users with their account numbers, names, branches, roles, and edit/view options.

Account Number	First Name	Last Name	Branch	Role	(options)
523445676543	System	Admin	1	4	edit View
523445676548	tony	tony	1	3	edit View
523445676549	Muguse	Tony	3	1	edit View
523445676550	Taffy	Ruturi	1	3	edit View
523445676551	tendai	dombo	1	3	edit View
523445676552	ton	goose	3	1	edit View
523445676553	aruwini	homs	1	3	edit View
523445676554	tee	mugu	2	3	edit View
523445676555	n'anga	n'anga	2	3	edit View
523445676556	n@tee	n@tee	2	3	edit View

Client Statement- This allows clients to view all their transaction statements made.

The screenshot shows the 'My Account' page. It features a user profile picture and a list of account details including Account Number, Branch, National ID, Account Balance (US\$), Physical Address, Mobile No, and E-mail Address. Below the details is a 'Select Statement' dropdown menu. The main content area displays a transaction statement for 'tony tony' as of Tuesday, October 11, 2016, 11:00:13 PM. The statement is a table with columns for Date, Description, and \$(USD).

Date	Description	\$(USD)
	Balance b/f	10.00
30-Aug-2016 11:44	deposit from Tee Tee	1000.00
30-Aug-2016 11:45	payment for Telone	(200.00)
30-Aug-2016 11:49	payment for Edgars	(25.00)

Funds Transfer- This allows to transfer funds from one account to another internally or to other banks. The user should input the recipient account details on the module below.

Online Transfers

Payments

Transfer Type: Internal

Account Type: Savings Account

Account Number: 523445676548

Available Balance(\$USD): 16511.00

Payee Account Number: 523445676549

Amount (\$USD): 90.00

Currency of Transfer: US Dollar

Submit Payment

Transfers

#	Transfer to	Transfer Amount (\$)	Date (\$)
1	5	200.00	8/30/2016 11:45:27 PM
1	4	25.00	8/30/2016 11:49:03 PM
1	4	23.00	9/3/2016 10:46:33 AM
1	1	20.00	9/6/2016 4:44:56 PM
1	1	20.00	9/6/2016 4:47:23 PM
1	1	20.00	9/25/2016 1:30:22 PM
1	1	2.00	9/27/2016 3:37:10 PM
1	1	50.00	9/27/2016 3:43:16 PM
1	523445676548	10.00	9/27/2016 5:05:30 PM
1	523445676547	20.00	9/27/2016 5:15:56 PM
1	523445676547	20.00	9/27/2016 5:17:09 PM
1	523445676547	10.00	9/28/2016 7:14:48 PM

Bill Payments-this is where the clients make their payments. The user should input the payment details select service to be paid, enter payment identifier and the amount then submit.

Online Payments

Payments

Service To Be Paid: Edgars

Account Type: Savings Account

Account Number: 523445676548

Available Balance(\$USD): 16511.00

Payment Identifier: 456555

Amount (\$USD): 511.00

Payment Type: Normal

Pay After Every: Days

Submit Payment

Payments Stop Orders And Standing Order

#	Payee	Account	Amount (\$)	Date	(options)
1	Edgars	2457889	6.00	10/10/2016 9:02:22 PM	remove
1	Telone	457895	25.00	10/10/2016 8:43:46 PM	remove
1	Edgars	45678910	20.00	10/10/2016 8:27:26 PM	remove
1	Zesa Prepaid Electricity	45678951 Token : 8067 8395 6913 4203 7873 Units : 40	20.00	10/9/2016 11:04:00 AM	remove
1	Zesa Prepaid Electricity	25647895 Token : 2532 7608 2788 2581 3388 Units : 40	20.00	10/9/2016 1:02:16 AM	remove
1	Telone	25647895	20.00	10/9/2016 1:01:39 AM	remove

Add Online Payment Service-This form shows how the bill payments services are added by the administrator.

The screenshot displays the 'Services Management' page. On the left, the 'Add New Service' form includes fields for 'Service Name' (with a placeholder 'Service Name') and 'Service Description' (with a placeholder 'Allows users to make payments to this merchant'). A green 'Add Service' button is at the bottom of the form. On the right, the 'Services in system' table lists existing services with columns for Service ID, Service Name, Created, Createdby, and options (edit, view).

Service ID	Service Name	Created	Createdby	(options)
1	Zesa Prepaid Electricity	7/27/2016 11:59:17 AM	TEMPUSER	edit View
3	Zesa Electricity Bill	7/28/2016 11:37:56 AM	TEMPUSER	edit View
4	Edgars	8/25/2016 3:17:18 PM	SYSTEM ADMIN	edit View
5	Telone	9/25/2016 1:44:20 PM	SYSTEM ADMIN	edit View

Offer Letter to the Client - This form shows the client's offer letter which reflect the details of the loan that a client can be issued.

The screenshot shows the 'Loan Application' form. It contains the following fields and values:

- Account Number: 523445676548
- Max Loan Request(\$USD): 99066.00
- Monthly Income: 2500.00
- Monthly Expenses: 250.00
- Loan Request: 1500.00
- Loan Payment Period (Months): 8
- Annual Interest (%): 35.32%
- Collateral Security (*.pdf,*.doc): Choose File Tony T Muguse Chapter One.pdf
- Select Currency: Rand
- I agree to the terms & conditions

A green 'Submit Loan Application' button is located at the bottom of the form.

Loans Issued- This is a report that shows all the loans that have been issued to the clients. By clicking on the loans issued icon, the administrator can view all the loans issued out to the clients

The screenshot shows the ZB Loans Management interface. At the top, there is a navigation bar with 'Home', 'Manage', and 'Account Settings'. A notification banner at the top center says 'Loan data loaded' with a checkmark. The main content area is divided into two sections:

Loan Viewer

Loan Id	7
Loan To	Taffy Ruturi (523445676550)
Loan Status	approved
Loan Amount	3000.00 2s
Loan Security	Security Document
Loan Information	Interest rate @ 35.32% per annum Repayment period : 8 months Currency applicable to loan : 2 Loan has been approved by none Information : approved

Below the loan viewer is a text area: 'Add any explanation to support your decision for this order'. At the bottom are two buttons: 'Decline Loan' (red) and 'Approve Loan' (green).

Loans in system

Loan ID	Loan To	Status	Created	(options)
<input checked="" type="checkbox"/> 1	tony tony	approved	8/30/2016 11:30:47 PM	Review
<input checked="" type="checkbox"/> 2	tony tony	approved	9/25/2016 1:34:36 PM	Review
<input checked="" type="checkbox"/> 3	tony tony	approved	9/28/2016 8:13:06 PM	Review
<input checked="" type="checkbox"/> 4	tony tony	approved	10/3/2016 2:03:05 PM	Review
<input checked="" type="checkbox"/> 5	tony tony	approved	10/3/2016 2:15:39 PM	Review
<input checked="" type="checkbox"/> 6	tony tony	approved	10/3/2016 4:22:41 PM	Review
<input checked="" type="checkbox"/> 7	Taffy Ruturi	approved	10/3/2016 8:08:30 PM	Review

ATM Cards and Cheque Book Ordering- This form shows how the orders made by the client when requesting for a new card.

The screenshot shows the ZB ATM Orders interface. The navigation bar includes 'Home', 'My Account', 'ATM', 'Transactions', 'Online Payments', 'Loans', 'Service Subscriptions', and 'Account Settings'. The user is logged in as 'tony tony'.

ATM Orders

Orders

Order Type	ATM Card
Account Number	523445676548
Details	TONY MUGUSE User Full name
Collection Branch	First Street
Card Type (only for cards)	Debit Card

At the bottom is a green button: 'Order Card/Cheque Book'.

Order History

#	Date	Order Type	Collection Branch	Status	(options)
1	8/30/2016 10:33:21 PM	ATM Card	Main Centre	processed	edit View
2	8/30/2016 11:02:21 PM	Cheque Book	West End	processed	edit View
3	9/6/2016 4:41:45 PM	Cheque Book	Main Centre	processed	edit View
4	9/25/2016 1:24:31 PM	ATM Card	First Street	declined	edit View
5	9/25/2016 1:25:01 PM	Cheque Book	West End	pending	edit View
6	9/29/2016 11:31:36 PM	ATM Card	Main Centre	processed	edit View

APPENDIX B: INTERVIEW CHECKLIST

Section 1

Name of interviewer.....

Interviewee position and department.....

Section 2: Questions for users of the client system

1. Can you give a brief description of the current system and what are the problems are you currently facing with traditional banking?
2. What are the activities you carry out in your department you consider manual and need to be automated?
3. What do you understand by the term virtual banking?
4. Do you understand the objectives and functionality of virtual banking?
5. What are the key aspects of the proposed system usability or security issues?
6. Will the virtual banking make your work easier and how?
7. Does the current system produce reports? Who requires the reports and what kind of reports?
8. Do you think the introduction of digital channels will solve the problems with traditional banking?

Section 3: Questions for the bank's clients'.

1. What is the main reason that you typically visit your bank?
2. What are the activities you carry out when you visit the bank you consider manual and need to be automated?
3. What do you understand by the term digital channels?
4. Are you willing to provide credit card information and personal information over the Internet?
5. How long have you been a user of the Internet and will you be able to use the proposed system?
6. Do you think the introduction of virtual banking will solve the problems with traditional banking?

APPENDIX C: QUESTIONNAIRE

I am Muguse Tony T, a student at the Midlands State University in Zimbabwe pursuing a Degree in Information Systems. One of the requirements for this award is a project report with a running software system. This questionnaire is designed to find out the requirements for the above mentioned system (ZB Bank Digital Channels).

I therefore kindly request you to assist me with the required information in this questionnaire. I promise to keep all the given information confidential and highly guard due rights. Thank you for your cooperation.

WORKERS AND MANAGERIAL QUESTIONNAIRE

Name of department.....

Gender male female

Job Title.....

Level of education Degree Diploma Certificate

Other specify

Qsn1. What are the activities you carry out in your department you consider manual and need to be automated?

.....
.....
.....
.....

Qsn2. Can you give a brief description of the current system and what are the problems are you currently facing with traditional banking?

.....
.....

Qsn3. What do you understand by the term digital channels?

.....
.....
.....
.....

Qsn4. Do you understand the objectives and functionality of digital channels?

.....
.....
.....
.....

Qsn5. What are the key aspects of the proposed system usability or security issues?

.....
.....

Qsn6. Will the virtual banking make your work easier and how?

.....
.....
.....
.....

Qsn7. Does the current system produce reports? Who requires the reports and what kind of reports?

.....
.....

.....
.....
Qsn8. Do you think the introduction of digital channels will solve the problems with traditional banking?

.....
.....
.....
.....

Thank you for this great contribution.

CLIENTS QUESTIONNAIRE

Qsn1. How long have you been banking with ZB Bank?

.....

Qsn2. Do you consider traditional banking to be manual?

.....
.....
.....

Qsn3. What do you understand by the term digital channels?

.....
.....
.....

Qsn4. How likely is it that you will open a digital channels account within the next 12 months?
(Tick where appropriate)

- Very Unlikely
- Somewhat Unlikely
- Neither Unlikely nor Likely
- Somewhat Likely
- Very Likely
- Not applicable

Qsn4. What banking services do you want digital channels to offer? (Please check all you would to use in the new system)

- Seeking product and rate information
- Download personal bank transaction activity
- Check balances online
- Apply for consumer loans or credit cards online
- Inter-account transfers
- Online bill payments

Qsn5. What are the most important reasons that you will open a virtual bank account? (Please prioritize the following list in the order of importance?)

.....

.....

.....

.....

Qsn6. What was the single most important reason that you chose this particular bank as your digital channels? (Please choose one)

I have a traditional bank account with the same bank

The brand name of the bank

The excellent service offered by this bank

Thank you for this great contribution

APPENDIX D: OBSERVATION SCORE SHEET

Name of observant:

Name of observer:

Date:

Time:

<p>Focus of observation:</p> <p>.....</p> <p>Brief description of current system:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>Areas of strength:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>Areas of development:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>Signed:..... Date:.....</p> <p>Signed:..... Date:.....</p>

APPENDIX E: SNIPPET OF CODE

Connection to the database

```
MySqlConnection dbconnect = new  
MySqlConnection(ConfigurationManager.ConnectionStrings["ZBDigiC"].ConnectionString);
```

Client registration

```
MySqlConnection dbconnect = new  
MySqlConnection(ConfigurationManager.ConnectionStrings["ZBDigiC"].ConnectionString);
```

```
protected void Page_Load(object sender, EventArgs e)  
{  
    if (!IsPostBack)  
    {  
        ShowAllUsers();  
        LoadingMenus();  
    }  
}  
  
// load drop down menus  
void LoadingMenus()  
{  
    //load roles menu  
    string dbquery = "SELECT `role_name`, `id` FROM `tbl_roles`";  
    using (dbconnect)  
    {  
        dbconnect.Open();  
        var query = new MySqlCommand(dbquery, dbconnect);  
        dbconnect.Close();  
        MySqlDataReader reader;  
        dbconnect.Open();//open new session to read data  
        reader = query.ExecuteReader();  
  
        //Loop This Data Below and insert it as rows  
        if (reader.HasRows)  
        {  
            while (reader.Read())  
            {  
                //reader.Read();  
                DropDownRoles.Items.Add(new ListItem(reader.GetString(0),  
reader.GetString(1)));  
            }  
        }  
        reader.Close();  
        dbconnect.Close();  
    }  
    //load bank branch menus  
    dbquery = "SELECT `branchname`, `id` FROM `tbl_bank`";  
    using (dbconnect)  
    {  
        dbconnect.Open();  
        var query = new MySqlCommand(dbquery, dbconnect);  
        dbconnect.Close();
```

```

        MySqlDataReader reader;
        dbconnect.Open();//open new session to read data
        reader = query.ExecuteReader();

        //Loop This Data Below and insert it as rows
        if (reader.HasRows)
        {
            while (reader.Read())
            {
                //reader.Read();
                drpBranch.Items.Add(new ListItem(reader.GetString(0),
reader.GetString(1)));
            }
            reader.Close();
            dbconnect.Close();
        }
    }

    {
        //connection string
        using (dbconnect)
        {
            bool temp = false;
            MySqlCommand check_command = new MySqlCommand(dbscript, dbconnect);
            MySqlDataReader read_rd;
            if (dbconnect.State == ConnectionState.Open)
                dbconnect.Close();
            dbconnect.Open();
            read_rd = check_command.ExecuteReader();
            if (read_rd.HasRows)
            {
                temp = true;
            }
            read_rd.Close();
            dbconnect.Close();
            return temp;
        }
    }
}
void SendToDatabase(string dbquery)
{
    using (dbconnect)
    {
        if (dbconnect.State == ConnectionState.Open)
            dbconnect.Close();
        dbconnect.Open();
        var queryHandler = new MySqlCommand(dbquery, dbconnect);
        queryHandler.ExecuteNonQuery();
        dbconnect.Close();
        //SEND ALERT AFTER COMPLETION

        //Refresh the services list by calling showallservices again
        ShowAllUsers();
    }
}
protected void btnAddUser_Click(object sender, EventArgs e)
{

```

```

        Label namer = (Label)Master.FindControl("lblFullname");
        string username = "tempuser";
    (())
    {
        //avoid duplicates
        bool userExists = preventDuplicateData("SELECT * FROM `tbl_users` WHERE
`username`='" + uname + "';");
        if (userExists == false)
        {
            string dbquery = "INSERT INTO `tbl_accounts` (`acc_balance`,`acc_type`)
VALUES ('" + bal + "','"+ accounttype + "');";
            using (dbconnect)
            {
                dbconnect.Open();
                var query = new MySqlCommand(dbquery, dbconnect);
                dbconnect.Close();

                MySqlDataReader reader;
                dbconnect.Open();//open new session to read data
                reader = query.ExecuteReader();
                id = query.LastInsertedId.ToString();
                reader.Close();
                dbconnect.Close();
            }
            dbquery = "INSERT INTO `tbl_users`(`username`, `password`, `account_num`,
`f_name`, `l_name`, `p_address`, `phone`, `email`, `branchcode`,
`user_role`,`createdby`,`nat_id`,`dob`,`gender`) ";
            dbquery += "VALUES ('" + uname + "','"+ encryptdpwd + "','"+ id + "','"+
+ fname + "','"+ lname + "','"+ address + "','"+ phone + "','"+ email + "','"+
branch + "','"+ role + "','"+ username + "','"+nat_id+'','"+DOB+'','"+gender+'')";
            SendToDatabase(dbquery);
            string msg = "Account for " + fname + " " + lname + " has been created
successully";
            showAlert("success", msg);
        }
        else
        {
            showAlert("danger", "Account creation failed : The username you assigned
to this account is already in use, please try another one");
        }
    }
    else
    {
        showAlert("warning", "Possible Errors : <br/>Passwords do not match <br/> No
input selected in dropdown menus <br/> User must be 18 years or older check date of
birth");
    }
}
bool Validate()
{
    bool Proceed = false;
    string confirmedPwd = tbxCpwd.Text;
    string Pwd = tbxPwd.Text;
    string[] dateFragments = tbxDOB.Text.Split("-".ToCharArray());
    int year = 0;
    int.TryParse(dateFragments[0], out year);
    int age = DateTime.Now.Year - year;
}

```

```

        if (Pwd == confirmedPwd)
        {
            Proceed = true;
        }
        if (age < 18)
        {
            Proceed = false;
        }
        return Proceed;
    }
    bool ValidateDropDown()
    {
        if (drpBranch.SelectedItem.Value != "select" && dropAcctype.SelectedItem.Value !=
"select" && DropDownRoles.SelectedItem.Value != "select")
        {
            return true;
        }
        else
        {
            return false;
        }
    }
    protected void usersRepeater_ItemCommand(object source, RepeaterCommandEventArgs e)
    {
        if (e.CommandName.ToString() == "edit")
        {
            //load the current role data selected in the edit textboxes
            string dbquery = "SELECT * FROM `tbl_users` WHERE `id`='" +
e.CommandArgument.ToString() + "'";
            using (dbconnect)
            {

                if (Validate() == true && ValidateDropDown() == true )
                {
                    string dbquery = "UPDATE `tbl_users` SET `f_name`='"+fname+"',
`l_name`='"+lname+"', `p_address`='"+address+"', `phone`='"+phone+"',
`email`='"+email+"', `branchcode`='"+branch+"',
`user_role`='"+role+"', `nat_id`='"+nat_id+"' WHERE
`account_num`='"+tbxAccNumber.Text+"'";
                    SendToDatabase(dbquery);
                    string msg = "Account for " + fname + " " + lname + " has been updated
successully";

                    showAlert("success", msg);
                    tbxName.Text = null;
                    tbxLastname.Text = null;
                    dropAcctype.SelectedItem.Value = null;
                    tbcAccBal.Text = null; // get the balance from the accounts table
                    tbxUsername.Text = null;
                    tbxNumber.Text = null;
                    tbxEmail.Text = null;
                    drpBranch.SelectedItem.Value = null;
                    tbxAddress.Text = null;
                    DropDownRoles.SelectedItem.Value = null;
                    tbxAccNumber.Text = null;
                    btnUpdate.Visible = false;
                    tbnAddUser.Visible = true;
                }
            }
        }
    }

```

```

        else
        {
            showAlert("warning", "Possible Errors : <br/>Passwords do not match <br/> No
input selected in dropdown menus <br/> User must be 18 years or older check date of
birth");
        }
    }
}

```

Login to the system

```

//Create a database connection
 MySqlConnection dbconnect = new
 MySqlConnection(ConfigurationManager.ConnectionStrings["ZBDigiC"].ConnectionString);
protected void Page_Load(object sender, EventArgs e)
{
    // Prevents JQuery resource mapping error from occurring
    ScriptResourceDefinition myScriptResdefn = new ScriptResourceDefinition();
    myScriptResdefn.Path = "~/plugins/jquery/jquery-2.1.4.min.js";
    ScriptManager.ScriptResourceMapping.AddDefinition("jquery", null,
myScriptResdefn);
}
protected void LgnBtn_Click(object sender, EventArgs e)
{
    string tohash = tbxPwd.Text + txtusername.Text;
    string hashedPwd =
System.Web.Security.FormsAuthentication.HashPasswordForStoringInConfigFile(tohash,
"SHA1");
    string queryconstruct = "SELECT * FROM `tbl_users`,`tbl_roles` WHERE
`tbl_users`.`username` ='" + txtusername.Text + "' AND `tbl_users`.`user_role`=
`tbl_roles`.`id`";

    string accnumber = "";
    string user = "";
    string username = "";
    string role = "";
    string pwd = "";
    string status = "";
    string accountstate = "";
    string accesslevel = "";
    string userData = "";
    using (dbconnect)
    {
        username = reader.GetString(1);
        role = reader.GetString(17);
        pwd = reader.GetString(2);
        accesslevel = reader.GetString(19);
        userData = string.Concat(user, "|", accnumber, "|", role, "|",
accesslevel);

        reader.Close();
        dbconnect.Close();
    }
    if (hashedPwd == pwd) // if the password that user entered is equal to
the one retrieved
    {

```

```

        showAlert("warning", "Correct creds");
        if (role != "Client")
        {
            //setting the forms authentication ticket
            FormsAuthenticationTicket ticket = new
            //Session["Portal_User"] = "Staff";

            // Response.Redirect("~/Admin/Welcome.aspx");
            Response.Redirect("~/admin/Default.aspx");

        }
        else
        {
            //Session["Portal_User"] = "Staff";

            // Response.Redirect("~/Admin/Welcome.aspx");
            Response.Redirect("~/customer/Default.aspx");
        }
    }
    else
    {
        showAlert("warning", "Password or username is incorrect");
    }
}

void showAlert(string type, string message)
{
    //Get Data container elements from Mastpage and prepare to create an alert or
notification

    //connection string
    using (dbconnect)
    {
        bool temp = false;
        MySqlCommand check_command = new MySqlCommand(dbscript, dbconnect);
        MySqlDataReader read_rd;
        if (dbconnect.State == ConnectionState.Open)
            dbconnect.Close();
        dbconnect.Open();
        read_rd = check_command.ExecuteReader();
        if (read_rd.HasRows)
        {
            temp = true;
        }
        read_rd.Close();
        dbconnect.Close();
        return temp;
    }
}
void SendToDatabase(string dbquery)
{
    using (dbconnect)
    {
        if (dbconnect.State == ConnectionState.Open)
            dbconnect.Close();
    }
}

```

```

        dbconnect.Open();
        var queryHandler = new MySqlCommand(dbquery, dbconnect);
        queryHandler.ExecuteNonQuery();
        dbconnect.Close();
        //SEND ALERT AFTER COMPLETION
    }
}
}

```

Loan application

```

//Create a database connection
MySQLConnection dbconnect = new
MySQLConnection(ConfigurationManager.ConnectionStrings["ZBDigiC"].ConnectionString);

protected void Page_Load(object sender, EventArgs e)
{
    if (!IsPostBack)
    {
        LoadingMenus();
    }

    loadCustomerDetails();
}
void loadCustomerDetails()
{
    string accountnumber = User.Identity.Name;
    string dbquery = "SELECT `acc_balance`, `acc_type` FROM `tbl_accounts` WHERE
`account_num`='" + accountnumber + "'";
    using (dbconnect)
    {
        dbconnect.Open();
        var query = new MySqlCommand(dbquery, dbconnect);
        dbconnect.Close();

        MySQLDataReader reader;
        dbconnect.Open();//open new session to read data
        reader = query.ExecuteReader();

        //Loop This Data Below and insert it as rows
        if (reader.HasRows)
        {
            while (reader.Read())
            {
                //reader.Read();
                lblAccBal.Text = reader.GetString(0);
            }

            //End Loop
        }
        reader.Close();
        dbconnect.Close();
    }
    double cal = 0;
    double.TryParse(lblAccBal.Text, out cal);
}

```



```

    cal *= 6;
    maxLoan.Text = cal.ToString("0.00");
    lblAnnualInterest.Text = "35.32%";

    lblAccountNumber.Text = accountnumber;
}
void LoadingMenus()
{
    string accountNumber = User.Identity.Name;
    //load bank branch menus
    string dbquery = "SELECT `c_name`, `currency_id` FROM `tbl_currency` ";
    using (dbconnect)
    {
        dbconnect.Open();
        var query = new MySqlCommand(dbquery, dbconnect);
        dbconnect.Close();

        MySqlDataReader reader;
        dbconnect.Open();//open new session to read data
        reader = query.ExecuteReader();

        //Loop This Data Below and insert it as rows
        if (reader.HasRows)
        {
            while (reader.Read())
            {
                //reader.Read();
                DrpDwnCurrency.Items.Add(new ListItem(reader.GetString(0),
reader.GetString(1)));
            }

            //End Loop

        }
        reader.Close();
        dbconnect.Close();
    }

}

string validation()
{
    //check if dropdowns have values
    string Msg = "";
    if (DrpDwnCurrency.SelectedItem.Value == "select" )
    {
        Msg += "Select a valid currency <br/>";
    }
    if (!SecurityFiles.HasFile)
    {
        Msg += "You need to upload securities <br/>";
    }
    else
    {
        var Filename = SecurityFiles.PostedFile.ContentType;
    }
}

```

```

        if (Filename != "application/pdf" && Filename != "application/doc" &&
Filename != "application/docx")
        {
            Msg += "Invalid document format selected <br/>";
        }
    }
    if (chbxAgree.Checked != true)
    {
        Msg += "You need to agree with our terms first before you can apply for a
loan <br/>";
    }

    if (Msg == "")
    {
        Msg = "Ok";
    }
    return Msg;
}
void showAlert(string type, string message)
{
    //Get Data container elements from Mastpage and prepare to create an alert or
notification
    HtmlGenericControl btndismiss = new HtmlGenericControl("button");
    Placeholder btnAlias = (Placeholder)Master.FindControl("btnPlaceHolder");
    Placeholder btnContentAlias =
(Placeholder)Master.FindControl("btnContentPlaceHolder");
    HtmlControl alertContainerDiv = (HtmlControl)Master.FindControl("alertMsg");
    Label lblAlertMsg = (Label)Master.FindControl("lblalert");

    btndismiss.ID = "dismissthis";
    btndismiss.Attributes.Add("type", "button");
    btndismiss.Attributes.Add("class", "close");
    btndismiss.Attributes.Add("data-dismiss", "alert");
    btndismiss.Attributes.Add("aria-label", "Close");
    btndismiss.InnerText = "x";
    //creating button content
    HtmlGenericControl btncontent = new HtmlGenericControl("span");
    btncontent.Attributes.Add("aria-hidden", "true");
    //setting the alertable div for displaying content
    alertContainerDiv.Attributes.Add("class", "alert alert-" + type + " alert-
dismissible col-md-12");
    alertContainerDiv.Attributes.Add("role", "alert");

    btnAlias.Controls.Add(btndismiss);
    btnContentAlias.Controls.Add(btncontent);
    if (type == "success")
    {
        message += " &nbsp;&nbsp;&nbsp; \u2714";
    }
    else if (type == "danger")
    {
        message += " &nbsp;&nbsp;&nbsp; \u2297";
    }
    else
    {
        //warning
        message += " &nbsp;&nbsp;&nbsp; \u26A0";
    }
}

```

```

        lblAlertMsg.Text = message;
    }
    //function to check if the data exists
    bool preventDuplicateData(string dbscript)
    {
        //connection string
        using (dbconnect)
        {
            bool temp = false;
            MySqlCommand check_command = new MySqlCommand(dbscript, dbconnect);
            MySqlDataReader read_rd;
            if (dbconnect.State == ConnectionState.Open)
                dbconnect.Close();
            dbconnect.Open();
            read_rd = check_command.ExecuteReader();
            if (read_rd.HasRows)
            {
                temp = true;
            }
            read_rd.Close();
            dbconnect.Close();
            return temp;
        }
    }
    //function for sending information to database
    void SendToDatabase(string dbquery)
    {
        using (dbconnect)
        {
            if (dbconnect.State == ConnectionState.Open)
                dbconnect.Close();
            dbconnect.Open();
            var queryHandler = new MySqlCommand(dbquery, dbconnect);
            queryHandler.ExecuteNonQuery();
            dbconnect.Close();
            //SEND ALERT AFTER COMPLETION

            //Refreshsh the services list by calling showallservices again
        }
    }
    long SendToDatabaseReturnHandle(string dbquery)
    {
        long handle = 0;
        using (dbconnect)
        {
            if (dbconnect.State == ConnectionState.Open)
                dbconnect.Close();
            dbconnect.Open();
            var queryHandler = new MySqlCommand(dbquery, dbconnect);
            queryHandler.ExecuteNonQuery();
            handle = queryHandler.LastInsertedId;
            dbconnect.Close();
            //SEND ALERT AFTER COMPLETION

            //Refreshsh the services list by calling showallservices again
        }
    }
}

```

```

        return handle;
    }

protected void btnSubmitLoadApplication_Click(object sender, EventArgs e)
{
    if (validation() == "Ok")
    {
        Label namer = (Label)Master.FindControl("lblFullname");
        string fullname = namer.Text;
        string path = Server.MapPath("~/\\securities\\uploads\\");
        string date_img = DateTime.Now.Year + "" + DateTime.Now.Month + "" +
DateTime.Now.Day + "" + DateTime.Now.ToString("HHmmss");
        string filetype = Path.GetExtension(SecurityFiles.FileName);
        string filename = fullname.Trim() + date_img + filetype;

        if (Directory.Exists(path) == false)
        {
            Directory.CreateDirectory(path);
        }
        SecurityFiles.SaveAs(path + filename);
        //Read Data In Uploaded excel
        string Relativepath = "../securities/uploads/" + filename;

        string dbquery = "INSERT INTO `tbl_loans`(`acc_number`, `clientname`,
`amount`, `repaymentPeriod`, `securityInf`, `interest`, `currency_id`, `status`,
`statusInf`, `actionedby`)" ;
        dbquery += " VALUES ('" + lblAccountNumber.Text + "','" + fullname + "','" +
tbxLoanAmnt.Text.Replace("'", "'") + "','" + tbxLoanRepaymentPeriod.Text.Replace("'",
"'") + "','" + Relativepath + "','" + lblAnnualInerest.Text + "','" +
DrpDwnCurrency.SelectedItem.Value + "','pending','client requested loan','none')";
        SendToDatabase(dbquery);
        showAlert("success", "Loan application has been sent successfully");

    }
    else
    {
        showAlert("danger", validation());
    }
}
}

```

Statement

```

void loadTransactions(string statementType)
{
    string accountnum = User.Identity.Name;
    string dbquery = "SELECT * FROM `tbl_transactionbuffer` WHERE `acc_number`='" +
accountnum + "' AND `state`='complete'";
    double AccBalance = 0;
    double.TryParse(lblBalance.Text, out AccBalance);
    double TotalPayments = 0;
    double TotalDeposits = 0;
    double depositBuffer = 0;
    double paymentBuffer = 0;

    dbconnect.Open();

```

```

var query = new MySqlCommand(dbquery, dbconnect);
dbconnect.Close();

MySqlDataReader reader;
dbconnect.Open();//open new session to read data
reader = query.ExecuteReader();

DataSet LoansDataSet = new DataSet();
DataTable LoansDataTable = LoansDataSet.Tables.Add("ItemsData");
LoansDataTable.Columns.Add("id");
LoansDataTable.Columns.Add("date");
LoansDataTable.Columns.Add("descrip");
LoansDataTable.Columns.Add("amnt");

DataRow ItemsRow;
//Loop This Data Below and insert it as rows
if (reader.HasRows)
{
    while (reader.Read())
    {
        //reader.Read();
        ItemsRow = LoansDataTable.NewRow();
        ItemsRow["id"] = reader.GetString(6);
        string transactiontype = reader.GetString(5);
        string serviceid = "";
        ItemsRow["descrip"] = transactiontype;
        string paymentID = reader.GetString(1);
        string description = reader.GetString(4);

        if (transactiontype == "payment") // hence subtracting
        {
            query = new MySqlCommand("SELECT `receipt`, `amount`, `date` FROM
`tbl_payments` WHERE `payment_id`='" + paymentID + "'", dbconnect2);
            MySqlDataReader read_rd2;
            if (dbconnect2.State == ConnectionState.Open)
            {
                dbconnect2.Close();
            }
            dbconnect2.Open();
            read_rd2 = query.ExecuteReader();
            if (read_rd2.HasRows)
            {
                read_rd2.Read();
                serviceid = read_rd2.GetString(0);
                ItemsRow["date"] = read_rd2.GetDateTime(2).ToString("dd-MMM-yyyy
hh:mm");
                ItemsRow["amnt"] = "(" + read_rd2.GetFloat(1).ToString("0.00") +
                double.TryParse(read_rd2.GetFloat(1).ToString("0.00"), out
                depositBuffer);
                TotalDeposits += depositBuffer;
            }
            read_rd2.Close(); dbconnect2.Close();

            query = new MySqlCommand("SELECT `service_name` FROM `tbl_services`
WHERE `service_id`='" + serviceid + "'", dbconnect2);
            if (dbconnect2.State == ConnectionState.Open)
            {
                dbconnect2.Close();
            }
            dbconnect2.Open();

```

```

        read_rd2 = query.ExecuteReader();
        if (read_rd2.HasRows)
        {
            read_rd2.Read();
            ItemsRow["descrip"] += " for " + read_rd2.GetString(0);
        } read_rd2.Close(); dbconnect2.Close();

    }
    else if (transactiontype == "transfer") // hence subtracting
    {
        if (preventDuplicateData("SELECT `amount` FROM `tbl_payments` WHERE
`receipt`='" + accountnum + "'") == true)
        {
            query = new MySqlCommand("SELECT `receipt`,`amount`,`date`
FROM `tbl_payments` WHERE `receipt`='" + accountnum + "';", dbconnect2);
            MySqlDataReader read_rd2;
            if (dbconnect2.State == ConnectionState.Open)
                dbconnect2.Close();
            dbconnect2.Open();
            read_rd2 = query.ExecuteReader();
            if (read_rd2.HasRows)
            {
                while (read_rd2.Read())
                {
                    serviceid = accountnum;
                    ItemsRow["date"] = read_rd2.GetDateTime(2).ToString("dd-
MMM-yyyy hh:mmm");
                    ItemsRow["amnt"] = "(" +
read_rd2.GetFloat(1).ToString("0.00") + ")";
                    double.TryParse(read_rd2.GetFloat(1).ToString("0.00"),
out depositBuffer);
                    TotalDeposits += depositBuffer;
                }
            } read_rd2.Close(); dbconnect2.Close();

            ItemsRow["descrip"] = description;
        }
        else
        {
            query = new MySqlCommand("SELECT `receipt`,`amount`,`date`
FROM `tbl_payments` WHERE `payment_id`='" + paymentID + "';", dbconnect2);
            MySqlDataReader read_rd2;
            if (dbconnect2.State == ConnectionState.Open)
                dbconnect2.Close();
            dbconnect2.Open();
            read_rd2 = query.ExecuteReader();
            if (read_rd2.HasRows)
            {
                read_rd2.Read();
                serviceid = read_rd2.GetString(0);
                ItemsRow["date"] = read_rd2.GetDateTime(2).ToString("dd-MMM-
yyyy hh:mmm");
                ItemsRow["amnt"] = "(" +
read_rd2.GetFloat(1).ToString("0.00") + ")";
                double.TryParse(read_rd2.GetFloat(1).ToString("0.00"), out
depositBuffer);
                TotalDeposits -= depositBuffer;
            }
        }
    }
}

```

```

        } read_rd2.Close(); dbconnect2.Close();

        ItemsRow["descrip"] = description;
    }
}
else
{
    //deposit thus adding

    query = new MySqlCommand("SELECT `date`, `depositInfo`, `amnt` FROM
`tbl_deposits` WHERE `deposit_id`='" + reader.GetString(1) + "';", dbconnect2);
    MySqlDataReader read_rd2;
    if (dbconnect2.State == ConnectionState.Open)
        dbconnect2.Close();
    dbconnect2.Open();
    read_rd2 = query.ExecuteReader();
    if (read_rd2.HasRows)
    {
        read_rd2.Read();
        ItemsRow["date"] = read_rd2.GetDateTime(0).ToString("dd-MMM-yyyy
hh:mm");

        ItemsRow["descrip"] += " from " + read_rd2.GetString(1);
        ItemsRow["amnt"] = read_rd2.GetFloat(2).ToString("0.00");
        double.TryParse(read_rd2.GetFloat(2).ToString("0.00"), out
paymentBuffer);

        TotalPayments += paymentBuffer;
    } read_rd2.Close(); dbconnect2.Close();

}
if (statementType == "mini")
{
    ItemsRow["descrip"] = transactiontype;
}
LoansDataTable.Rows.Add(ItemsRow);
}
//End Loop
AccBalance += TotalPayments;
AccBalance -= TotalDeposits;
lblBalBF.Text = "10.00";
}
else
{
    dbconnect3.Close();
    dbquery = "SELECT `recipient`, `amount`, `date`, `payment_id` FROM
`tbl_payments` WHERE `recipient`='" + accountnum + "';";

    if (dbconnect3.State == ConnectionState.Open)
        dbconnect3.Close();
    dbconnect3.Open();
    var query1 = new MySqlCommand(dbquery, dbconnect3);
    dbconnect3.Close();
    dbconnect3.Open();
    reader = query1.ExecuteReader();
    if (reader.HasRows)
    {
        while (reader.Read())
        {
            //serviceid = accountnum;

```

```

        ItemsRow = LoansDataTable.NewRow();
        ItemsRow["date"] = reader.GetDateTime(2).ToString("dd-MMM-yyyy
hh:mm");

        ItemsRow["amnt"] = reader.GetFloat(1).ToString("0.00");

        query = new MySqlCommand("SELECT `trans_description`,`acc_number`
FROM `tbl_transactionbuffer` WHERE `payment_id`='" + reader.GetString(3) + "'",
dbconnect2);

        MySqlDataReader read_rd2;
        if (dbconnect2.State == ConnectionState.Open)
            dbconnect2.Close();
        dbconnect2.Open();
        read_rd2 = query.ExecuteReader();
        if (read_rd2.HasRows)
        {
            read_rd2.Read();
            ItemsRow["descrip"] = read_rd2.GetString(0) + ". Received from "
+ read_rd2.GetString(1);
        } read_rd2.Close(); dbconnect2.Close();

        double.TryParse(reader.GetFloat(1).ToString("0.00"), out
depositBuffer);

        TotalDeposits += depositBuffer;
        if (statementType == "mini")
        {
            ItemsRow["descrip"] = "transfer";
        }
        LoansDataTable.Rows.Add(ItemsRow);
    }
}
reader.Close(); dbconnect2.Close();
AccBalance += TotalPayments;
AccBalance -= TotalDeposits;
lblBalBF.Text = "10.00";
}
reader.Close();
transactions.DataSource = LoansDataTable;
transactions.DataBind();

dbconnect.Close();

}
void showAlert(string type, string message)
{
    //Get Data container elements from Mastpage and prepare to create an alert or
notification
    HtmlGenericControl btndismiss = new HtmlGenericControl("button");
    Placeholder btnAlias = (Placeholder)Master.FindControl("btnPlaceHolder");
    Placeholder btnContentAlias =
(Placeholder)Master.FindControl("btnContentPlaceHolder");
    HtmlControl alertContainerDiv = (HtmlControl)Master.FindControl("alertMsg");
    Label lblAlertMsg = (Label)Master.FindControl("lblalert");

    if (type == "success")
    {
        message += " &nbsp;&nbsp;&nbsp; \u2714";
    }
    else if (type == "danger")

```



```

    {
        message += " &nbsp;&nbsp;&nbsp; \u2297";
    }
    else
    {
        //warning
        message += " &nbsp;&nbsp;&nbsp; \u26A0";
    }
    lblAlertMsg.Text = message;
}
//funtion to check if the data exists
bool preventDuplicateData(string dbscript)
{
    //connection string
    using (dbconnect3)
    {
        bool temp = false;
        MySqlCommand check_command = new MySqlCommand(dbscript, dbconnect3);
        MySqlDataReader read_rd;
        if (dbconnect3.State == ConnectionState.Open)
            dbconnect3.Close();
        dbconnect3.Open();
        read_rd = check_command.ExecuteReader();
        if (read_rd.HasRows)
        {
            temp = true;
        }
        read_rd.Close();
        dbconnect3.Close();
        return temp;
    }
}
//function for sending information to database
void SendToDatabase(string dbquery)
{
    using (dbconnect)
    {
        if (dbconnect.State == ConnectionState.Open)
            dbconnect.Close();
        dbconnect.Open();
        var queryHandler = new MySqlCommand(dbquery, dbconnect);
        queryHandler.ExecuteNonQuery();
        dbconnect.Close();
        //SEND ALERT AFTER COMPLETION

        //Refressh the services list by calling showallservices again
    }
}
long SendToDatabaseReturnHandle(string dbquery)
{
    long handle = 0;
    using (dbconnect)
    {
        if (dbconnect.State == ConnectionState.Open)
            dbconnect.Close();
        dbconnect.Open();
        var queryHandler = new MySqlCommand(dbquery, dbconnect);
    }
}

```

```

        queryHandler.ExecuteNonQuery();
        handle = queryHandler.LastInsertedId;
        dbconnect.Close();
        //SEND ALERT AFTER COMPLETION

        //Refresh the services list by calling showallservices again
    }
    return handle;
}

protected void statementSelector_SelectedIndexChanged(object sender, EventArgs e)
{
    if (statementSelector.SelectedItem.Value == "full")
    {
        loadTransactions("full");
    }
    else if (statementSelector.SelectedItem.Value == "mini")
    {
        loadTransactions("mini");
    }
    else
    {
        //do nothing
    }
}

```

Funds Transfer

```

MySQLConnection dbconnect = new
MySQLConnection(ConfigurationManager.ConnectionStrings["ZBDigiC"].ConnectionString);
SMSserver objSMS = new SMSserver();

protected void Page_Load(object sender, EventArgs e)
{
    if (!IsPostBack)
    {
        loadCustomerDetails();
        LoadAllTransfers();
    }
}

void loadCustomerDetails()
{
    string accountnumber = User.Identity.Name;
    string dbquery = "SELECT `acc_balance`, `acc_type` FROM `tbl_accounts` WHERE
`account_num`='" + accountnumber + "'";
    using (dbconnect)
    {
        dbconnect.Open();
        var query = new MySqlCommand(dbquery, dbconnect);
        dbconnect.Close();

        MySqlDataReader reader;
        dbconnect.Open();//open new session to read data
        reader = query.ExecuteReader();

        //Loop This Data Below and insert it as rows
    }
}

```

```

        if (reader.HasRows)
        {
            while (reader.Read())
            {
                //reader.Read();
                lblAccBal.Text = reader.GetString(0);
                lblAccType.Text = reader.GetString(1) + " Account";
            }
            //End Loop
        }
        reader.Close();
        dbconnect.Close();
    }
    lblAccountNumber.Text = accountnumber;
}

//function to display an alert or notification information
void LoadAllTransfers()
{
    string accountnumber = User.Identity.Name;
    string dbquery = "SELECT * FROM `tbl_payments` WHERE `payer`='" + accountnumber +
";";
    using (dbconnect)
    {
        dbconnect.Open();
        var query = new MySqlCommand(dbquery, dbconnect);
        dbconnect.Close();

        MySqlDataReader reader;
        dbconnect.Open();//open new session to read data
        reader = query.ExecuteReader();

        DataSet ATM_OrdersssDataSet = new DataSet();
        DataTable ATM_OrdersssDataTable = ATM_OrdersssDataSet.Tables.Add("ItemsData");
        ATM_OrdersssDataTable.Columns.Add("paymetid");
        ATM_OrdersssDataTable.Columns.Add("service_name");
        //ATM_OrdersssDataTable.Columns.Add("service_acc_no");
        ATM_OrdersssDataTable.Columns.Add("service_amnt");
        ATM_OrdersssDataTable.Columns.Add("service_date");
        DataRow ItemsRow;
        string paymentType = "";
        //Loop This Data Below and insert it as rows
        if (reader.HasRows)
        {
            while (reader.Read())
            {

                ItemsRow = ATM_OrdersssDataTable.NewRow();
                ItemsRow["paymetid"] = reader.GetString(0);
                ItemsRow["service_name"] = reader.GetString(1);
                ItemsRow["service_amnt"] = reader.GetString(3);
                ItemsRow["service_date"] = reader.GetString(4);
                //ItemsRow["service_acc_no"] = reader.GetString(2);

                ATM_OrdersssDataTable.Rows.Add(ItemsRow);
            }
        }
    }
}

```

```

        //End Loop
    }
    reader.Close();
    dbconnect.Close();
    payment.DataSource = ATM_OrderssDataTable;
    payment.DataBind();
}

dbquery = "SELECT `rate` FROM `tbl_currency` WHERE `c_name`='Rand'; ";
using (dbconnect)
{
    dbconnect.Open();
    var query = new MySqlCommand(dbquery, dbconnect);
    dbconnect.Close();

    MySqlDataReader reader;
    dbconnect.Open();//open new session to read data
    reader = query.ExecuteReader();

    //Loop This Data Below and insert it as rows
    if (reader.HasRows)
    {
        while (reader.Read())
        {
            randtxtbx.Text = reader.GetString(0);
        }
    }
    reader.Close();
    dbconnect.Close();
}

dbquery = "SELECT `rate` FROM `tbl_currency` WHERE `c_name`='Pula'; ";
using (dbconnect)
{
    dbconnect.Open();
    var query = new MySqlCommand(dbquery, dbconnect);
    dbconnect.Close();

    MySqlDataReader reader;
    dbconnect.Open();//open new session to read data
    reader = query.ExecuteReader();
    if (reader.HasRows)
    {
        while (reader.Read())
        {
            pulatxtbx.Text = reader.GetString(0);
        }
    }
    reader.Close();
    dbconnect.Close();
}

protected void btnMakePayment_Click(object sender, EventArgs e)
{
    string accNumber = lblAccountNumber.Text;
    string CurrentBalance = lblAccBal.Text;
    double Balance = 0;
    string TransferType = transferTypeList.SelectedItem.Value;

```

```

//string ServiceToPayID = servicesDrpDwn.SelectedItem.Value;
string PaymentIdentifier = tbxPaymentID.Text.Trim();
string Bank = banklist.SelectedItem.Text;
//string PaymentType = drpDwnPType.SelectedItem.Text;
//string PaymentTypeValue = drpDwnPType.SelectedItem.Value;
string AmountToPay = tbxPaymentAmount.Text;
double creditAmount = 0;
//string paymentCycle = tbxPaymentCycle.Text;

//CONVERT ALL STRING AMOUNTS TO DIGITS FOR MATHEMATICAL MANIPULATION
double.TryParse(CurrentBalance, out Balance);
double.TryParse(AmountToPay, out creditAmount);
double AccountMin = 10;
if (creditAmount < 10 || creditAmount > 3000)
{
    showAlert("danger", "minimum transfer is $10.00 and maximum allowed is
$3000.00 for transfers. Please adjust your transfer amounts");
}
else
{

double bufferBalance = Balance - creditAmount;
//check if the amount remaining after subtracting the amount to be paid is
greater than the account minimum balance
if (bufferBalance > AccountMin && currencyToUse.SelectedItem.Value != "select")
{
    if (TransferType == "interbank")
    {
        if (Bank != "select")
        {
            string moneyInfo = "";
            if (currencyToUse.SelectedItem.Value == "rands")
            {
                moneyInfo = "Transferred as Rands. Total transferred is "
+randtxtbx.Text + " " + currencyToUse.SelectedItem.Text;
            }
            else if (currencyToUse.SelectedItem.Value == "pula")
            {
                moneyInfo = "Transferred as Pula. Total transferred is " +
pulatxtbx.Text + " " + currencyToUse.SelectedItem.Text;
            }
            else
            {
                moneyInfo = "Transferred as USD";
            }
            //save this in the transaction buffer
            string dbquery = "INSERT INTO `tbl_payments`(`recipient`, `payer`,
`amount`, `payer_id`) VALUES ('" + PaymentIdentifier + "', '" + accNumber + "', '" +
AmountToPay + "', '" + PaymentIdentifier + "')";
            lblToValidate.Text = SendToDatabaseReturnHandle(dbquery).ToString();

            //request user confirmation
            panelConfirmPayment.Visible = true;
            panelDefault.Visible = false;
            btnMakePayment.Visible = false;
            dbquery = "INSERT INTO `tbl_transactionbuffer`(`acc_number`,
`payment_id`, `state`, `state_description`, `trans_description`, `transType`, `cycle`)";

```

```

                dbquery += " VALUES ('" + accNumber + "','" + lblToValidate.Text +
"', 'pending', 'Client initiated but has not authorized', 'Interbank transfer to " + Bank +
". Recipient Account number is " + PaymentIdentifer + ". " + moneyInfo +
"', 'transfer', '0')";
                SendToDatabase(dbquery);
            }
            else
            {
                showAlert("danger", "You have not selected a valid bank to transfer
to, please do so to complete transfer ");
            }
        }
        else if (TransferType == "intrabank")
        {
            string moneyInfo = "";
            if (currencyToUse.SelectedItem.Value == "rands")
            {
                moneyInfo = "Transferred as Rands. Total transferred is " +
randtxtbx.Text + " " + currencyToUse.SelectedItem.Text;
            }
            else if (currencyToUse.SelectedItem.Value == "pula")
            {
                moneyInfo = "Trasferered as Pula. Total transferred is " +
pulatxtbx.Text + " " + currencyToUse.SelectedItem.Text;
            }
            else
            {
                moneyInfo = "Transferred as USD";
            }

            if (PaymentIdentifer != User.Identity.Name)
            {
                //check if the account number exists
                if (preventDuplicateData("SELECT * FROM `tbl_accounts` WHERE
`account_num`='" + PaymentIdentifer + "';") )
                {
                    dbquery = "INSERT INTO `tbl_transactionbuffer`(`acc_number`,
`payment_id`, `state`, `state_description`, `trans_description`, `transType`, `cycle`)" ;
                    dbquery += " VALUES ('" + accNumber + "','" + lblToValidate.Text
+ "','" + 'pending', 'Client initiated but has not authorized', 'Internal bank transfer.
Recipient Account number is " + PaymentIdentifer + ". " + moneyInfo +
"', 'transfer', '0')";
                    SendToDatabase(dbquery);
                }
                else
                {
                    showAlert("danger", "Transfer failed ! Account number you entered
does not exist. Please double check the account number and try again.");
                }
            }
            else
            {
                showAlert("danger", "Transfer to own account is not allowed !!!");
            }
        }
        else
        {

```

```

        showAlert("danger", "Please select a valid transfer type. Either internal
or interbank then try again");
    }
}
else
{
    showAlert("danger", "Insufficient Funds to process this payment or no
transfer currency selected");
}
}
}

```

```

protected void btnConfirmPayment_Click(object sender, EventArgs e)
{
    string accNumber = lblAccountNumber.Text;
    string CurrentBalance = lblAccBal.Text;
    double Balance = 0;
    string TransferType = transferTypeList.SelectedItem.Text;
    //string ServiceToPayID = servicesDrpDwn.SelectedItem.Value;
    string PaymentIdentifer = tbxPaymentID.Text.Trim(); ;
    //string PaymentType = drpDwnPType.SelectedItem.Value;
    string AmountToPay = tbxPaymentAmount.Text;
    double creditAmount = 0;
    double.TryParse(CurrentBalance, out Balance);
    double.TryParse(AmountToPay, out creditAmount);
    double AccountMin = 10;

    double bufferBalance = Balance - creditAmount;
    string dbquery = "UPDATE `tbl_transactionbuffer` SET `state`='complete',
`state_description`='Client Authorized' WHERE `acc_number`='" + accNumber + "' AND
`payment_id`='" + lblToValidate.Text + "'; ";
    SendToDatabase(dbquery);
    dbquery = "UPDATE `tbl_accounts` SET `acc_balance`='" +
bufferBalance.ToString("0.00") + "' WHERE `account_num`='" + accNumber + "';";
    SendToDatabase(dbquery);
    string cbal = "";
    if (transferTypeList.SelectedItem.Value == "intrabank")
    {
        //getting Rand CrossRate conversion
        dbquery = "SELECT `acc_balance` FROM `tbl_accounts` WHERE
`account_num`='" + PaymentIdentifer + "'; ";
        using (dbconnect)
        {
            dbconnect.Open();
            var query = new MySqlCommand(dbquery, dbconnect);
            dbconnect.Close();

            MySqlDataReader reader;
            dbconnect.Open();//open new session to read data
            reader = query.ExecuteReader();
            if (reader.HasRows)
            {
                while (reader.Read())
                {
                    cbal = reader.GetString(0);
                }
            }
            reader.Close();
        }
    }
}

```

```

        dbconnect.Close();
    }

    double.TryParse(cbal, out Balance);
    bufferBalance = Balance + creditAmount;
    dbquery = "UPDATE `tbl_accounts` SET `acc_balance`='" +
bufferBalance.ToString("0.00") + "' WHERE `account_num`='" + PaymentIdentifer + "'";
    SendToDatabase(dbquery);
    //send sms to receipient
    string smsMsg = "An amount of $ " + creditAmount.ToString("0.00") + " has
been transferred into your account. New balance is $" + bufferBalance.ToString("0.00");
    string phone = "";
    dbquery = "SELECT `phone` FROM `tbl_users` WHERE `account_num`='" +
PaymentIdentifer + "'";
    using (dbconnect)
    {
        dbconnect.Open();
        var query = new MySqlCommand(dbquery, dbconnect);
        dbconnect.Close();

        MySqlDataReader reader;
        dbconnect.Open();//open new session to read data
        reader = query.ExecuteReader();

        //Loop This Data Below and insert it as rows
        if (reader.HasRows)
        {
            while (reader.Read())
            {
                phone = reader.GetString(0).Trim();
            }
        }
        reader.Close();
        dbconnect.Close();
    }
    if (phone == "" || phone == null)
    {
        showAlert("warning", "Transfer suuccessful. No phone number detected for
this account, no sms was sent;");
    }
    else{

        Regex numberValidator = new Regex("[+][0-9]{12,15}$");
        if (numberValidator.IsMatch(phone))
        {
            //remove white spaces first
            phone.Trim();
            objSMS.SendSms(smsMsg, phone);
        }
        else
        {
            string cleanedNumber = "+" + phone;
            objSMS.SendSms(smsMsg, cleanedNumber);
        }
        showAlert("success", "Transfer Confirmed and SMS notification sent to
recipient");
    }
}

```



```

    }
}

panelConfirmPayment.Visible = false;
btnMakePayment.Visible = true;
panelDefault.Visible = true;
}

protected void transferTypeList_SelectedIndexChanged(object sender, EventArgs e)
{
    if (transferTypeList.SelectedItem.Value == "interbank")
    {
        banklist.Visible = true;
        bankrow.Visible = true;
    }
    else
    {
        banklist.Visible = false;
        bankrow.Visible = false;
    }
}

// ----- function ----- //
//dba and alert functions
void showAlert(string type, string message)
{
    //Get Data container elements from Mastpage and prepare to create an alert or
notification
    HtmlGenericControl btndismiss = new HtmlGenericControl("button");
    Placeholder btnAlias = (Placeholder)Master.FindControl("btnPlaceHolder");
    Placeholder btnContentAlias =
(Placeholder)Master.FindControl("btnContentPlaceHolder");
    HtmlControl alertContainerDiv = (HtmlControl)Master.FindControl("alertMsg");
    Label lblAlertMsg = (Label)Master.FindControl("lblalert");

    btndismiss.ID = "dismissthis";
    btndismiss.Attributes.Add("type", "button");
    btndismiss.Attributes.Add("class", "close");
    btndismiss.Attributes.Add("data-dismiss", "alert");
    btndismiss.Attributes.Add("aria-label", "Close");
    btndismiss.InnerText = "x";
    //creating button content
    HtmlGenericControl btncontent = new HtmlGenericControl("span");

}
return handle;
}
}

```