ABSTRACT

This research is aimed at development of a Service Procurement Decision Support System that is meant to assist the ICT department in procurement decision making processes. The researcher had proposed the idea of introducing a new system after discovering problems that were being experienced as a result of manual processes, some of the problems include; delays in procurement decision making, corruption as some procurement members can choose their relatives or friends and also lack of consistency in procurement decision making. To identify these problems the researcher had used various data finding methodologies which includes questionnaires, interviews and observations. After discovery of the weaknesses of the system which was in place the researcher then came up with a solution in form of an automated procurement decision support system. The system allows the procurement section to quickly come up with a procurement decision without holding any meeting as the system give the decision makers the capabilities to login into the system and access the decision that would have been automatically generated by the system basing on the data that would have been captured for the service providers. Unified Modelling Language was used to carry out the in-depth analysis and also the design of the system. Objectives that had been stated were used as the guideline to the development of the project. These objectives were altered a bit due to the changing requirements of the system users and also the equipment available. The system can also be improved based on the system modules that needs to be changed and also to be in line with technological advancements.

DECLARATION

I, ABEL ZIMUSI, here declare that l am the sole author of this dissertation. I authorize Midlands State University to lend this dissertation to other institutions or individuals for the purpose of scholarly research.

Signature…… Date…….

APPROVAL

This dissertation entitled **"ZIMRA SERVICE PROCUREMENT DECISION SUPPORT SYSTEM"** by **ABEL ZIMUSI** meets the regulations governing the award of the degree of BSC INFORMATION SYSTEMS HONOURS DEGREE of the Midlands State University, and is approved for its contribution to knowledge and literal presentation.

Supervisor ……..

Date ……..

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I would like to acknowledge the Computer Science and Information System Department for allowing me to carry out this research. I would also want to acknowledge the support and assistance they gave me at the time I was doing the research. I would also want to thank my supervisor Mr. S. Furusa for the great unforgettable assistance he made towards the accomplishment of this research. I would also want the thank the Midlands State University (MSU) at large for providing me with this learning environment that is comfortable and well acquitted with learning resources that helped me in carrying me the research. Special thanks goes to Mr. C. Goredema for the brilliant system development ideas he gave me at the time I was attached at ZIMRA. I would also want to thank my brother Ngonidzashe Zimusi and the Zimusi family at large for the great support they offered, not forgetting Shingairai for the exceptional help, motivation and support she made towards my studies. Not Last but not least would like to thank the God Almighty for giving me with the capability to carry out the project, if it was not by His hand I could have done nothing.

DEDICATION

I would like to dedicate all my work to my lovey brother Ngonidzashe Zimusi for his great support, being my source of inspiration and also for doing everything necessary for me to accomplish my studies. Thank you very much for all the support and God bless and be with you in all your endeavors.

TABLE OF CONTENTS

LIST OF ACRONYMS

- DFD Data Flow Diagram
- ERD Entity Relationship Diagram
- EERD Enhanced Entity Relationship Diagram
- GUI Graphic User Interface
- LAN Local Area Network
- WAN Wide Area Network
- PBP Pay Back Period
- SQL Structured Query Language
- ROI Return On Investment
- NPV Net Present Value
- CBA Cost Benefit Analysis
- IT Information Technology
- HTML Hyper Text Markup Language
- GSM Global System for Mobile Communications
- PTC Post and Telecommunications
- SMS Short Messaging Services
- SPB State Procurement Board
- HOD Head Of Department
- ICT Information Communication Technology
- SDLC System Development Life Cycle
- ZIMRA Zimbabwe Revenue Authority
- ICT Information Communication Technology

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

In today's world IT has become a significant instrument for competitiveness and success of every organization. It is not only commercial businesses that have been affected by this transition but even parastatal organizations and other non-profit making organization. It is one of Zimbabwe Revenue Authority's policies to try by all means to computerize almost all operations. It is with this view that the writer of this thesis was challenged to carry out a research into ZIMRA's system so as to find areas that are still trailing back in technology and the researcher discovered that the ICT Service Procurement Decision Making Process is still manual and all the processes are being carried out in the traditional paper and pen way, and like-wise the manual processes related problems are being suffered by the stakeholders of the Service Procurement Decision Making Process. In this thesis the researcher will give a detailed analysis of the current system and the advantages of introducing a new technology based decision making system.

1.2 BACKGROUND STUDY

In ZIMRA the ICT service procurement decision making system is manual, and this attracted the writer of this research to take a closer look and research into limitations and problems that might be experienced as a result of manual processes in procurement decision making. The researcher had managed identify weaknesses and problems that are being experienced as a result of manual operation in service procurement processes and service providers' management. It is the resulting problems that assisted him to come up with an IT based solution that will automate the procurement decision processes.

1.3 COMPANY BACKGROUND

ZIMRA is a parastatal organization that specializes in revenue collection from taxes and customs duty. ZIMRA was established on the 19th of January 2001 following the Revenue Authority act of 2000. ZIMRA started its mandate on the 1st of September 2001 under the leadership of Mr. T.G Pasi. The revenue collected by ZIMRA include income tax, customs duty, VAT and other income taxes. In delivering those services ZIMRA engages various organizations and stakeholders to facilitate and fulfil its mandate. ZIMRA also use information systems in the automation of the revenue collection processes, and the systems include SAP for taxes and ASYCUDA for customs revenue processes. ZIMRA also engages service providers such as Liquid, Telone and AFRICOM in the provision of VSAT and it also engage companies like Afrosoft and THTF in the provision

of servers to supplement its own servers and also Nashua and Xerox companies in the provision of printing services.

1.4 ORGANOGRAM

Below is an organisational structure for Zimbabwe Revenue Authority:

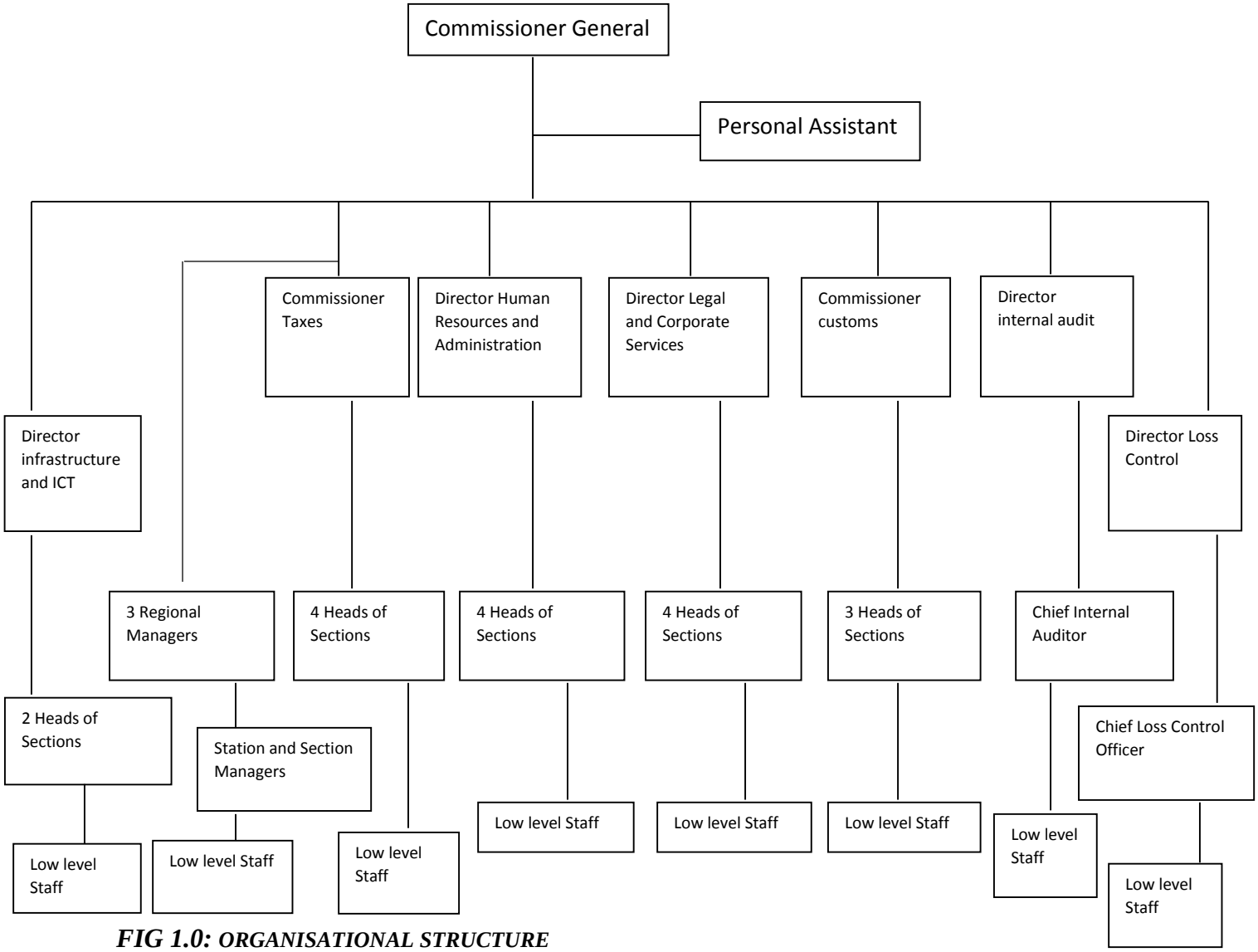

FIG 1.0: ***ORGANISATIONAL STRUCTURE***

*1.4.1 **VISION***

A beacon of excellence in the provision of fiscal services and facilitation of trade and travel.

*1.4.2 **MISSION***

To promote economic development through efficient revenue generation and trade facilitation. This is achieved by:

- developing competent and motivated staff,
- using environmentally sustainable processes, and
- Engaging with the global community in a socially responsible way.

1.5 PROBLEM DEFINITION

The current service providers' evaluation, selection and recommendation is based on manual processes which may be inconsistent or unfair as it base on human judgement. This result in selection of poor service providers when the need come. Some of the problems noted include:

- There is no automation in procurement decision making processes, the evaluation of the bidders is based on some of the written documents of which some may not be available and also it is difficult and time consuming to search for documents of every company and come up with decision.
- On the current setup there is no formalized automated ways for rating and assessing the performance of the service providers
- The is no system in place to track time from error reporting to response from the client and time when the error is fixed as some organization may take long time to respond while others respond quickly.
- There is no system in place to notify management on the performance of the service providers and also to keep record about the performance of the services providers.
- There is no database in place to keep track and record all the external clients' performance and capabilities as well as their coverage.
- There is use of manual processes to accommodate new potential suppliers and also assess them against the ones who are already working with the organization.
- No reports are being produced on the performance of current service providers.

1.6 AIM OF THE RESEARCH

The major aim of this research is to come up with a system that will assist ZIMRA in service procurement decision making, manage and asses its external service providers.

1.6.1 OBJECTIVES OF THE RESEARCH

The objectives of the study are to develop a system that:-

- To develop a decision support system that assist in procurement decision making processes by recommending suppliers on the basis of on supplier history and provider score card.
- To come up with a system that allows service providers to check the status of their tender bids.
- To come up with a system that provide a score card for supplier assessment after every assigned duty has been completed.
- To come up with a system that enables the ICT service procurement team to give feedback to tender bids in form of status that is (pending, accepted or rejected).
- To develop a system that will enable the administrator to trigger an email notification to companies that would have had won the tender.

1.6.2 LIMITATIONS OF THE STUDY

- There may be network problems
- It may take time to compile data.
- The project requires adequate finance
- Company restrictions and protocols may limit the amount of information that can be acquired.

1.7 HYPOTHESIS

1 MySQL – robust and scalable relational database.

2 PHP – hypertext pre-processor (a server side scripting language)

3 VB.NET 2010 – a flexible, strong and user friendly programming language

1.6 JUSTIFICATION AND RATIONALE OF THE STUDY

The proposed system will solve all service provider assessment problems that had been mentioned above in the following ways:

- The system will be able to have a database that is intact and that can be used for future use

- The system will produce clear and unique reports which allows clear and simplified analysis and assessment of the various service providers.
- The proposed system will simplify the services procurement process and automate the assessment and recommendations of the procurement process
- The proposed study seeks to reduce the workload and the use of paper work.

1.7 **CONCLUSION**

This chapter was mainly focusing on the analysis of the problems of the current system, objectives of the proposed system and its justification, the next chapter will be focusing on planning and feasibility study of the proposed system.

CHAPTER 2: PLANNING PHASE

2.1 INTRODUCTION

The planning phase will give an assessment of whether the building of ZIMRA SERVICE PROCUREMENT DECISION SUPPORT SYSTEM is economically, technically or operationally feasible or not. This will involve analysis of the benefits and costs that the system might bring. This will help to determine give a clear business value of the system and determine whether it worth to continue building the system or not.

2.1 WHY BUILD THE SYSTEM

Since the world has turned digital and the use of computers and internet is rising every day, it has become a priority of every organization to computerize their operations so as to improve efficiency and automate manual operations. This is one of the reason why ZIMRA Service procurement decision support System has been proposed so as to automate and simplify the assessment of service providers and also give automated decisions when there is a need for selection of a service provider. The following are some of the reasons for building the system:

- The system will increase the speed in procurement decision making processes to overcome some of the delays that where being experienced as a result of the old manual system.
- The system will provide a platform for recording the performance scores basing on the performance of a service provider so as to make sure that records are kept for service providers unlike the old system which does not keep any performance records.
- The System will reduce corruption in choice of service providers when a need arise as it will automatically choose the best service provider basing on provided data.
- The system will reduce manual estimation of potential benefits form service providers.
- The system will enable records-keeping for each and every service provider for future use in case there arise a need for the performance results.
- The system will enhance quicker and automated generation of service providers' performance reports.

So the building of the newly proposed system is very crucial and necessary as it will improve the ICT service procurement decision support system processes.

2.2 BUSINESS VALUE

This refers to the advantages that the organization will get through the use of the system that is to be developed. Some of the benefits which the system will bring are as follows:

- Increased efficiency in procurement decision making as the system will enable automation of selection of the best service provider with evidence justifying the reason behind the recommendation.
- Time is one of the most critical aspects in the business world, so the use of the proposed system will be very important as it will reduce the time required to make procurement decisions.
- The proposed system will reduce communication cost as bidders will get their feedback through automated emails rather than calling all of them.
- Records of all the service providers will be kept which will make it easy for future selection and decision making basing on what they would have done in the past.
- The system will enable making of traceable decisions which will reduce the chances of corruption related expenses as it will ensure that there is transparent in procurement decision making.

2.2.1 BUSINESS NEEDS

- The organization expects a system with a database that allows back-up and recovery just in case if server crushes it should enable recovery of the lost data.
- The organization will also need a system that will produce periodic and aperiodic reports that will assist management in decision making and strategic planning.
- The organization will also want a system that will enhance its relationship with its external service providers through transparency selection and traceable decisions.
- It is also one of the organization's need to have a system that will keep record of all the decisions that it would have made for future analysis.

2.3 FEASIBILITY STUDY ANALYSIS

Feasibility study refers to the process of measuring the potential benefits that the organization may get from the development and implementation of the proposed system and the benefits could be economic, social or technical (Norman, 1999). The outcome of the feasibility study will determine if it is necessary to proceed to the physical design phase of the system. One of the purpose of the

feasibility study is to determine the best solution to the identified problems after a thorough analysis of all the possible solutions.

2.3.1 TECHNICAL FEASIBILITY

This refers to the process of measuring currently available technical expertise as compared to the technical expertise that the proposed system will require (Norman, 1999). This will determine if the organization have the capacity to produce the system basing on the available expertise. The technical requirements of the project will be compared to the available technical expertise within ZIMRA. If the available technical expertise can support the minimum requirements of the project, then the project is considered technically feasible.

2.3.1.1 TECHNICAL EXPERTISE

Basing on the available staff ZIMRA has the capacity to develop and implement the system as it has .NET and C# certified programmers who can develop both windows applications and web based applications which the system require. On the database maintenance and administration part ZIMRA had a team of four database administrator who have certifications in various database which include MySQL which is going to be used in the proposed system.

2.3.1.2 HARDWARE REQUIREMENTS

In this section comparison between available hardware against what is required for successful development and implementation of the system.

ITEM	WHAT IS RECOMMENDED	WHAT IS AVAILABLE
CLIENT SIDE		
PCs	5	50
Computer Hard Drive Disk	Minimum of 10GB	From 350 to 500GB
CD ROM Disk Drive	Minimum 45X	50X
Server	4GB RAM,50HHD,2.5GHz	4GB ram, 500HDD,5 GHz
Printer	Any	Hp Laser jets and Xerox printers
Network cards	LAN 10/100	LAN 10/100
System memory	Minimum of 1GB	4GB
SERVER SIDE		
Server	4GB RAM,50HHD,2.5GHz	4GB ram, 500HDD,5 GHz

Table 2.1: HARDWARE REQUIREMENTS

The system is a client server. Clients will be accessing the system from the server through web browsers. So the system will be installed on to the server were clients will be accessing it from.

2.3.1.3 SOFTWARE REQUIREMENTS

In this section the researcher will compare the available software against the required software. A summary of the available software and the required software is shown in the following table.

ITEM	RECOMMENDED	AVAILABLE
Operating system	Windows 8 or 7	Windows 8.1
Visual Studio	At least VS 2008	VS 2012 ultimate
ASP.NET	Any	ASP.NET 4
SQL Server	Any	SQL server 2014

Table 2.2: SOFTWARE REQUIEREMENTS ANALYSYS

2.3.1.4 CONCLUSION

Since all the system's requirements can be met by the organization, this means that the system is technically feasible.

2.3.2 OPERATIONAL FEASIBILITY

Operational feasibility is the measure of effectiveness in terms of performance of the system in a given environment (Goel, 2010). The proposed system will be developed internally (in-house development) this means that there is going to be no issues since the developers of the system are the ones who are administering the currently available systems.

Stakeholders' acceptance analysis was also made and the researcher concluded that the stakeholders will accept the system since the users of the system will be involved in the development process whilst management will be indirectly involved since they will be consulted frequently. This means that the system will be use friendly since all the stakeholders will be familiar with the system. This means that the system will be implemented as early as development is completed since all the users will be aware of it and readily waiting to switch from current manual system.

OVERVIEW OF OPERATIONAL FEASIBILITY

From the observations that were made by the researcher the results clearly indicated that the system will integrate with the current system and operate without any problem.

2.3.3 SOCIAL FEASIBILITY

Rani (2004) referred to social feasibility as the impact that they system may have to its environment. This can also be considered as the benefits that the system may have to the society.

- Increase in government revenue base as a result of reduction in corruption levels in the issuing of tenders since the unnecessary service cost will be cut since contracts will be offered to the best most affordable service providers.
- Increased morale on the IT team since everyone will be happy to see his or her duties being simplified by automation of most manual works.
- Improved relations with the service providers since there will be day to day interactions with the service providers on the ground when performance assessments will be made.

- The system may result in some of the employees losing their jobs especially those who were working on the manual tasks in the tender evaluation and selection.
- Lack of physical interaction among employees may reduce morale as interactions enhances socialization.

OVERVIEW OF SOCIAL FEASIBILITY

Though the system has some short comings, however the researcher's social feasibility results clearly indicate that its merits overshadow its demerits there by making it socially feasible.

2.3.4 ECONOMIC FEASIBILITY

Williams (2006) put it that, economic feasibility refers to the measure of the potential benefits in terms of revenue against the potential expenses that the system will bring to the organization. This will involve assessing the benefits that ZIMRA Service Procurement Decision Support System will bring against the expenses that will result from its implementation and operation.

2.3.4.1 TANGIBLE BENEFITS

According to Norman, (1999), these are benefits that can be calculated and expressed in quantitative monetary form. Some of the tangible benefits are given below:

- **Automated responses** – The introduction of the system will ensure that all the request for procurement decisions will be given automatically after just a click.
- **Reduction in number of personnel required –** The introduction of the proposed system will result in reduction of man-power requirements since there will be no need for a team of experts to sit down to discuss about the best service provider since the system will do it automatically, this will result in reduction of salary and wages expenses.
- Increased time for other activities- Instead of going for procurement meetings that time may be invested onto other profitable activities.

The following table gives a summary of the potential benefits:

EXPECTED BENEFITS PER ANNUM	AMOUNT(USD)	TOTAL(USD)
Other Projects	$3 000	
Increasing employees' productivity	$1 000	
Reduction in poor decisions related cost	$2 000	
Total		$6 000

Table 2.3: TANGIBLE BENEFITS

2.3.4.2 INTANGIBLE BENEFITS

This refers to benefits that are not physical though they can be expressed in financial terms, (Norman, 1999). Some of the intangible benefits are listed below:

- **Improved employee detention** – This will result in elimination of the need of procurement meetings which waste a lot of time as employees will be debating on the best service provider before reaching consensus.
- **Improved procurement decisions** – The use of an automated decision support system will improve the quality of decisions that will be made.
- **Improved quality of service** – The system will facilitate constant monitoring and capturing of all work being done by the external service providers and that will improve the quality of services.

Below is a tabular expression of a summary of intangible benefits:

BENEFIT	**MONETORY VALUE(USD)**	**TOTAL(USD)**
Improved employees detention	$2 000.00	
Quality decisions	$2 000.00	
Improved quality of service	$1 500.00	
Total		$5 000.00

Table 2.4: INTANGIBLE BENEFITS

2.3.4.3 DEVELOPMENT COST

This refers to the total expenditure on development of the system. Since the system will be developed internally the development cost will be low. On top of that the development cost will be less since all the hardware and software required for the development are readily available. However there are some inevitable costs which the organization is going to incur which are listed below:

- **Training of staff -** This involve the process of ensuring that all the staff members who are going to use the system are equipped with the knowledge of the system.
- **Stationery –** This include bond paper and printer toner and cartridges that is going to be used for printing.
- **Salary for external staff -** The acquisition and installation of servers will require external staff which will be paid.

On the next page is a tabular expression of a summary of approximated costs that are going to be incurred:

DEVELOPMENT COST PER ANNUM	AMOUNT(USD)	TOTAL(USD)
Salary for external staff	$2 000	
Stationery	$100	
Installations	$150	
Training	$500	
Total		$2 750

Table 2.5: DEVELOPMENT COST

2.3.4.4 OPERATIONAL COST

These are costs that the organization will incur as the system becomes operational. Below is a list of some of the operational costs:

- **System maintenance** – This involve continuous improvements and updates on the system.
- **Renewal of license –** Software licenses for various software that are used within the organization has to be renewed to avoid violation of licenses terms and conditions.
- **Maintenance of hardware –** This involves servicing of computers, printers, network equipment and servers.
- **Stationery –** These are required in day to day operation of the business.
- **Salaries –** These are payments made for the services of employees who uses the system.
- **Backup –** System data need to be backed up to avoid data loss in case of emergence, this will help in data recovery and these back-ups operations requires tapes and hard drive disks.

Below is a table that shows a summary of some of the costs that will be encountered by the organization during the operation of the system.

OPERATION	**AMOUNT PER YEAR(USD)**	**TOTAL(USD)**
Maintenance of hardware	$500	
Maintenance of software	$600	
Licenses	$2000	
Stationery	$300	
Payment of Salaries	$1 500	
Backups	$200	
Total		$5 100

Table 2.6: OPERATIONAL COST

2.3.4.5 COST BENEFIT ANALYSIS

In this part of research section a breakdown of all the potential estimated benefits and expenses of the proposed system will be made. The table on the next page gives a summary of the potential benefits and costs

EXPECTED COSTS AND BENEFITS PER ANUM	**AMOUNT IN (USD)** **$**	**TOTAL(USD)** **$**
Tangible benefits	6 000	
Intangible benefits	5 000	

Total Benefits		**11 000.00**
Development Costs	2 750	
Operational Costs	5 100	
Total Costs		**(7 850)**
Net Profit		**3 150**

Table 2.7: COST BENEFIT ANALYSIS

The above table 2.7 clearly shows that the system's potential benefits are more that its potential costs, so this means that the system is economically feasible.

2.3.4.6 RETURN ON INVESTIMENT

The return on investment is calculated by dividing the potential benefits by the approximated investment costs and the outcome can be represented as a percentage or ratio.

FORMULA: ROI= **TOTAL BENEFITS-TOTAL COST * 100**

TOTAL COST

Below are the calculations for the proposed project:

ROI= $11 000-7850*100

$7 850

= $3 150 *100

$7 850

ROI = 40%

Basing on the outcome from the calculation of ROI of the project, it can be clearly depicted that the project is economically feasible since it has a good ROI of 40%.

2.3.4.7 ANALYSIS FOR FOUR YEARS

The following table gives a summary of approximated cost and benefits for a four year period:

EXPECTED COSTS AND BENEFITS PER YEAR	**FIRST YEAR**	**SECOND YEAR**	**THIRD YEAR**	**FOUTH YEAR**
Intangible benefits	$5 000.00	$5 500.00	$5 600.00	$5 000.00
Tangible benefits	$6 000.00	$6 000.00	$6 000.00	$5 000.00
Total	**$11 00.00**	**$11 500.00**	**$11 600.00**	**$10 000.00**
Operational cost	$5 100.00	$5 000.00	$5 100.00	$5 000.00
Development cost	$2 750.00	$2 750.00	$2 700.00	$2 700.00
Total	**($7 850.00)**	**($7 750.00)**	**($7 800.00)**	**$7 700.00**
Net Profit	**$3 150.00**	**$3 750.00**	**$3 800.00**	**$2 300.00**

Table 2.8: COST BENEFIT ANALYSIS

2.3.4.8 NET PRESENT VALUE (NPV)

This refers today's value of a future income (Sehlhorst, 2006).

Formula: NPV = **value in year t**

$$(1+r)^t$$

Where t is the year.

Assuming that 0.08 is the discount factor and initial is $7 000.00

Year 1 NPV = $\frac{2\ 951}{(1.08)^1}$

= $2732.41

Year 2 NPV = $\frac{3\ 750}{(1.08)^2}$

=$ 3 215.02

Year 3 NPV = $\frac{3\ 800}{(1.08)^3}$

=$3 016.56

Year 4 NPV = $\frac{2\ 300}{(1.08)^4}$

= $1 690.57

Given the yearly calculated incomes now we can calculate the total NPV for the projects

= $2732.41 + $3 215.02 + $3 016.56 + $1 690.57 + (-$7000.00)

=$ 10 654.56 - $ 7 000.00

TOTAL NPV = $ 3654.56

OVERVIEW OF ECONOMIC FEASIBILITY

Calculations from the economic feasibility shows that implementation of the project will result in more economic benefits than costs, that means implementation of the system is profitable.

2.4 RISK ANALYSIS

According to Duncan (1996) this refers to the process of identifying potential hazards and the possible ways of curbing them if they occur. Below is a list of some of the possible risks that may be encountered:

2.5.2 TECHNICAL RISK

- Changes in users' requirements – This comes as it is common with system users that the more they familiarize with the software the more the chances of them proposing changes before even the development is complete. To avoid this a thorough data collection about their expectations and requirements from the system should be made.
- Changes in technology – Since technology is dynamic, it may change during development or even after the system has been implemented and this may result in compatibility issues of the system. The only way by which this can be avoided is through buying of the latest available development packages and technologies.
- Users failing to accept the system due to fear of the unknown – It is common in most non – technical staff that they usually deny technological propositions as they may be afraid of failing to use the system. This may be avoided by user training and awareness operations to make sure that all the users are aware of how the system operates.

2.5.2 ECONOMIC RISKS

- Financial challenges may hit the development and implementation of the project since anything can happen in the economic world and this can result in problems in acquiring some of the items that need to be purchased. This can be prevented by making sure that everything is available in place before the development commence.

2.5.3 OTHER RISKS

- Employees' turnover may negatively affect the development of the project if it occurs since introduction of new minds will slow down the development process as the newly employed team will need to be introduced to the system and familiarize it before they can join the development process.
- Change in leadership - changes in leadership may also hinder the development process of the system as different people will always have different thoughts and perceptions towards the same system. So a new manager can be against the system or can adjust the budget and this will result in problems in the development and or implementation of the proposed system.

2.5 WORK PLAN DEVELOPMENT

For the development to be traceable there is need for a work plan to be put in place which will be showing steps to be taken and time frames for each and every activity. In the development of the proposed system the Traditional SDLC will be adopted because of its simplicity and clarity of its steps, which will increase the chances of success of the project.

In the development the following stages are to be followed:

1. System study
2. Feasibility study
3. Detailed System Study
4. System Analysis
5. System Design
6. Coding
7. Testing
8. Implementation
9. Maintenance

The following table shows the work plan that is going to be adopted in the development of the proposed system

PHASE	STARTING DATE	COMPLETION	TIME FRAME
Project Proposal	09/02/2015	16/02/2015	1 week
Introduction	16/02/2015	21/02/2015	1 week
Project Planning	22/02/2015	01/03/2015	1 week
System Analysis	02/03/2014	16/03/2015	2 weeks
System Design	17/03/2015	31/03/2013	2 week
Implementation	01/04/2015	08/04/2015	1 week
Maintenance	08/04/2015	Continuous	Continuous

Table 2.9: WORK PLAN TABLE

2.5.1 GANTT CHART

Gantt chart refers to a graphical representation of the project task. It helps in planning and reviewing project phases and schedules as well as what is supposed to be done and when (Rouse 2007).

Below is a Gantt chart showing phases to be carried out and their dates and respective time frames in weeks

WEEKS PHASES	1	2	3	4	5	6	7	8	9
Proposal									
Project Introduction									
Project Planning									
System Analysis									
System Design									
Implementation									
System Maintenance									
Documentation									

Table 2.10: GANTT CHART

2.6 CONCLUSION

Basing on the feasibility study and analysis it can be concluded that the proposed project pass the feasibility test and also the risk evaluation since all the identified risks has solutions to curb or avoid them. The next section will be mainly focusing on the analysis of the current system and data gathering techniques that will be carried out during the development process of the system.

CHAPTER 3: ANALYSIS

3.1 INTRODUCTION

The project has passed the feasibility test, so in this chapter the researcher will be focusing on the analysis phase of the system which include data analysis and functional analysis. This section will also highlight the procedures used to gather information and their rationale.

3.2 INFORMATION GATHERING METHODOLOGIES

Information gathering methodologies are the various ways that a researcher can adopt in order to get necessary information to carry out a project (Spingies, 2010). Techniques that will be used in data collection are: interviews, observations and questionnaires.

3.2.1 QUESTIONNAIRES

According to Powell and Steele (1997), these are set of questions written or printed and usually the have answers designed for data collection. Questionnaires were designed for gathering information about the current system, its strength and weaknesses as well as areas that need to be improved. These questionnaires were designed with a provision to give the responded the chance to give his or her suggestions on the system to be developed. Questionnaires were distributed to the stakeholders who will be directly or indirectly affected by the system. All stakeholders who were involved responded properly and the answered the questionnaires satisfactorily. Questionnaire results give a clear indication that stakeholders are not happy with the current system and are desperately waiting for the proposed system.

There are two types of questionnaires namely Closed-ended questionnaires and Open-ended questionnaires.

- Open-ended questionnaires – These are questionnaires that does not contain pre-coded answers. They give the responded room to express what he or she thinks (Powell and Steele 1996).
- Closed-ended questionnaires – These are questionnaires that contain pre-coded answers which the responded can select from (Powell and Steele, 1996). They have a specified answers on which the responded can select from. However for them to be meaningful, a survey has to be carried out first.

For this research the researcher had used open-ended which gives the responded room to express freely his or her perception and experience towards the current system.

3.2.1.3 MERITS OF QUESTIONNAIRES

- An email or phone call can be used in the data collection process.
- Comparisons can be made basing responses.
- There is anonymity in the expression of feelings and thoughts
- The identity of the responded is protected since he or she does not have to put his or her name on the questionnaire.

3.2.1.4 DEMERITS OF QUESTIONNAIRES

- Some stakeholders may fail to understand them, and this may result in wrong answers
- The number of respondents needs to be larger in order for them to be meaningful.
- Closed ended questionnaires limit the response that can be given by the respondent.

3.2.1.5 QUESTIONNAIRE FINDINGS

Only eight questionnaires were distributed to various stakeholders and all of them were answered and returned, that means the researcher get a 100% response from the stakeholders. Questionnaires were distributed as follows: 5 to management, 10 to ICT department and 15 to service providers to make them 25.

Below is a table that show a summary of questionnaire results.

Question	**Popular response**
Brief description of current procurement process	A procurement meeting is held and decisions are reached basing on human judgment and recommendations
How long does it take to come up with a procurement decision	It varies at times it may take more than one procurement meetings to reach consensus.
Are you happy with the current system?	No
What do you think about the proposed system?	It is a great idea that is going to bring a solution to our long time problem.
Comments and suggestions	We want the system to be implemented as soon as possible, we are eagerly waiting for it.

TABLE 3.1: QUESTIONNAIRE RESULTS

3.2.2 INTERVIEWS

Modwell (2007) refers to interviews as a technique of acquiring data through asking questions to a group of people or individuals who are stakeholders of the system. Interviews were carried out so as to find detailed comments and views about the proposed and current system. Selected

stakeholders at different levels where interviewed so as to give their views. Two different types of interviews exist namely structured and unstructured.

3.2.2.1 STRUCTURED INTERVIEWS

These are interviews with pre-suggested answers, on which the interviewee is to select his or her response from (Modell, 2007). These are usually suitable for short answers which usually require one word answer like yes or no and they do not give room for opinions.

3.2.2.2 UNSTRUCTURED INTERVIEWS

Modell (2007) describe unstructured interviews as interviews that do not contain structured predefined answers. They give the interviewee room to express his or her opinions and suggestion towards the subject in question.

In this research the researcher adopted the unstructured interviews so as to give stakeholders room to express their feelings and views, and also to avoid stakeholders' resistance to change.

3.2.2.3 MERITS OF INTERVIEWS

- They are very useful if there is need to acquire information about personal views, opinions and suggestions
- They allow the interviewer to ask more questions and acquire as much information as possible.
- They allows the interviewee to respond to questions directly without being influenced by others.
- Usually they are difficult to ignore since the interviewer goes in person.

3.2.2.4 DEMERITS OF INTERVIEWS

- They are usually time consuming.
- Interpretation of the interviewee's responses depend on the interviewer's understanding, this means that there is risk of wrong interpretations which may result in wrong conclusions.
- It may be expensive to conduct.

3.2.2.5 FINDINGS FROM THE INTERVIEWS

Five managers, five ICT personnel and fifteen external service providers were interviewed to give their views, comments and perceptions towards the current and the newly proposed system. All of these stakeholders indicated their positive perception and understanding of the need for a new

system as they were highlighting challenges that are being currently faced as a result of the current system which they indicated their thoughts and expectations that the new system will solve.
They indicated that the current system is inconsistent and also lack trust on the client side since they think that nepotism and corruption plays a vital role in decision making. Although this might not be always the case, however it is very difficult to prove them wrong, this is one of the problem that the system will solve since it will be an automated decision maker whose decision does not involve human comments but real facts and value.

3.2.3 OBSERVATIONS

Powell and Steele (1996) referred to observations refers to a process of acquiring information or data on the actual working environment paying attention to what people will be doing and how they will be doing it. In an effort to get as much data as possible the researcher also carried observation data collection process. In the process the researcher visited fifteen stakeholders of the system and recorded the findings from all the stakeholders' processes and ways of carrying out their duties. In the process the researcher came to understand that for a procurement process to reach final decision various stakeholders has to participate which are: management, procurement manager, procurement board and also the interested parties. This means that it might take about a week or more for the process to be completed. There is a lot of paperwork and manual calculations as well as human judgement in the process. This result in inconsistences, delays and poor decisions.

3.2.3.1 MERITS OF OBSERVATIONS

- They give the researcher room to get primary information about the system since the researcher will go to the working ground to collect information as it happen.
- The researcher is enabled to analyze findings
- There is little respondent participation as the researcher will be recording while the user caries his or her normal duties.

3.2.3.1 DEMERITS OF OBSERVATIONS

- They need a lot of time as the researcher has to visit a working site and spend some time recording his or her findings.
- Usually people tend to pretend as if everything is all right after discovering that they are being observed how they work and this may distort the observations finding.

3.2.3.2 FINDINGS FROM OBSERVATIONS

Through the observations that the researcher had carried out it comes out clear that for a procurement decision to be reached after a service need has been identified potential service providers has to be notified and they are required to make their bids then the procurement team meet to discuss and debate on the best possible provider basing on written records and bidders prices as well as services that they will be promising, then a decision is reached then they forward their suggestions to the manager who then approve before a contract is inked.

3.3 ANALYSIS OF THE EXISTING SYSTEM

Analysis of the existing system focus on how the current system operates, that is its inputs, outputs and processes and how they are executed. Currently the services procurement at ZIMRA start by the organization advertising its need for a new service provider to supply a certain service, then this will be followed by the applications (bids) from potential service providers then a sitting by the procurement board to decide on the best provider. This selection process base on written records that would have been recorded in the past if the organization had worked with ZIMRA before or judgement basing on the promised services and pricing if the organization or company is new to ZIMRA. After the team had agreed on a certain decision they forward their suggestion with justification statement attached to it for management approval, once the decision has been approved by the management, then the winner of the tender will be notified through a letter that will be send by the procurement board. The inputs of the system will be application details from service providers, the processes of the system include automated decision making, reports generation and also service providers rating and the outputs of the system includes automatically generated decisions, reports and also email notifications to selected service providers.

3.4 PROCESS ANALYSIS

Anderson (1999) describe process as the activity or activity sequence that when carried out transform inputs into output. This stage of process analysis will be showing all the processes that are currently carried out in service procurement before a final decision is reached. This section will also show the stages that are being followed in the procurement decision making process.

3.4.1 ACTIVITY DIAGRAM

According to Martin and Odell (1996) an activity diagram is a diagrammatic illustration of activities that take place concurrently and or sequentially which altogether produce a final product.

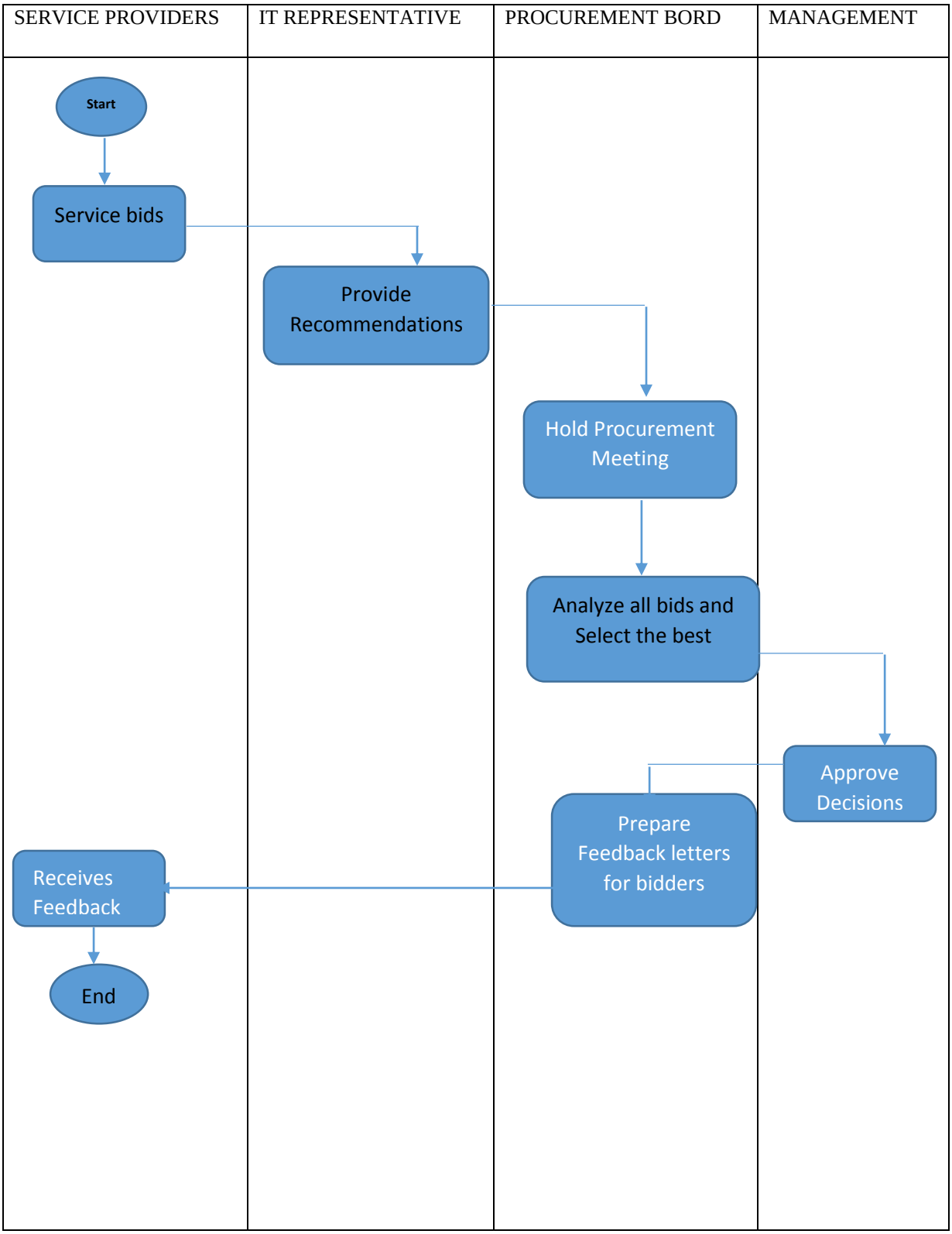

Fig 3.1: ACTIVITY DIAGRAM FOR THE EXISTING SYSTEM

3.5 DATA ANALYSIS

In the data analysis section there will be illustration of how the data is currently flowing in the current system. To show the flow of data the researcher will use a context diagram and a data flow diagram respectively.

3.5.1 CONTEXT DIAGRAM

Jordan (2011) described a context diagram as a diagrammatic expression of a system as the main process with functionality as entities.

The following context diagram represents the current system at the center with four entities.

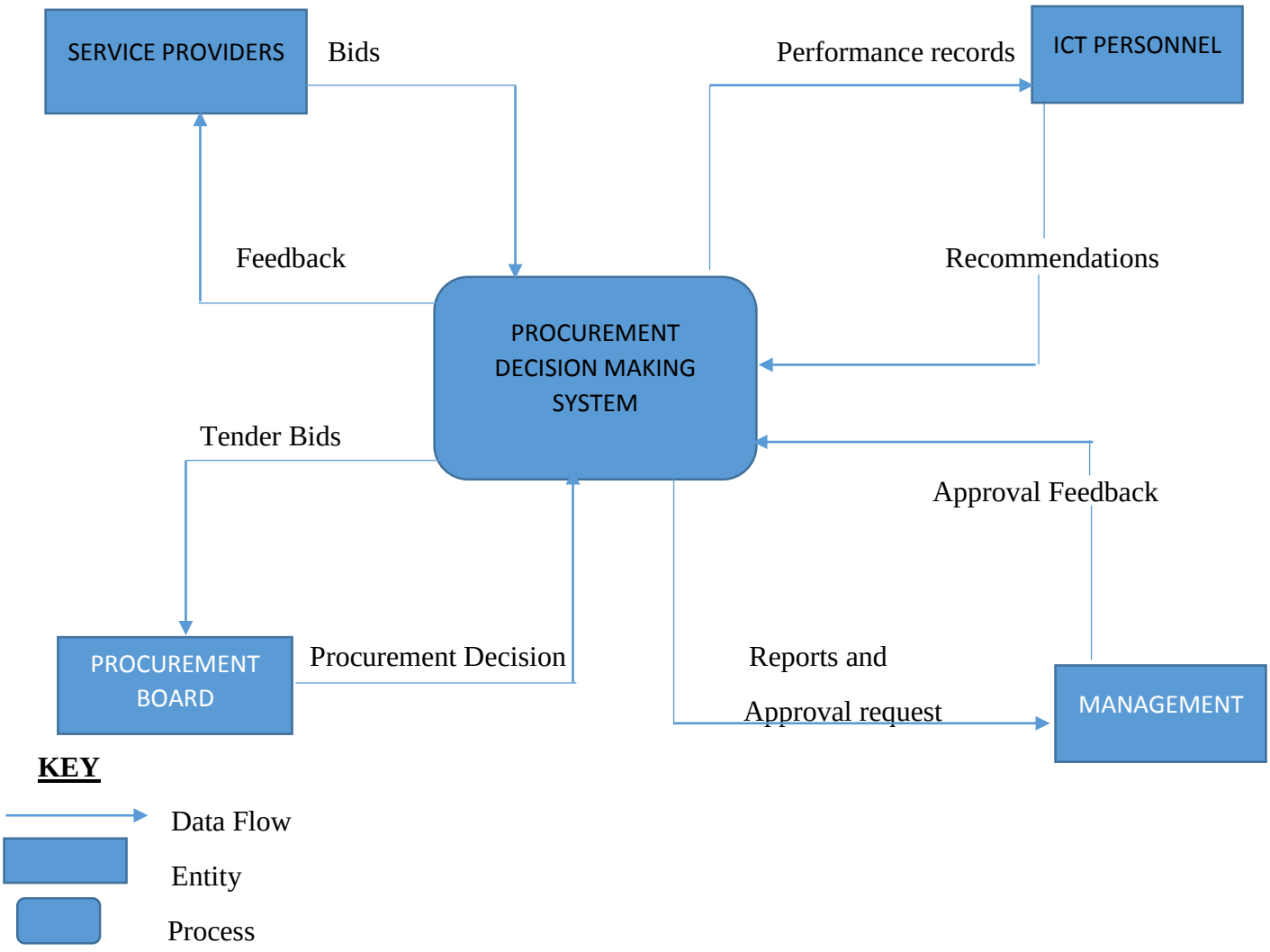

Fig 3.2: CURRENT SYSTEM CONTEXT DIAGRAM

3.5.2 DATA FLOW DIAGRAM

Ambler (2004) describes a data flow as a diagrammatic representation of the flow of data and processes which also indicate where the data is stored and the process that retrieves it from the data store. A data flow diagram also show the type of data that is stored in each data store.

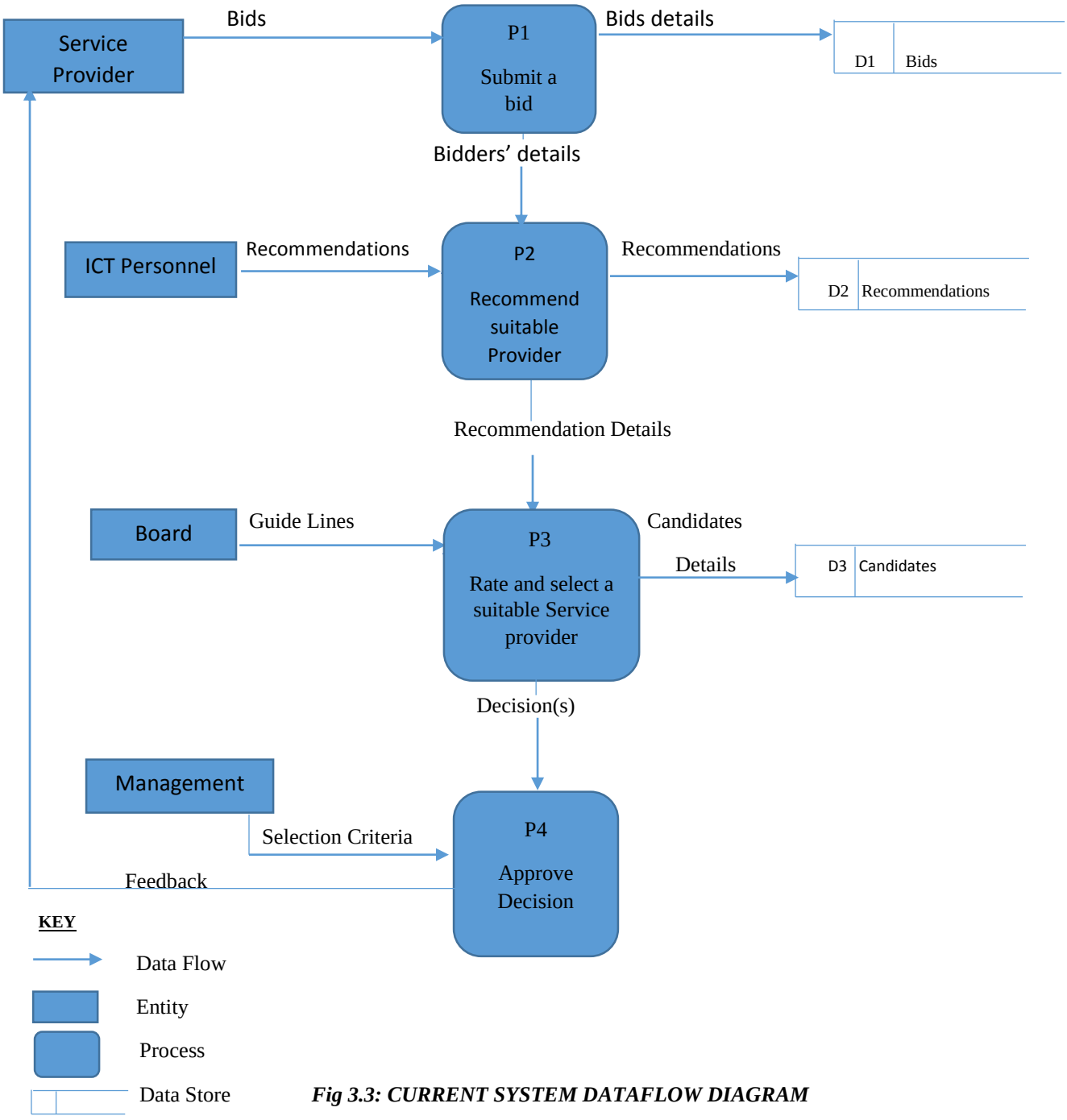

Fig 3.3: CURRENT SYSTEM DATAFLOW DIAGRAM

3.6 WEAKNESSES OF THE CURRENT SYSTEM

The data gathering processes that were carried by the researcher helped in unveiling the following problems associated with the current system:

- Too much paperwork as the IT personnel tries to record performance rating of the service providers during their terms at the contract.
- Lack of consistence in decision making since the processes are based on manual work and human evaluation and judgement.
- Prone to nepotism and corruption since the management has the final say in procurement decision making hence there are high chances of corruption.
- The information recorded can be easily lost through theft or deletion since there is no much security in place to protect it.
- There is no standardized way of selection when it comes to issuing of tender.
- No periodic reports are produced for service provider performance rating

3.6.1 STRENGTHS OF THE CURRENT SYSTEM

Although the current system is characterized by many problems, however it also boast the strength of less cost in the sense that there is no need for any software licensing or programmers for it to be functional.

3.6.7 EVALUATION OF ALTERNATIVES

In system development there are various ways on which the researcher had to analyze and choose from before making a decision on which option to take. The researcher will analyze each and every one of the approaches that can be adopted highlighting the merits and demerits of each so as to give management room to make choice. The available possible options are in-house development, improvements and outsourcing.

3.7.1 OUTSOURCING

Outsourcing refers to a situation whereby an organization seeks external company or individuals to carry on the project on their behalf (Ebert 2011). Outsourcing can involve hiring of skilled professionals to assist only in certain areas or it can also involve leaving the whole project to be done by externals. Purchasing

finished software is usually expensive since the organization will have to engage the developers of the software in installations, day to day operations and also licensing and these are all expenses on top of the purchasing fees. The other problem with buying readymade software is that they need to be customized after being purchased to suit the requirements of the organization.

3.7.1.1 MERITS OF OUTSOURCING

- Less time is required for implementation
- They are usually less risky since they are developed by experienced developers
- Usually they are provided with warrant if anything goes wrong the developer will pay for the damage.

3.7.1.2 DEMERITS OF OUTSOURCING

- Need for training since the users have to get familiar with the system.
- The system will be very difficult to maintain and administer since the organization's ICT team would not be the ones who would have had developed the system so the developers usually have to be conducted which will result in more expenses.
- Since the software will have been developed as a general package this means that it is usually not an easy task to customize the software to meet the organization's need.

3.7.2 IMPROVEMENT OF THE CURRENT SYSTEM

Ebert (2011), describe the process of improvement of the current system as nothing other than a way of trying to make things better through utilization of what is currently on the ground and or adding a few other resources to achieve better results. If this option is to be adopted it means the organization has to employ some employees who will be meant only for the tracking and recording of service providers' performance and balance score cards. This will also mean the need for additional time in procurement meetings so as to improve the quality of decision made. However most of the problems will still persist after a manual upgrade, so it is not a wise decision to upgrade the system from manual to manual as this would not help but will only add costs.

3.7.2.1 MERITS OF UPGRADE OF THE EXISTING SYSTEM

- Reduction in development time
- No need for training since most employees will be are of the system.

3.7.2.2 DEMERITS OF UPGRADING THE CURRENT SYSTEM

- Most of the current problems will continue to occur.
- Hiring of new employees will mean additional expenses.

3.7.2.3 IN-HOUSE DEVELOPMENT

Biafore and Stover (2012) refer to in-house development as a situation whereby an organization decide to develop a software on its own basing on internally available employees and resources. When the system is being developed internally there is no need for hiring of external skilled individuals or companies' since the available development team will do everything using available resources to make sure that the required system is produced. This method of development is cheaper as compared to others since they resources that will be used are internally available and there team that will be developing the system have the organization in mind and they are aware of all the processes so the will develop a system that fits the requirements and expectations of the stakeholders. The system developed internally will also be easy to maintain since the ICT team will be aware of the system.

3.7.3.1 MERITS OF IN-HOUSE DEVELOPMENT

- The organization will be in full control of the system since there are no external third parties.
- Easier to maintain and upgrade since the internal programmers will be aware of their system
- Usually the users' requirements and expectations are meet since the development is done to meet specific objectives.
- Increased user involvement which will reduce chances of failure of user rejection
- Easy in integration into the existing system since it is developed internally
- Improvements and upgrades won't take much longer since they are generated internally.

3.7.3.2 DEMERITS OF INHOUSE DEVELOPMENT

- There may be indirect costs which may be difficult to estimate until the completion of the development process
- It might take much time than planned due to users' participation and contributions which may result in many changes being made before completion.
- Lack of skilled staff may force the organization to hire external staff.

3.7.4 RECOMMENDATIONS

From the analysis and evaluation made on all available possible alternatives it can be depicted that it is more beneficiary to adopt in-house development. This is supported by the advantages of this approach as compared to its rivalry approaches. Furthermore this approach is also supported

by the calculations that were made in chapter two which indicated a positive return on investment and overall profit of this method of development. Though in-house development has some short-falls, but its benefits overshadow its short-falls and the advantages of the other approaches, thus the researcher recommend in-house development.

Below is a table that show a summary of cost analysis of the different approaches

Approach	Estimated Costs(USD)
In-house development	$7 850 (from chapter two)
Upgrade	$8 000
Out-sourcing	$10 000

TABLE 3.2: ANALYSIS

3.8 REQUIREMENT ANALYSIS

The main purpose of this section is to identify the employees expect from the system and what the system has to do. These requirements will be classified into functional and non-functional requirements. These are some of the features that improve the importance of the system.

3.8.1 FUNCTIONAL REQUIREMENTS

These are functions, tasks and capabilities that make the system important and necessary to be developed (Robertson and Robertson 2012). Below are tasks that the system is supposed to perform:

- Allow service providers to submit their bids online
- Allow capturing of performance score card
- Automate service providers rating
- Recommend the best service provider when a need arise
- Generate periodic and aperiodic reports

3.8.1.1 USE-CASE DIAGRAM

Pilone and Pitman (2005), referred to use-case diagram as a diagram that is used to represent the system to be developed in form of actors and the system. In our case the actors are stakeholders of the system which are: management, employees, and board and ICT personnel.

A case diagram of the system is shown below.

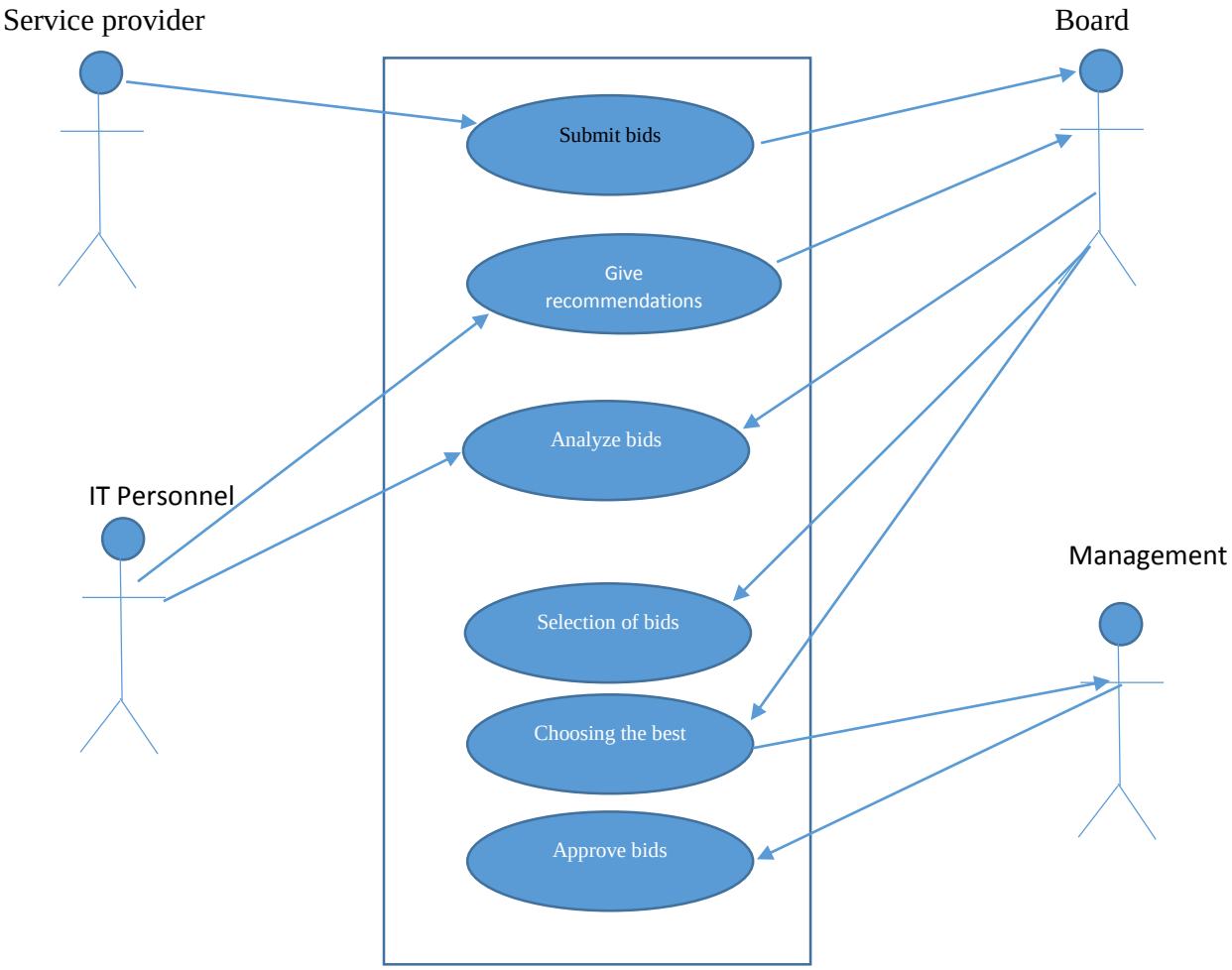

Fig 3.4: USE-CASE DIAGRAM FOR THE PROPOSED SYSTEM

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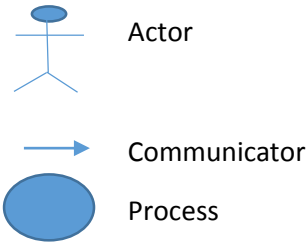
KEY



3.8.2 NON-FUNCTIONAL REQUIREMENTS

According to Robertson and Robertson (2012) this refers to additional functionality of the system which is supposed to be included so as to make sure that the system has more functions and is also user friendly. Below is a list of some of these non-functional requirements of the system:

- User friendly - The system is supposed to be easy to use so as to help in simplifying the duties that were being carried out by employees manually rather than adding problems.
- Availability – In order for the system to successfully solve currently available problems, it has to be available whenever a user wants to use it.
- Security - The system should be secure so as to protect confidential information and also to acquire users trust.
- Handling of errors – The system should be able to recover from errors.
- Employee satisfaction – for the system to be a success it has to improve the employee morale and satisfaction by simplifying their duties.

3.8.2.1 CONSTRAINTS

There are some constraints that the proposed system might face which are listed below:

- Cost constraints – This may arise if the prices of the resources that are needed for development rises, this may result in need for additional funding which may be difficult to secure.
- Time – Since the system is being developed internally, chances are very high that time may be less due to continuous users' changes request since users' expectations and demand continues to rise when they get familiar with the system.
- Resources – Since development will be carried by internal staff, chances are high that there might be shortage of staff as some may be occupied by some duties like user support and other system administration or other projects.

3.9 CONCLUSION

This chapter was mainly focusing on evaluation of the current system that is currently being used at ZIMRA. In the next chapter the researcher will be looking at the design part of the proposed system.

CHAPTER 4: DESIGN PHASE

4.1 INTRODUCTION

The researcher had finished analysis on how the current system operates in the previous chapter, the researcher is now moving on to design phase of the proposed system. The researcher will be concentrating on the design of the proposed system as it exist in the following forms: physical design, logical design, program design, interface design and architectural design.

4.2 SYSTEM DESIGN

Saffer, (2006) describe it as a process of designing a system in a way that enables development of a good system that can meet all the requirements and expectations. Below is a list of some of the features that a good system should have:

- Security – A good system should be secure enough so as not to allow unauthorized access to the system. A good system should protect information and data from outside world.
- Reliability – A good system should be available whenever users want to use it. A good system should be reliable.
- Maintainability - A good system should be maintainable with minimal or no difficulties, this reduce problems on the ICT team side when there is need for a system maintenance.
- Efficiency – A good system should also be efficient such that the users would not have any delays when they want to perform a certain process.

4.2.1 DESCRIPTION OF THE PROPOSED SYSTEM

The way the system operates and behave is going to be mainly governed by organizational rules, regulations and policies. After a thorough analysis and evaluation of the existing system the researcher has seen it necessary to come up with a new automated decision support system. The newly proposed system will enable rating of service providers. The system will rate the service providers basing on their performance score card and or pricing if they are new to the organization. The system will store all the service providers that are currently operating in the organization and their current performance status as well as line of business. The proposed system will also allow the service providers to submit their bids and be able to get their feedback online. The online platform will also enable automated rejection of bids with fees outside the accepted range. The system will also recommend good service providers basing on the information in the database

pertaining the service providers. This will ensure fairness in the selection of service providers and issuing of tenders as well as reduction of time required to assess and issue a tender.

4.2.2 FUNCTIONALITIES

Below is a list of functions that ZIMRA Service Procurement and Management Decision Support System should have:

- Service providers performance score card - This module will enable ZIMRA to rate service providers basing on their performance.
- Service procurement decision support module – This will automate the procurement decision making process basing on the information from the performance score card and or charges.
- Bids management module – This will enable online submission of bids and access of feedback from the organization.
- Reporting module – The system will produce periodic and aperiodic reports which will be used in long term management decision making.

4.2.3 CONTEXT DIAGRAM

Jordan (2011), describes a context diagram as a diagrammatic representation of a system and its high level process as represented by entities and the system as the main process. On the next page there is a context diagram that shows the proposed ZIMRA Service Procurement and Management Decision Support System:

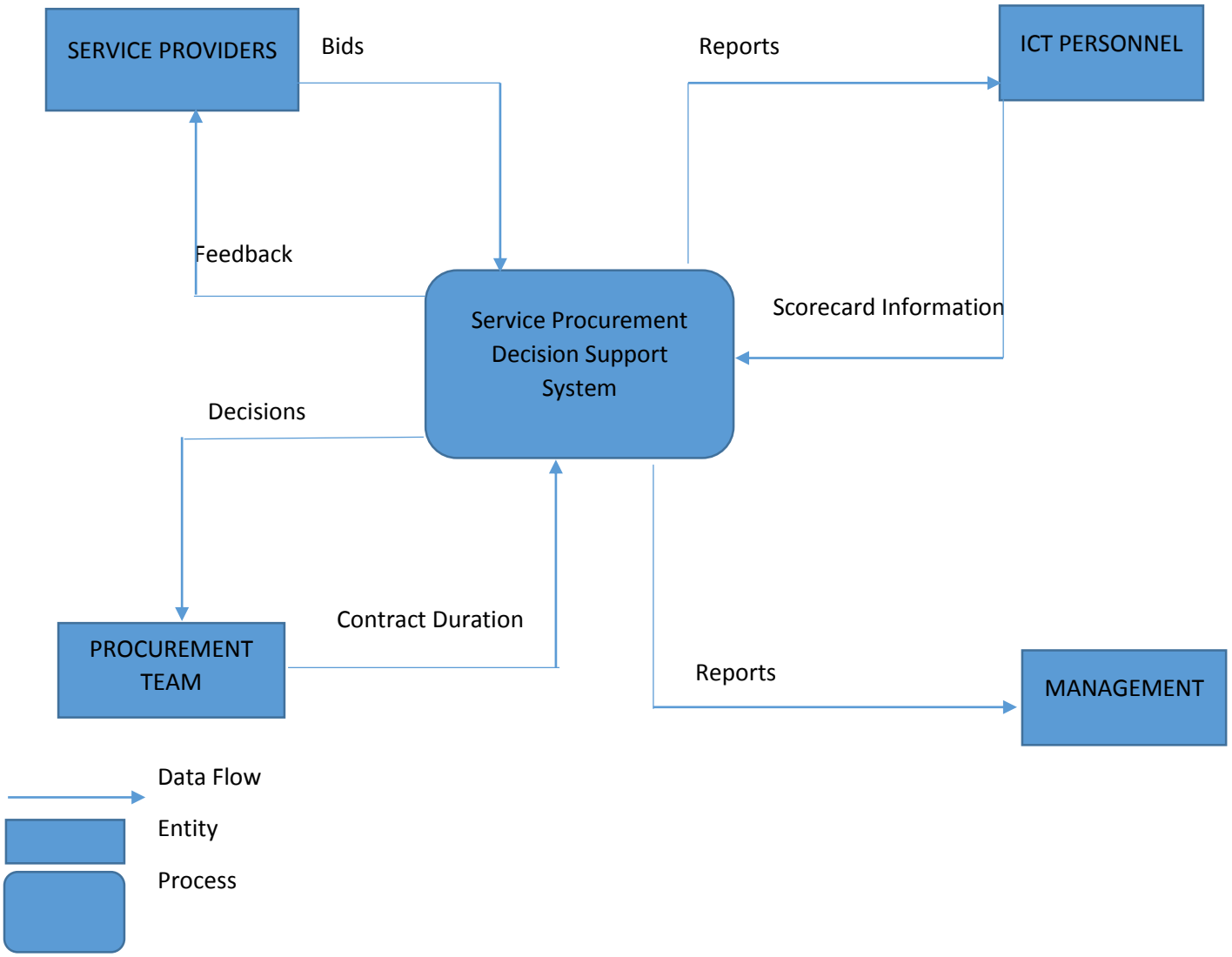


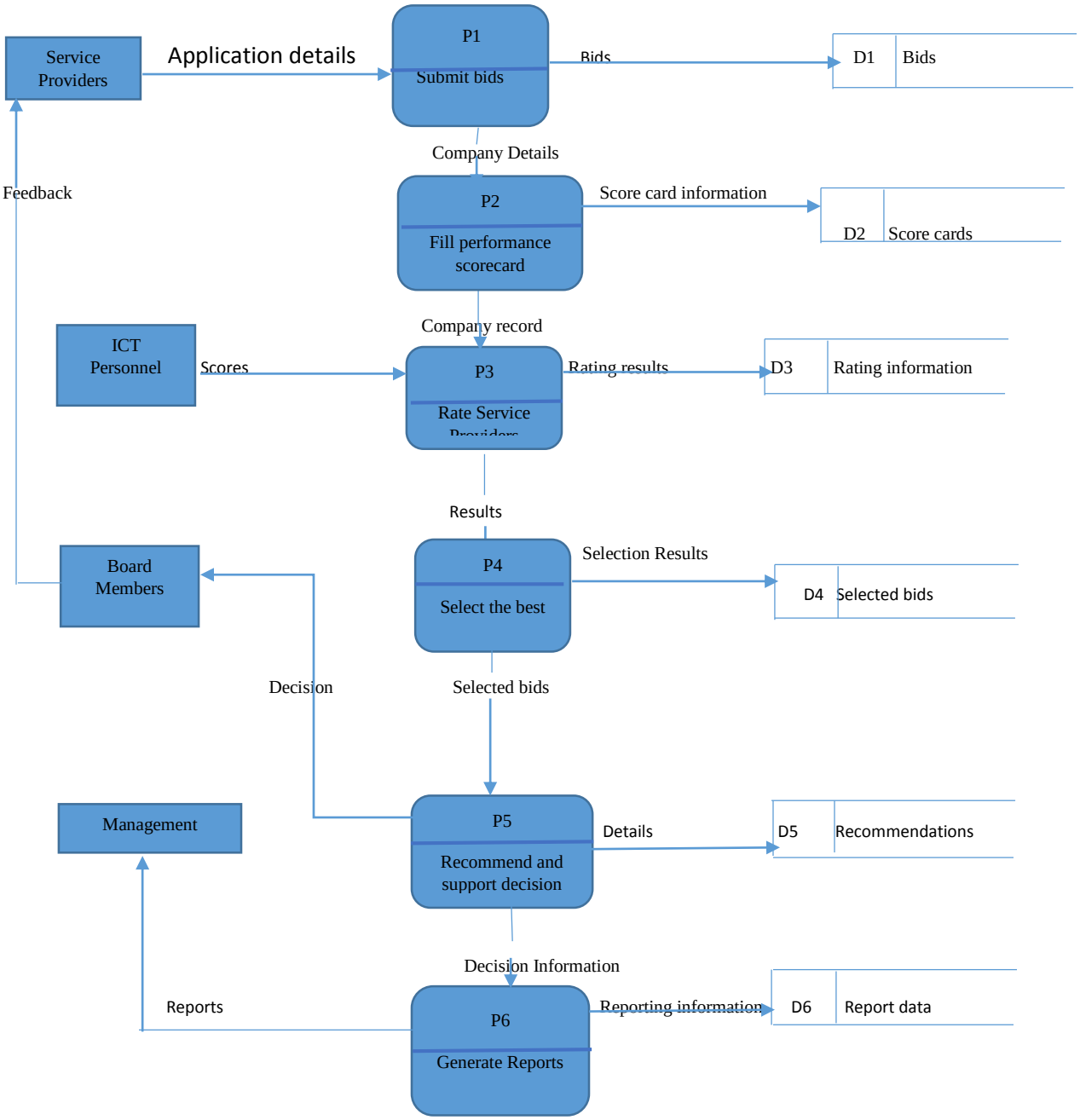
FIG 4.1: CONTEXT DIAGRAM

On the context diagram above a service provider bids for a tender to supply a certain service and the system give feedback to the service provider pertaining the status, that is whether the bid has been accepted or rejected, the choice of service provider is made basing on the data from score card or price if the company is new to the organization.

4.2.4 DATA FLOW DIAGRAM OF THE PROPOSED SYSTEM

Ambler (2004), describe data flow diagram as a diagram that shows the flow of data from one component of the system to the other, that is from processes, entities and data store. It shows how

data flows from an entity to a process and from a process to the data store and or to other process. On the next page there is a data store for the proposed system:



KEY

Data Flow

Entity

Process

Data Store

Fig 4.2: DATAFLOW DIAGRAM FOR THE PROPOSED SYSTEM

4.3 ARCHITECTURAL DESIGN

According to Martin (2003), architectural design refers to the notion which are used to highlights the system's modules and joining them into a full functional system. It also gives an overview of the hardware that is to be used in the system. The architecture of a system should be stable and last longer. The architecture design also gives an overview of the platform on which the system will be developed on. Below is an architectural diagram:

4.3.1 NETWORK ARCHITECTURAL DESIGN

McCabe (2010) defined a network architectural design as a diagrammatic outline of the network structure of the system showing the hardware, network connectivity, software and procedures of the system. In the proposed system the network architecture will include a browser that will be used to lint the external service providers with the system as they will be accessing the system from outside through the browser and also the LAN which will be used by internal stakeholders through windows application to access and communicate with the database. To communicate with the database the external service providers will use the browser interface, but for some of the internal employees they will use windows platform for example for rating service providers the ICT representative will use windows platform but for updating the web platform the administrator will do so through the browser. The diagram on the next page show a network architecture diagram for the proposed system.

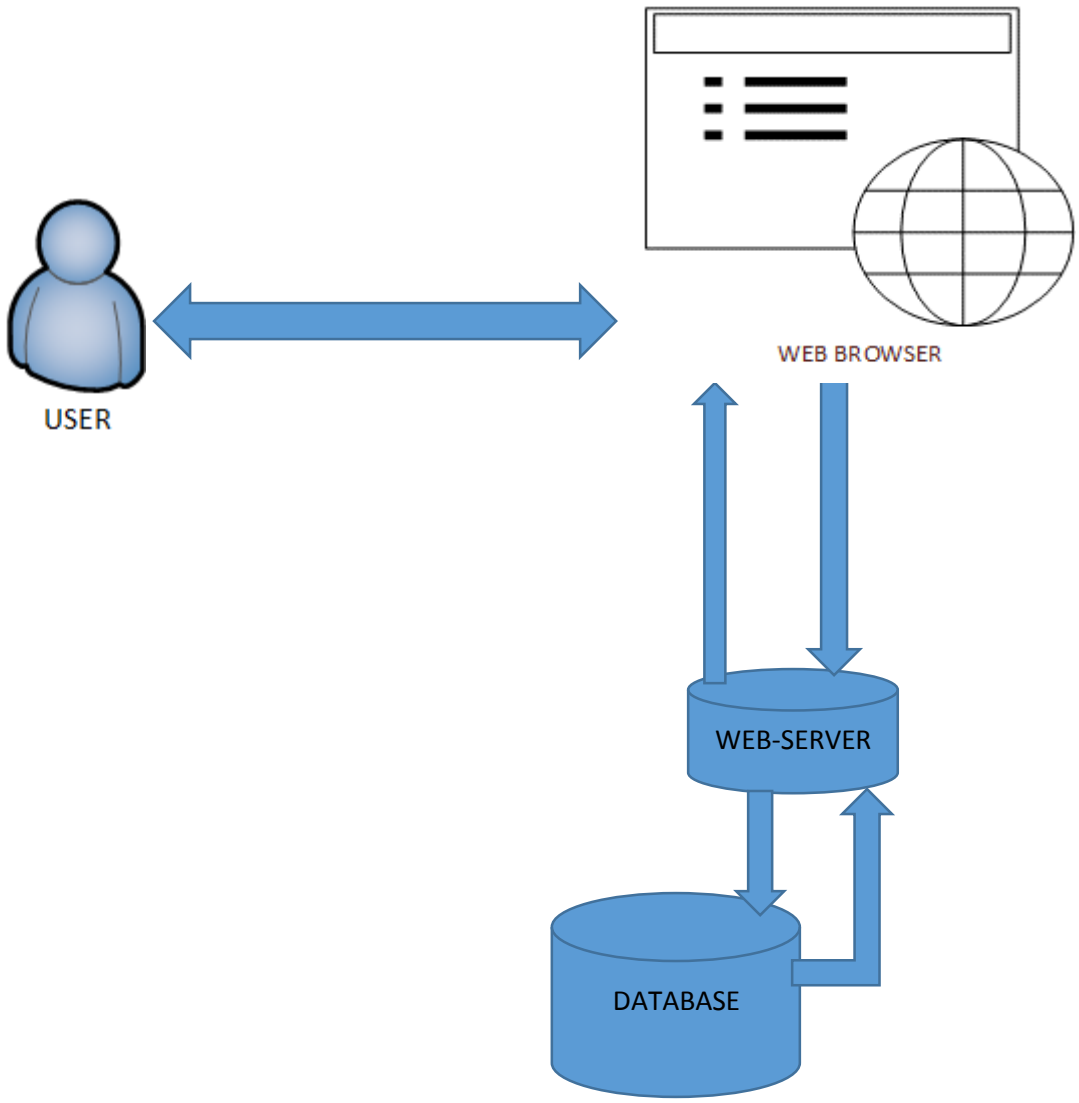


Fig 4.3: NETWORK ARCHITECTURE DESIGN (from McCabe, 2010).

4.3.2 CLIENT SERVER APPROACH

According to McCabe (2010), this refers to an approach that shows the link between the user and the web server. In the proposed system the users of the system will be communicating with the servers in two different ways depending on their access levels and functionality. The external service providers will be communicating with the server through the web browser. This is when they will be applying and checking their bids status. For the internal ICT representatives they communicate with the server through windows platform for the rating and reporting and through the browser for website management and updates.

4.4 PHYSICAL DESIGN

McCabe (2010) describes physical design as a design which is used to show the connections between physical components and various platforms. The physical design structure of the proposed system will be showing the whole network of ZIMRA as the system will be accessed across the whole organization's LAN and also over the World Wide Web (www) for the web part since it will be communicating to the outside world. The system will be comprising of personal computers that will be used to access the system, switch for network connection, internet service provider for the bandwidth that will be used, firewall to protect the system from attacks and server. All these components are already available in the organization. Below is a diagram showing physical design for the proposed system:

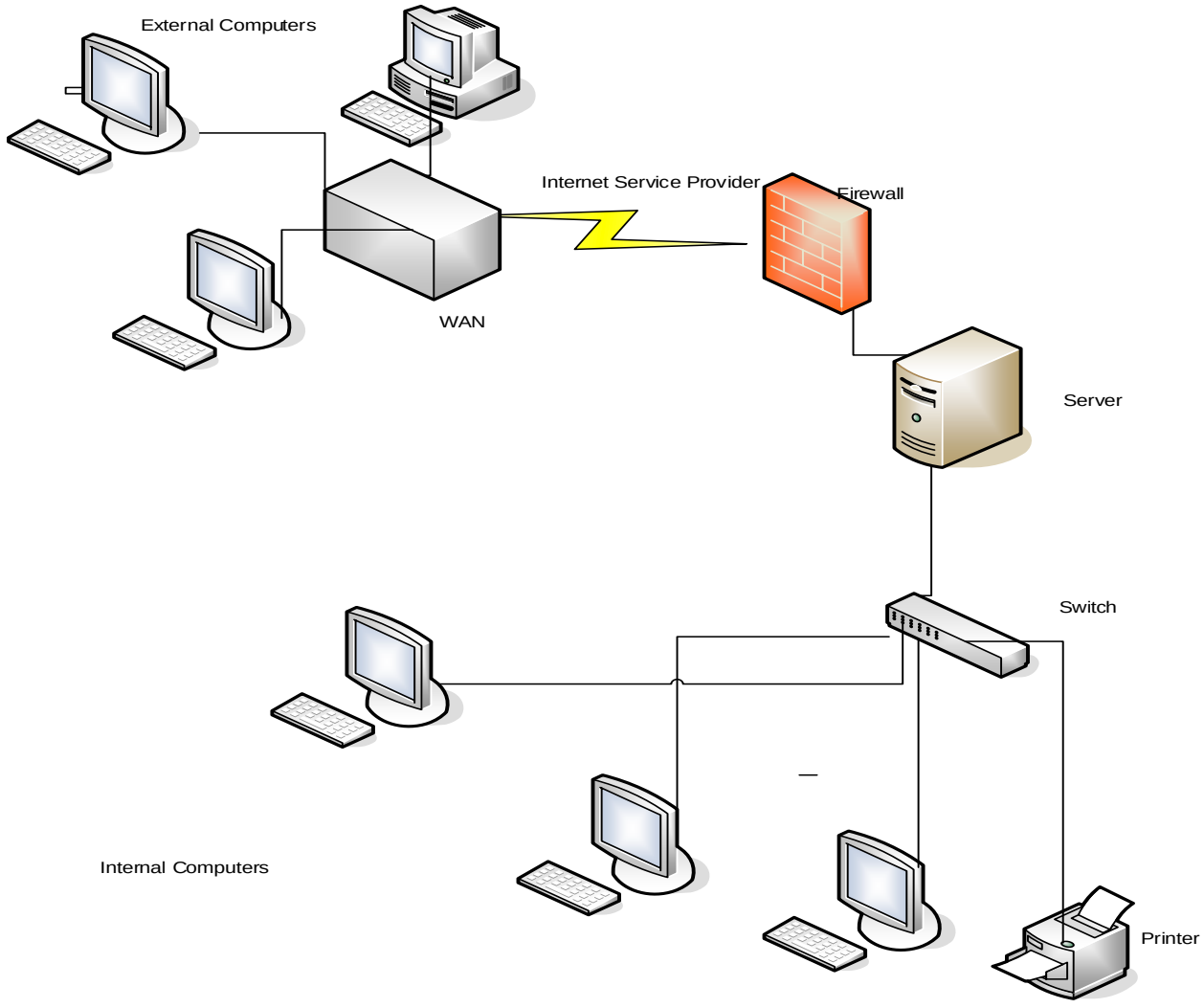


Fig 4.4: PHYSICAL INFRASTRUCTURE DESIGN FOR THE PROPOSED SYSTEM (McCabe, 2010).

4.5 DATABASE ARCHITECTURE DESIGN

Stephens (2010) referred to database design as a way that is used to create a simplified and detailed data model which is usually simple to understand. The database to be created should be inclusive of the following prerequisites; data consistency, integrity and data security. All the database queries and processes will be executed in the server which will be containing the database.

4.5.1 ARCHITECTURE DESIGN

This section mainly focuses on the way in which the data is store and arranged and ways that will be used to access it depending on the users' privileges. Below is a diagrammatic representation of the database schemas of the proposed system.

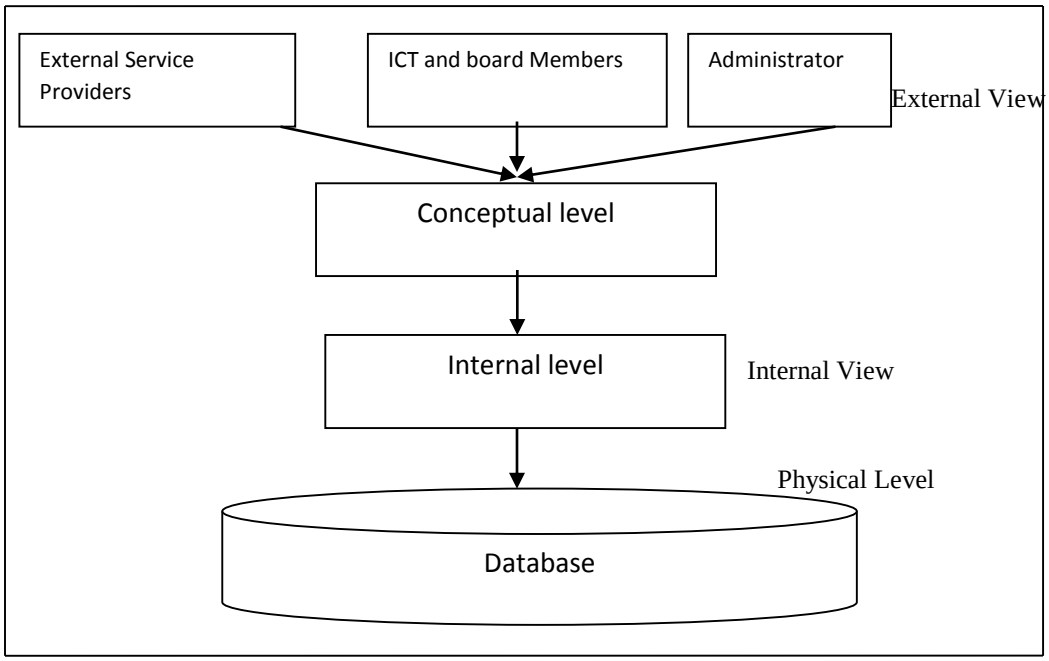


Fig 4.5: CONCEPTUAL SCHEMA DESIGN (Date, 2010)

Date (2010) describes the conceptual schema as follows:

Conceptual level – It gives definition of data to be stored in the database and all the relationship among the data to be stored. It is the next level that comes after the user's view.

View level – It is a user customized as it shows only information or data that is designed or defined specifically for one person or view. It provides interface for ease access of the data by specific user(s).

Internal level – This is mainly meant for the database as it defines how data is to be stored in the database. It is mainly concerned about the low level database design as it only focusses on the data definition at database level.

Data store – This is the physical location where actual storage of data takes place. It contains the lowest abstraction level.

4.5.2 DATA MODELLING

Limeback (2008), describes data modelling as the processes of identifying attributes, entities and relationships of data to be stored in the database. In this section of the research this is going to be represented using an entity relationship diagram and an extended entity relationship diagram.

4.5.2.1 ENTITY RELATIONSHIP DIAGRAM

Podeswa (2008) view an entity relationship diagram as a diagrammatic representation of entities and their respective relationships. In the ERD the researcher will draw a diagram that will be showing the entities and their relationship as well as their attributes. Following is an entity relationship diagram for the ZIMRA proposed system:

Fig 4.6: ERD FOR THE PROPOSED SYSTEM

4.5.2.2 SYSTEM DATABASE TABLES

This refers to tables in which the system's data will be stored and also where the reports and decisions will be generated from. Below is a structure of the system's tables:

Table of users details:

Field_	datatype	Length	Description
id	Int	3	Primary key
companyname	Text	30	
service ID	nvarchar	16	
phonenumber	nvarchar	16	
e- mail	nvarchar	25	
address	nvarchar	30	
Username	nvarchar	15	Not null
Password	nvarchar	15	Not null

Table 4.1: TABLE OF USERS

The users' table above stores the credentials and details for the users as well as their encrypted passwords. All the companies' details will be stored in this table which will be the source of information to all the other tables and or modules that might require the user's details.

Table for decision support

Field	Datatype	Length	Description
id	int	100	Primary Key
serviceid	int	100	Foreign Key
contractno	int	100	
scores	int	2	

Table 4.2: DECISION TABLE

The above table is the source of information that will be used for decision making and recommendations as it stores the scorecard results from the ICT representative after assessing the performance of a certain service provider. The system will then use this information to make decisions.

Table for audit trail

Field	Datatype	Length	Description
id	int	100	Primary Key
Username	nvarchar	100	Not null
time	Date/Time	100	Not Null
Login	nvarchar	100	Not Null

Table 4.3: AUDIT TRAIL

The above audit trail table will be keeping all the users who had logged into the system and their dates and time. This will make sure that all the logs to the system are traced.

Table for Services

Field	Data type	Length	Description
Serviceid	int	3	Primary Key
Name	nvarchar	100	Not null
Duedate	Date/Time	100	Not Null
Station	nvarchar	100	Not Null

Table 4.4: SERVICES

The table for services will be storing all services that requires service providers and the stations in which they are needed.

Table for Restrictions

Field	Datatype	Length	Description
id	int	3	Primary Key
serviceid	int	3	Foreign Key
Minimumprice	Decimal	100	Not Null
Maximumprice	Decimal	100	Not Null
initialpayment	Decimal	100	Not Null

Table *4.5: RESTRICTIONS TABLE*

Table 4.5 on the previous page will be storing the minimum and maximum price accepted for the service delivery as well as the initial payment that is required. This table will be used by the system to reject an application before further screening if its charges are outside the specified limits.

Table for Applications

Field	Datatype	Length	Description
id	int	3	Primary Key
serviceid	int	3	Foreign Key
Date	DateTime	100	Not Null
Maximumprice	Decimal	100	Not Null
initialpayment	Decimal	100	Not Null
Status	nvachar	20	Not Null

Table 4.6: APPLICATIONS

The above table 4.5 for applications will be storing companies that had applied for services and the results that the status of their bids. If the company's bid was outside the required minimum limits then its bid will be automatically rejected, but if it is within the required limits it will be put to pending when it will be waiting for the due date to arrive when all applications had been received and the system will decide.

Table Contracts

Field	Datatype	Length	Description
id	int	3	Primary Key
serviceid	int	3	Foreign Key
Date	DateTime	100	Not Null
Contractid	nvarchar	100	Not Null
name	nvarchar	100	Not Null
Companyid	int	10	Foreign Key

Table 4.7: CONTRACTS

Table 4.7 on the previous page will be storing contracts and companies whom they had been issued to. The service providers to whom the contracts will have had been issued to will be represented by their ids and in this table it will be a foreign key which will be inherited from the source table service provider id.

4.5.2.3 ENHANCED ENTITY RELATIONSHIP DIAGRAM

This is an entity relationship diagram that shows additional relationships between entities that cannot be included on a normal entity relationship diagram (Talburt 2011). On the next page there is an Enhanced Entity Relationship diagram for the proposed system.

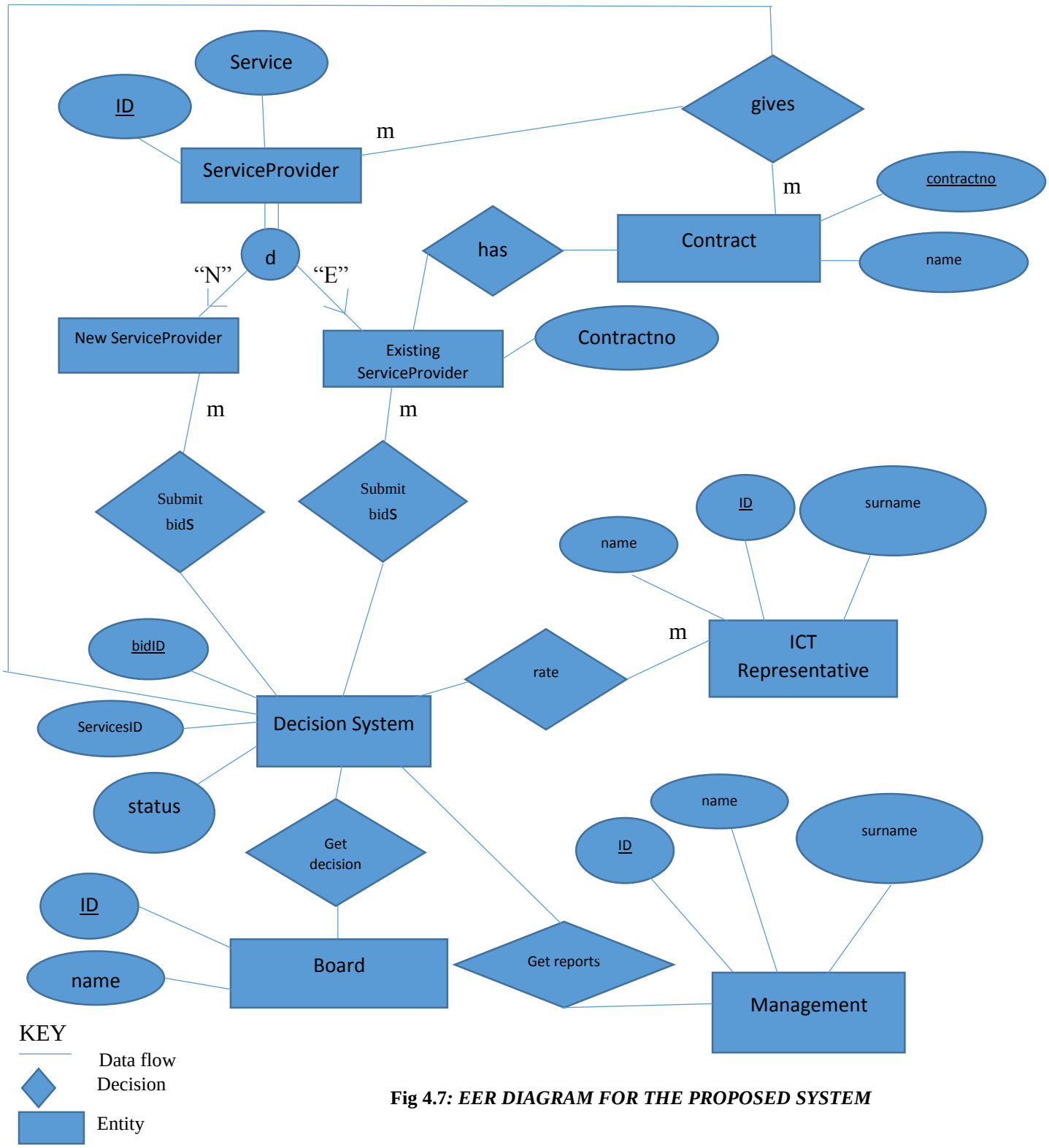


Fig 4.7: ***EER DIAGRAM FOR THE PROPOSED SYSTEM***

4.6 PROGRAM DESIGN

Talburt (2011) describes program design as a process that is meant to assist developers in laying out the steps that are to be taken in the development of the system to avoid wastage of time and development of wrong modules or functionality on the system. Its main aim is to assist developers by giving a clear procedural layout of the steps that are to be followed in the development. It also gives a sequence of activities and processes that are to be performed by the system.

4.6.1 PACKAGE DIAGRAM

Dennis et al (2012), referred to a package as a diagram that is used to represent plan and association of elements of a system. It is usually used for big or medium systems. They are also used to give a generalized idea of the way a proposed system will operate. Below is a package diagram for the proposed system

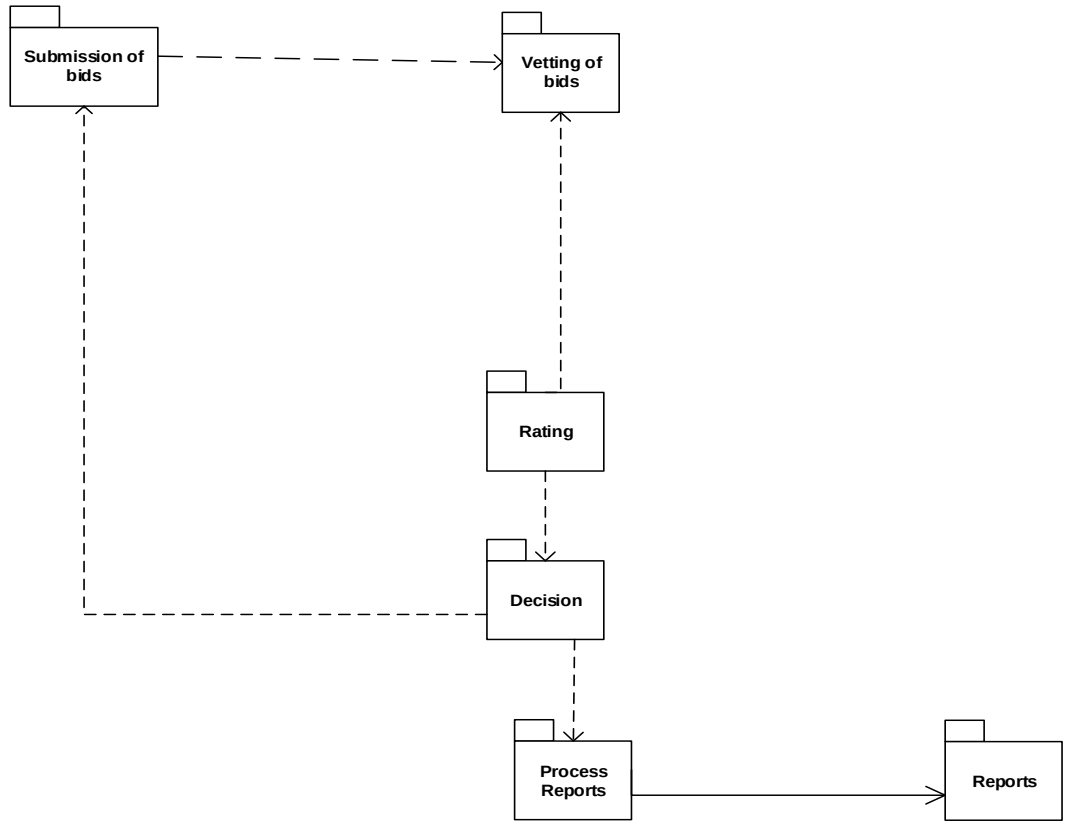


Fig 4.8: ***PACKAGE DIAGRAM***

4.6.2 CLASS DIAGRAM

Dennis et al (2012) define a class diagram as a diagrammatic representation of various objects of a system and their relationships. A class diagram shows objects which are represented as classes and their attributes as well as their relationships. Below is a class diagram for the proposed ZIMRA Service Procurement Decision Support System.

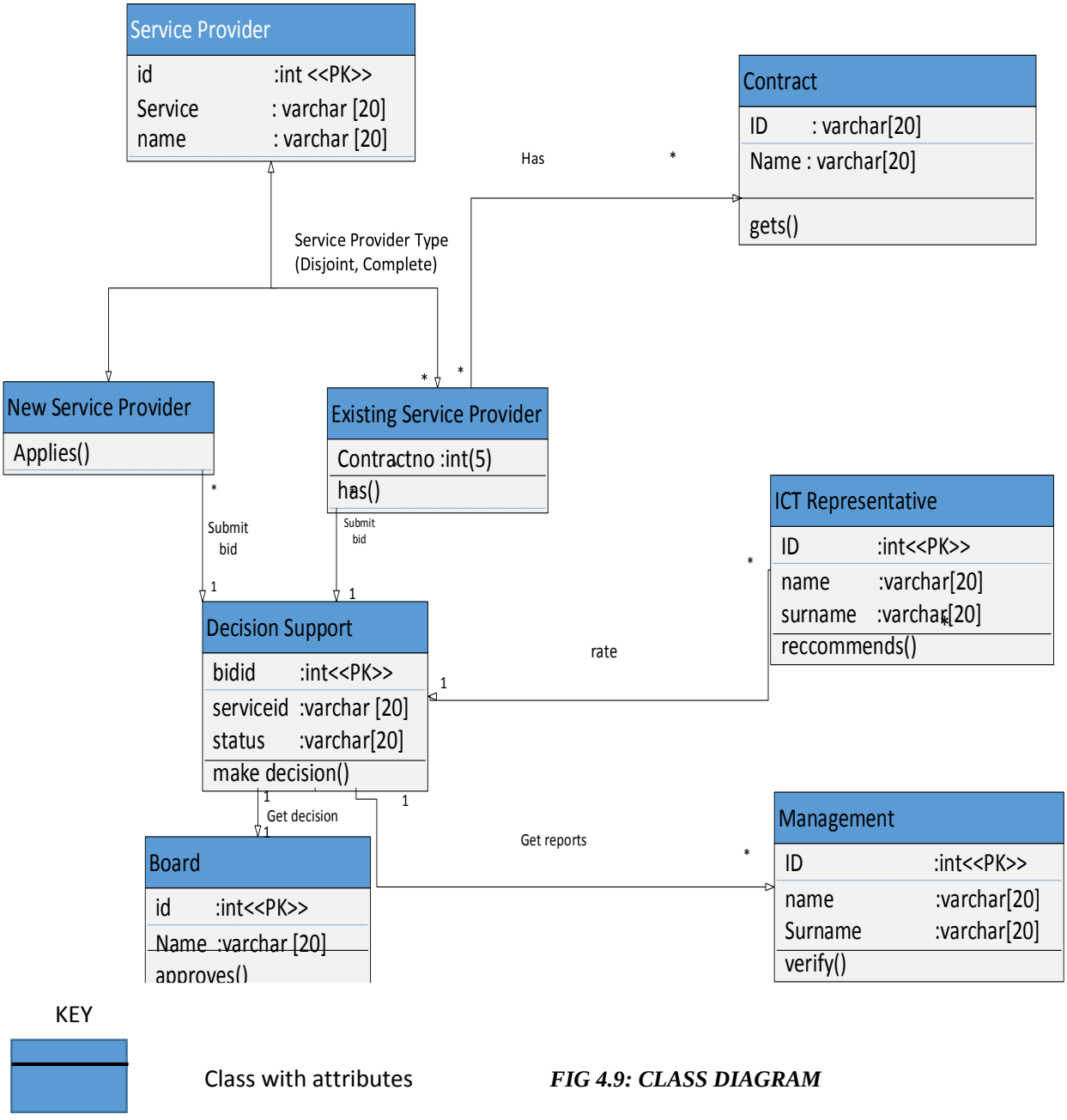


FIG 4.9: CLASS DIAGRAM

4.6.3 SEQUENCE DIAGRAM

Dennis et al (2012) describes a sequence diagram as a diagrammatic illustration of objects that will be participating in the use case diagram and the messages that will be moving between them. Belo is an illustration of the sequence diagram for the proposed system.

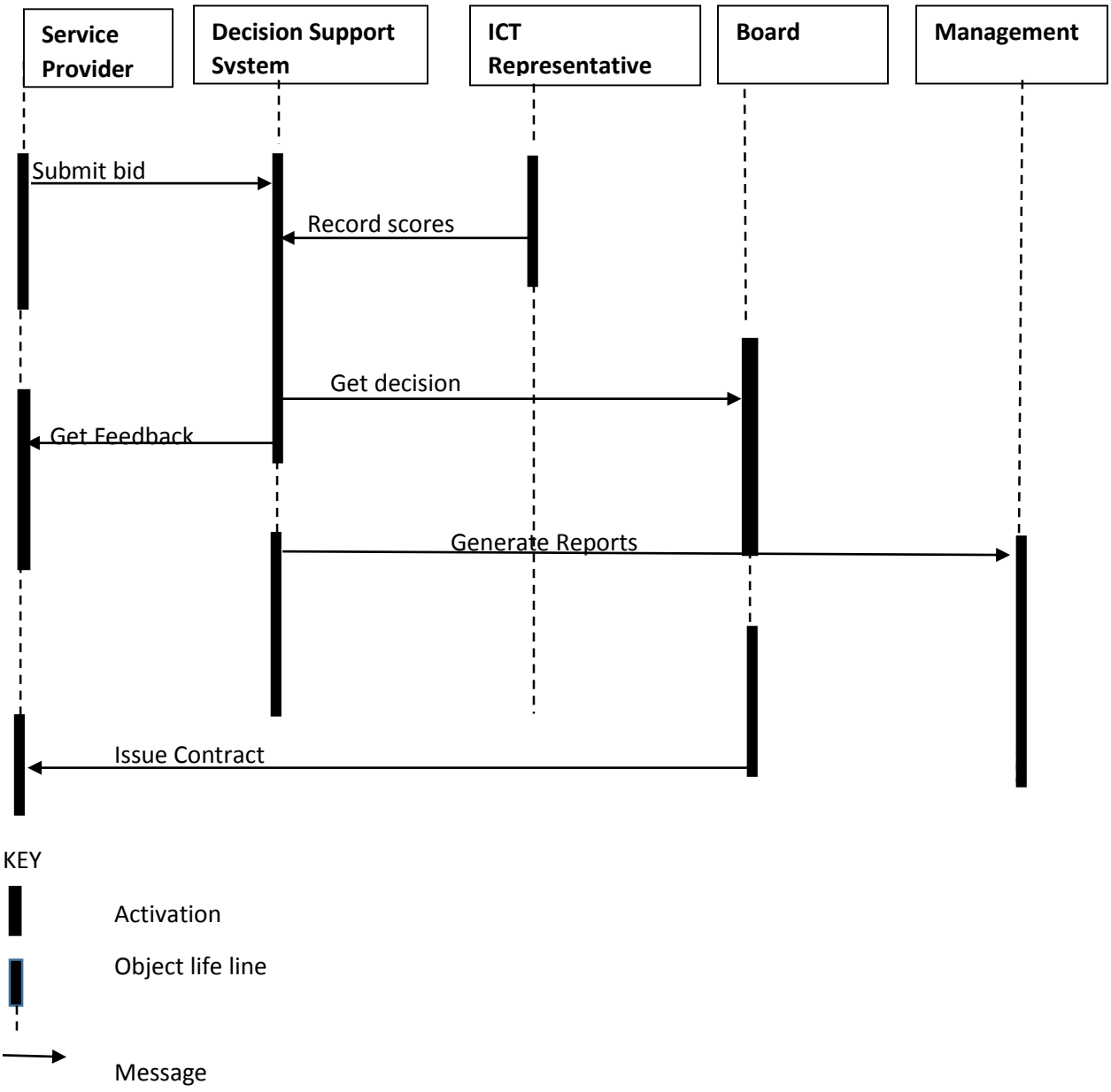


Fig 4.10: SEQUENCE DIAGRAM

4.7 INTERFACE DESIGN

Interface design give an illustration and description of how the users of the system will be interacting with the system accessing various functionality. The interface is the link between the system and its users as it gives the users a way of communicating with the database and execute their duties and or processes. The design interface also show the show the menu design of the system that is to be developed and how the users are supposed to interact and use it.

4.7.1 FUNCTIONAL STRUCTURE DESIGN

Functional design defines hot the system will communicate or interact with its users. It includes the design structure of the interface and the security setup in place to protect the system from unauthorized access.

The proposed system will have a simple web interface for external service providers. Upon opening the website the providers will see a display of link images of the services that are vacant with names attached and by clicking those links the use will be redirected to a page where he or she can submit his or her company bid. On top there will be a clear navigation bar with options to login or register which is simplified for users' convenience and ease of use. In order for a service provider representative to apply or view bid status he or she have to log into the system or register.

4.7.1.2 SECURITY DESIGN

This is one of the generic objectives of every system. For a system to be trusted and accepted it has to be secure. It should not allow unauthorized access to information or data. This can be achieved by making sure that there is a firewall that protect internal information from external threats or passwords restrictions and access levels in the system. For all users to start accessing various processes in the system they have to register or login using registered credentials.

4.7.2 LOGIN FORM

This is where the user is supposed to enter his or her credentials before accessing various functionality of the system. In order for the user to get access the credentials should be correct otherwise an error message will be displayed.

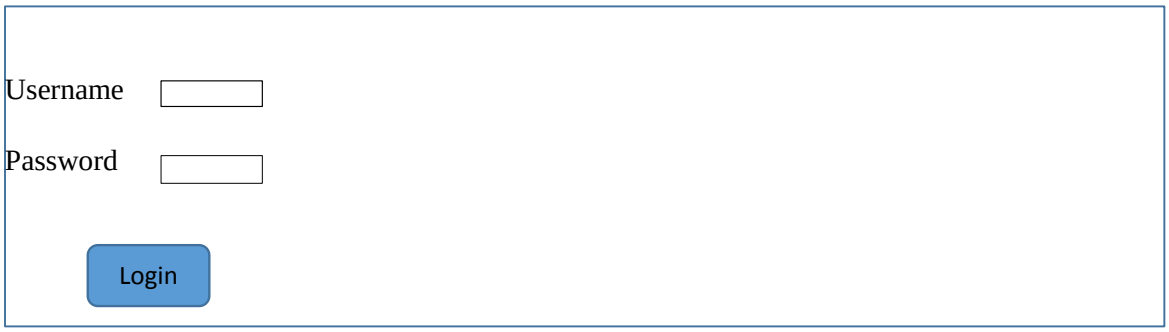


Fig 4.11: LOGIN FORM

4.7.3 MAIN FORM

For the users to use the system they have to do so through forms and some of these forms are shown below. These forms will allow users to navigate to various functionality forms depending on their access levels and specialization.

4.7.3.2 INPUT DESIGN

This refers to the forms that will allow users to register their accounts online and also to submit their bids. The main objective of the system is to allow the users to submit their bids online and also to automate the decision making system and allow the users to get their feedback online with minimal effort.

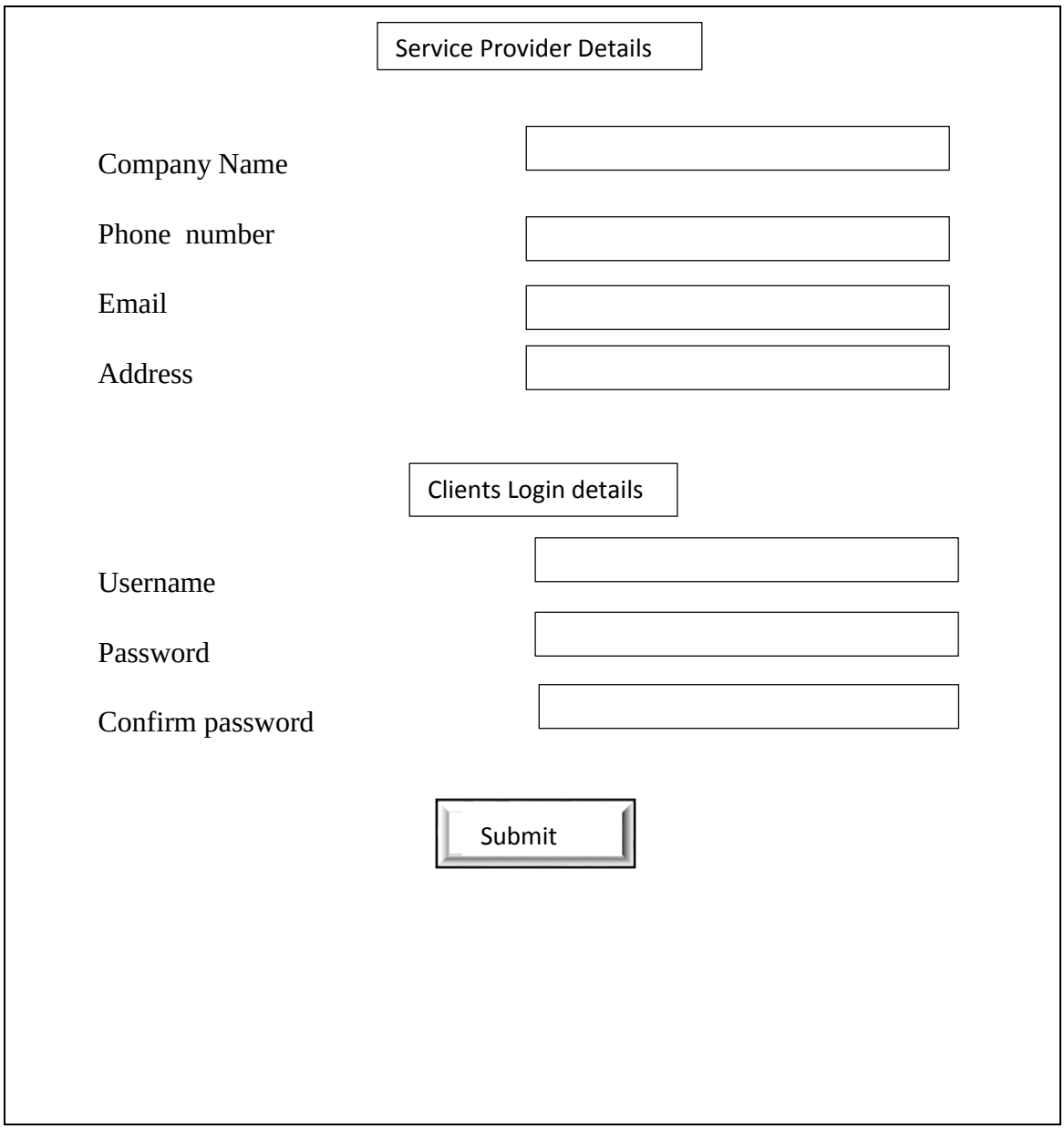


Fig 4.12: INTERFACE FOR REGISTRATION

This page is through which the users creates their accounts to user the system. The passwords should be at least six characters and the user has to fill in all the text fields to create the account.

Reset Password

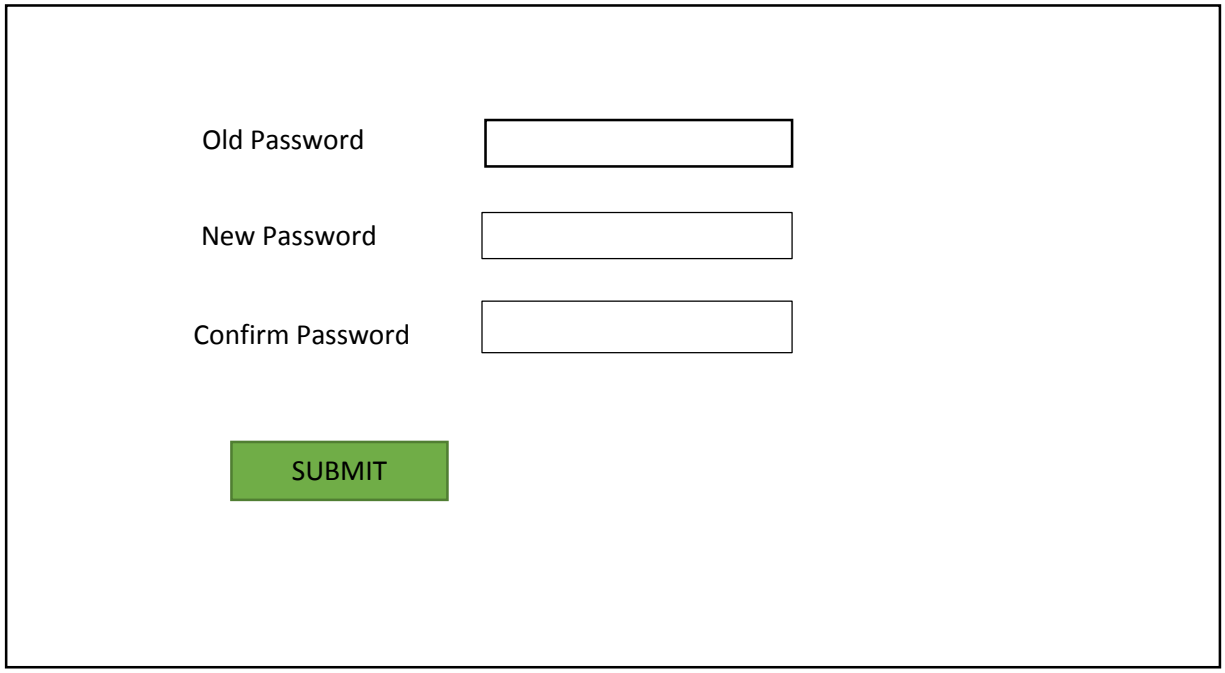


Fig 4.13: RESSET PASSWORD

In the above form the user enter old password and then the new password and confirmation of the new password and click the button submit to effect changes.

Applying for a service

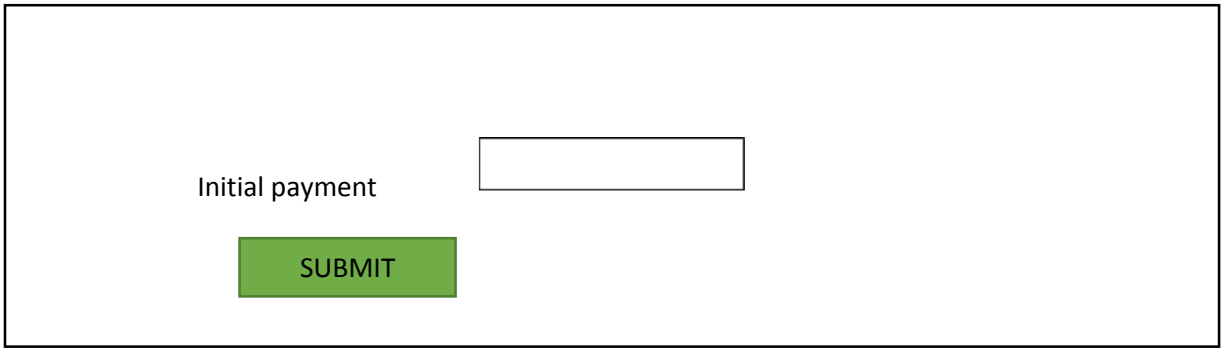


Fig 4.14: SUBMITTING BID

On the above form the user has to fill in the initial payment that the company need for provision of the service and then the monthly payment that they need. This form will be displayed after the user would have had clicked a link picture for a certain service.

Form for adding a new service

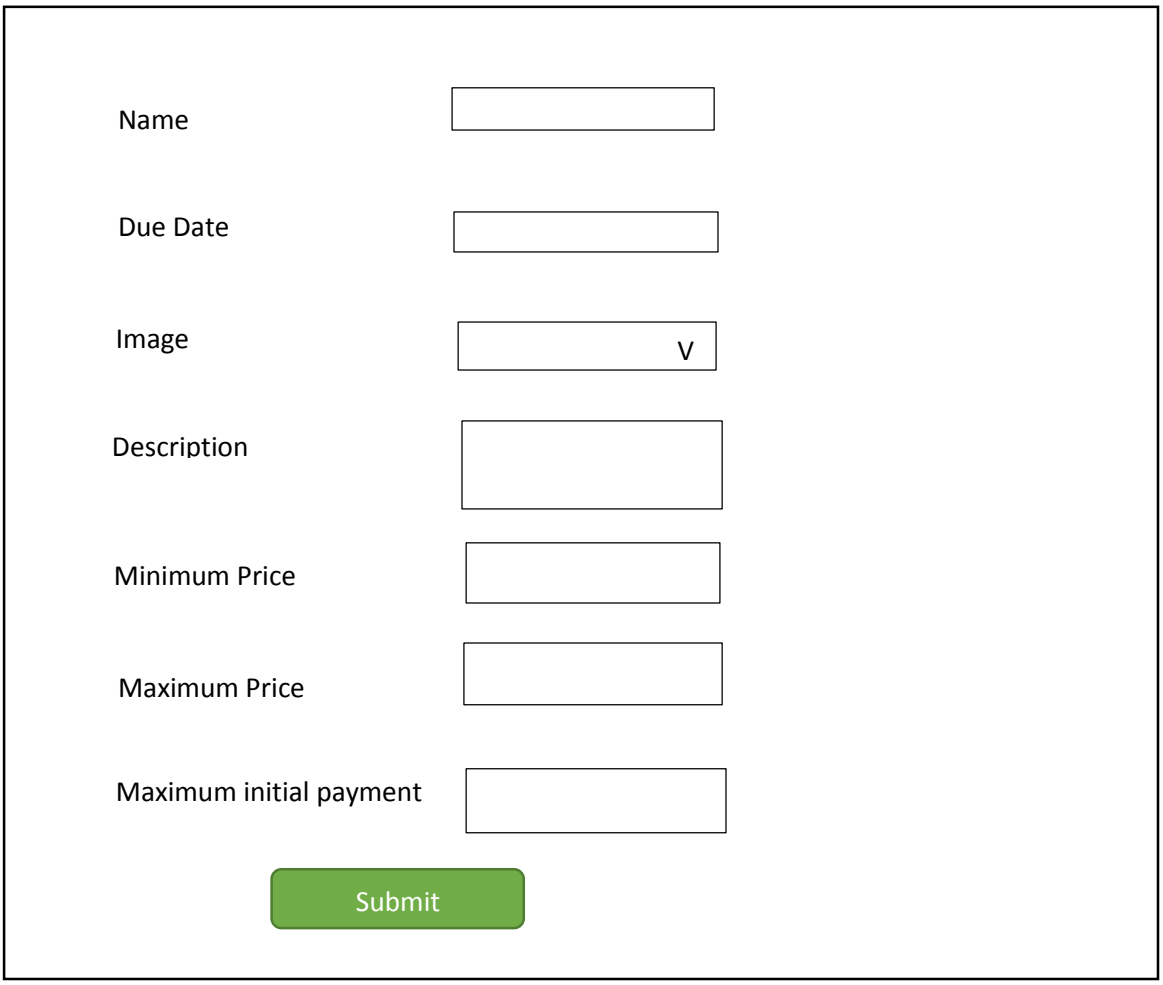


Fig 4.15: ADDING NEW SERVICE

In the procurement board member have to login to the system and add the product to be added to the website. To complete the process all the fields should be filled otherwise he or she will get an error message.

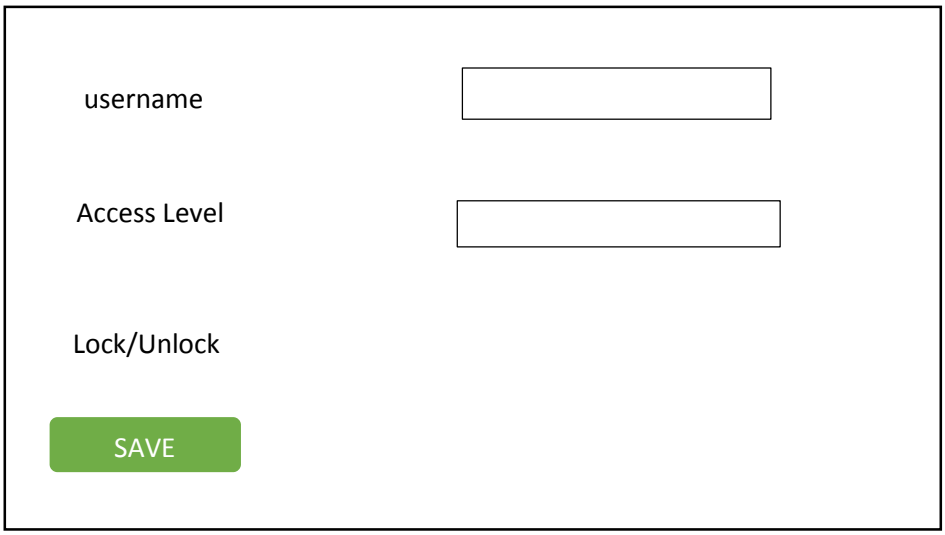


FIG 4.16: ACCOUNTS MANAGEMENT

4.7.3.3 OUTPUT DESIGN

This refers to all the forms that will be giving feedback or output to the users. This output includes all processed information that will be used in decision making and the reports to the management as well as feedback to the service providers that would have had applied for services.

Report form for the system

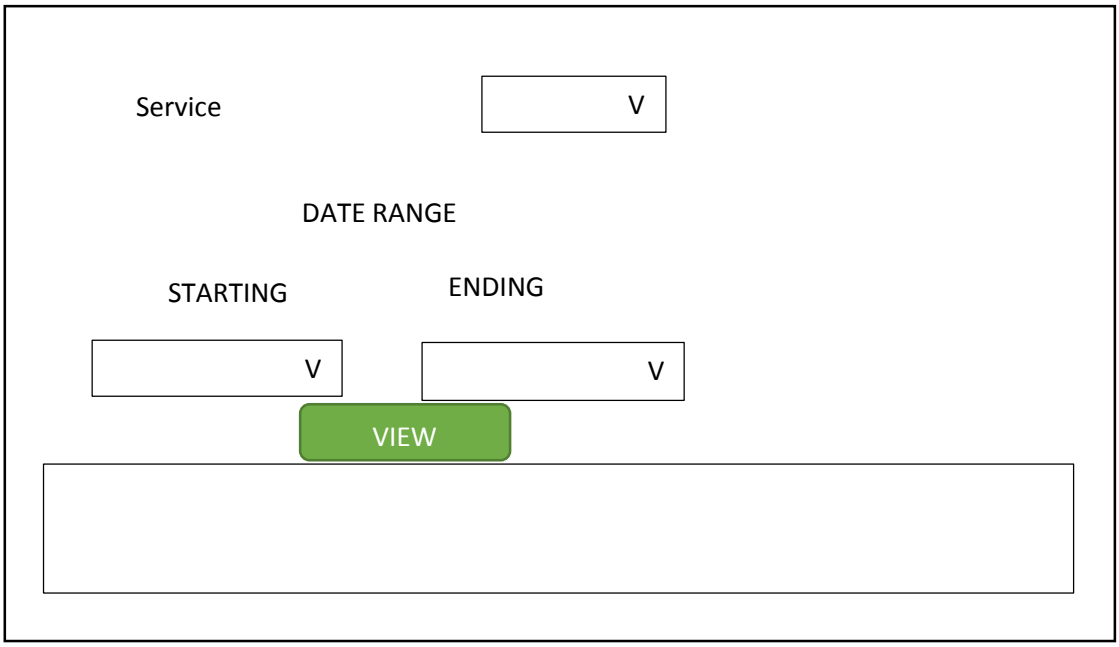


Fig 4.17: REPORTING

On the above form the user has to select the service to get report and then enter the date range to filter the data to be displayed and then click view.

Form for decision generated

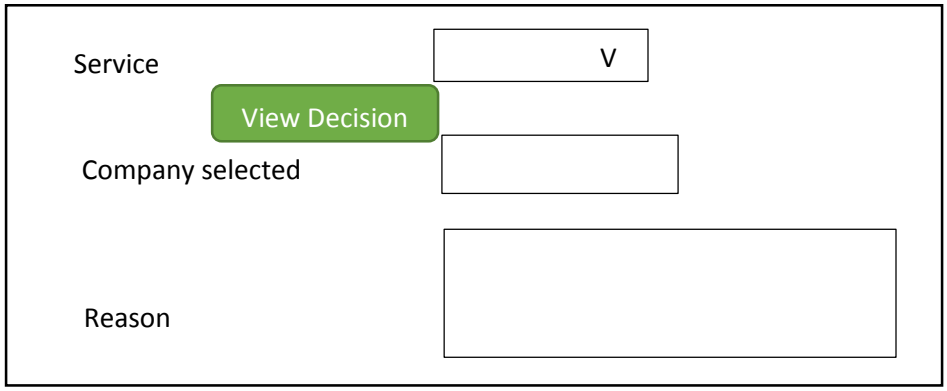


Fig 4.18: DECISION FORM

On the interface on the previous page for decision the user will have to select the service to get decision on and the system will show the recommended decision and the reason behind the decision as supported by the score card or pricing.

Form for Feedback to the Service Provider

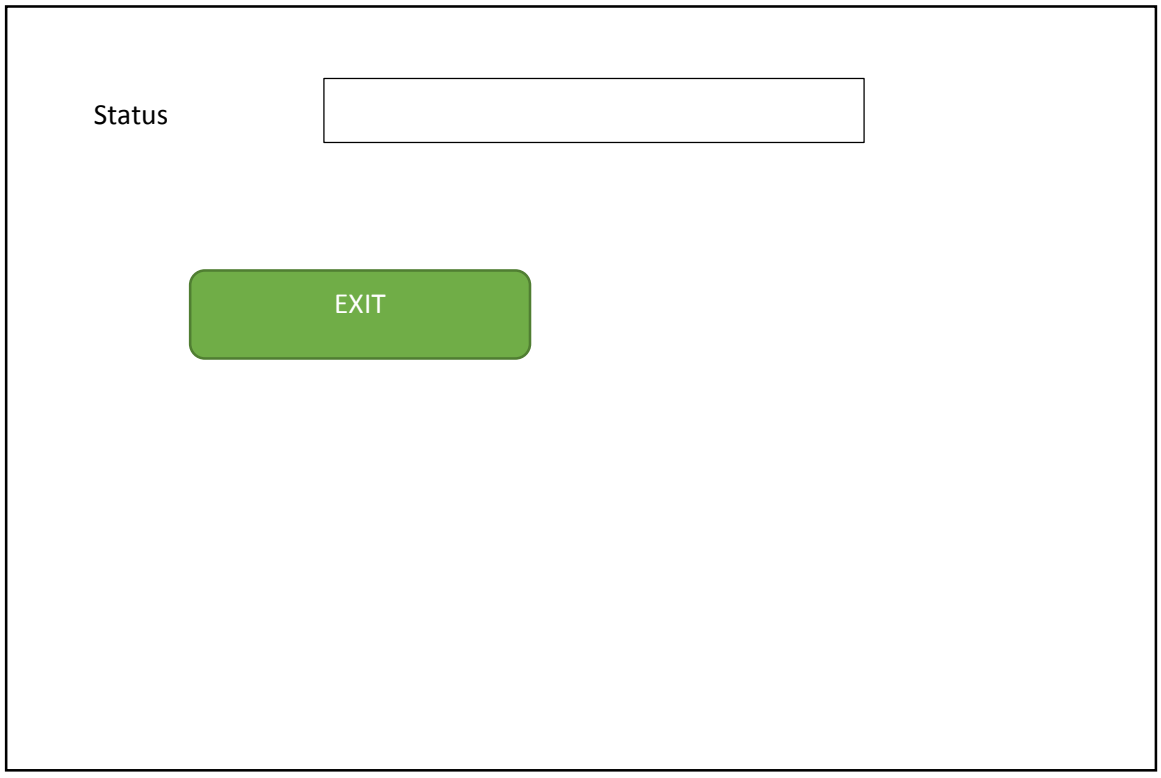


FIG 4.19: FEEDBACK TO SERVICE PROVIDERS

The form above will show the service provider feedback to bids made. The service provider will access the feedback after logging into the system and navigate to bids feedback.

Contracted Companies Form

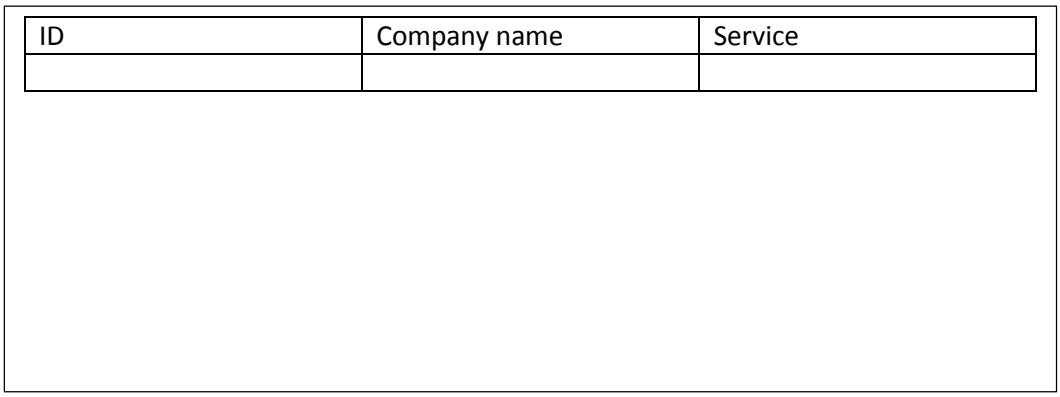


FIG 4.20: FORM FOR VIEWING CONTRACTED COMPANIES

The above form will be used to display all the contracted companies. The table will also give an option to the administrator to click for more company details.

All Services Form

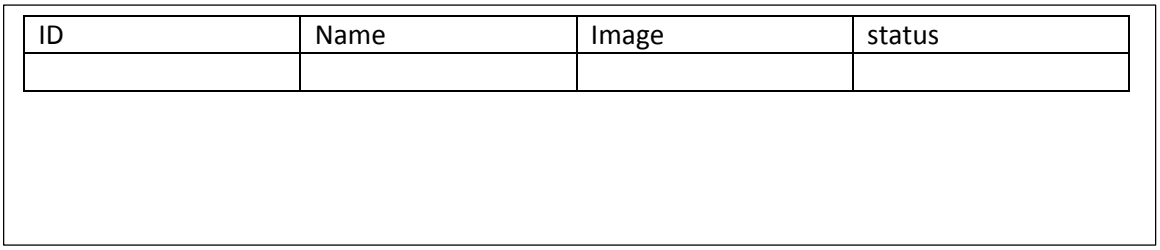


TABLE 4.21: SERVICES

The above table services will be used to display all services on offer and their status whether they are still vacant of they are taken

4.8 CONCLUSION

In this section the researcher had illustrated the way the system will be operating and also its general design structure of the interface. In the next chapter the user will now be looking at the physical structure of the system, testing and as well as the implementation of the system if it passes the testing phase.

CHAPTER 5: IMPLEMENTATION PHASE

5.1 INTRODUCTION

In this section of the research the researcher will be giving a detailed presentation of the implementation phase of the proposed system basing on the analysis and design that has been presented in the previous sections of the research. The implementation phase will be entailing the translation of the propose solution into code. This will be involving application of objects methods, characteristics and integration of all system modules. This stage will also cover system testing segment. On system testing the researcher will be identifying the loopholes of the system. If the system passes the testing phase then it can be installed and begin to be functional.

5.2 CODING

This covers the actual wring of source code of the system modules and this will also define how the system modules will interact with the database. Source code will be written for each and every control that will be used in the system, so it means several lines of code are going to be written. In this system VB.NET and asp.net(C#) are going to be used. VB.NET will be used for the windows platform modules of the system and asp.NET will be used for the web platform modules of the system. And the database to be used is SQL server.

5.2.1 PSEUDO CODE

Goel (2010) describe pseudo code as a formal and structured way of writing and explaining algorithms that will be used in the system in a much simpler way that makes it easy for none technical people to understand. The pseudo code will be simplified and it usually does not contain declarations and initialization of variables. Below is a pseudo code for user registration.

User registration

Connect to the database

After successful connection then

Check if the user exist

If it exist then give a notification to the user

If it does not exist then create it

Then login the user and redirect to the home page

System login

Connect to the database
If connection is established

Then
Check if the username and password entered by the user are correct
If they are correct
Then
Redirect to home page
If they are wrong
Then
Give user an error message and remain at the login page

Check for decision

Connect to the database

If connection is successful

Then

Add all services that had been applied for by users

Check for the applicant with the lowest acceptable price that is within the restriction parameters

Select the details of the selected applicant

Then

Return the applicant's details

5.3 TESTING

Rani (2004) referred to system testing as a process that is implemented for the purpose of identifying the differences between the currently existing system and the proposed system. It is used to identify the variations that exist between the proposed system and the existing system. Testing was introduced so as to try to identify problems that may arise after implementation of the proposed system and correct them so as to defer them from occurring.

System testing stages

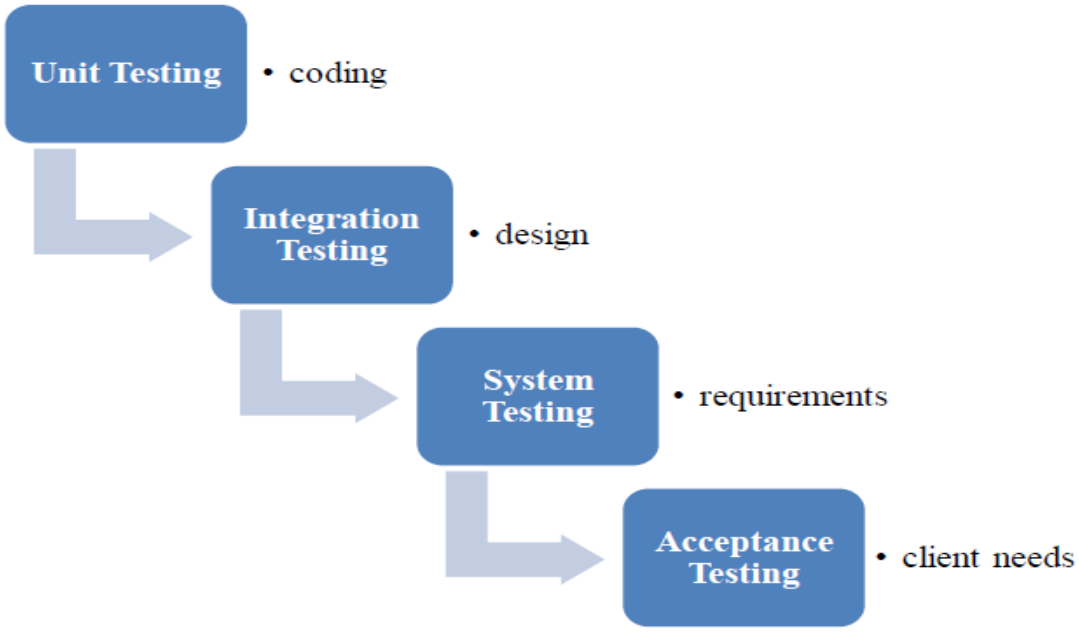
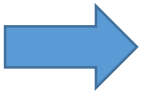


Fig 5.1: STAGES IN SYSTEM TESTING (from Rani, 2004)

KEY



Flow of data or information

5.3.1 UNIT TESTING

Williams (2006) referred to it as a process whereby system units will be tried to evaluate their capabilities to execute various processes that they are supposed to carryout. The units that will be tested in this section are supposed to be as small as possible and they are supposed to have a single input and output. The researcher is going to carryout system testing in two phases namely white box and black box testing.

5.3.1.1 BLACK BOX TESTING

Williams (2006) describes black box testing as a type of tests that is carried out by external entity or entities who does not possess any knowledge or idea of the design and or implementation details of the proposed system. This test is also referred to as functionality testing. For the proposed

system the external service provider was given details and allowed to apply for a service. Below is a diagram that shows the test;

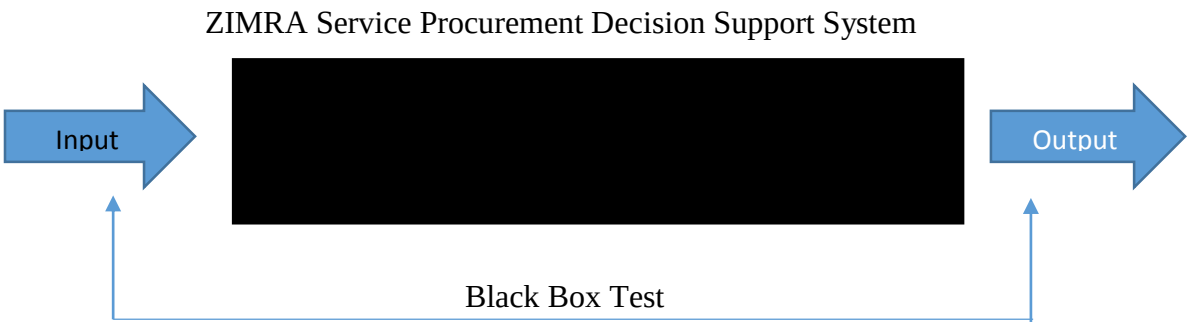


Fig 5.2: BLACK BOX TEST

5.3.1.1.1 ADVANTAGES OF USING BLACK BOX TESTING

- It suits for large projects with several lines of code
- There is no need for accessing the code
- It gives the developers room to understand the users views towards the system
- The system can be tested by people without knowledge of programming

5.3.1.1.2 DISADVANTAGES OF USING BLACK BOX TESTING

- There is generalization since there is no testing of specific codes
- The test will be limited since the user won't be having any software knowledge.

5.3.1.2 WHITE BOX TESTING

Williams (2006) describes white box testing as a process of examining the system basing on its interior logic as well as the structure of the code. The tests will be carried out basing on the structure of the available code. The researcher carried out these tests so as to identify errors and correct them before deployment. These tests were done by developers as this type of test requires people who understand code better.

5.3.1.2.1 ADVANTAGES OF USING WHITE BOX TESTING

- It assist in code enhancing processes.
- It assists in discovery and removal of lines that brings defects

- Since it is carried out by examiners with a better understanding of code most errors will be noted and corrected.

5.3.1.2.2 DISADVANTAGES OF WHITE BOX TESTING

- It increases costs since there is need for a skilled programmer to test the system
- It is too demanding since there a lot of tools needed

5.3.2 MODULE TESTING

Myers (2004) describes module testing as this is a testing process that involve examination of systems' individual modules and also its procedures and subroutines. This process also involve several modules being examined at the same time. In the process the login was tested and also the service providers rating was also tested as an independent module of the system, and the results showed that all were working finely. The researcher also moved on to test the reporting module before the system was combined and tested as a whole.

5.3.3 ACCEPTANCE TESTING

Powers (2012) referred to acceptance testing as a process of finding out if the system satisfy the users and meet their requirements and expectations as they are highlighted in the data gathering section of this research. To examine if the system meets the users' requirements the researcher logged into the system and check for functionality as highlighted in the data gathering section. The researcher also made the system available to some of the users like the IT representative and some selected external service providers and they tested. Acceptance testing was also carried out to check the reliability and security aspects of the system as well as its ease of use. Acceptance testing comprise of beta and alpha testing.

5.3.4.1 ALPHA TESTING

Powers (2012) describes alpha testing as a type of testing that involves users' tests of the system. The system will be given to various stakeholders so that they can test and report any bug if found such that the developers can correct it. The proposed system was presented to management and other selected internal and external users for examination and problems that were noted where corrected.

5.3.4.2 BETA TESTING

Powers (2012) describes to beta testing as a type of test that is made by the administrators and developers of the system. The system was examined using data that was given by external service

providers who were selected to test the system and the process was continuously repeated and errors that were noted where corrected.

5.3.4.2 TESTS STRATEGIES

Various strategies were implemented in verification and validation of the system. In the process the researcher managed to identify some errors and they were successfully corrected. Some of the techniques that were used in the process are shown below.

5.3.4.3 VALIDATION

Grady (1997) referred to validation as a process of proving if the correct system had been built. For the proposed system the author had to examine if the built system was the correct system. In the process the author checked various components of the system to see if they were designed according to the users' requirements and specifications. Some of the tests that were made involve entering texts in fields that are meant for numbers only and the system is supposed to show error messages.

5.3.5.1.1 LOGIN VALIDATION

In order to access the system the users are required to enter correct usernames and passwords, otherwise an error message will be displayed. If the credentials entered by the users are correct then the user will be redirected to his or her view basing on his or her access level.

Login failed error display

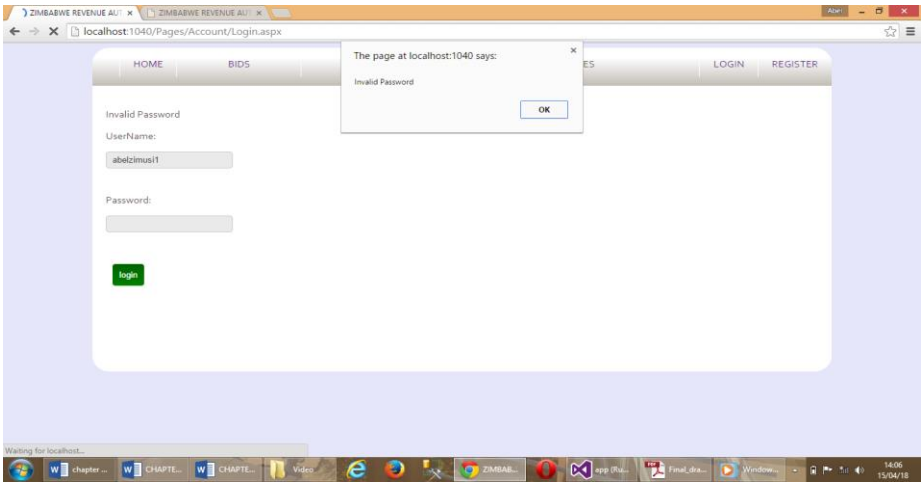


Fig 5.4: FAILED LOGIN MESSAGE

5.3.5.1.2 USER INPUT VALIDATION

This refers to validation which is carried on when the user enters inputs. An error message will be shown if a wrong input is entered. This is used for client side validation to reduce server load on validation. If the user enters an invalid input for example a letter instead of a number then the page an error will be displayed.

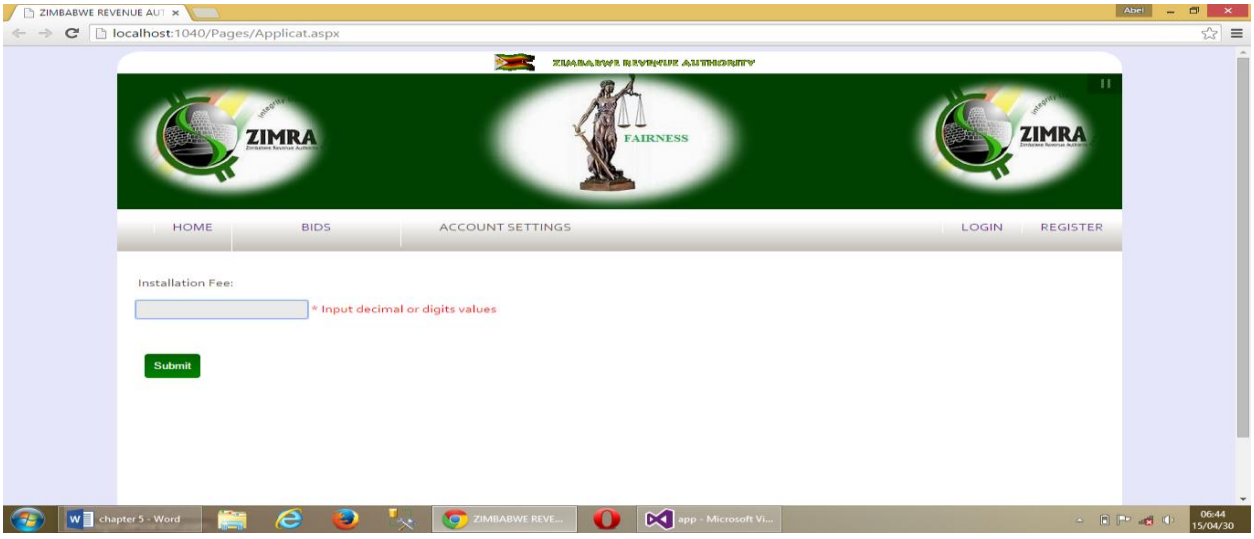


Fig 5.5: USER ENTERING INVALID CHARACTERS

5.3.5.2 TEST CASES

Copeland (2004) describes a test case as a type of test that is used to examine components of the system which includes, procedures as well as that are required to come up with certain results. The researcher will look at some of the important cases.

Case 1: logging in

Preconditions	Steps	Expected Results
The user must have only his or her correct credentials	1. Enter a valid user-name. 2. Enter a correct password. 3. Click login.	After a successful login no popup message but the user will be redirected to home page and the login name will be displayed on the top right corner

Table 5.1: TEST CASE1

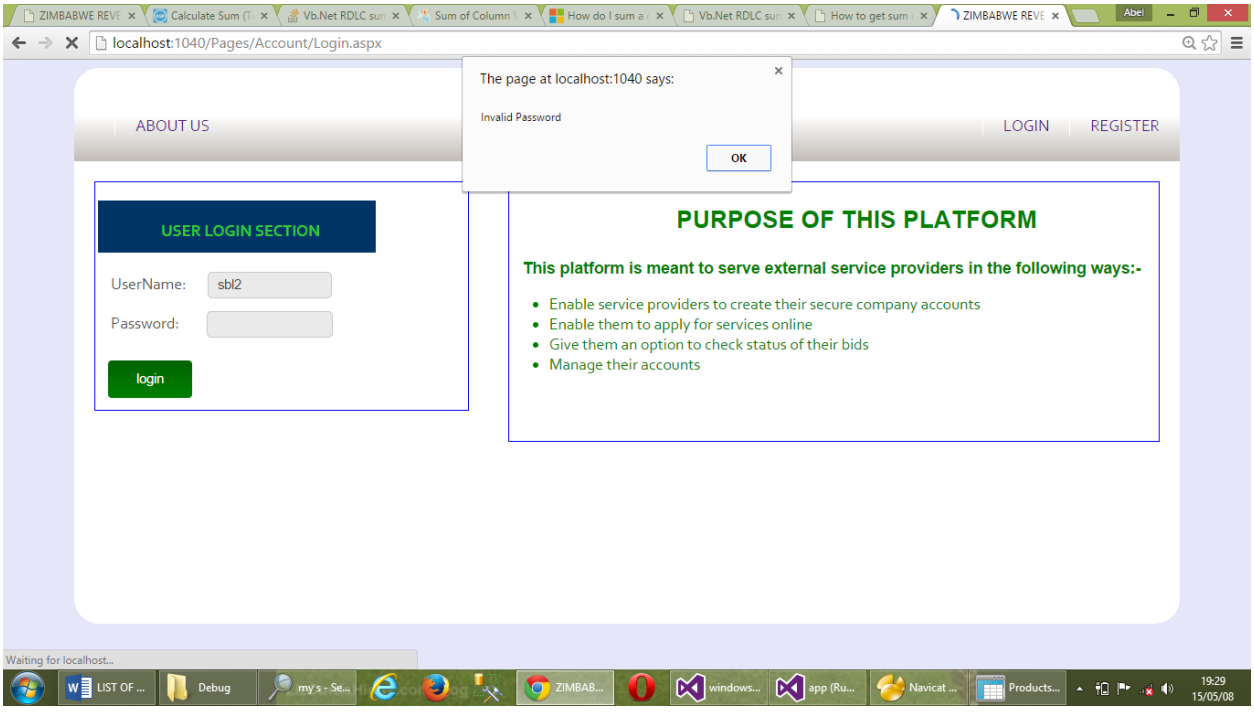


Fig 5.6: TEST CASE 1

Test Case 2: User registration

Preconditions	Steps	Expected Results
The user visits the system home page	1. Enter details 2. Click submit	If the user fill in the service provider correct details then the system will automatically login the user and then redirect him or her to the home page

Table 5.2: TEST CASE2

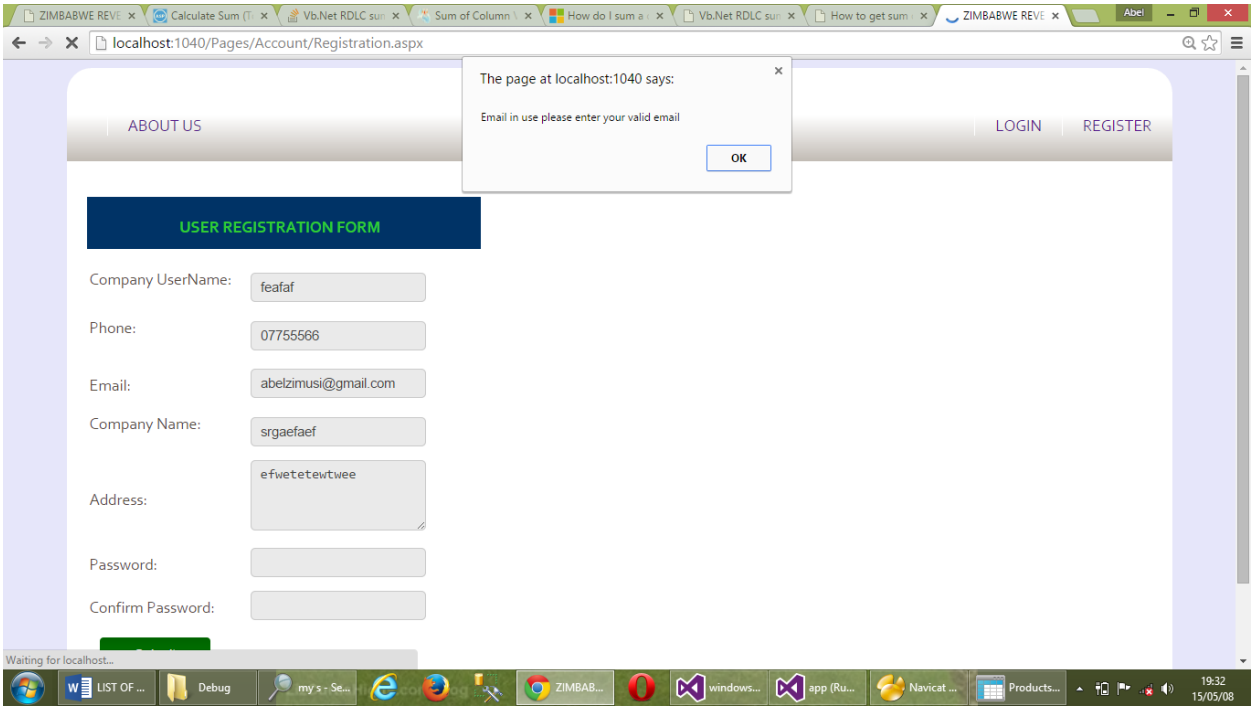


Fig 5.7: TEST CASE 2

Test case3: Applying for a service

Preconditions	Steps	Expected Results
User has to login to the system	1. click the desired service 2. enter the initial payment	After successful application the user will be redirected to a feedback page

Table 5.3: TEST CASE2

Table 5.3: TEST CASE 3

Test case 4 restricting services

Preconditions	Steps	Expected Results
The user has to login to the system	1. select service 2. enter minimum and maximum acceptable price	After successful restrictions a message will be displayed

Table 5.4: TEST CASE 4

Test case 4

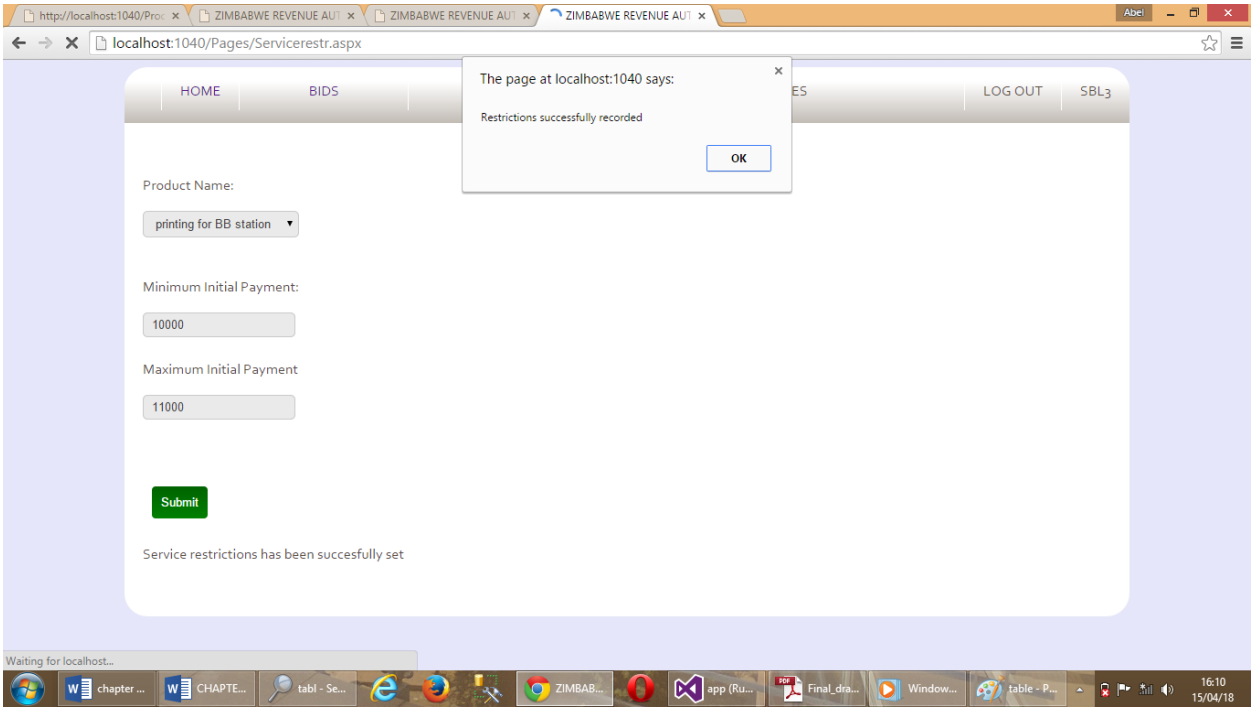


Fig 5.9: TEST CASE 4

5.3.5.3 VERIFICATION

Grady (1997) referred to verification as a process whereby a system will be evaluated against the initial primary objectives so as to make sure that the system meets the required objectives. This process will also involve checking of the processed data is correct and is the same as the captured

data. This process will be done so as to make sure that the output of the system tally with the inputs because it might be possible for a system to accept inputs and process wrong data and presents wrong output. The researcher tested the system and checked the data processed and the system passed the verification test.

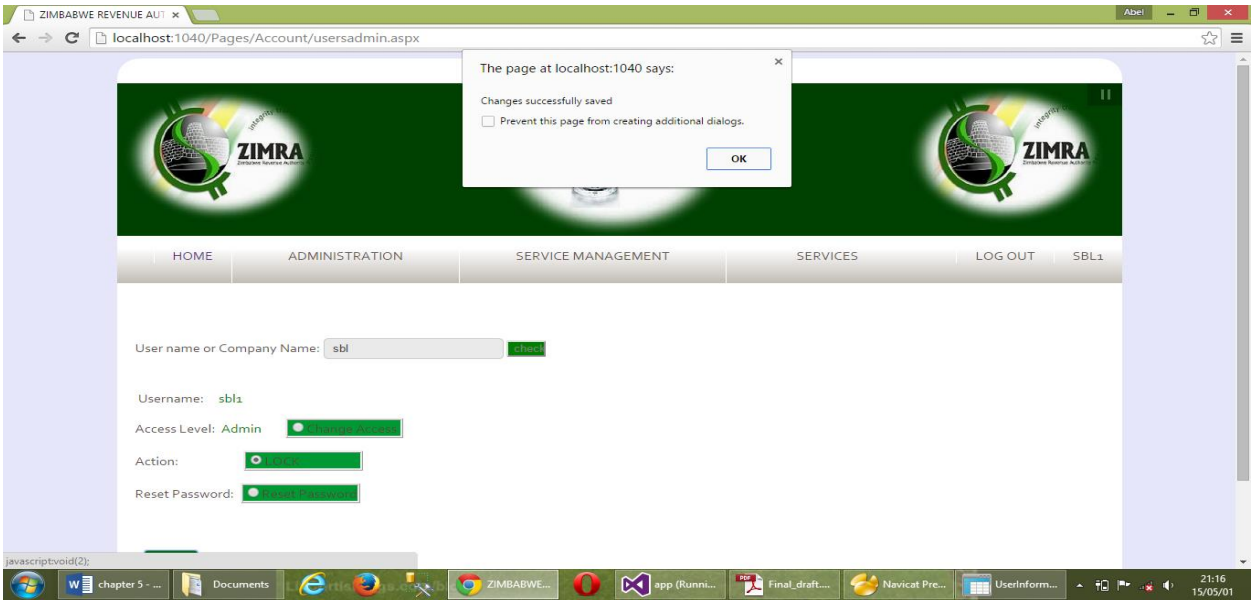


Fig 5.10: VERIFICATION

After successfully entering correct information on user administration a pop up message will be displayed notifying the user that the operation was successful.

5.4 INSTALLATION

Grady (1997) define installation as procedures and processes that are involved during the deployment of a system. On a certain platform. Some of the issues that will be looked at during the installation segment are, user training, methods to be adopted on the deployment of the system and also the location of the system server. For the proposed system the server will be located at the ZIMRA ICT head office in Harare at Kurima house where other system servers are located.

5.4.1 THE SOFTWARE INSTALLATION PROCEDURES

- A CD containing the system will be used to install the system on the server.
- The next step will be to follow the installation wizard
- The folder in which the application will be residing will be selected
- Database connection and configuration

- Test database connectivity

5.4.2 USER TRAINING

The researcher had come up with a training program for users of the system. The training program was mainly aiming at ensuring familiarization of the system to its users. The training program covers even the management as they will also be involved in using the system as they will be the ones who will be viewing and print reports from the system. The training program also covered existing service providers so as to make sure that they are able to use the system without any complication. After the training users were given room to ask on all areas that requires clarification, this was done so as to make sure that everyone who attended the training understand how the system operates and is to be used. At the end of the training some of internal and external users of the system were asked to log into the system and demonstrate to others.

User Training Schedule

TRAINING Days	TARGET GROUP	COMMENTS
Day 1	Administrators	Training was mainly focusing on the administrative functionality of the system which include adding services, user administration, decision support section and user support
Day 2	ICT Personnel	Service providers rating module of the system
Day 3	External Service Providers	The training was mainly focusing on application of services and checking of bids status
Day 4	Management	Managers were trained on how to access and print reports

TABLE 5.5: TRAINING SHEDULE

5.4.3 OPERATION ENVIRONMENT

This refers to the platform on which the new system is to be installed and will be residing. The operating environment is very crucial as it determines the performance of the system, so it has to be tested before any change is made. Some of the components of the system environment are:

- Network equipment
- Operating system
- Hardware
- Software configuration

All these component were tested and passed.

5.4.4 CONVERSION

After successful completion of the system testing then files of the old system had to be transferred to the database of the new system. Since the old system is manual, it means that the new system won't affect the old system in any way. All the stakeholders of the old system were involved in the conversion process so as to make sure that no modifications will occur on the data and also that no valuable data will be left out.

5.4.5 SYSTEM CHANGEOVER

Culley et al (2001) describes system changeover as a process of shifting from an old system to the newly proposed system. A number of changeover strategies exists and some of them are explained below.

5.4.5.1 DIRECT CHANGEOVER

Culley et al (2001) referred to direct changeover as an instant process of moving from the old system to the new system and immediately putting the new system into operation and full control. In this process the old system is quickly abandoned for the new system. This is the simplest and least expensive changeover strategy.

5.4.5.1.1 MERITS OF DIRECT CHANGEOVER

- Implementation is cheap
- No keeping of duplication records

5.4.5.1.2 DEMERITS OF DIRECT CHANGEOVER

- It is risky, if anything goes wrong there is no alternative system to cover up.
- May take a lot of time for users to familiarize the system while it will be already functional
- The might be system unavailability during installation

5.4.5.2 PARALLEL CHANGEOVER

Culley et al (2001) referred to parallel changeover as a process of using the two systems together for a certain finite period of time. The inputs and outputs from the system will be compared until it is certain that the new system is producing correct results. When it is concluded that the new system is free from bugs then the old system can be eliminated.

5.4.5.2 MERITS OF PARALLEL CHANGEOVER

- It is less risk since if anything goes wrong an old system will be used
- No stress on the stakeholders side since they will be having the old system for cover up
- It gives enough time for users to learn the new system

5.4.5.2.2 DEMERITS OF PARALLEL CHANGEOVER

- Costly since two system has to be used at the same time.
- Requires confirmation of similarities of the data entered into both systems.

5.4.5.3 PILOT CHANGEOVER

Culley et al (2001) this is a method of shifting from old system to the new that involve implementation of the system to a certain part of the organization or branch and check if the results are satisfactory. The part of users that are selected to use the system for a certain period of time during evaluation stage is called the pilot group.

5.4.5.3.1 MERITS OF PILOT CHANGEOVER

- Reduction in risk of failure
- Cheaper in comparison with other changeover strategies
- Less time consuming

5.4.5.3.2 DEMERITS OF PILOT CHANGEOVER

- It is costly when compared to direct changeover

CHANGEOVER DECISION

After a thorough analysis and evaluation of all possible changeover strategies the researcher recommended parallel changeover to the management. The researcher reaches this decision after discovering that though this changeover strategy is costly but it is less risk and safe and it also gives the users of the system time to learn and get familiar to the system. This will reduce stress on the users and also gives them room to learn the system without pressure. Furthermore parallel changeover also gives developers and other concerned stakeholders time to compare the results from the two systems and see if the new system is giving correct results.

5.5 MAINTAINANCE

Edward and Bramante (2009) said that system maintenance is a process of managing and improving the components and modules of the system so as to make sure that they are operating in the best possible way. The maintenance process ensures that the system is free from errors and is functioning in a satisfactory way. Maintenance is not a once for all process but it is an ongoing process as the system need to be constantly checked, corrected and improved to ensure that it will remain reliable. It is the duty of the administrators and developers of the system to always make

sure that the system is up-to date and is operating in a proper way with the current technologies. Various types of maintenance exists and some of them are explained below;

5.5.4 PERFECTIVE MAINTAINANCE

This can be defined as a process of improving and refining the existing system, Edwards and Bramante (2009). This process is necessary as it ensure that the system will be able to carter for the changes in users' requirements and also change in technology as well as operating environment. All the changes that will be made to the system will be documented for error recovery and also for future maintenance.

5.5.5 PREVENTIVE MAINTAINANCE

Edwards and Bramante (2009) referred to preventive maintenance as a process of maintaining the system so as to make sure that it won't lose value but will keep on being necessary and that it will also not lose its functionality through use. This can be achieved having constant maintenance on the system.

5.4.1 DISASTER RECOVERY

Mechanisms has to be put in place to enable data to be recovered if things go wrong. To do this the developers had incorporated an option for database backup such that everything will be safe.

5.5.6.1 SECURITY

Dorian et al (2003) describes system security as the access control mechanisms that are put in place to protect the system from unauthorized access and also prevent data lose to intruders and other threats. These mechanisms are put in place such that only authenticated users can access the system. To make sure that the system is secure various security policies has been incorporated by the developers and some of them are listed below:

User authentication – It is one of the generic objective of the system that is meant to make sure that only approved users should be given access to the system.

System security – In order for a system to be considered acceptable it should have access levels that is to say that it should filter the type of data, functionality and processes accessed by each and every user depending on his or her profile

Data backup – in order to make sure that data is recovered if anything goes wrong, a backup of the database is to be made, this will enable data recovery and prevent information loss.

5.5.6.1.1 SECURITY MEASURES

In the implementation of the policies the researcher added some policies which are mentioned below.

- Password characters should be at least six characters to make sure that accounts are secure.
- All users should have usernames and passwords.
- Access levels are in place so as to filter the type of information accessed by users basing on their access levels
- There is backup in place which ensures that the data in the database is safe.

5.5.6.2 SYSTEM BACKUP

To ensure maximum security of the data in the database a backup strategy should be in place. To make sure that this is achieved a continuous backup has been put in place which will enable database backup to be carried out any time and any day. All the tapes on which data is to be stored after backups are to be labelled so as to simplify the recovery process and avoid guess work. All the backup tapes are kept in a secure locked room so as to ensure maximum security.

5.5.6.3.1 FULL BACKUP

Dorian et al referred to full back-up as a backup process that involve backing up all the selected files. In this process the whole file will be backed up whenever a backup is made. This type of backup has the advantage of a quick recovery whenever recovery is to be made. However this process is time consuming and requires a lot of backup space that's being expensive.

5.5.6.3.2 INCREAMENTAL BACKUP

Dorian et al (2003) states that incremental backup is a type of backup which involve the changes of data to the last backup. It means that only new data will be added to the backup data. In this type of backup only the first backup will be full backup and all other backups will be partial. The problem with this type of backup only comes when recovery is needed as the process will be slower as compared to that of full backup.

5.5.6.3.3 DIFFERENTIAL BACKUP

Dorian et al (2003) describes incremental backup as that type of backup that only stores changes that were made since the last backup. In this type of backup full back-up is made only at the first backup process and thereafter only changes will be backed up. The advantage of this backup is that recovery will be slow though it possess the advantage of a fast backup execution process.

5.5.6.3.4 MIRROR BACKUP

From Dorian et al this is a type of backup in which a mirror of the source data is backed up. In this type of backup when the source file is deleted then the backed up file will also be deleted. It is a replica of the source file. In this type of backup when a source file is modified then the backup file will also be modified. Its advantage is that it will be containing the most current state of the database.

The researcher recommends that the organization adopts full backup though it might be expensive and time consuming to carryout but it is certain that data will be recovered after running restore and it also has the advantage of a quick recovery process and it also allows data from different backup processes to be stored on different labelled tapes for ease of recovery.

5.5.7.1 SYSTEM VS. OBJECTIVES

Here all the developed system will be evaluated against objectives that were mentioned in chapter 1. To develop a decision support system that assist in procurement decision making processes by recommending suppliers on the basis of on supplier history and provider score card. This objective was met as the developed system allows the administrator to view and save service procurement decision that would have been generated by the system.

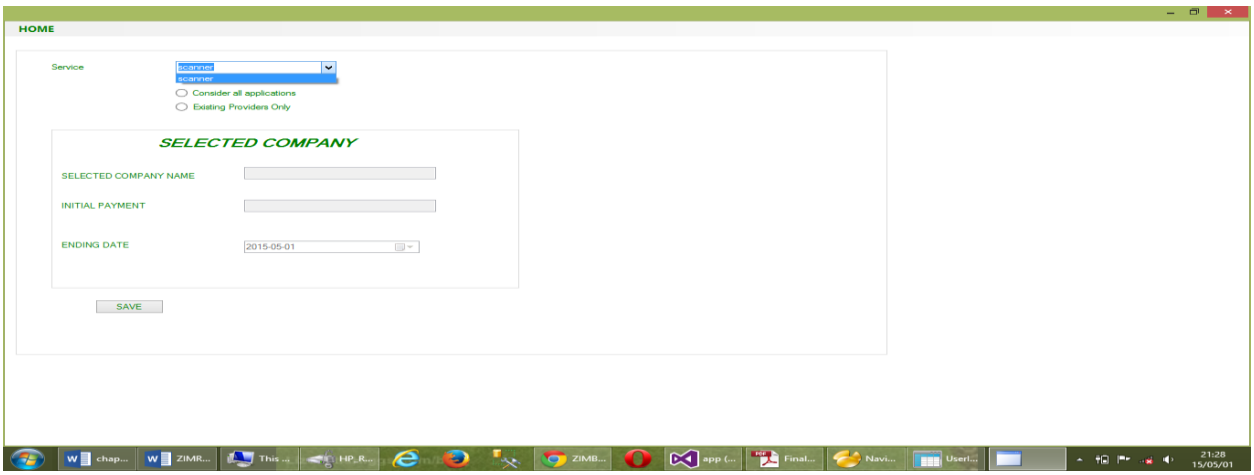


Fig 5.11: DECISION SUPPORT SECTION

2. To come up with a system that allows service providers to check the status of their tender bids. This objective was achieved as the system give service providers an option to check for the status of their

bids so as to see if they have been accepted or rejected. The following screen show shows a page for viewing bids.

FIG 5.12: BIDS STATUS

3. To come up with a system that provide a score card for supplier assessment after every assigned duty has been completed. This objective was met since the developed system give an administrator an option for rating service providers basing on their performance in their operations per given service. The following screen shot shows a platform for service provider rating.

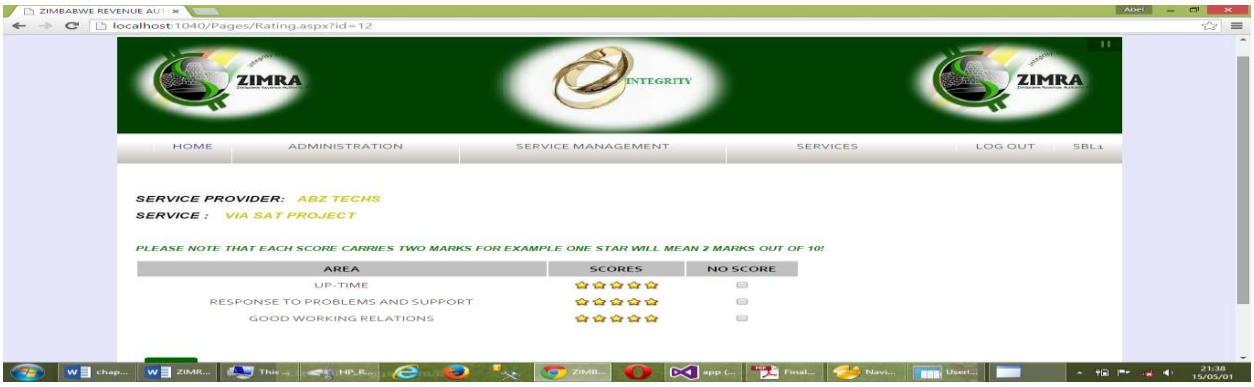


Fig 5.13: SERVICE PROVIDER RATING

4. To come up with a system that enables the ICT service procurement team to give feedback to tender bids in form of status that is (pending, accepted or rejected). This has been achieved as the

system will automatically add a status comment in the service provider bids feedback section giving information about the status of the bid.

5. To develop a system that will enable the administrator to trigger an email notification to companies that would have had won the tender. This objective was achieved since the developed system enables the administrator to send email notifications to companies that would have won the tender.

RECOMMENTATIONS

The results from all the system tests that were made reflected that the system had passed all the requirements and expectations therefore the researcher made the following recommendations:

- The database has to be backed up each and every day. This is very crucial as it will prevent data loss if anything goes wrong as the data will be recovered from the backed up files.
- A training has to be made for all users of the system especially internal users so that it will be easy for them to use the system.
- The system needs to be constantly maintained so as to make sure that it is up to date and functions properly.
- All users of the system should not disclose their passwords to others as this will make their accounts prone to attacks or abuse.
- If any problem is encountered during the use of the system, only developers are supposed to make changes to the source code as if this is left to people without programming skills it may result in data loss or worsening of the situation

5.6 CONCLUSION

The main focus of this chapter was installation, testing and implementation of the system and all were carried out successfully. The system has been tested and evaluated against its objectives and everything was clarified and the system had passed all the tests. The planning of the project was properly carried out and this led to a successful implementation of the project. All the stakeholders of the project are happy and satisfied however to the researcher it's just a stepping stone as there is still more work to be done on research to improve the system as technology is continuously changing every day.

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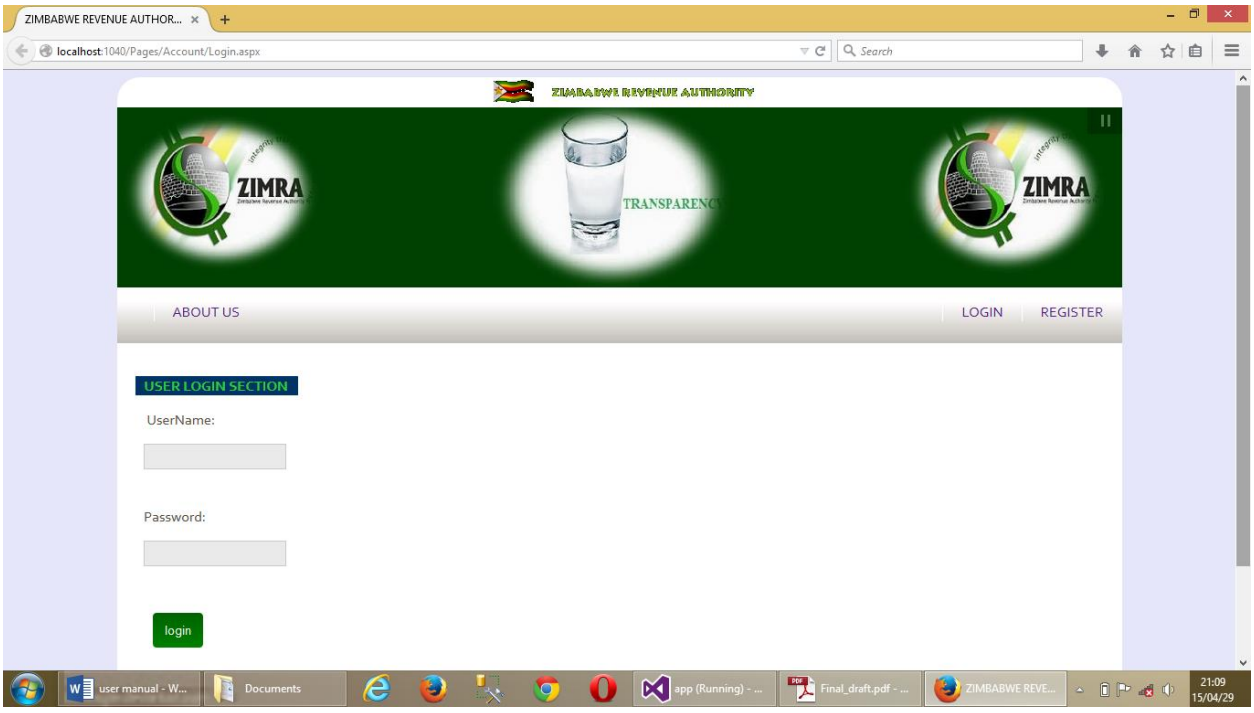
APPENDIX A: USER MANUAL

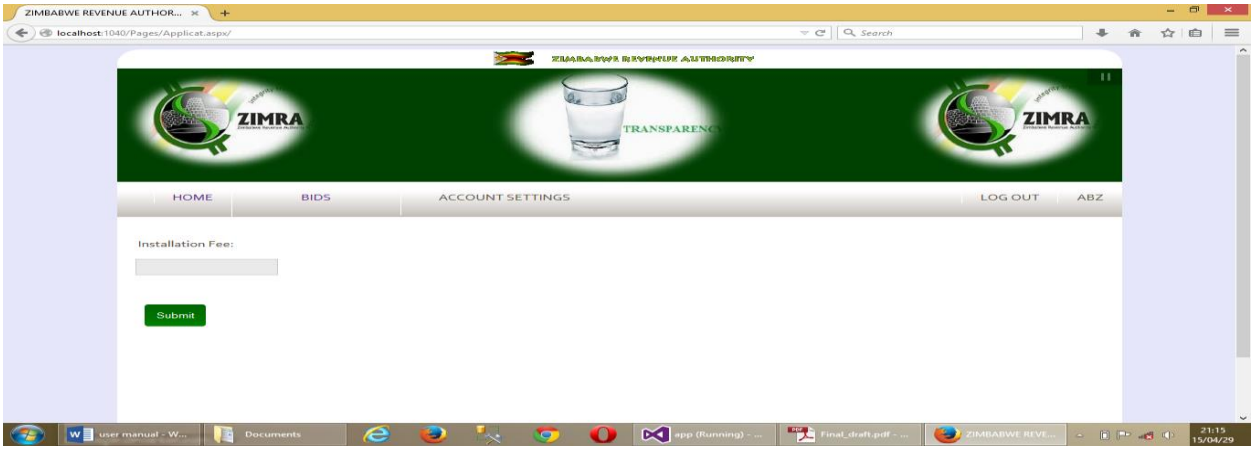
LOGIN

For existing users they have to enter valid credentials which were registered into the system. After entering correct credentials then you should press login. The system will then redirect you to the home page depending on your access level.



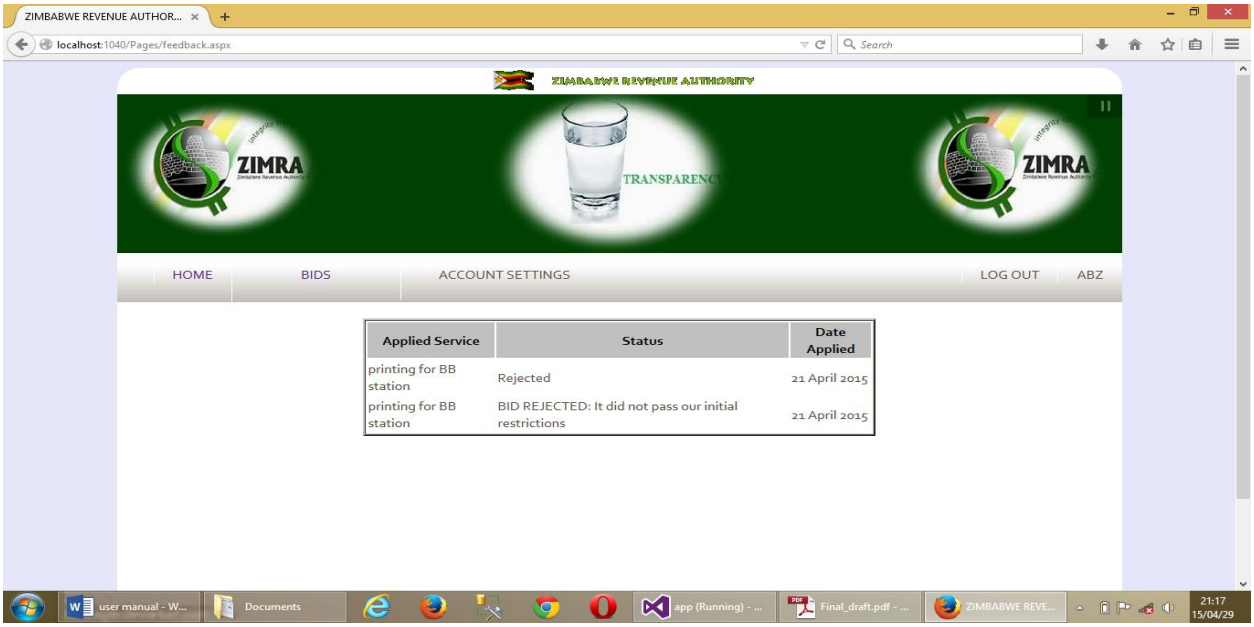
Correct username and password should be entered into password and username field then press login button. IF you enter an invalid password the system will deny you access.

APPLICATION FORM



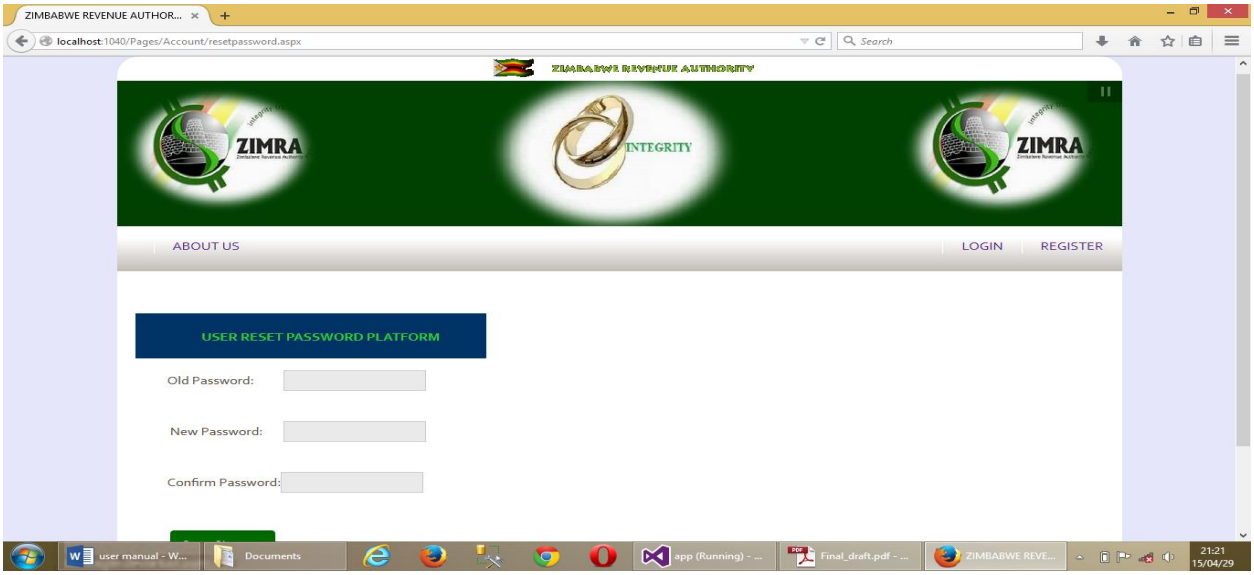
To apply for a service you have to first login or register into the system, then click the desired service on the home page, from the service additional information click the button apply then enter the installation fee and click button submit.

CHECK BID STATUS



To check for a bid status first login with correct credentials, then on the navigation bar click or hover on bids and select view bid then all you bids and status will be displayed. This option can only be accessed after logging into the system and having made an application before.

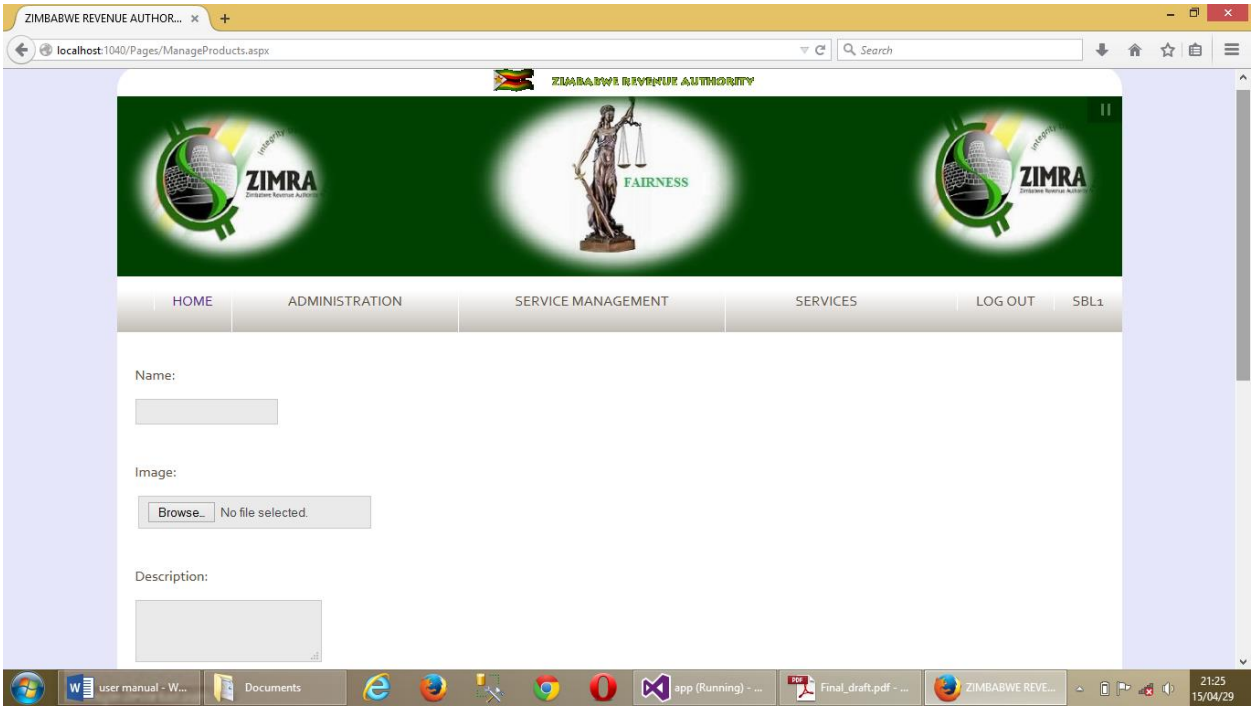
CHANGING PASSWORD



To change password first login to the system using correct credentials, then on the navigation bar select account settings and enter the old password then enter the new password and confirm it then click the button save changes.

ADMINISTRATOR MANUAL

ADD NEW SERVICE

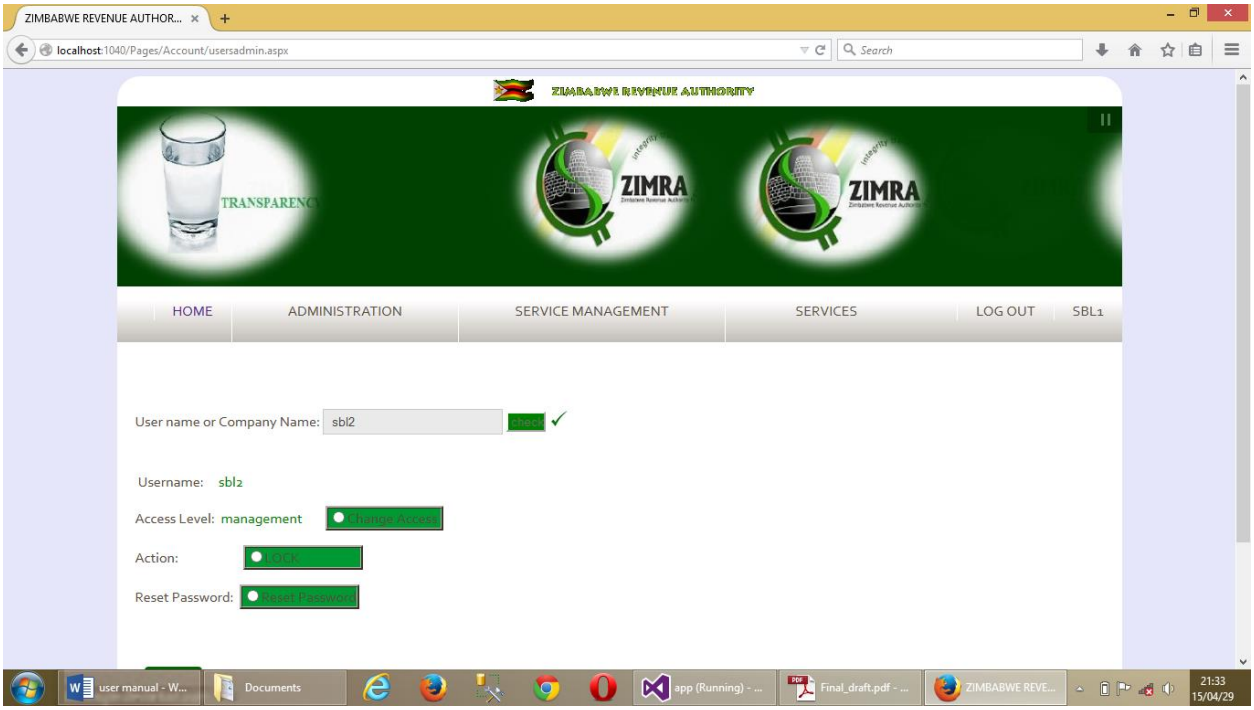


To add a new service first login with an account with administrative privileges. Navigate to manage services on the navigation bar and select add new service. Fill in the required service details and image then click the button save.

VIEW AND MANAGE SERVICES

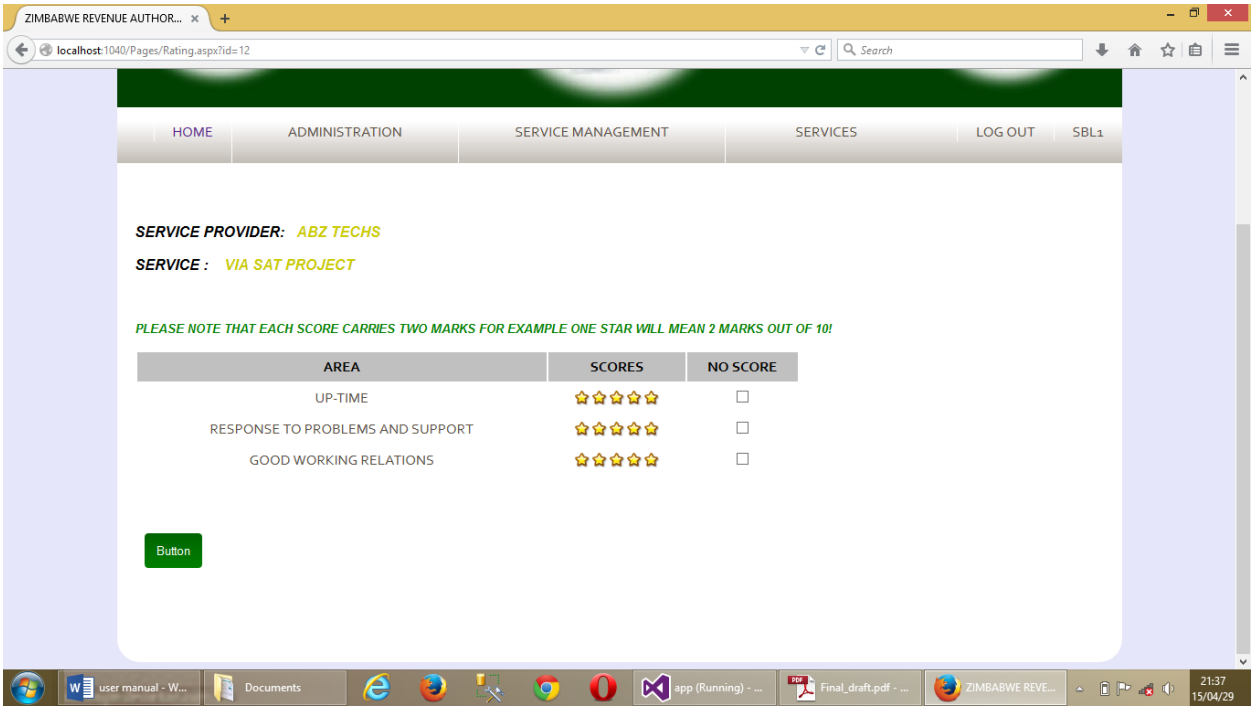
To view and or edit or delete available services in the system first login to the system with the management credentials, on navigation bar select service management. To delete a service just click on button delete in the service to be deleted row and to edit a service just click button edit then click update after making changes.

USER ADMINISTRATION



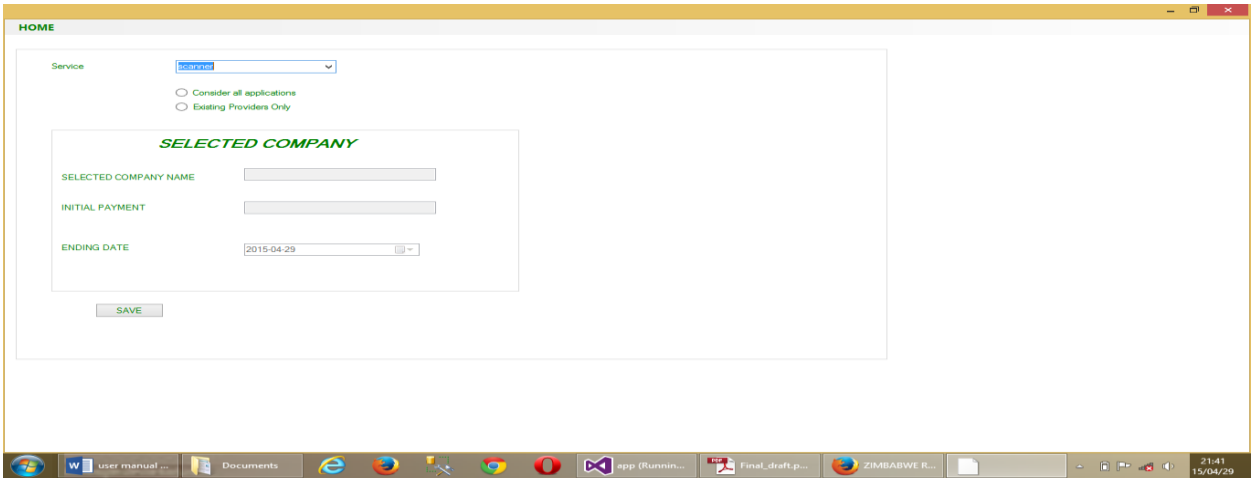
First enter the username of the user to be administered. Then make the desired changes, to lock or unlock the user just check the corresponding radio button, to change user access level check the change access level radio button, and to reset password check the reset password radio button then click the button save to save the changes.

RATE SERVICE PROVIDERS



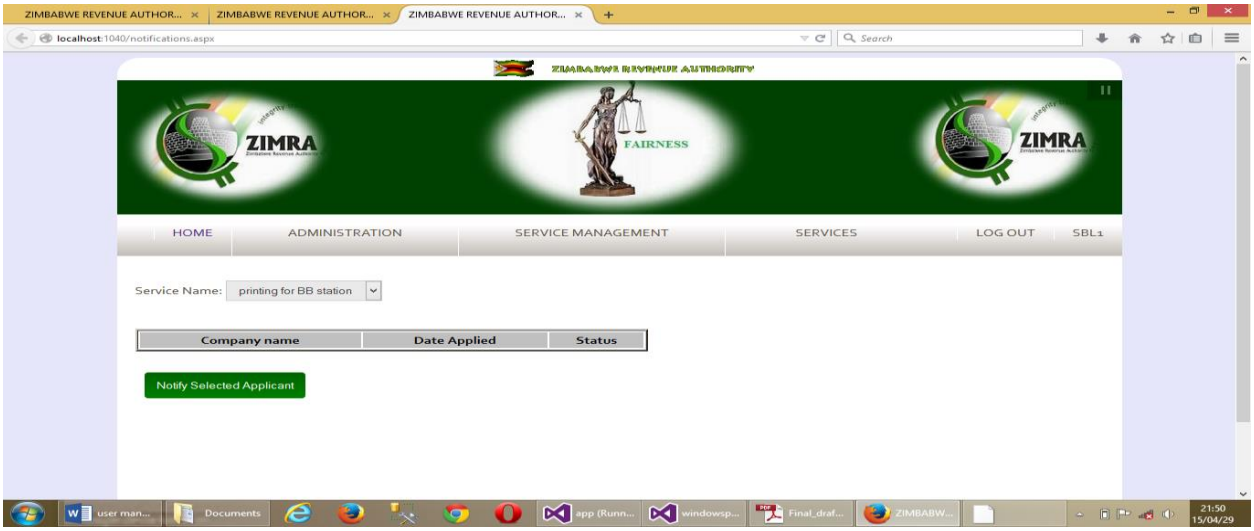
To rate service providers navigate to services on navigation bar and select rate then in the companies table select the company to be rated, then click on the service to be rated and tick the scores from the five stars displayed and click button save.

DECISION MAKING



To get the decision select the service to get decision for, then choose the decision criteria that is whether to choose from available providers or new providers, then enter the expiry date of the contract and click save.

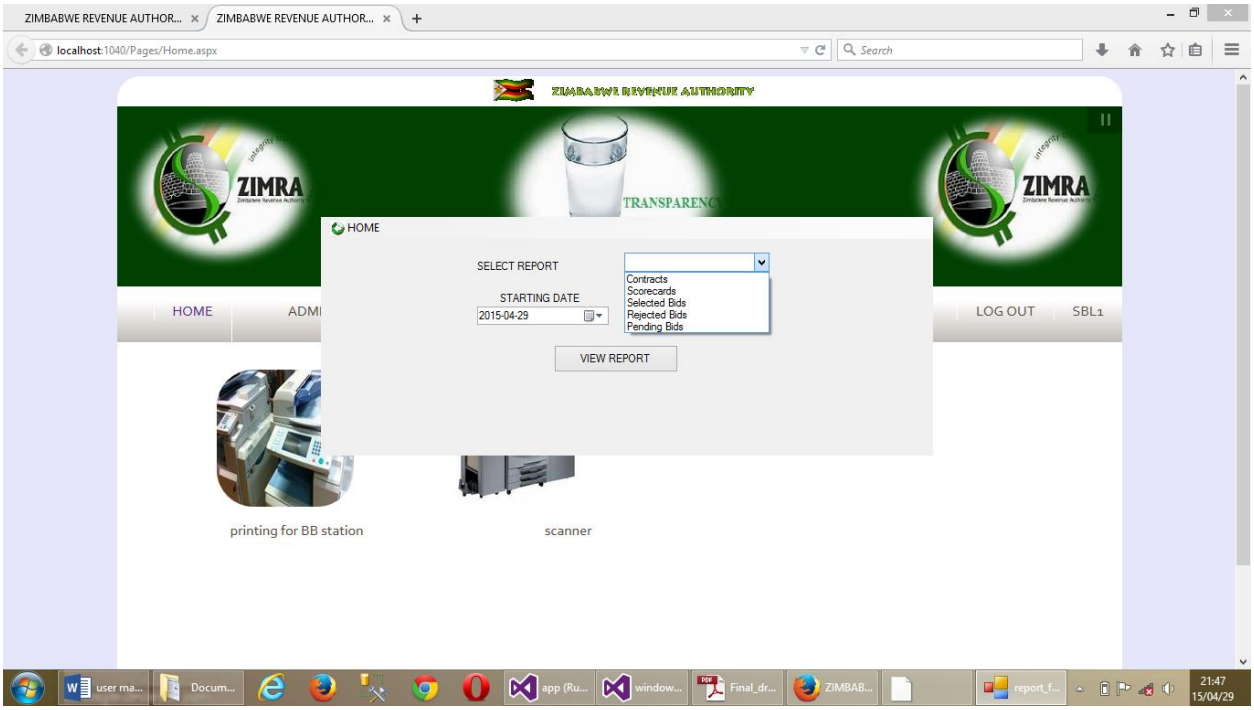
NOTIFY SERVICE PROVIDERS



To notify selected applicants on their bids on navigation click on bids then notifications and click the button notify users.

MANAGEMENT MANUAL

VIEW REPORTS



In the dropdown list select or type in the report to be viewed then select the date range and click button view report.

APPENDIX B: SAMPLE QUESTIONNAIRE

I am a final year student at Midlands State University and am proposing to develop an ICT Service Procurement Decision Support System which will assist you in automating the service procurement decision support process with minimum human effort. In this survey your responses are of paramount importance but it is also important for you to note that you are not forced to fill in this questionnaire. Please do not enter your name or contact details on the questionnaire. It remains anonymous. Information provided by you remains confidential and will be reported in summary format only.

QUESTIONNAIRE CHECKLIST

Gender Male: ☐
Female: ☐

(Please tick where appropriate above)

1. Give a brief of how the current decision making process works

……
……
……

2. How long does it take for you to reach a decision?

……
……
……

3. Are you satisfied with the current decision support system? Yes/No.
If No state the reason

……
……
……

4. What major enhancements would you like in the present system?

……
……
……
……

5. What do you think about introducing a new Service Procurement Decision Support System?

……
……
……

7. Do you think the Service Procurement Decision Support System will help you solve the current problems that are resulting from the use of manual system?
Yes ☐ No ☐ not sure ☐

6. Comments/suggestions

……
……
……

.....
.....
.....
Thank you for this great contribution.

APPENDIX C: INTERVIEW QUESTIONS

1. Are you satisfied with the current Service Procurement Decision Making System?
2. What major enhancements would you like in the present system?
3. What do you think about introducing a new system?
4. What do you expect to be in the new system?
5. Do you have any computer back ground and how much do you know?
6. In making a decision how many problems do you usually encounter?
7. What is the trend that you follow when making a decision?

APPENDIX D: OBSERVATION FORM

Date: ……..

Time: …….

Department: ……..

OBSERVATION	NOTES	RECOMMENTATIONS

APPENDIX E: SNIPPET OF CODE

LOGIN

//server side

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
using System.Web.UI;
using System.Web.UI.WebControls;
using Microsoft.AspNet.Identity;
using Microsoft.AspNet.Identity.EntityFramework;
using Microsoft.Owin.Security;
namespace app.Pages.Account
{
    public partial class Login : System.Web.UI.Page
    {
        protected void Page_Load(object sender, EventArgs e)
        {

        }

        protected void Button1_Click(object sender, EventArgs e)
        {

            Session["loginpassword"] =txtPassword.Text;
            Session["loginname"] = txtUserName.Text;
            ZIMRAEntities ctx = new ZIMRAEntities();
            var query = from m in ctx.UserInformationns
                        where m.username ==txtUserName.Text // or what ever the foreign
key name is...
                        select m;
            var count = query.Count();
            if(count==0)
            {
                ScriptManager.RegisterStartupScript(this, this.GetType(), "popup",
"alert('User does not exist in the system');", true);
            }
            if (count >0)
            {

            ZIMRAEntities we = new ZIMRAEntities();
            UserInformationn con = new UserInformationn();
            UserInformationn conn = new UserInformationn();
            conn = we.UserInformationns.SingleOrDefault(x => x.username ==
txtUserName.Text);

            string status = conn.status;
            if (status == "Locked")
            {
                ScriptManager.RegisterStartupScript(this, this.GetType(), "popup",
"alert('This account is currently locked please contact the acministrator for
assistance');", true);
            }
            if (status == "active")
            {
```

```
                con = we.UserInformationns.SingleOrDefault(x => x.username ==
txtUserName.Text);
                string role = con.role;
                if (role == "Admin")
                {
                    UserStore<IdentityUser> userStore = new UserStore<IdentityUser>();
                    userStore.Context.Database.Connection.ConnectionString =
System.Configuration.ConfigurationManager.
                        ConnectionStrings["ZIMRAConnectionString"].ConnectionString;
                    UserManager<IdentityUser> manager = new
UserManager<IdentityUser>(userStore);
                    var user = manager.Find(txtUserName.Text, txtPassword.Text);

                    if (user != null)
                    {
                        //call OWIN functionality
                        var authenticationManager =
HttpContext.Current.GetOwinContext().Authentication;
                        var userIDentity = manager.CreateIdentity(user,
DefaultAuthenticationTypes.ApplicationCookie);
                        //sign in user
                        authenticationManager.SignIn(new AuthenticationProperties
                        {
                            IsPersistent = false
                        }, userIDentity);
                        //redirect user to home page
                        Response.Redirect("~/Pages/adminhome.aspx/");

                    }
                    else
                    {
                        ScriptManager.RegisterStartupScript(this, this.GetType(),
"popup", "alert('Invalid Password');", true);
                    }
                }
                if (role == "user")
                {
                    UserStore<IdentityUser> userStore = new UserStore<IdentityUser>();
                    userStore.Context.Database.Connection.ConnectionString =
System.Configuration.ConfigurationManager.
                        ConnectionStrings["ZIMRAConnectionString"].ConnectionString;
                    UserManager<IdentityUser> manager = new
UserManager<IdentityUser>(userStore);
                    var user = manager.Find(txtUserName.Text, txtPassword.Text);

                    if (user != null)
                    {
                        //call OWIN functionality
                        var authenticationManager =
HttpContext.Current.GetOwinContext().Authentication;
                        var userIDentity = manager.CreateIdentity(user,
DefaultAuthenticationTypes.ApplicationCookie);
                        //sign in user
                        authenticationManager.SignIn(new AuthenticationProperties
                        {
                            IsPersistent = false
                        }, userIDentity);
                        //redirect user to home page
```

```
                        Response.Redirect("~/Pages/Home.aspx/");

                    }
                    else
                    {
                        ScriptManager.RegisterStartupScript(this, this.GetType(),
"popup", "alert('Invalid Password');", true);
                    }
                }
                if (role == "management")
                {
                    UserStore<IdentityUser> userStore = new UserStore<IdentityUser>();
                    userStore.Context.Database.Connection.ConnectionString =
System.Configuration.ConfigurationManager.
                        ConnectionStrings["ZIMRAConnectionString"].ConnectionString;
                    UserManager<IdentityUser> manager = new
UserManager<IdentityUser>(userStore);
                    var user = manager.Find(txtUserName.Text, txtPassword.Text);

                    if (user != null)
                    {
                        //call OWIN functionality
                        var authenticationManager =
HttpContext.Current.GetOwinContext().Authentication;
                        var userIDentity = manager.CreateIdentity(user,
DefaultAuthenticationTypes.ApplicationCookie);
                        //sign in user
                        authenticationManager.SignIn(new AuthenticationProperties
                        {
                            IsPersistent = false
                        }, userIDentity);
                        //redirect user to home page
                        Response.Redirect("~/Pages/managementhome.aspx/");

                    }
                    else
                    {
                        ScriptManager.RegisterStartupScript(this, this.GetType(),
"popup", "alert('Invalid Password');", true);
                    }
                }

                }

            }

            }
        }
    }
```

//Client side

```
<%@ Page Title="" Language="C#" MasterPageFile="~/Login.Master" AutoEventWireup="true"
CodeBehind="Login.aspx.cs" Inherits="app.Pages.Account.Login" %>
<asp:Content ID="Content1" ContentPlaceHolderID="head" runat="server">
</asp:Content>
<asp:Content ID="Content2" ContentPlaceHolderID="ContentPlaceHolder1" runat="server">
```

```
    <p style="font-size: medium; font-weight: bolder; text-decoration: blink; color:
#33CC33; background-color: #003366; height: 21px; width: 178px;">
              USER LOGIN SECTION</p>
        <p>
       
    UserName:</p>
<p>
       <asp:TextBox ID="txtUserName" runat="server"
CssClass="inputs"></asp:TextBox>
    <asp:RequiredFieldValidator ID="RequiredFieldValidator1" runat="server"
ControlToValidate="txtUserName" ErrorMessage="please enter a valid username"
ToolTip="username required" ForeColor="Red"></asp:RequiredFieldValidator>
</p>
<p>
       Password:</p>
<p>
       <asp:TextBox ID="txtPassword" runat="server" CssClass="inputs"
TextMode="Password"></asp:TextBox>
    <asp:RequiredFieldValidator ID="RequiredFieldValidator2" runat="server"
ControlToValidate="txtPassword" ErrorMessage="password required" ToolTip="password
required" ForeColor="Red"></asp:RequiredFieldValidator>
</p>
<p>
       <asp:Button ID="Button1" runat="server" CssClass="button" Text="login"
OnClick="Button1_Click" />
</p>
</asp:Content>
```