GCC E PROCUREMENT SYSTEM

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Submitted in partial fulfilment of the requirements for the degree of

BSc Honours Information Systems

Department of Computer Science and Information Systems

in the

Faculty of Science and Technology

at the

Midlands State University

Gweru

November 2019

Supervisor: **Mrs Mutembedza**

ABSTRACT

This research is aimed at development of an E Procurement System that is meant to assist the procurement 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, there was no a website to update suppliers about new tenders at Gweru City Council, there is no system in place for suppliers to check their tender status. In order 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 e-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 be been automatically generated by the system basing on the data that would have been captured for the service providers. 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.

DECLARATION

I, **Ronald Chiweshe,** hereby declare that I am the sole author of this dissertation. I authorize the **Midlands State University** to lend this dissertation to other institutions or individuals for the purpose of scholarly research.

Signature: ……. Date: ……..

APPROVAL

This dissertation, entitled **"GCC E-PROCUREMENT SYSTEM"** by **Ronald Chiweshe** meets the regulations governing the award of the degree of **BSc Honours Information Systems** of the **Midlands State University,** and is approved for its contribution to knowledge and literary presentation.

Supervisor's Signature: …….

Date: ……..

ACKNOWLEDGEMENTS

I want to thank my supervisor Mrs Mutembedza for her guidance and assistance in putting this dissertation together. I am grateful for her commitment, patience and knowledge she imparted to me. I would also like to express my gratitude to the Almighty God for seeing me through my project. My last acknowledgements goes to all those who may have helped me in one way or another and they include my family and friends.

DEDICATION

I dedicate this study to the almighty, family and friends. I wish to acknowledge the support you gave me either directly or indirectly. Thank you very much for all the support and God bless and be with you all.

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LIST OF ACRONYMS

GCC: Gweru City Council

ROI: Return On Investment

NPV: Net Present Value

CBA: Cost Benefit Analysis

DFD: Data Flow Diagram

ICT: Information Communication Technology

SDLC: System Development Life Cycle

GUI: Graphical User Interface

ERD: Entity Relationship Diagram

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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 with this view that the writer of this thesis was challenged to carry out a research into Gweru City Council 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 system.

1.2 Background of the study

At Gweru City Council 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 to 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.

1.2.1 Background of the Organisation

Gweru City was founded in 1894 by Dr.Leander Starr Jameson. The City of Gweru grew and attained City status in October 1973.Currently the Municipal area of City of Gweru covers about 30 000 hectares and the population as at the 2012 census was estimated at 143073 and is now estimated to be floating around 200 000 . The city is divided into 18 wards that are represented by elected Councillors. The council of Gweru is led by His Worship the Mayor councillor Josiah Makombe. The Executive Management is comprised of the town clerk, director of the engineering services, director of finance, director of health, chamber secretary, director of housing and community services.

1.2.2 Organisational Structure

According to Buchman (2004) an organisational structure is a formalized system for task and reporting relationships that manages, coordinates and motivate the organisation's employees so that there would be team work such that the organisational goals are achieved. Therefore it is put in place to characterize how the jobs, roles, duties and posts are isolated, coordinated and assembled in formally in an organisation. Below is an organisational structure for Gweru City Council:

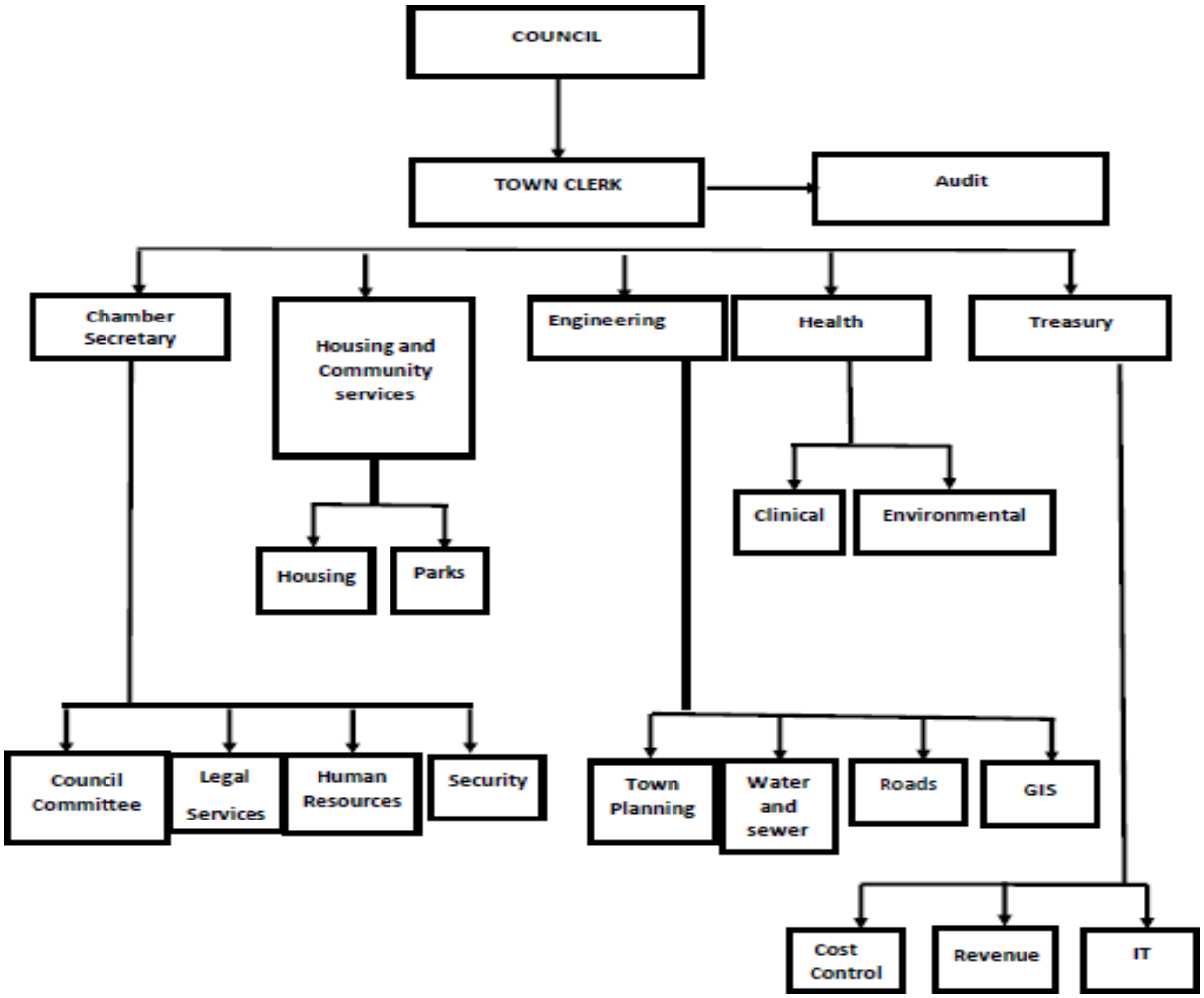


Fig 1.1: Organogram of Gweru City Council

1.2.3 Vision

A Sustainable Prosperous City of Choice by 2030.

1.2.4 Mission Statement

To Provide Quality Services to Residents, Clients and Stakeholders**.**

1.3 Problem definition

According to Chang (2005) problem definition is a structured description of the design problem, with the goal of creating an explicit statement on the problem and possibly the direction of idea generation. The current service providers' evaluation, selection and recommendation at Gweru City Council is based on manual processes which may be inconsistent or unfair as it is based 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
- 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.

1.4 Aim of the research

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

1.5 Objectives of the research

Objectives are short and medium term goals that an organization aims to achieve. They are concise, time based, measurable actions that support the completion of a goal. They play an enormous role in developing policies and determining, allocation of resources.

The objectives of the study are:

- To create a system that allow advertising of tenders to the public through GCC website i.e (open tenders and their due date)
- To come up with a system that allows service providers to send their bids and quotations in form of pdfs and documents and check the status of their tender bids.
- To develop an online system that helps in decision making, by ranking bids according to their prices and show the most preferable one based on price, or date
- To come up with a system that enables the procurement manager to give feedback to tender bids in form of status that is (pending, accepted or rejected).
- To come up with a system that provide a scores for supplier rating and assessment after every assigned duty has been completed.
- To develop a system that record all user login logs(procurement manager and suppliers) for audit reasons and risk management
- To develop a system that will enable the administrator to trigger an email notification to companies that would have had won the tender contracts

1.5.1 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.

1.6 Instrument and methods

The following development tools will be used to develop the proposed system:

Php: a broadly used open source universally useful scripting language that is particularly suited for web development and can be implanted into HTML to make dynamic web applications.

MySQL: robust and scalable relational database.

Xampp: a multi-operating system open source Application Server

Javascript, Sublime Text, Jquery, Ajax

1.6.1 Data gathering methodologies

To gather information so as to identify the problems being faced the following data gathering

methodologies were used. The identification of the problems of the current system a pilot study was carried out using the data gathering techniques which include the interviews, observations as well as the questionnaires.

a. Interviews

These are formal meetings where an analyst can collect information about the working of the present systems and the requirements of any planned system (ISRD Group, 2007). Interviews are the most common fact finding method which has to be conducted with full corporation of the employees using the system. This technique has qualities that other methods of data gathering do not possess. In this study the researcher (interviewer) came face to face with the person being interviewed at GCC creating a chance of flexibility in getting the required information. The researcher was also able to observe the subject (interviewee) and studied their body language.

b. Questionnaires

The use of questionnaires is also another popular and useful technique for data gathering especially when information is being solicited from a large group of people although it can also be used for small groups (ISRD Group, 2007). This technique was best suitable for this study as was not possible for the researcher to interview all persons involved in the system due to varying factors such as time, distance, cost and other factors. There are two types of questionnaires that is open ended and close ended questionnaires. The researcher used both types of questionnaires in gathering user requirements. The questionnaires were targeted to users mostly at operational level because they are many such that it was not feasible to interview most of them due to limited time and resources. They were also targeted to the members of the public (clients) due to their scattered geographical locations.

c. Observations

The researcher had an opportunity to observe the existing system in normal operations as this enabled revelation of many other features which could not be revealed by other data gathering techniques. This has proved beneficial in collecting information about office conditions of which employees takes for granted. Onsite observation also gave insight to the researcher an

insight into the levels of supervision and control, the flow of work, the occurrence of obstruction in the work flow, the pace of work and the levels of normal and peak workload.

1.7 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.

1.8 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. It is fundamental for the organisation to automate the current manual system in operation in order for them to cope up with the dynamic changes in the technology.

CHAPTER 2: PLANNING PHASE

2.1 Introduction

Richman (2002), defines planning phase as the second stage in system development life cycle and the phase is more concerned about creating set of plans that are to be followed by the team developing the system This phase gives an assessment or valuation to find if developing of GCC E PROCUREMENT DSS is socially, economically, technically or operationally feasible or not. Planning phase also involve analysing and calculating those costs that is expenditure and paybacks that proposed system might brought in the organisation. Besides the above, reasons and of developing the new system is reviewed. Business value of the proposed system are identified and process of justifying if it worth to continue developing the system is done.

2.2 Business value

This refers to the benefits or the advantages business will gain through the use of the proposed system to be developed. Sliger and Stacie, 2008 defines it as the total sum of features that determine well-being and health of a business in the long run. Those gains or benefits appreciated from developing the new system make up the business value. Below are some of the advantages and benefits that are to be brought by the system. Increased effectiveness in tendering decision making since the system automatically select and recommend the best service providers and the reasons to justify selecting that service provider, the new system will reduce the amount of time needed in making procurement decisions and this is more important since time is one of serious aspects in the business world, communication cost are going to be reduced since the winning bidders will get their response through automated emails, so calling expenses are going to be eliminated. The proposed system will keep records of suppliers and those records can be used for future selection and also for future reference.

2.2.1 Organisational value

Buchman and Huczynski (2004), they defined organisational value as a belief that a particular mode of behaviour is desirable to an opposite or different mode of conduct. Some of the organisational values will be reduction in costs since file based system will be eliminated and costs of paying those employees who were involving in manual processing and service provider selection and record keeping is going to reduced. Control of procurement is increased since immediate placement of orders with e procurement is done, Increased effectiveness in tendering decision making since the system will automatically select and recommend the best service providers and the reasons to justify selecting that service provider.

2.2.2 Managerial value

Managers will be able to make decisions efficiently and faster since reliable and accurate information will be provided by the system since the proposed system will automatically make decision process and select who win the bid. It also enhances easy communication and coordination among all individuals involved including suppliers, employers, managers in the procurement process.

2.2.3 Employee value

Lynch (2009), defines employee value as an understanding among an organisation that is the employer and its employees on what the organisation will provide in exchange for the production, commitment, and involvement of its employees. The new system will reduce the amount of time needed in making procurement decisions and this is more important since time is one of serious aspects in the business world. Employees' motivation will increase since those manual tasks will be now done easily. The proposed system also satisfies the user as it reduces work effort, paper work is reduced and efficient results are produced.

a) Employee knowledge: Knowledge of using IT system and computer literacy of employees will increase since training will be done to make employees aware of the new system. Knowledge and way of using technology will be acquired by employees.

2.2.4 Societal value:

Society is one of the most significant stakeholder in an organisation and so anything that will be made or any change should be evaluated so as to detect its influence to the society therefore the society receives the value.

2.2.5 Customer value

According to Jewell (2000), Customer value is the value received by the end-customer of a product or service. Communication cost are going to be reduced since the winning bidders will get their response through automated emails, so calling expenses are going to be reduced.

The application of this system will likely to bring some more value to the organisation and its stakeholders. So, implementing the proposed system will be a benefit to the organisation.

2.3 Feasibility study analysis

Feasibility study is the process of assessing the potential benefits that a business might get from developing and implementing the new proposed system. The benefits could be economic, social or technical (Norman, 1999). Munsaka (2013) defines feasibility as a process that is used for

ascertaining difficulties, chances, determining goals, defining conditions, describing fruitful results and benefits connected with some alternatives for solving a specific problem. Mall (2004) also defines feasibility study as the assessment of technical, economic and operational benefits of the proposed or new project to see whether it is worthy for a project to continue to the next phase that is the analysis phase. The feasibility step tries to examine the issues that will make the project viable or unfeasible and also determine the best methodology to use in the project. This all is done through a thoughtful analysis of technical feasibility, operational feasibility, economic feasibility and social feasibility. The conclusion of the feasibility study will define if it is necessary to continue to the physical design phase of the proposed system. Another aim or goal of feasibility study is to find out the best solution to the recognised difficulties after a detailed analysis of all the possible solutions that might be available.

2.3.1 Technical feasibility

Technical feasibility refers to the process of assessing presently existing technical knowledge or capability as compared to the technical knowledge or expertise the new system will need (Norman, 1999). This will conclude if the organization have the capacity to produce the system basing on the available proficiency. Rodger (2005) defines technical feasibility as a thought of the particular requirements of the proposed new project and contrasted with the technical capability of the organisation, the system project is considered in fact practical if the internal technical ability is sufficient to support the task's necessities. The study assessed GCC resourcefulness relating to resources, programming capability and innovativeness that is needed to objectify the proposed system. Proposed system’s technical requirements will be compared to the existing technical skill within GCC. If the presently available technical expertise can back up the minimum needs of the project, then the new system will be measured technically feasible.

2.3.1.1 Technical expertise

A study on the readiness of the technical expertise required to build the system and use the system after its application in the organisation was done. Basing with the available workforce, Gweru City Council has the capability to build and apply the system since it has php programmers who can develop web based applications which the new system needs. The system developers also have knowledge about html, css and a vast amount of knowledge of PHP programming languages and knowledge of MySQL database that will be essential to develop a complete system. The research also discovered that users of the system have basic computer knowledge which might make it

easier for them to advance and gain more knowledge on IT software systems

2.3.1.2 Hardware requirements

In the following table, distinction concerning existing hardware against what is needed for effective developing and implementation of the proposed system was done. In order to develop this software system, the following are hardware components which are suggested.

Table 2.1: Hardware requirements

ITEM	ITEM DESCRIPTION	QUANTITY REQUIRED	QUANTITY AVAIBLE
Core i7 laptops	8-12GB RAM, 4GB Graphics Card, 500GB HDD	5	5
Uninterrupted Power Supply	5500watts	2	2
Backup	1TB	2	2
Printer	Any	1	1
Server	4GB ram, 500HDD,5 GHz	1	1
Core i7 desktop	8GB ram, 1TB	1	1

GCC Procurement DSS is a client server system. User of the system will be accessing it from the server through web browsers using internet. Therefore, the system will be running on the server where users will be accessing it from.

2.3.1.3 Software requirements

On the following section the writer will compare the readily available software against needed software. Summarisation of the present software and the required software is shown in the following table.

Table 2.2: Software requirements analysis

ITEM	RECOMMENDED	AVAILABLE
Operating system	Windows 8 , 7 or 10	Windows 10
Sublime text(text editor)	Any	Yes
Web server software	Xampp / Wamp server	Available

The tables shows that the system's requirements can be met by Gweru City Council. Therefore the proposed system is technically feasible.

2.3.2 Economic feasibility

Williams (2006) defined economic feasibility as the degree of possible benefits in terms of income or revenue in contradiction of the potential expenditures or payments that the system will bring into the organization. Economic feasibility is an essential piece of speculation examination, managing components that can be evaluated, measured, and analysed in monetary terms (Harland, 2000). Economic feasibility involves evaluating the benefits that GCC E Procurement DSS will bring against the costs that will come out from its application and operation. To conduct the economic feasibility several different appraisal methods are used. Those techniques used are Net Present Value (NPV) the cost benefit analysis (CBA) and the return on investment (ROI).

2.3.2.1 Tangible benefits

According to Norman, (1999), tangible benefits are benefits that can be calculated and conveyed in measurable monetary form. The following are some of the tangible benefits which are; increased production or output, reduction in human errors as well as reduction in costs. Introducing the proposed system will result in decrease man power requirements since there will be no need to make a meeting deciding which on is the best suppliers and service provider because the system will automatically do that for the organisation and by doing this, costs in terms of salaries and wages will be reduced. Quick and automated responses on procurement decisions will be available since the system will cater for that service. Time for other tasks will increase since the will be no need to waste time going to procurement meetings.

The following table gives a summary of the benefits:

Table 2.3: Tangible benefits

EXPECTED BENEFITS PER ANNUM	AMOUNT(USD)	TOTAL(USD)
Reduced recurring costs	$3 000	
Increasing employees' productivity	$1 000	
Reduction in poor decisions related cost	$2 000	
Time enquiries	$3000	
Total		$9 000

2.3.2.2 Intangible benefits

This refers to benefits that are not physical. (Norman, 1999). These are the positive situations that are appreciated by an organisation but they cannot be quantified or given a monetary value (Lucey, 2002). The following are some of the intangible benefits which are: The new system will improve work performance in all organisation processes, the system will enhance good supplier/ service providers and organisation's association through regular communication and teamwork, procurement meetings will be eliminated and saves time which is wasted when employees debate on choosing the supplier, use of computerized decision support system will increase quality of decision making in an organisation.

2.3.2.3 Development cost

Development cost is the total outflow or payments on developing a new system. The proposed system will be developed within the organisation and by doing this, the development cost will be low. Also, the development budget will be not as much because all the hardware and software essential for the development of the system are available. However, there are some unavoidable expenses which the organization is going to suffer which are listed below:

Training of staff - This include confirming and ensuring that all the employees who are going to use the system are furnished with the knowledge of the new system.

Stationery – This consist of bond paper, cartridges and toner that is going to be used for printing purposes.

Salary or wages for hired staff - The purchase and setting up of servers will require external staff which will be paid.

Table 2.4 : Development cost

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

2.3.2.4 Operational cost

Operational costs are those expenses that the organization will incur as the system come to be functioning. Lucey (2005) said that operational costs are expenditures that are always incurred after all the other expenses have been dealt with. With reference to GCC Procurement DSS, operational costs included printer cartridges and toner, bond paper and maintenance of the system. Some f operational costs include:

System maintenance – which include continuous perfections and updates of the system.

Licenses renewal – it involves renewal of software licenses that are used in the organisation to avoid violating licenses terms and conditions.

Hardware maintenance – This includes servicing of servers, computers, printers and network equipment.

Stationery – includes bond paper needed in day to day running of the business.

Salaries – These are expenditures and payments done to the employees for their services they provide.

The following table shows a summary of some operational costs that will be incurred by the organization during the operation of the system.

Table 2.5: Operational cost

OPERATION	AMOUNT PER YEAR(USD)	TOTAL(USD)
Maintenance of hardware	$500	
Maintenance of software	$600	
Stationery	$300	
Training and consultation	$1 500	
Backups	$200	
Total		**$3 100**

2.3.2.5 Cost benefit analysis

CBA is a financial approach that assesses the costs that are to be brought as a result of the proposed new system compared with the probable benefits to be gained from it so as to figure out if the intended action is great or poor (Bryman and Bell, 2007). Cadle and Yeats (2008), defined it as a procedure used in the business to examine the profits or benefits of a particular sequence of action, and the benefits are summed up against the related costs of that certain action. In order to do this, list of all the benefits and the costs should be recorded. Benefits will include direct benefits, indirect benefits for example increase in customer satisfaction. Below is the breakdown of all the probable estimated benefits and costs of the new system. The table on the next page summarizes the possible benefits and expenses.

List of possible benefits and expenses

Table 2.6: Cost benefit analysis

EXPECTED COSTS AND BENEFITS PER ANUM	**AMOUNT IN (USD)** **$**	**TOTAL(USD)** **$**
Tangible benefits	9 000	
Total Benefits		**$9000**
Development Cost	$2750	
Operational Cost	$3100	
Total Cost		**$5850**
Total Benefit		**$3150**

The above table 2.6 noticeably indicates that the system's likely benefits are more that potential expenses, by this, the system is economically feasible.

2.3.2.6 Return on investment

The return on investment is calculated by dividing the potential benefits by the estimated investment costs and the result is represented as a percentage or ratio.

FORMULA: ROI= **Total benefits-Total cost * 100**

Total cost

The following are the calculations of Return on Investment for the proposed project:

ROI= $9 000-5850*100

$5 850

= $3 150 *100

$5 850

ROI = 53.8 %

With the result of the calculation done above, it can be evidently illustrated that the project is economically feasible since it has a worthy ROI of 53.8%.

2.3.2.7 Analysis for four years

The following table summarises estimated cost and benefits for a period of four years

Table 2.7: Cost benefit analysis

EXECTED COSTS AND BENEFITS PER YEAR	**FIRST YEAR**	**SECOND YEAR**	**THIRD YEAR**	**FOURTH YEAR**
Tangible benefits	$9000	$10000	$9500	$11 000
Total Benefits	**$9000**	**$10000**	**$9500**	**$11000**
Operational Cost	$3100	$3100	$3000	$2800
Development Cost	$2750	$2750	$2850	$2550
Total Costs	**$5850**	**$5850**	**$5850**	**$5350**
Total Benefits	**$3150**	**$4150**	**$3650**	**$5650**

2.3.2.8 Net present value (npv)

Net Present value can be defined as today's value of a future income (Sehlhorst, 2006). Lets take initial investment as $7000 in the following calculation:

Table 2.8: Net Present Value.

Year	Net Cash Flow USD	Discount Factor USD	NPV USD
0	(7000)	1	(7000)
1	3150	0.870	2740
2	4150	0.756	2390
3	3650	0.658	2402
4	5650	0.542	3062
NPV			**3594**

The NPV of $3594 indicates that the system is feasible enough to be executed and hence a practicable project.

Overview of economic feasibility

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

2.3.3 Operational feasibility

Operational feasibility is the degree of efficiency and usefulness in terms of performance of the system in a specified setting (Goel, 2010). The proposed new system will be developed within the organisation that is in-house development and this means that problems will be eliminated since the system developers will be the one controlling and managing the new systems and available system.

Stakeholders' acceptance analysis was also done and the student found out that the stakeholders will agree and accept the system because users of the system will be participating in the development process and the management team will be indirectly involved as they will be consulted regularly. By doing this, it means the system will be user friendly because stakeholders will be familiar with the system. The system will be applied and implemented as soon as the development process is completed because the user aware and eagerly waiting to shift from manual system to the new system. From the above explanations that were done by the writer, the results point out that the system will operate effectively and efficiently without any problem.

2.3.4 Social feasibility

Rani (2004) defined social feasibility as the influence or control that the system may have to its surroundings that is the environment. This can also be regarded as the benefits the system might give to the society. Following are some of the benefits and drawbacks of the new system. Improved determination on the developing team and users/employees since they will be happy to see their work being simplified by computerisation of most manual works. Better relationships with the service providers since there will be day to day communications with the suppliers. However, the proposed system may result in some of the employees losing their jobs especially those who were working on the manual procurement system and are totally computer illiteracy. Although the system has some disadvantages, the writer's social feasibility results showed that its advantages outshine its imperfections there by making the system socially feasible.

2.4 Risk analysis

Duncan (1996) referred risk analysis as the procedure of ascertaining possible threats and the probable ways of solving them if they occur. Chavas (2004) also defined risk analysis as drawbacks that can be faced in the implementation of system and discovering techniques or procedures to respond to those risks in an expert feasible way. During the development of a project several risks are always a danger. Below are some of the potential risks that may be come across.

2.4.1 Technical risk

Users' requirements changes – this occur as it is common and possible with system users that as they continue familiarize with the software, there will be more likelihoods of them suggesting modifications and changes even before the development is through. In order to avoid this a comprehensive data gathering about their expectations and needs from the system must be prepared.

Technology change – Since technology is dynamic, the probability that it may change during development or soon after the system has been implemented may end up in compatibility issues of the system. However this can be solved or avoided by buying and using latest available development technologies.

System acceptance failure by users due to fear of unknown – It mostly happens to non–technical workforce that they reject new technological suggestions as they may be anxious of being unable to use the system. This can be a solved by effective user training

and awareness processes to make them aware of how the system functions.

2.4.2 Economic risks

Financial problems may hit the organisation during development and implementation of the project since anything can occur especially with the current situation in Zimbabwe and this can result in complications in obtaining some of the resources that need to be purchased. This all can be avoided by ensuring that everything is readily available before the development commence.

2.4.3 Other risks

Employees' turn-over may adversely disturb the development of the system if it happens since introduction of new minds will slow down progress of system development as recently engaged team will need to be familiarized to the system and explain it before they can join the development progression.

Leadership change - this may also delay and affect the development process of the system as different people at all times have diverse opinions and views towards the same system. So, a new manager can be against the system or can change the budget and the end result may be complications in developing and implementing the new system.

2.5 Stakeholder risk analysis

Stakeholder analysis allows someone to recognise the most significant people in the project and choose where to give more time and resources. According to Chavas (2004), stakeholder analysis refers to forensic study and finding out of the several stakeholders and their reactions to the system. Those stakeholder interests that hinders the system under development should be taken into consideration so to ascertain how one effects the development. The stakeholders include suppliers, GCC employees and management, potential investors and service providers.

2.5.1 Primary stakeholders

These are directly affected by the development and implementation of the proposed GCC Procurement DSS in either positive way or negative way. They include employees, suppliers and customers. In order for the project to be effective, the contribution from the operations employee is significant. Those stakeholders are going to benefit in a positive way from the new system as revealed in business value stage.

2.5.2 Secondary stakeholders

Secondary stakeholders are organisations and people who are affected by the proposed

system secondarily or indirectly for instance society and competing organisations.

Employees

The automation of work is done due to the introduction GCC Procurement DSS. This eases up their job in making decisions. Therefore the quantity of work load, and use of paper work is reduced by the system and therefore addressing the employee worries.

GCC management

The management by the introduction of the proposed system can benefit mainly through its use due to use of reports facilities produced automatically by the system instead of collecting a lot of paperwork. Therefore it will be easier to reach decision making. Therefore the system caters for the management interests of making decision making easier.

Potential Investors

The web based application will be available at GCC's website and become available for anyone to use mostly service providers and suppliers and may invites other investors in the organisation who would willing to be part of the prosperous and transparent organisation.

2.6 Project workplan

Richman (2002) defined it as a summary that frameworks the goals and purposes of the project providing a summary of the schedule including the duties to be accomplished so as to realise the stated objectives. A work plan is also designed so as to make the development of the project traceable showing all the steps to be followed and time that is going by each and every activity. During development of the proposed system the traditional Software Development Life Cycle will be implemented because of its easiness and simplicity of its steps, and this increase chances of project success.

Below is a table which shows the work plan that is going to be implemented in the development system.

Table 2.9: Work plan table

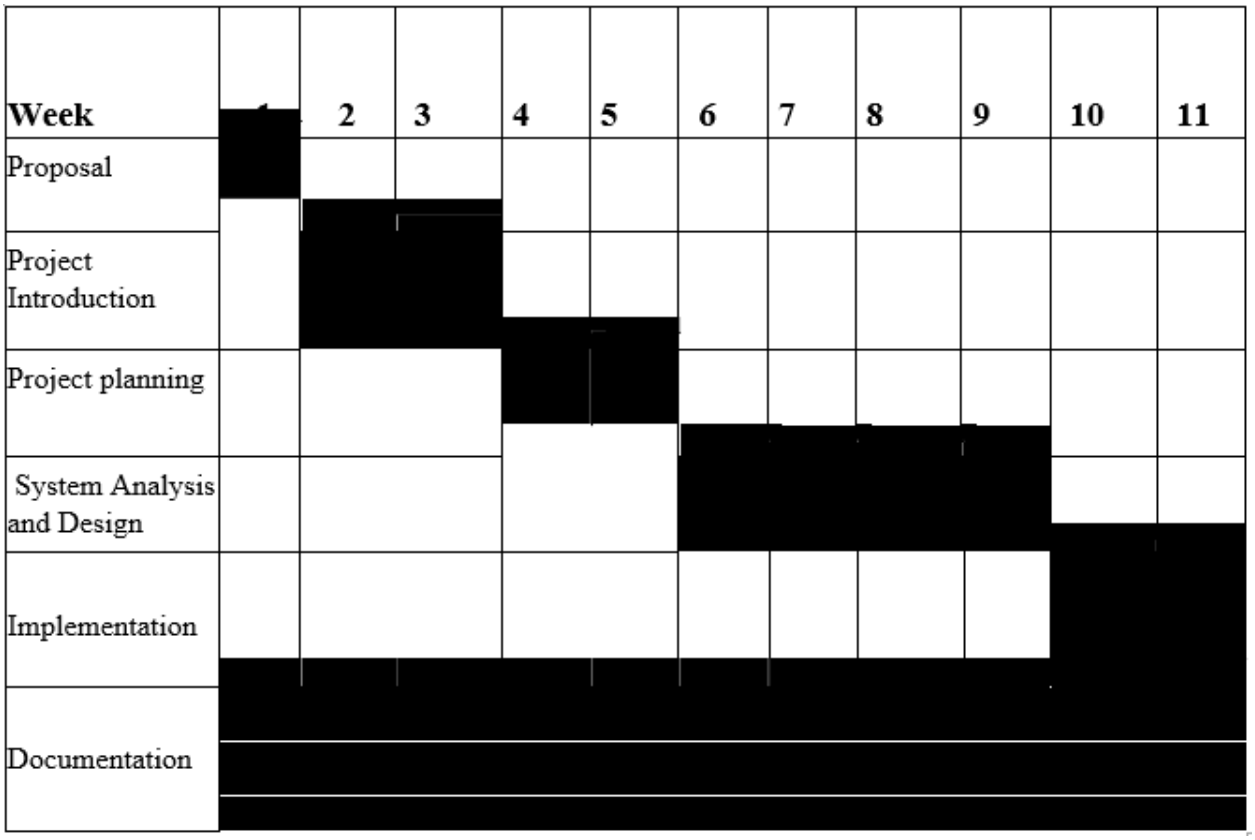
PHASE	STARTING DATE	COMPLETION	TIME FRAME
Project Proposal	25/02/2019	15/03/2019	2 week
Introduction	16/03/2019	03/04/2019	2 week
Project Planning	05/04/2019	15/04/2019	2 week
System Analysis	16/04/2019	30/04/2019	2 weeks
System Design	01/05/2019	14/05/2019	2 week
Implementation	15/05/2019	22/05/2019	1 week
Maintenance	23/05/2015	Continuous	Continuous

2.6.1 Gantt chart

Gantt chart refers to a graphical representation of the project task. It helps in planning and project stages and timetables and what is supposed to be done and when (Rouse 2007). A Gantt chart is a horizontal chart which illustrates the task and their related time frames (Richman, 2002).

The following is the Gantt chart which shows phases to be carried out and their respective time frames in weeks.

Table 2.9.2: Gantt Chart



2.7 Conclusion

Basing on the feasibility study and analysis it can be concluded that the proposed project passed the feasibility analysis and the risk evaluation since all the recognised risks has resolutions to control, restrict or avoid them. The next section will be mostly focuses on the analysis of the current system and data gathering methods that will be carried out during the development process of the system.

CHAPTER 3: ANALYSIS PHASE

3.1 Introduction

Feasibility study showed us the costs and requirements of the proposed system. Analysis phase answers the questions of who will make use of the proposed system, how the system will work, and where and when it will be implemented (Dennis, 2002). Analysts will work with the users to find out the user requirements and expectations to the proposed system. Output of the analysis phase will give a brief outline of the analysing team's alternative recommended solution in line with user requirements. Once recommendation has been accepted then system design will begin. (Hoffer, 2002). This phase will look at the current system functionality, process flows involved and their coordination. The main functionality of the current system will be analysed together with the inputs, processes and outputs. 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 used in data collection are: interviews, observations and questionnaires. Information gathering is done so as to get a realistic view of system functionality from various stakeholders who are directly and indirectly involved in system use.

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. They were distributed to the stakeholders who will be directly or indirectly affected by the system. All stakeholders who were involved responded properly and they answered the questionnaires satisfactorily. Questionnaire results give a clear indication that stakeholders are not happy with the current manual 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 specified answers on which the responded can select from. However for them to be meaningful, a survey has to be carried out first.

Through 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 base on 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.

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

Table 3.1: 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.

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.

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.

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.

Findings from the interviews

All of the 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 and 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 as 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 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 will be able to analyse 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 City Of Gweru 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 GCC(Gweru City Council) before or judgement basing on the promised services and pricing if the organization or company is new to GCC. 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.

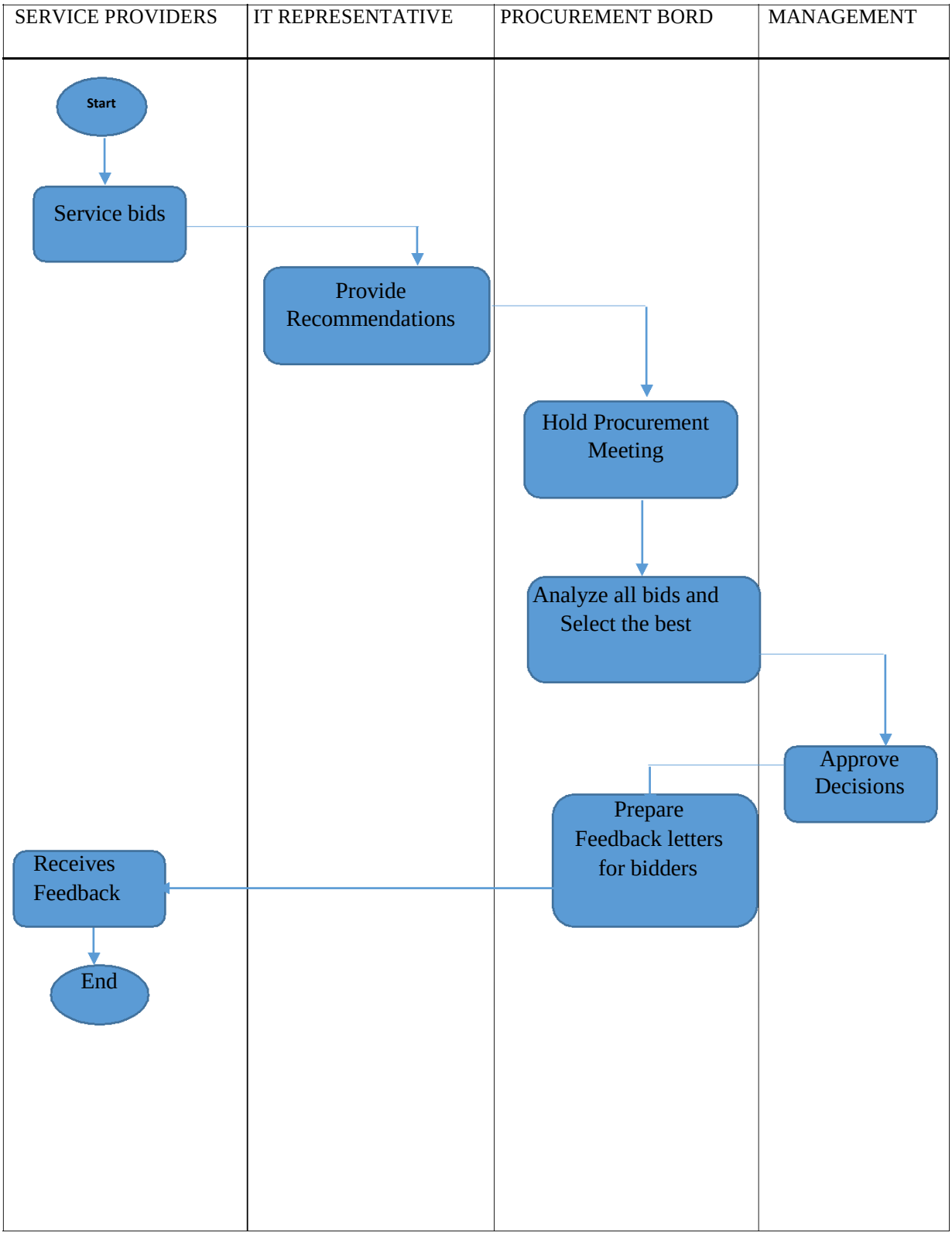


Fig 3. 1: Activity diagram

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.

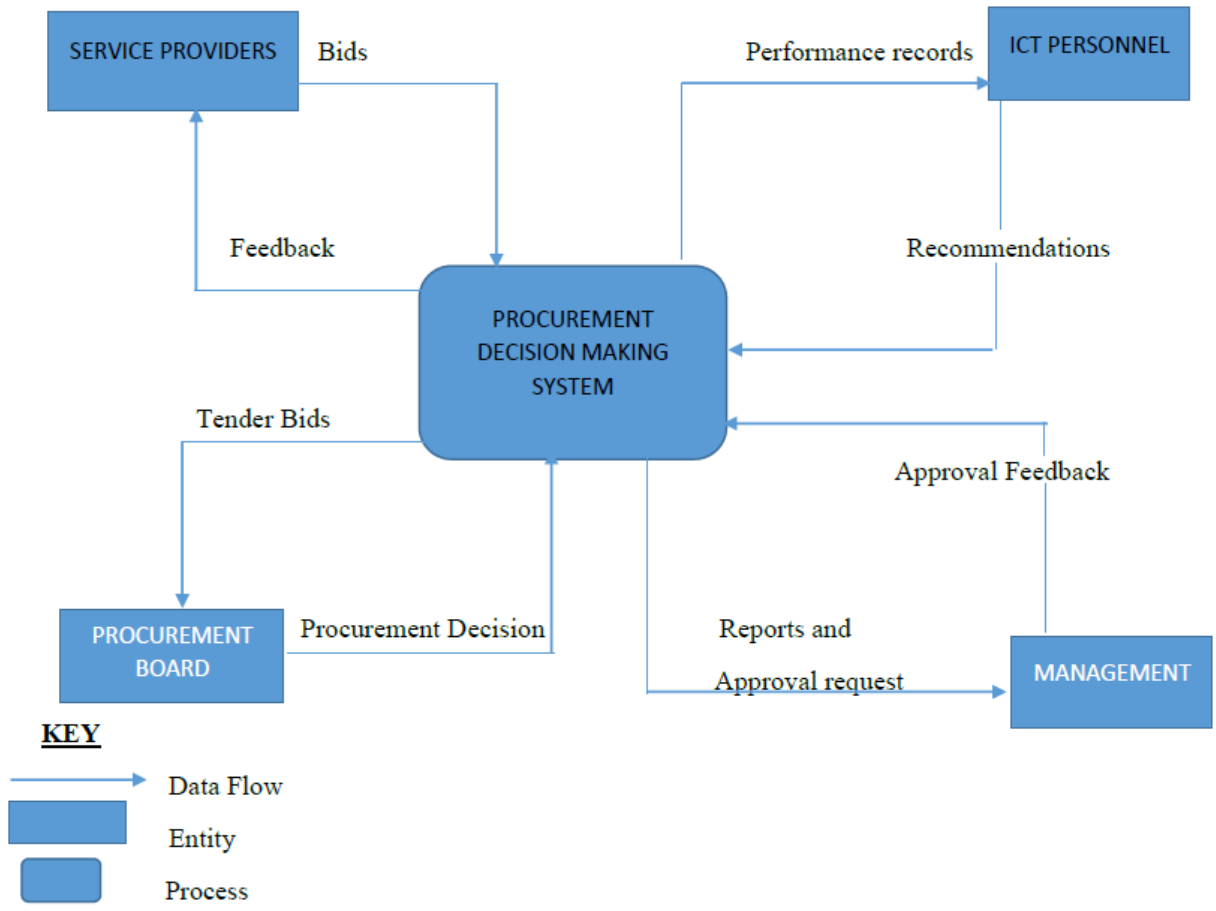


Fig 3. 2: Current system context diagram

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.

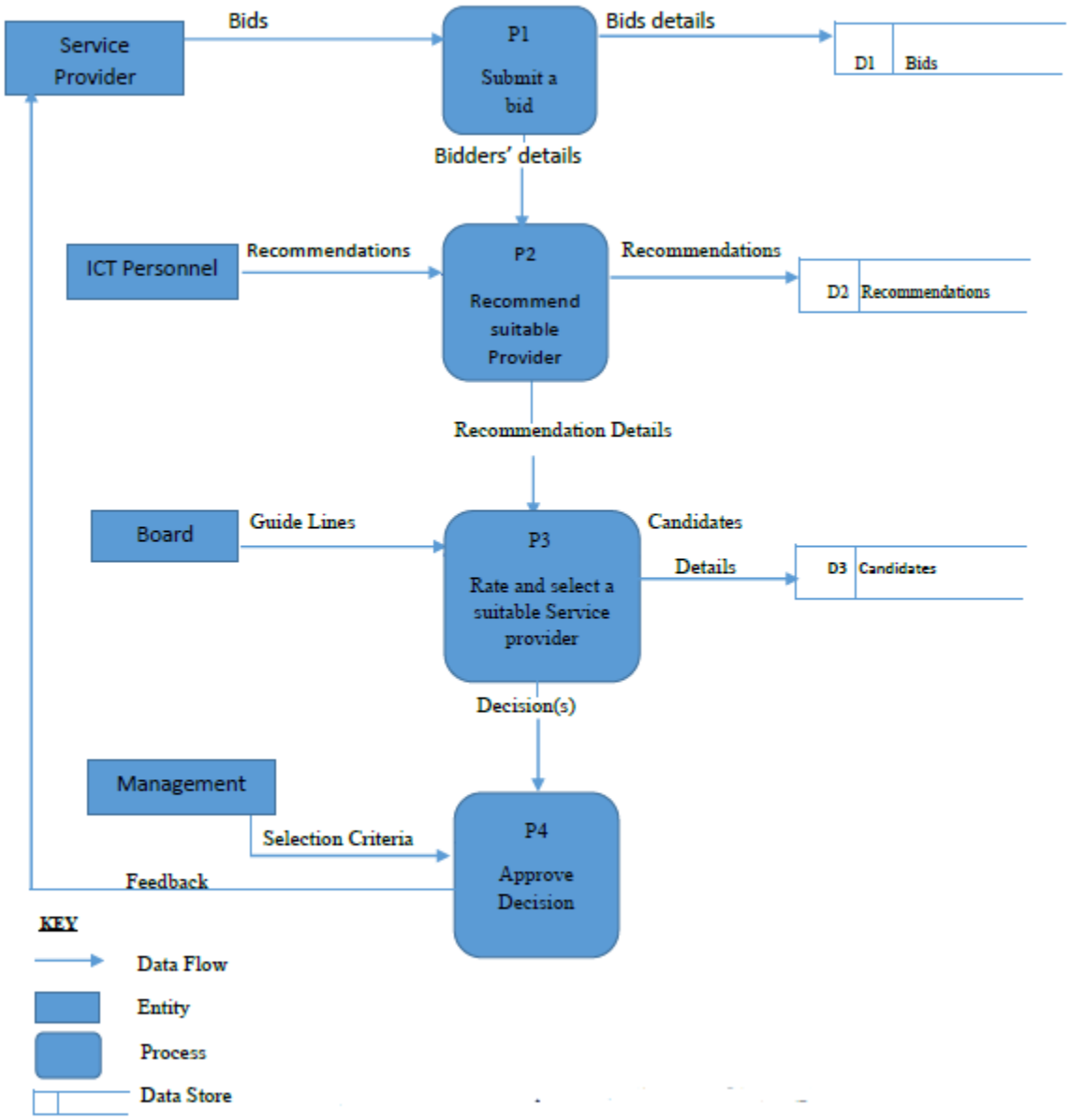


Fig 3. 3: Current system dataflow diagram

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 analyse and choose from before making a decision on which option to take. The researcher will analyse 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. 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.

3.7.3 In-house development

In-house development is 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 the 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 or 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.

3.8 Requirement analysis

The main purpose of this section is to identify the employees' expects 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
- Automate service providers rating
- Recommend the best service provider when a need arise
- Generate periodic 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 use-case diagram of the system is shown below.

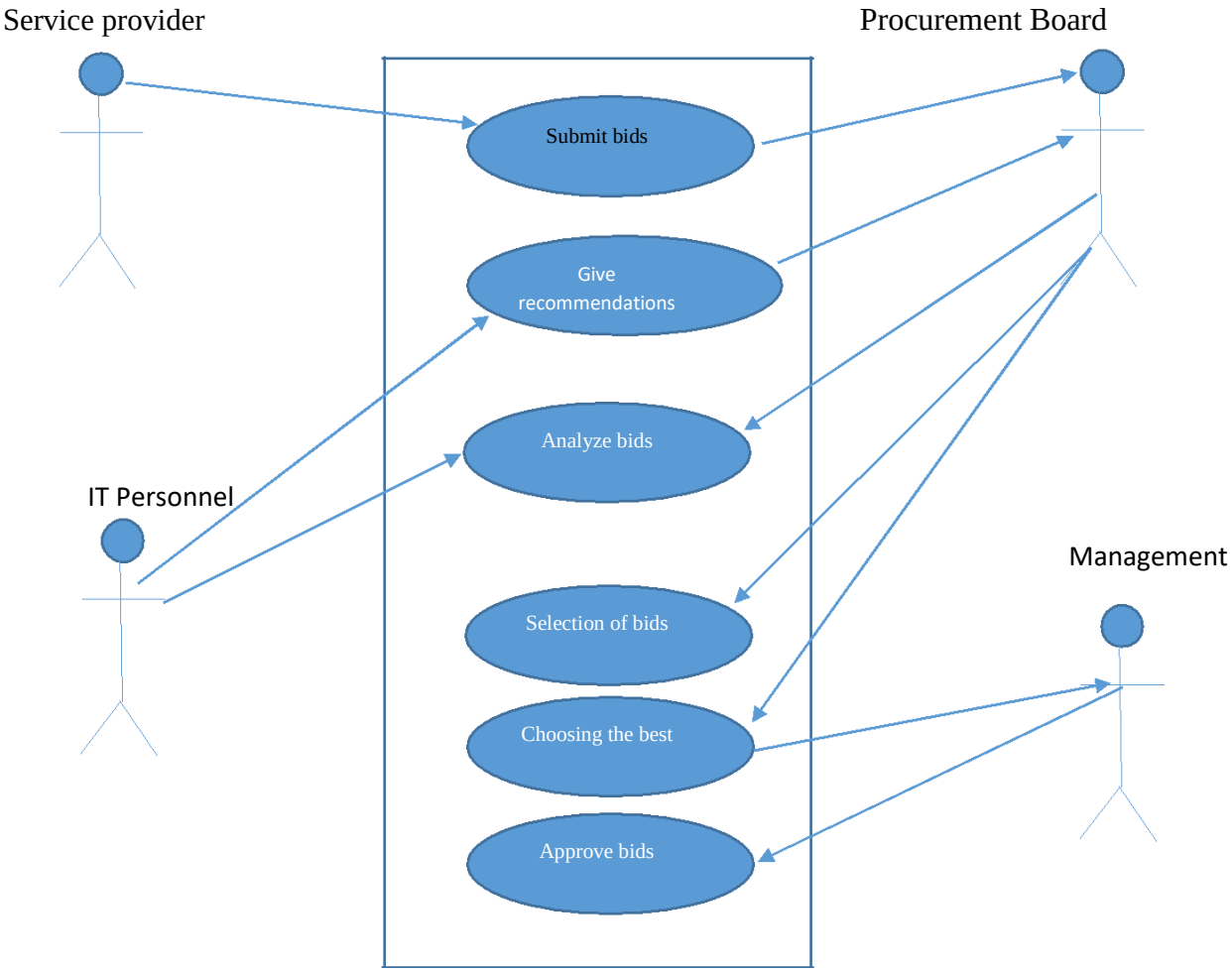


Fig 3. 4: Use-case diagram of the proposed system

KEY

Actor

Communicator

Process

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.
- 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 Gweru City Council. After considering available information through the use of various techniques, such as questionnaire, observations and document review, it was unanimously decided that a new system should be developed internally, to address current processing needs in the procurement processes. In the next chapter the researcher will be looking at the design part of the proposed system.

CHAPTER 4: DESIGN PHASE

4.1 Introduction

This chapter will involve in defining and analysing the system's architecture, modules, components and system data. An analysis was made in the previous chapter and after analysing the loopholes of the current system then we moved on to the design phase. Basing on the system requirements analysed in the previous chapter, the system will be developed to meet user requirements and at the same time solving problems analysed.

4.2 System design

According to Flynn (2011) system design is the process of defining the architecture, components, interfaces, modules and system data. Major concern is to meet user requirements and organizational goals through a well-functioning system. An impressive functioning system should have the following characteristics:

- **Efficiency:** the term efficiency in context to system characteristics refers to the ability of a system to run all its operations within a short period of time enabling the end user to process system jobs with very few commands.

- **Security:** a well-designed system should have a very tight security detail so as to protect the system from hackers and allows for the maintenance of user confidentiality and control the access rendered to users.

- **Reliability:** the need of a new system arises because of a rise in problems with the current system. A well-designed system should be able to reduce these problems, therefore the ability of a system to counter system problems is of paramount importance.

- **User friendliness:** the user interaction with the system helps determine the failure or success of a system. Most systems are usually judged by their ability to function up to user expectations with little or minimal supervision and support. A well designed system should be easily operated by even a lay man hence system friendliness is a vital aspect of well-designed systems.

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 proposed system will also be able to rate service providers basing on their pricing. It will also store all the suppliers that are currently operating in the organization and their current performance status as well as line of business. Apart from the above, the new system will allow the service providers to submit their bids and be able to get their feedback online. An online platform will also enable rejection of bids with prices outside the accepted range. This 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 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. Below is the context diagram of the proposed system.

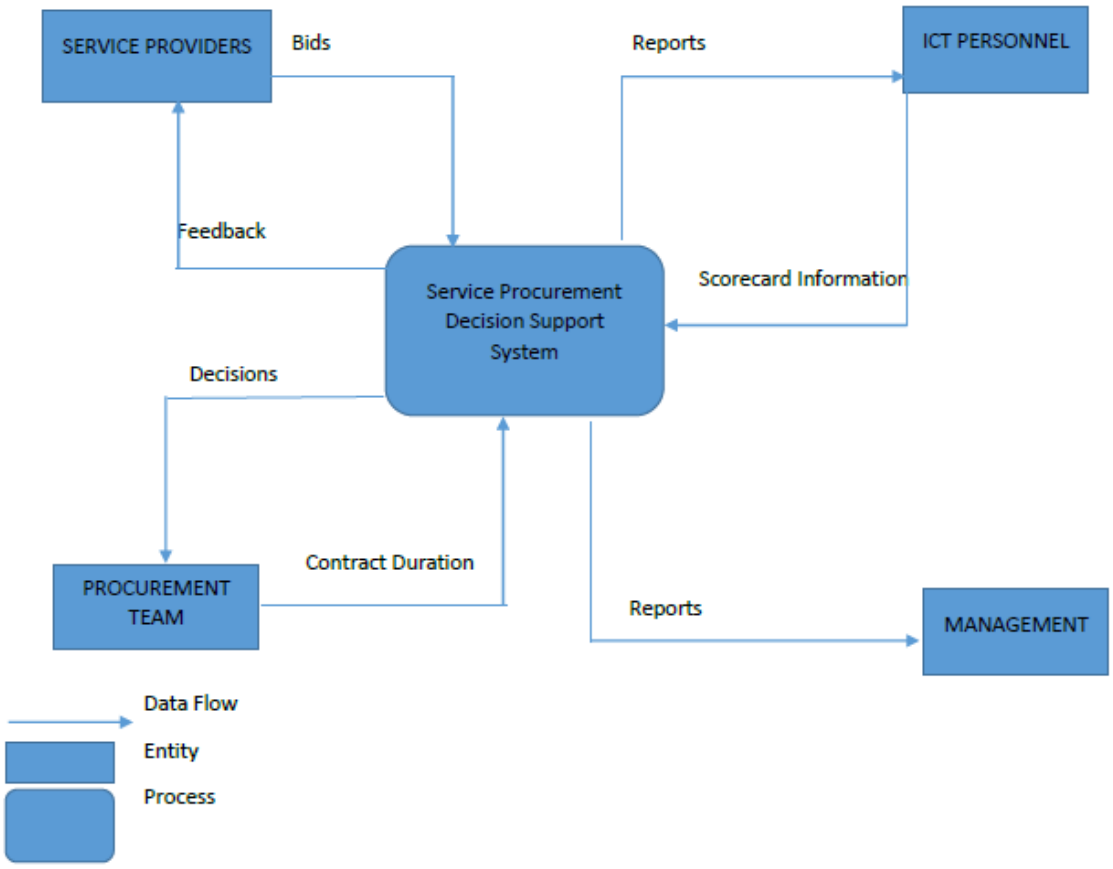


Fig 4.1: Context diagram

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 price or previous performance of the supplier.

4.2.3 Data flow diagram of the proposed system

The dataflow diagram is the viewpoint that explains the main functions of the system modifying its inputs into anticipated outputs (Rosenblatt, 2013). It can also be described 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.

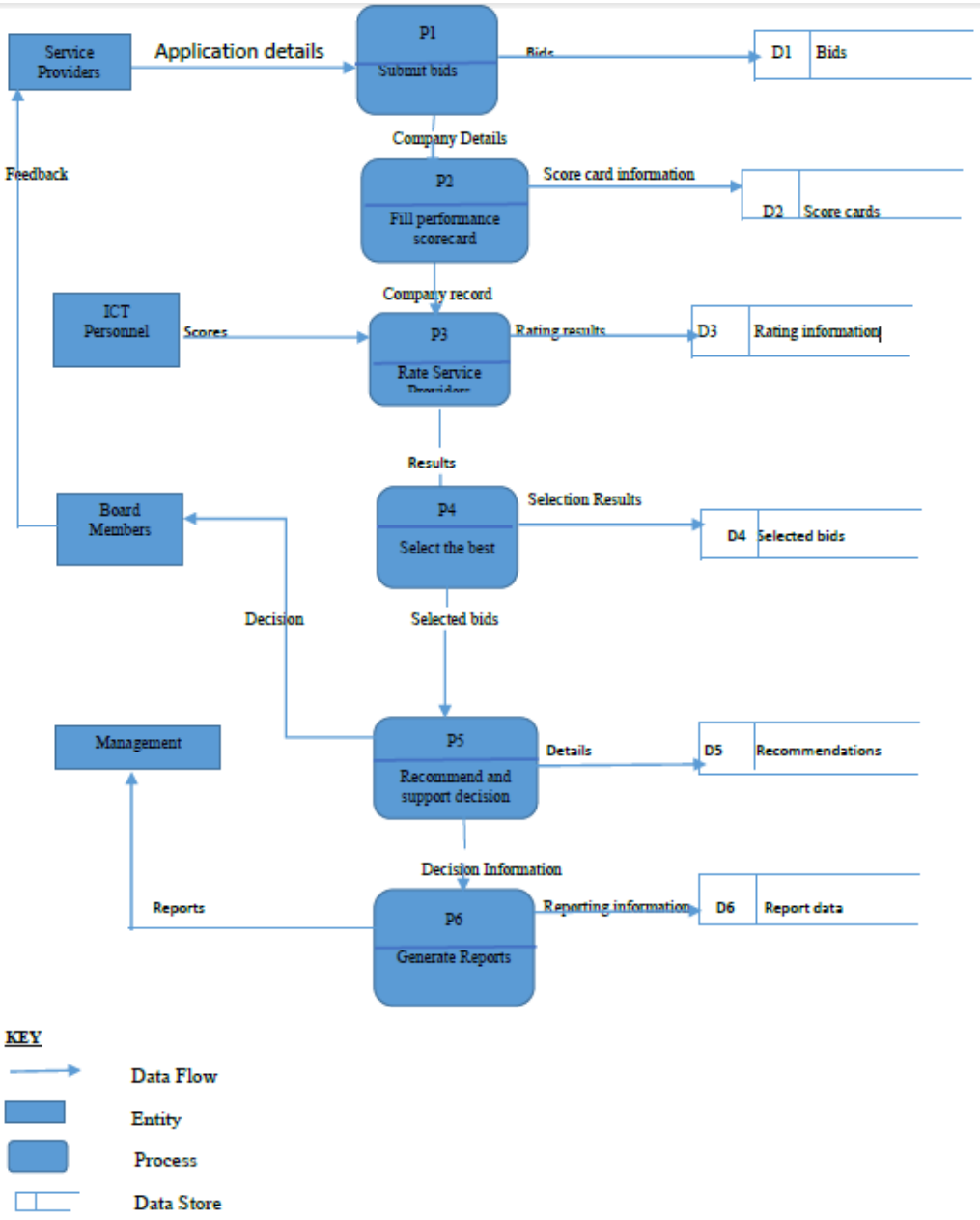


Fig 4.2: Dataflow diagram for the proposed system

4.3 Architectural design

The main emphasis of the architectural design is to split a system into its distinct components and into the relationships that are present within these components with the objective of matching the representations of the system requirements either functional or non-functional (Albin, 2003). Architectural design is generally regarded as the description of the logical and physical components of the system. These system components include hardware, software procedures, and the users of the system who are involved in the operation of the system. This section also encompasses the relationship between these components and how it is physically represented.

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 link 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.

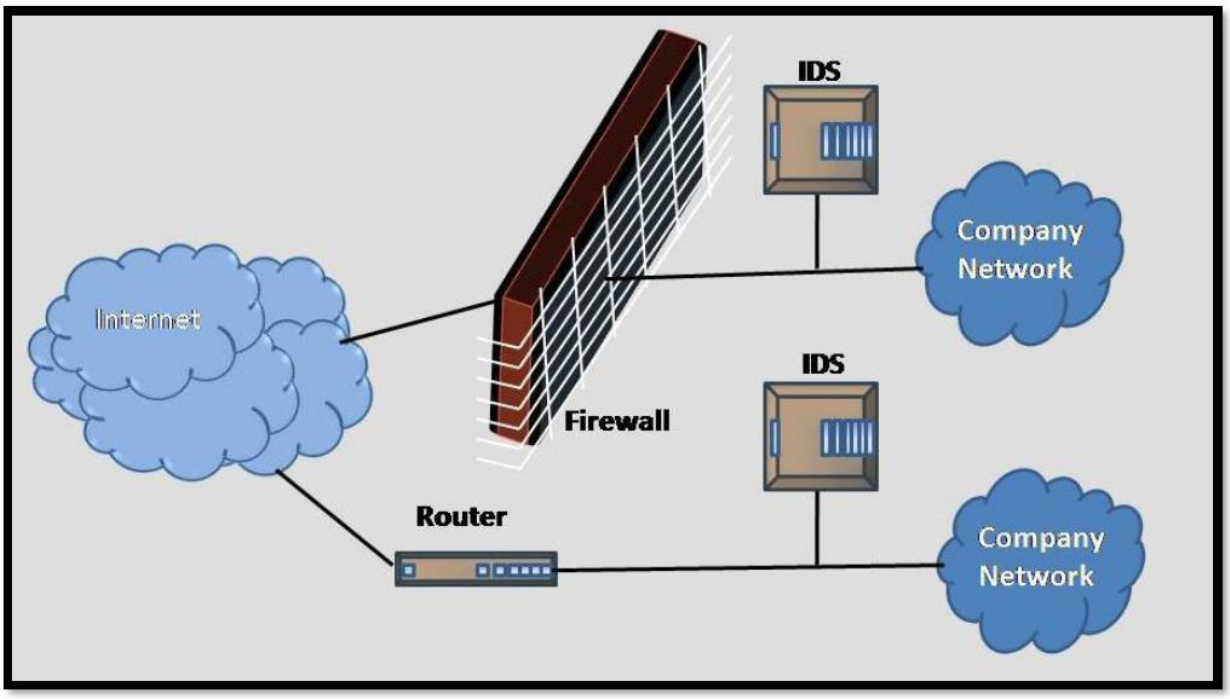


Fig 4.3: Network architecture design

4.4 Physical design

The physical design illustrates how the physical interfaces and software components will be arranged (O'Brien and Marakas, 2013). The scheme transforms the logical design into technical design. The interaction between the hardware and software determine the behaviour (as shown by

the software inputs, processes and outputs) as a result of the connection made to the server (Rosenblatt, 2013). The physical design is characterized by the following components which include the router, for bridging networks and keep traffic under control (Denis et al, 2013). The server connects most of the processes, stores them and delivers output to the client. Below is a physical design of the system.

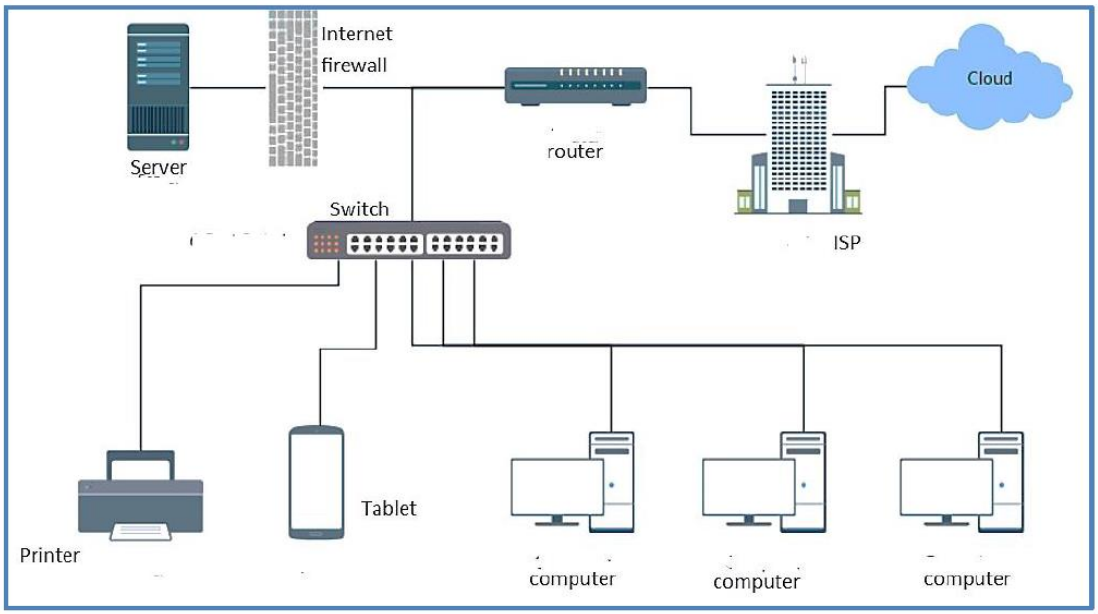


Fig 4.4: Physical design

4.5 Database 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.

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.
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.

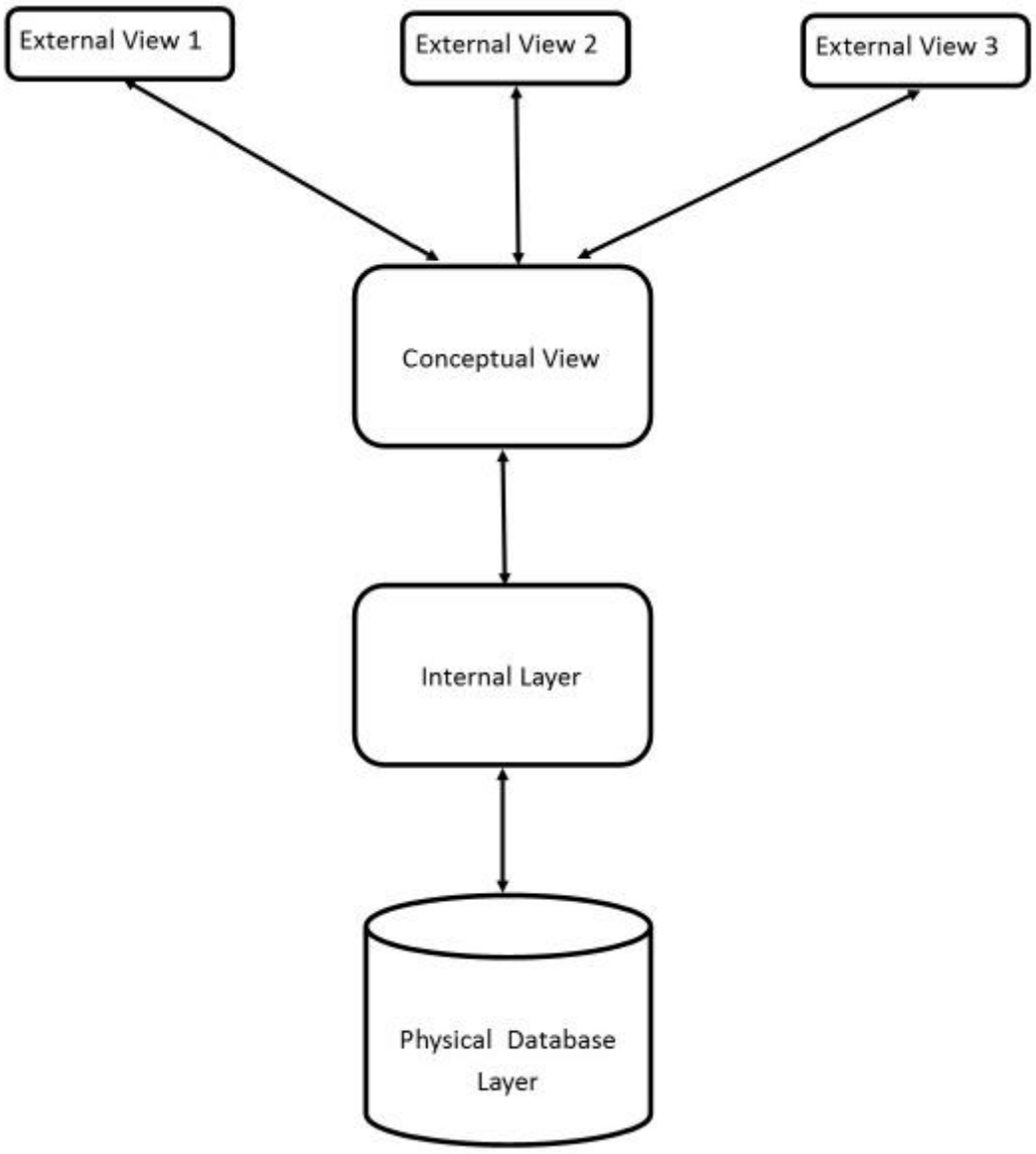


Fig 4.5 Database design

4.5.1 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 4.1: User Login

FIELD NAME	*DATA TYPE*	*DESCRIPTION*
Id	*Int (10)*	*Primary key*
Username	*Varchar*	
Password	*varchar*	

The users' table above stores the credentials and details for the users as well as their encrypted passwords.

Table 4.2: Users details

FIELD NAME	DATA TYPE	DESCRIPTION
Id	Int (8)	Primary key
Name	Varchar (20)	
Surname	Varchar (20)	
phone	Varchar (15)	
Email	Varchar (18)	
Password	Varchar(20)	
Username	Varchar(20)	
Department	Varchar (20)	

Table 4.3: Suppliers details

FIELD NAME	DATA TYPE	DESCRIPTION
Id	**Int (8)**	**Primary key**
Companyname	**Varchar (30)**	
Phone	**Varchar (15)**	
Username	**Varchar (15)**	
Password	**Varchar (15)**	
Email	**Varchar (30)**	

Table 4.4: Tenders

FIELD NAME	DATA TYPE	DESCRIPTION
Id	**Int (8)**	**Primary key**
Service	**Varchar (100)**	
Due_date	**Varchar (30)**	
Pricescore	**Varchar (20)**	
Deliverydays	**Varchar (20)**	
Quantity	**Varchar (20)**	
Details	**Varchar (20)**	

The above platform is where the buyer create a tender invitation for the suppliers specifying the product to be supplied, quantity to be supplied, due dated as well as the price and delivery scores for the product

Table 4.5: Tender application

FIELD NAME	DATA TYPE	DESCRIPTION
Id	**Int (8)**	**Primary key**
Priceperunit	**Varchar (100)**	
Deliverydays	**Varchar (100)**	
Uploads	**Varchar (100)**	

4.5.2 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.

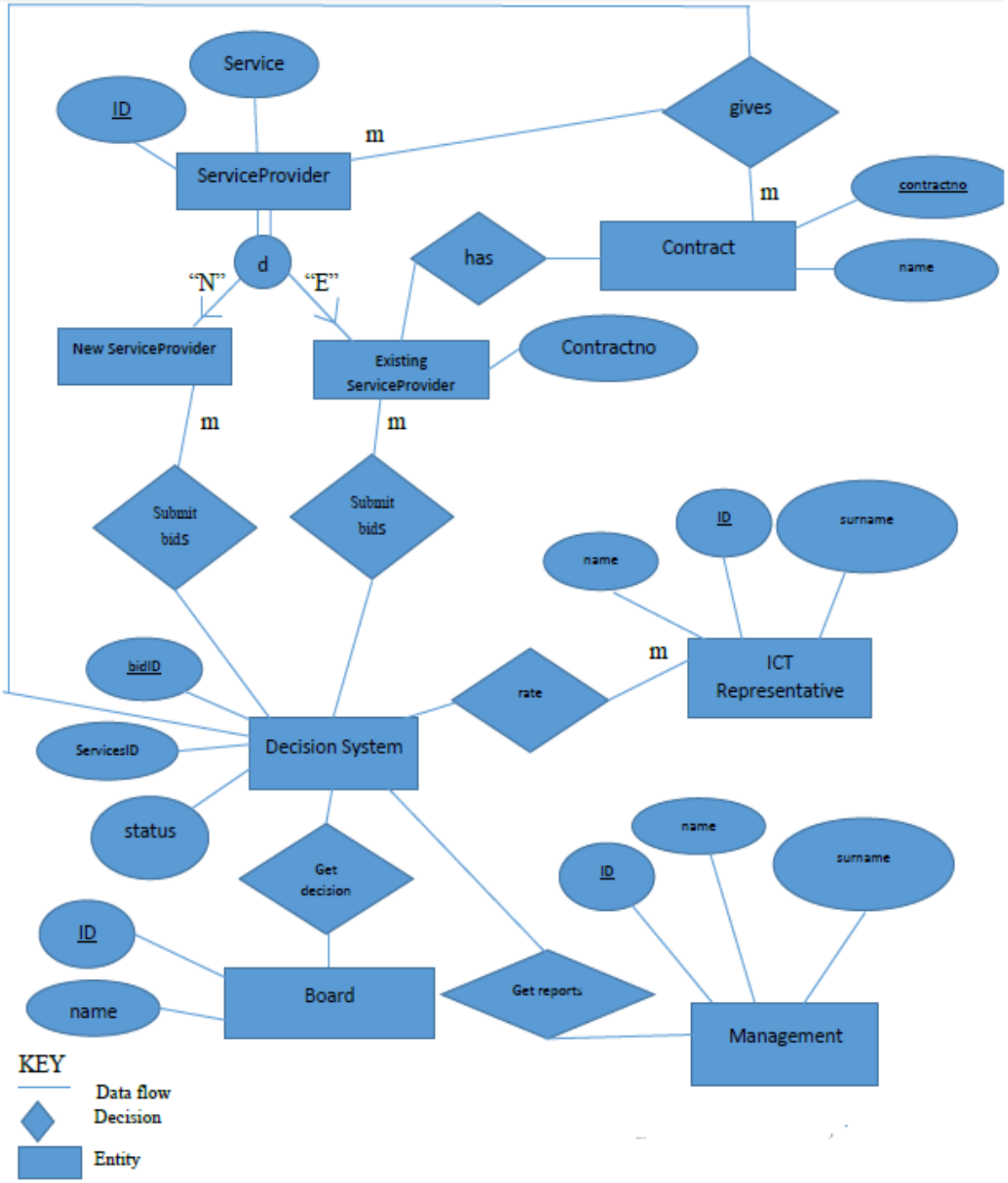


Fig 4.6: Enhanced Entity Relationship diagram

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

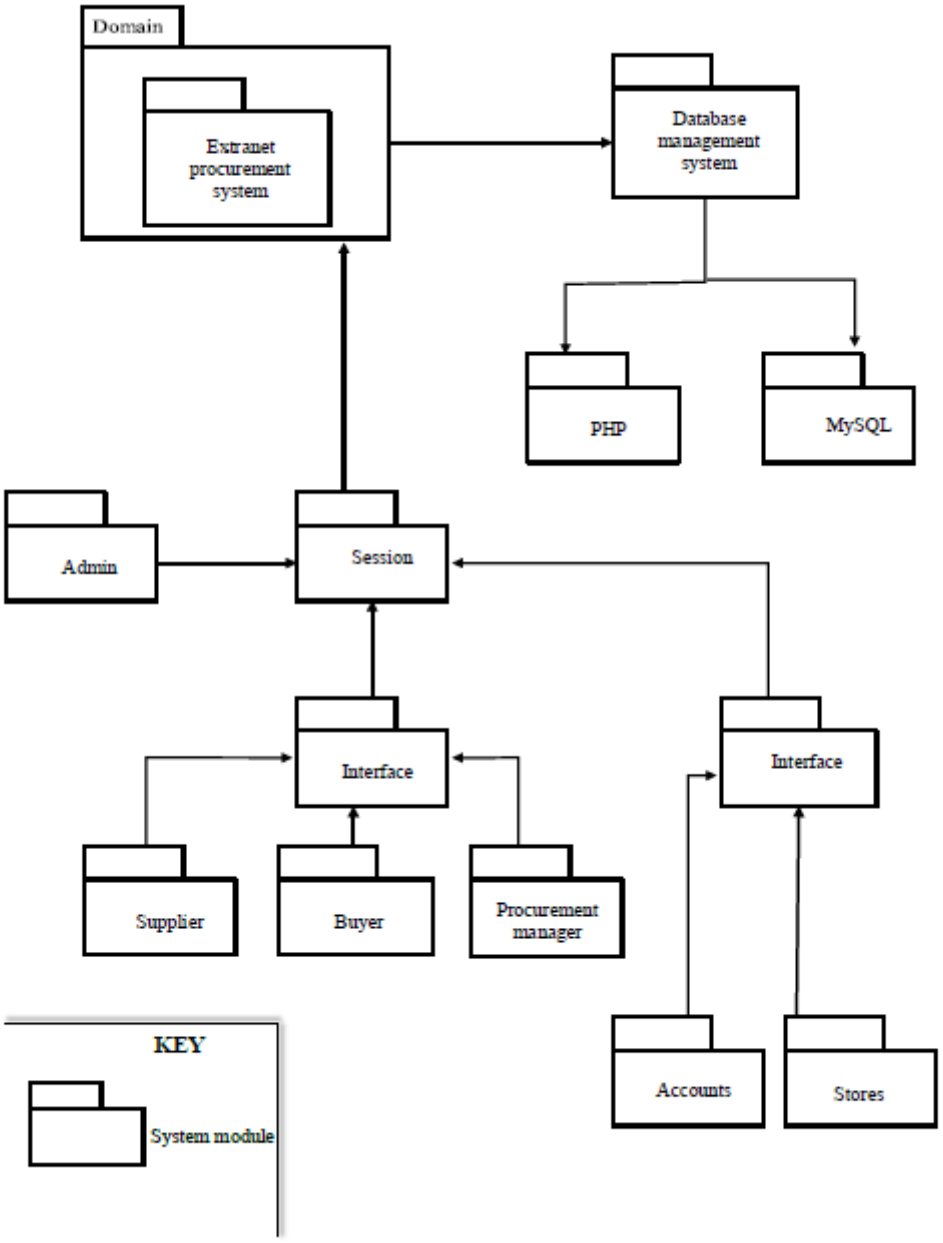


Fig 4.7: Package diagram

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 GCC Service Procurement Decision Support System.

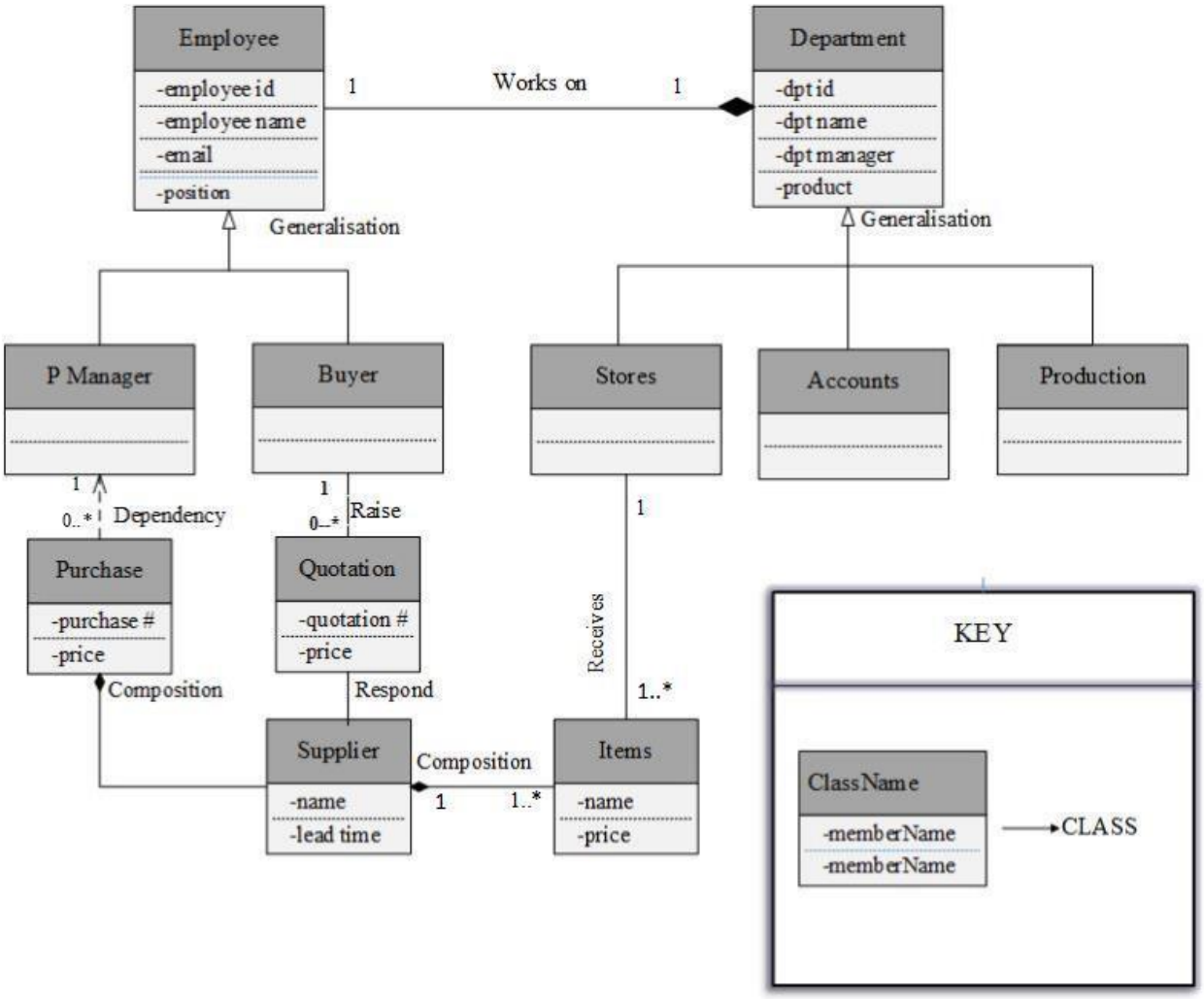


Fig 4.9: Class diagram

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. The following diagram is an illustration of the sequence diagram for the proposed system.

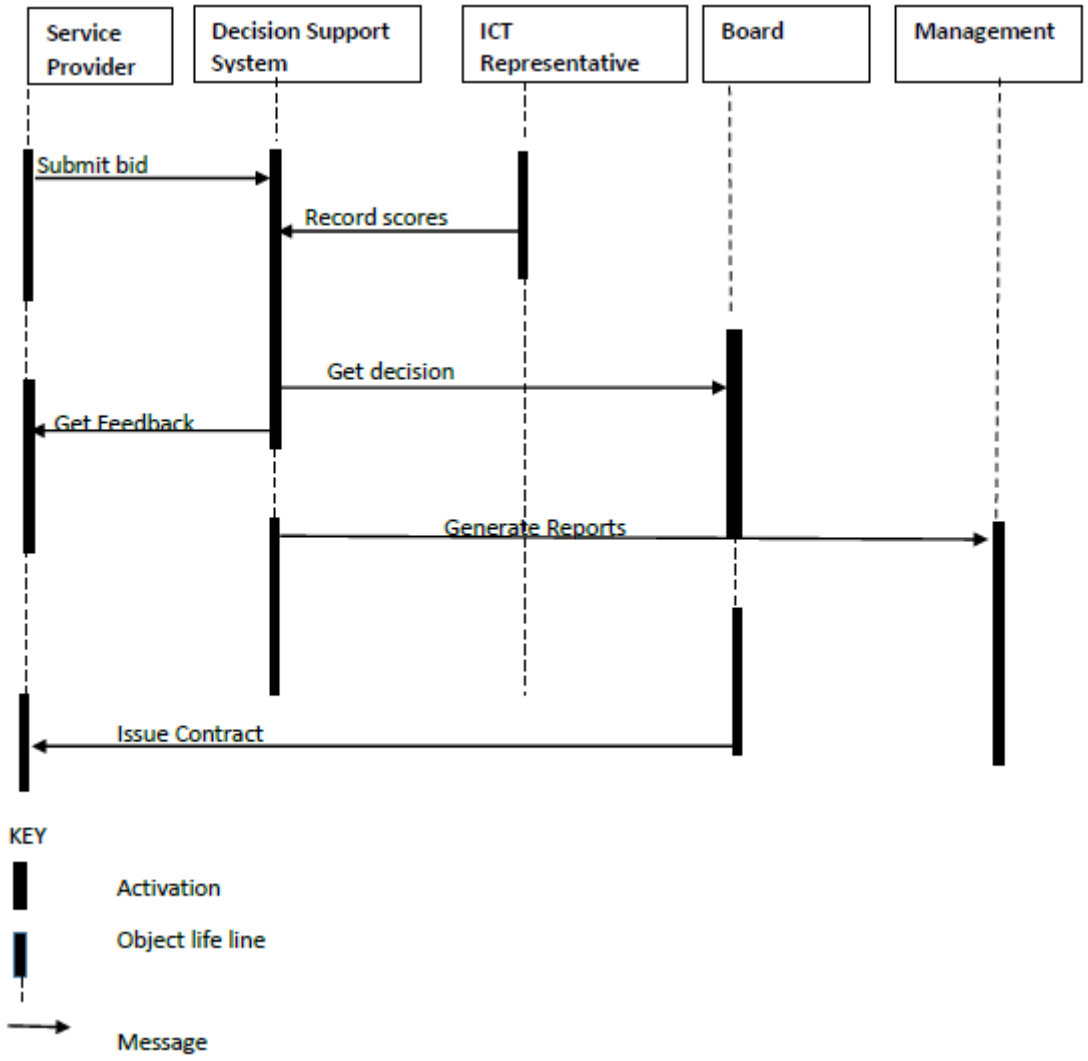


Fig 4.10: Sequence diagram

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 menu design of the system that is to be developed and how the users are supposed to interact and use it. Functional design defines how the system will communicate or interact with its users. 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 Menu design

The main menu is the interface that shows all the functions of the system. It encompassed by the commands that will enable users to navigate menus through the system in an easy way that they can understand. Users often make a selection from a list of possibilities presented to them by the system through the use of menus (Somerville, 2000).

4.7.1.1 Main menu

The home page which is the main menu of the system consists of the navigation to the login page and the company information

4.7.1.2 Sub-menus

Menus are further divided into a number of sub menus depending on the requirements (James, 2009). Separator bars were used by the researcher in the e procurement system to help group together sub menus of identical nature. Just like menus sub menus can be created in order to make a selection from a number of options. Usually the keyboard options are also provided while setting sub menus similarly the way it is done with menus.

4.7.2 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.

4.7.2.1 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

The above platform allows the users to put their credentials (username and password) then they will be re directed to the specific pages depending on the roles and rights of that user. 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.

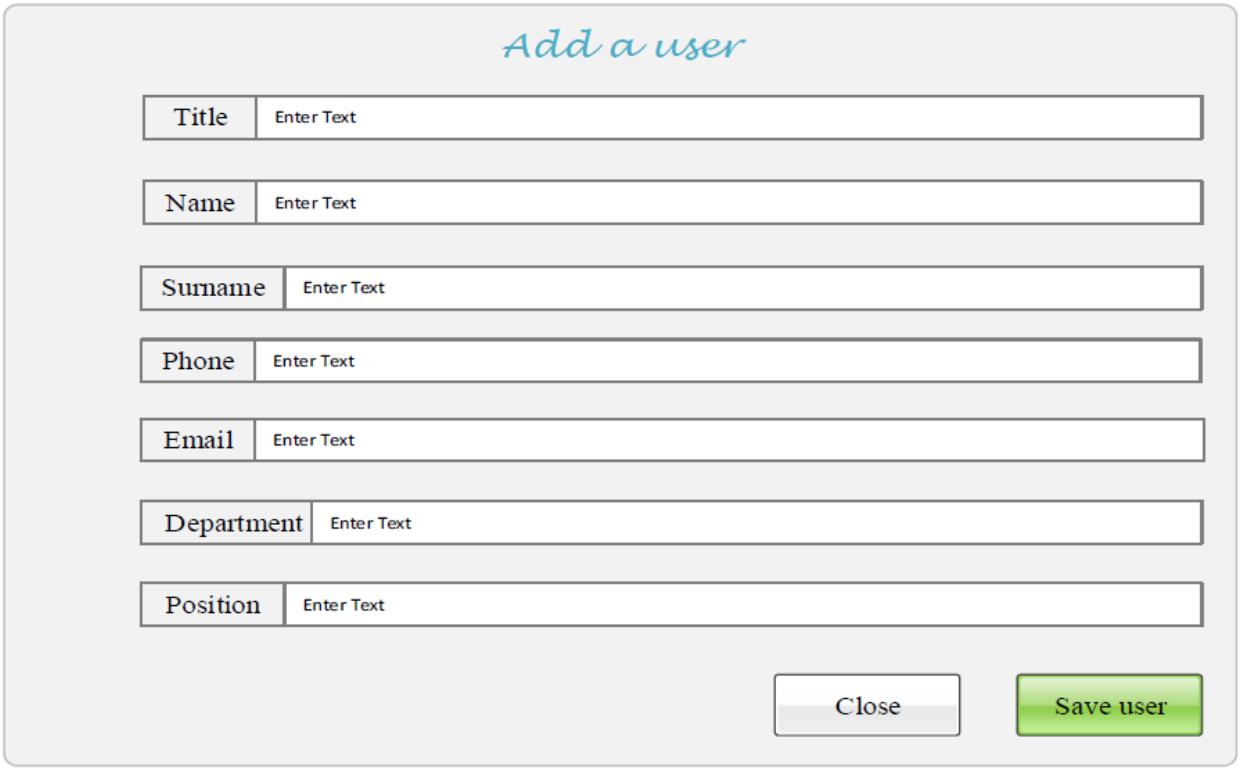


Fig 4. 12 Add new user

The above platform provides all requirements that will be needed upon new user account creation and a random password will be created and send to the user's email account

Fig 4.13: Create a supplier

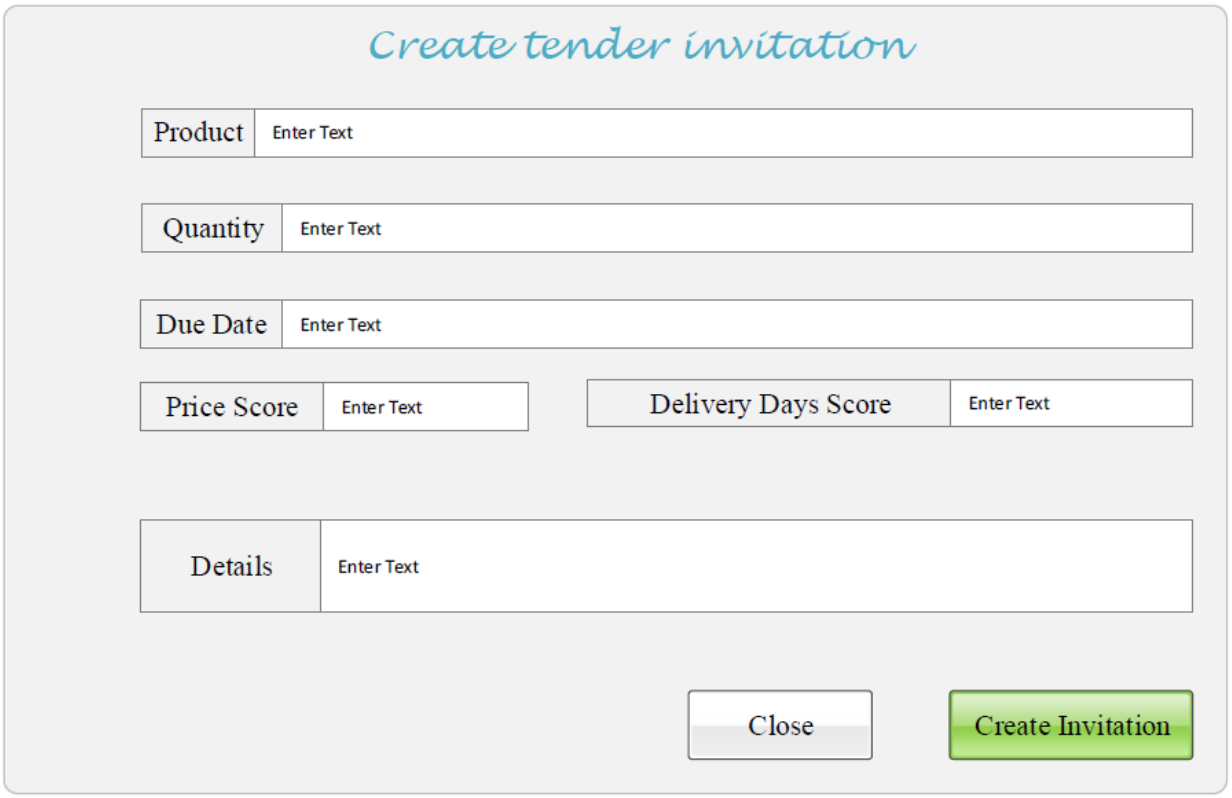


Fig 4. 14 Create tender invitation

The above platform is where the GCC create a tender invitation for the suppliers specifying the product to be supplied, quantity to be supplied, due dated as well as the price and delivery scores for the product.

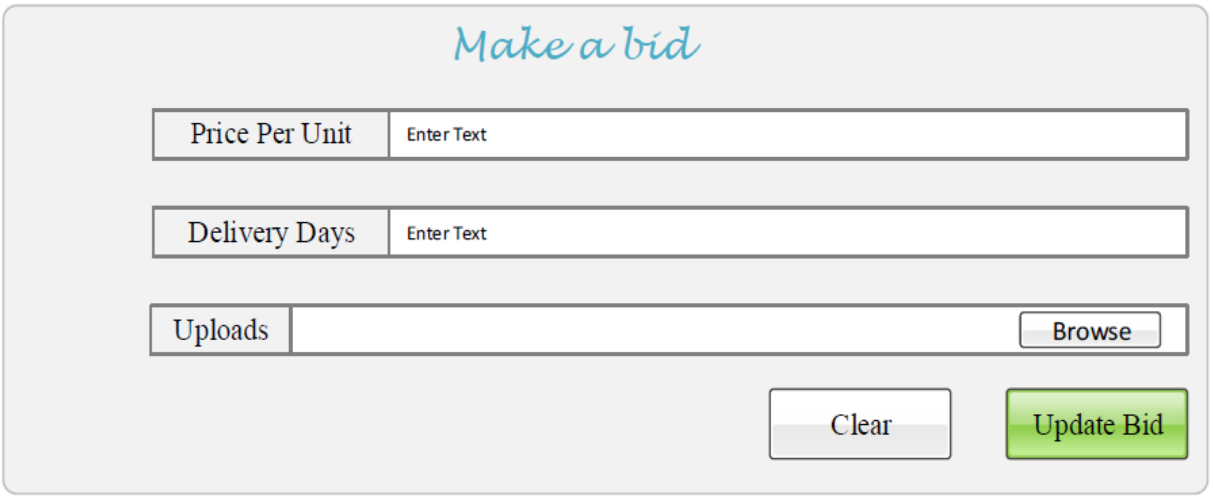


Fig 4. 15: Make a bid

Above is a platform that allows supplies to make bids and submit them before the deadlines. Suppliers should specify price per units and possible delivery dates.

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.

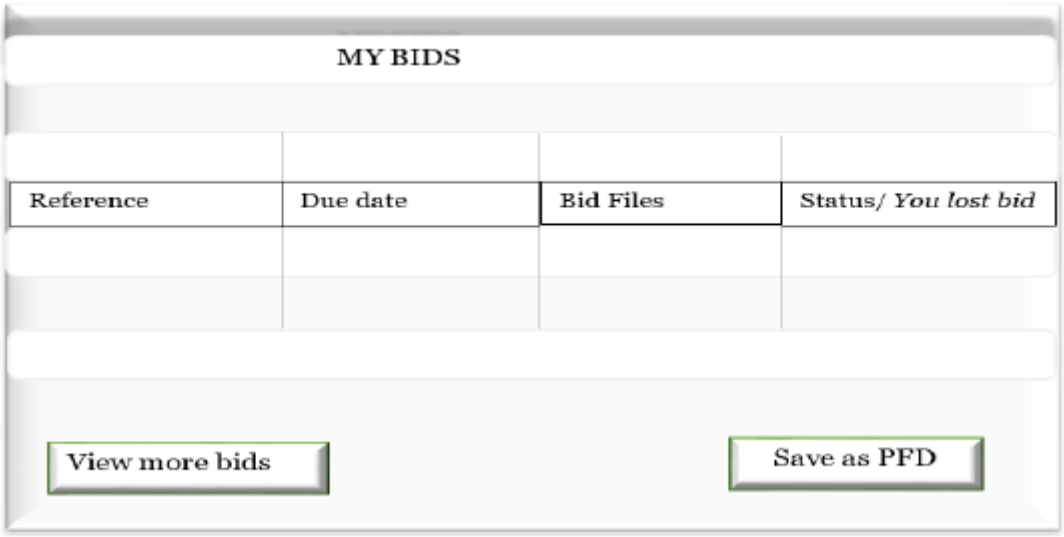


Fig 4.16: Feedback to service providers

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.

4.8 Pseudo code

According to Furman (2010) a pseudo code is a program that is written in a way of describing a set of instructions. It is the best way of planning before actual coding to ensure that every module needed is included. A pseudo code allows easy translation of statements into any programming language.

Database connection

Check if there are connections

If no connection, exits

Establish connection

Else

Ignore

End if

Login

Enter username and password

If username and password are correct

Open the main menu.

Else

Invalid login

End if

Add supplier

Enter required Supplier details

Validate user input

If input is invalid

Display error

Else

Save input data using existing connection

Display confirmation

End if

Updating data in the database

Get the key fields

Check if record does exist

If not then

Report error

Else

Validate all the information

If some of the input is invalid

Report error

Else

Save record

End if

Selecting Best Supplier

If

Product price is less

Else if days of delivery is less

Then

Bid approved

Else

Bid Rejected

Tender Adverts

Check if there are connections

If no connection, exits

Establish connection

Website display tenders/Purchase Requisitions

Else

Ignore

End if

4.9 Security design

This is whereby the developer comes up with features that help the system to be fully protected (Flynn and Luke, 2011). The system developer therefore need to keep in mind that system security is also of paramount importance and needs attention in system development. Procedures and policies governing the use of the system need to be designed in different ways that include the physical and logical security. This platform is designed in different ways and some of these are network security, physical security as well as the operational security.

4.9.1 Physical security

Physical security are measures designed to prevent unauthorized access to resources and equipment and to protect personnel and property from damage or harm (Forouzan, 2007). Lockers and intrusion detection systems already installed by the organisation help to safeguard all computer hardware components. The database administrator is the only person who can change the physical attributes of the database.

4.9.2 Network security

According to O'Hanley and Tiller (2013), network security provides message confidentiality, entity authentication and integrity. The server will be using cisco technology which helps by providing firewalls that will curb intrusions and unauthorized interference. To ensure entity authentication all personal computers will be secured by usernames and passwords. Esset antivirus will be used for internet security since it can detect malware online. The system will centralize its information and in some instances cryptography will be used to safeguard the information.

4.9.3 Operational security

User privacy is one of the most important features that the system enforces this is achieved by making use of access levels working in conjunction with passwords (Solomon, 2010) .The administrator of the system holds the highest privilege as he or she is able to come up with user activity report and relative active times in the system**.**

4.10 Conclusion

During the design phase, the analyst was able to come out with a satisfactory way of how the system is supposed to work and appear, with the fact of a user-friendly interface in mind. The design considerations above were sufficient for the developer to move to the coding and implementation phase. The design phase defined how the system would work in the actual environment. The specifications of the components of the software developed was defined in detail. The system was designed in such a way that the users found it easy to use, easy to maintain and not cause problems. In this section the researcher had illustrated the way the system will be operating.

CHAPTER 5: IMPLEMENTATION PHASE

5.1 Introduction

After the system has passed through the design phase there is need to test the designed system for errors. This will be done through validation and verification and the detected errors should be corrected before the system is implemented. User training is to be undertaken to maximize the use of the system to its maximum capacity. The implementation phase is the last stage in the system development and this is the stage where the developed system is introduced to the users of the system (Dennis et al., 2012). Objectives stated in the first chapter of this documented are also tested so as to determine if they tally with the needs of the targeted users. According to Stair and Reynolds (2013), the implementation is the procedure by which the issues which have to do with the technical, workforce and issues with administration are attended to. This phase also consists of coding, testing, installation, evaluation and maintenance of the new system. Maintenance stages will be highlighted that help ensure that the system accommodates changes and new user requirements.

5.2 Coding

Coding is the process which involves the conversion of a plane text into syntax that a fixed channel or a medium can be used to transmit the code (Reynolds, 2013). This implies that the process of coding refers to the conversion of the system design phase into a sequence of structured code syntaxes that can be implemented as a suite to produce a functional system and this involves the creation of a pseudo code. A pseudo code is a structured-English or program-design- language that is created in programming so as to imitate or simulate the instructions in real programming code (Craig and Jaskiel, 2002). The use of the pseudo code has got the advantage in the sense that it is easier to understand and also enables one to use any programming language one can wish to use.

5.3 Testing

System testing assures or makes sure that processes such as validation and verification, quality assurance and estimation of reliability are all achieved (Fujita and Zualkerman, 2008). System testing should be confined to the specifications of that particular system hence revisiting the needs of the users is vital in testing the system. Thereby the verification and validation processes are done in order to ensure that the user specifications are being me by the developed system. It can also be referred to as the type of testing to check the behaviour of a complete and fully integrated software product based on the software requirements specification (SRS) document. Intensive testing was conducted by the researcher in order to make sure that all components of the database were

functional. This will make the system run smoothly eliminating all the negative deviations which could have been encountered in the actual operation of the system and hence minimise system errors. Testing follows a sequence of steps and fig 5.1 illustrates the steps.

- **Unit testing**
- **Module Testing**
- **Sub system testing**
- **System testing**
- **Acceptance Testing**

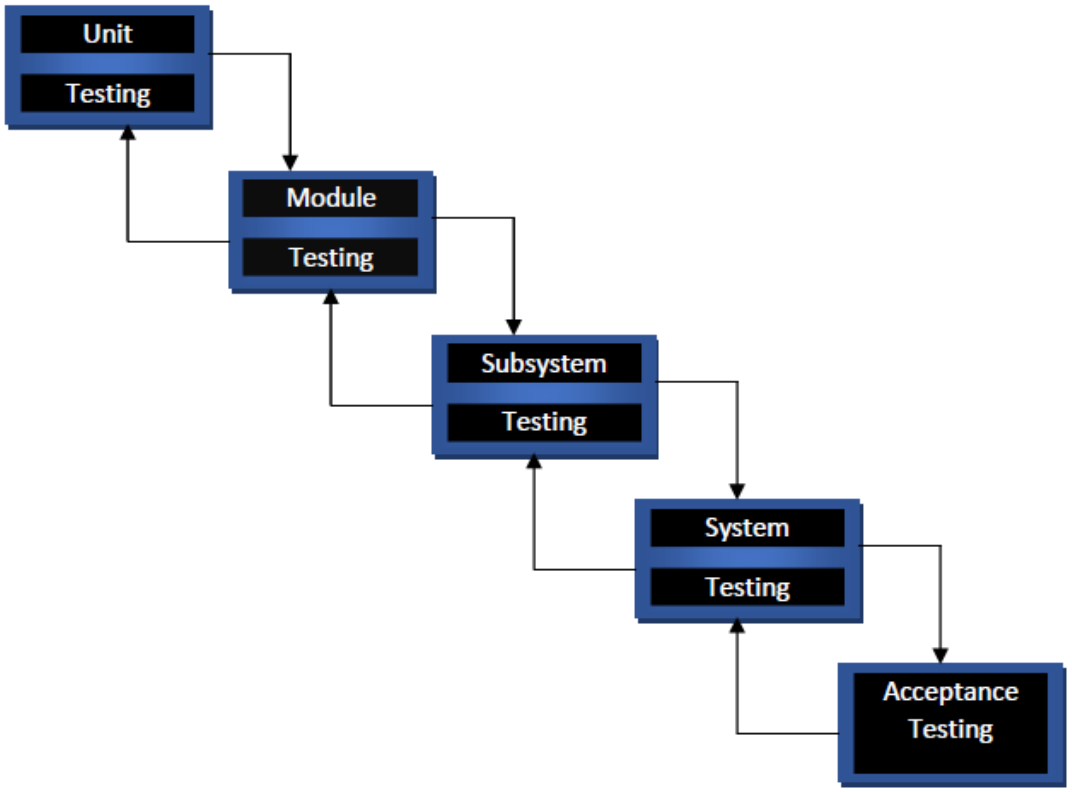


Fig 5.1: Stages in system Testing

5.3.1 Unit testing

According to Whitten (2013), unit testing involves the trying and testing the small bits of software that can be composed to produce software. This implies that unit testing involves the validation and the verification of the smallest component of a software module. Independent testing was carried out on the individual system components so as to determine their functionality when being implemented independently. Upon carrying the unit testing independent forms were tested to determine whether the inputted information was being stored in the database. The system went through this process successfully as the suppliers and users' information was successfully added

into the MySQL database. Several other units were tested for error in the system with various user inputs provided by the GCC employees.

5.3.2 Module testing

Module testing strategy combines the linked software abilities or units and is examined to authenticate whether the different dependent units are functioning hand in hand as this is important to the system (Saleh, 2009).

5.3.3 Integration Testing

According to Shelly and Rosenblatt (2011), integration testing combines the software elements and the hardware elements and is tested up until the application software has been integrated. The objective of integration testing is to make sure that the design objectives are met and they comply with the operational and user requirements. Integration testing tests the individual units that are to be later integrated or combined if they are functioning without errors. Modules in the GCC e procurement system were tested and all the errors detected were corrected.

5.3.4 System Testing

System testing technique evaluates the execution of the combined system by combining the different sub-systems (Limaye, 2009). This is the stage where the productivity of the system is measured that is the system will be assessed or measured against the user requirements. The system will be tested so as to identify those errors that arise due to the fusion of the different modules. System testing includes the two types of testing which includes white box and black box testing.

a) Black box Testing

Black box testing includes the usage of tests whereby the inner structures of the developed or the system source code are unclear to the analyser (Saleh, 2009). The black box testing strategy includes the analysis of the different sections of the system conduction for assessing the relations between inputs, output and its functionality as per customer requirements. It is a programming testing technique whereby the inputs are controlled and yields are then seen to check whether the resulting outputs are the ones anticipated.

b) White Box Testing

White box testing refers to the software testing technique whereby the internal structure, the design as well as the implementation of the items being tested are known to the tester (Limaye, 2009). In this case the tester chooses the path that exists in the code as well as determining the suitable outputs. White box testing mechanism took into account the internal or inner architecture of the system or the system components. It is also known as the glass box testing or the structural testing indicating that there is transparency in the inner workings of the system that is the logic and the structure of the code.

5.3.5 Acceptance Testing

Acceptance testing is a formal software testing technique which is undertaken so as to determine if the developed system satisfies the acceptance criteria and at the same time determining the customers to choose to use the system or not (Agarwal, Tayal and Gupta, 2010). This technique is used in determining whether the system met all the user specifications and that all the objectives are met. This is the final stage of testing which will determine the success factor of the system since it is the stage where the users of the system chose whether to use it or not. Acceptance testing involves the use of the two sorts of tests which include:

a) Alpha Testing

According to Craig and Jaskiel (2002), alpha testing is a sort of acceptance testing that is carried out at the site for development. The technique involves the use of past information obtained from the old system so as to compare and evaluate the effectiveness of the new system in error handling. This is where any abnormal system behaviour is identified and rectified so as to eliminate errors.

b) Beta Testing

The site of the targeted client environment is where the system is tested (Agarwal et al., 2010). The organisation in which the system is designed for is given the system so that the users of the system familiarize with the developed system. This is done so as to allow them to get a feel of the system with the objective of finding errors which might still exist in the system. These identified errors are then brought up so that they can be corrected.

5.3.6 System security testing

After the successful completion of integration testing the system was tested for security. According to Bentley and Whitten (1995), system security testing is one of the most crucial areas in system

development and also added that secure software is highly unlikely to fail. Thus the system should have highly secure mechanisms so that they guard against unauthorised access into the system. The GCC e procurement system was developed and the use of user authentication as well as access levels was implemented and thereby guarding against unauthorised access. Therefore the several testing mechanisms were implemented and the system yielded positive results through those stages.

5.3.7 Validation

According to Bentley and Whitten (1995), validation refers to the process of ensuring that the input is correct and can be accepted by the system. The data entered in the system should be consistent as well as being correct and any errors made should not be entered in the system. The system will therefore validate all the input parameters entered in the system through various techniques which include the following.

Screenshots of the various test cases

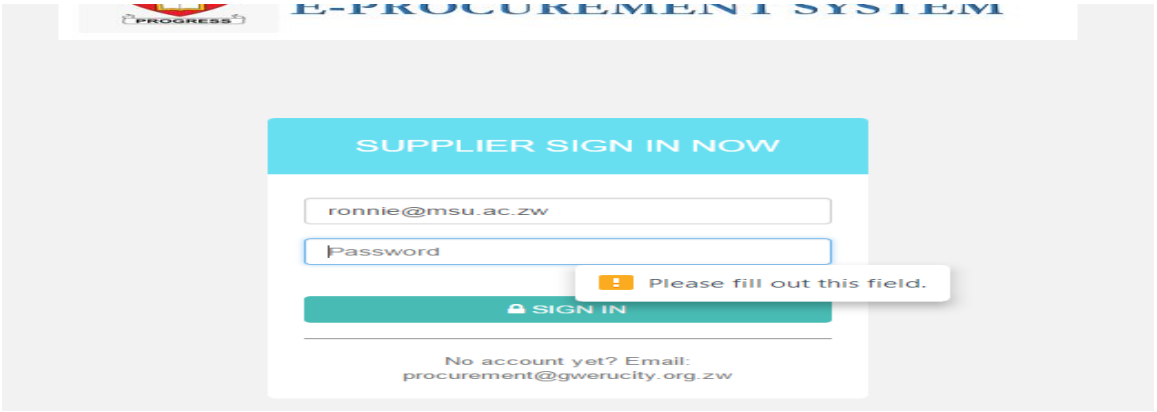


Fig 5.2: Supplier Login

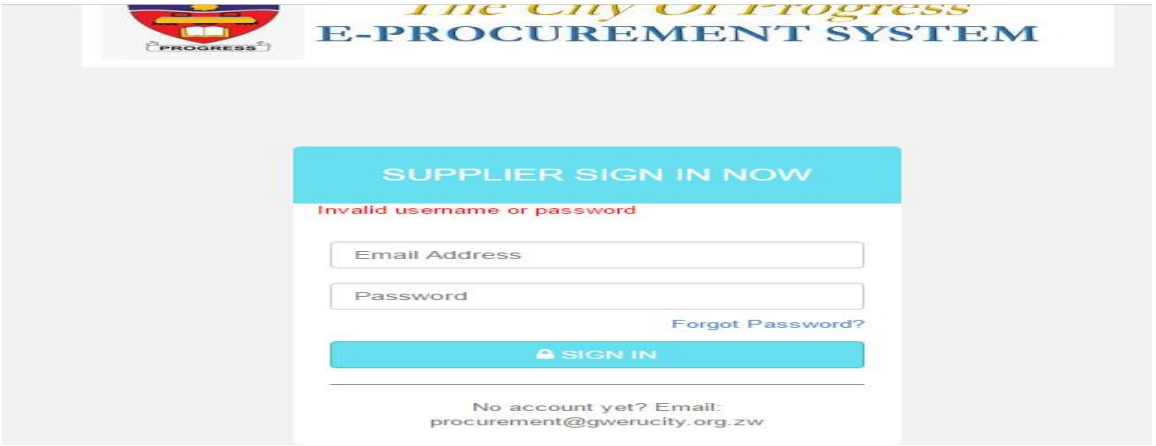


Fig 5.3: Testing for correct credentials

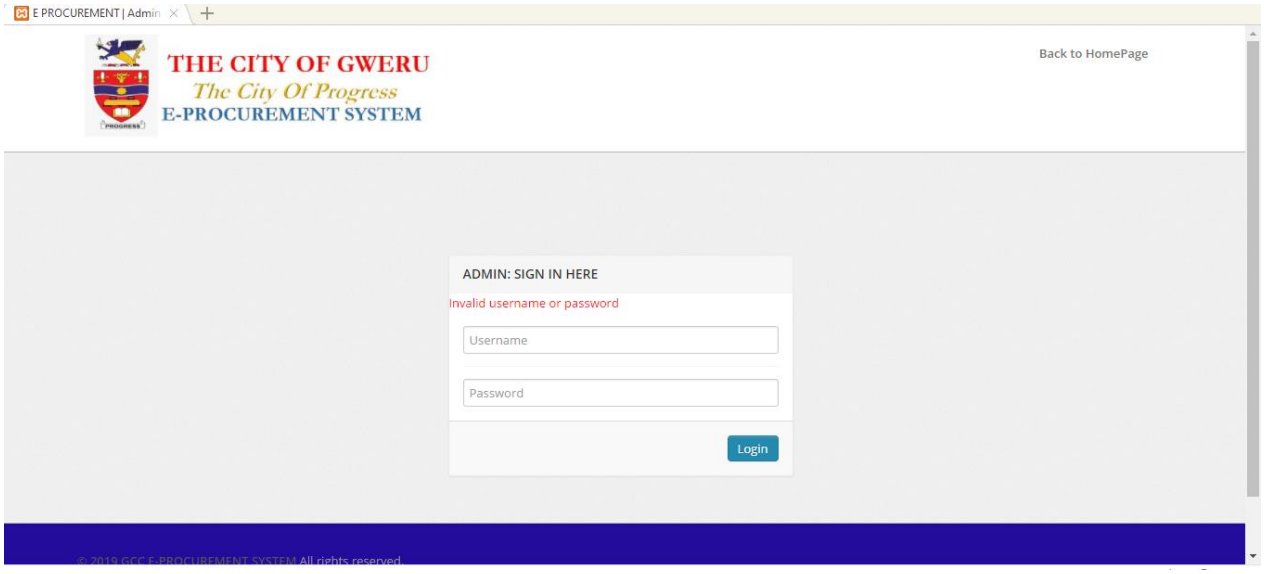
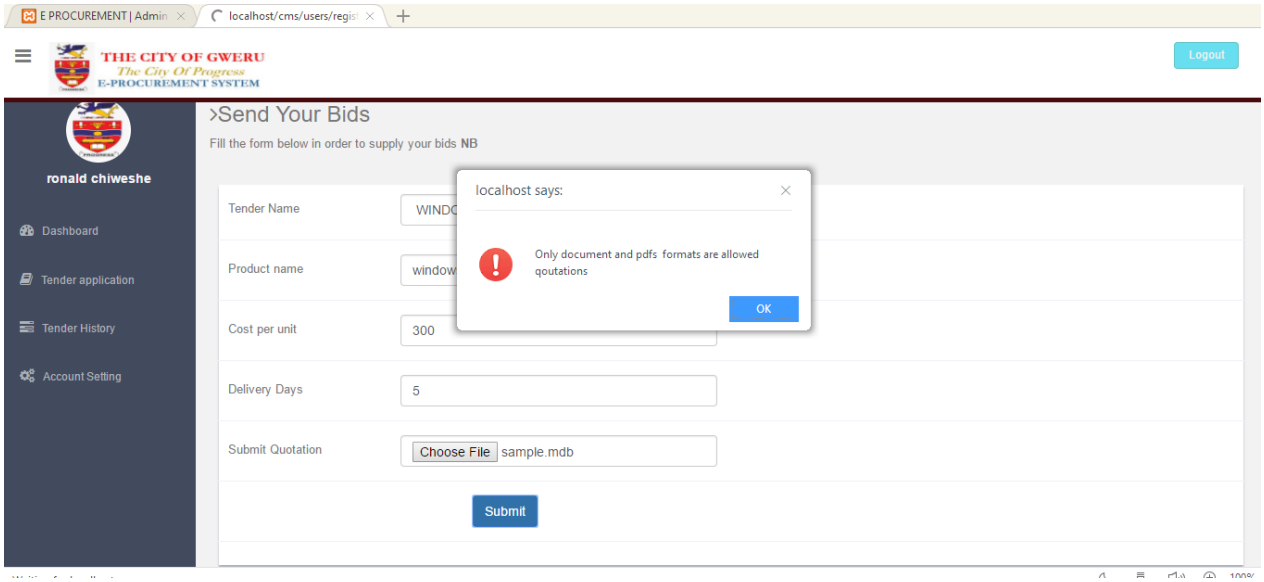


Fig 5.4: Procurement manager login page



5.4: Testing on sending wrong quotation file

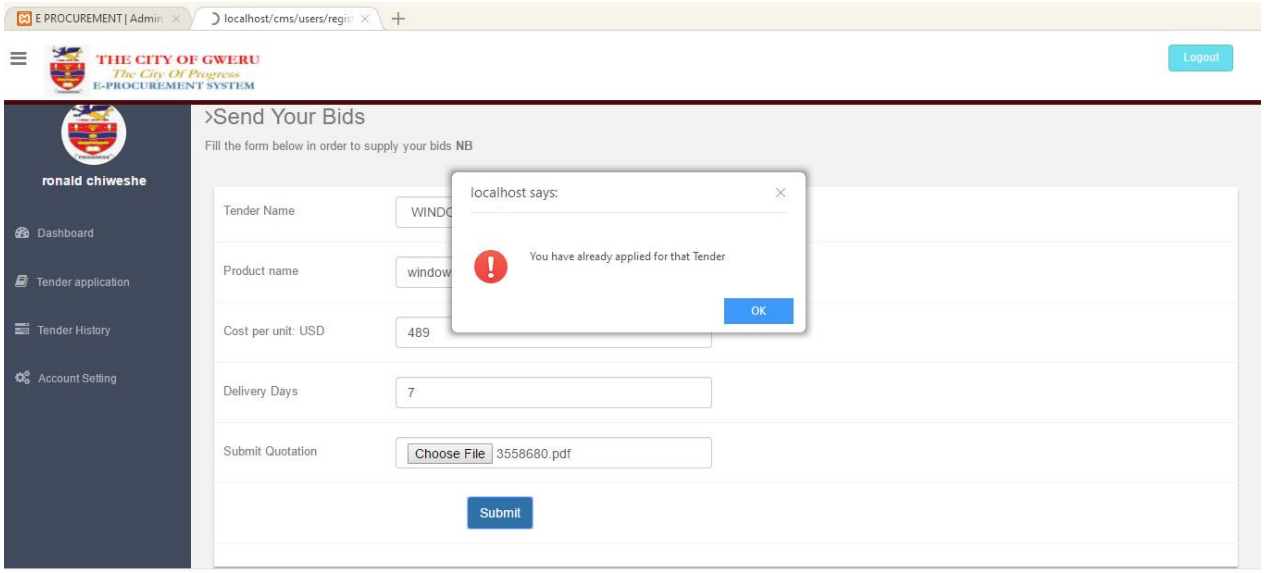


Fig 5.6 : Testing when supplier sends a quotation again

5.3.8 Verification

According to Limaye (2009), verification refers to a process of inspecting and ensuring that the system meets its expectations and the expected use. It ensures that the system performs the functions that it is claimed to be performing.

5.3.1 System versus objectives

Here all the developed system will be evaluated against objectives that were mentioned in chapter

1. To come up with a system that allows service providers to check the status of their tender bids. This has been achieved as the system will add a status comment in the service provider bids feedback section giving information about the status of the bid.

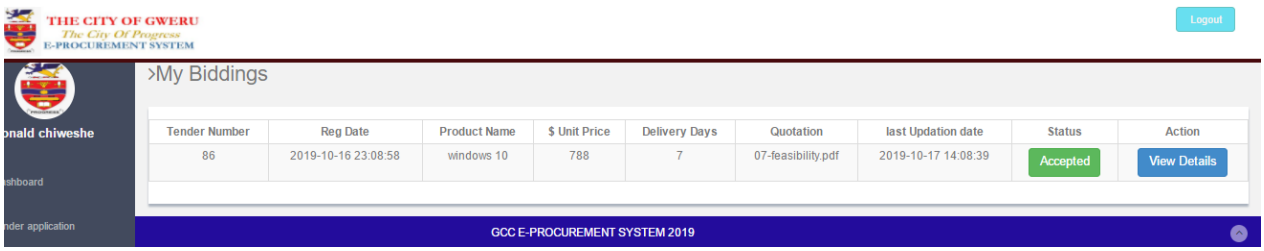


Fig 5.7: Objective one bid status

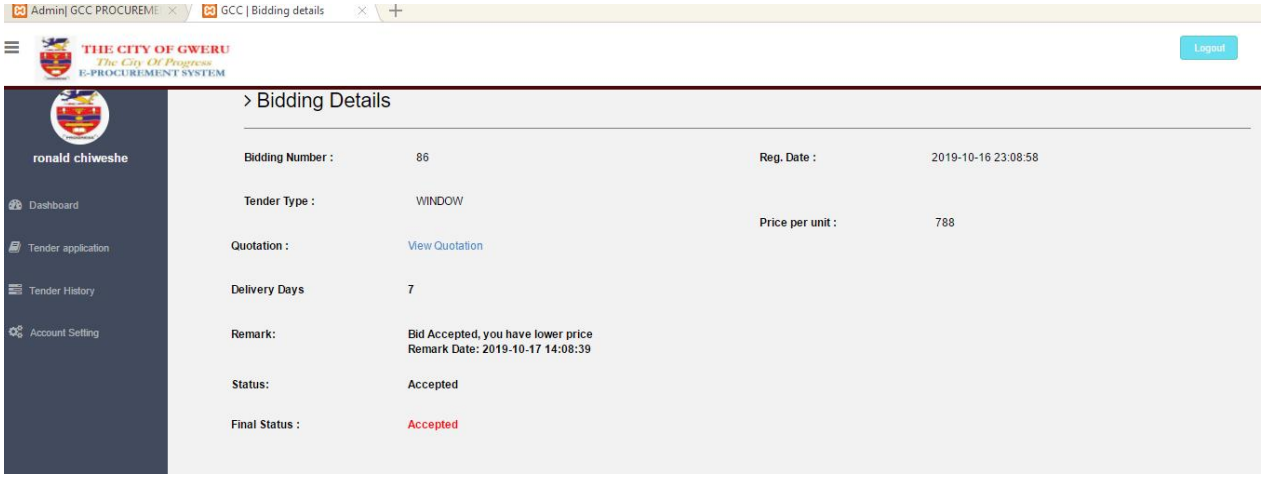


Fig 5.8: Bidding status

2. To develop an online system that helps in decision making, by ranking bids according to their prices and show the most preferable one based on price, or date

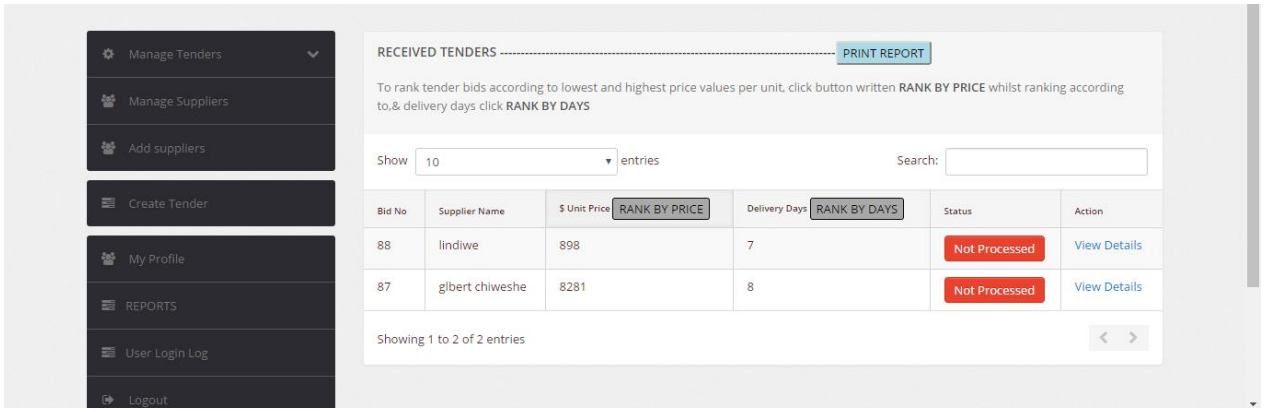


Fig 5.9: Bid ranking

3. To come up with a system that enables the procurement manager to give feedback to tender bids in form of status that is (pending, accepted or rejected).

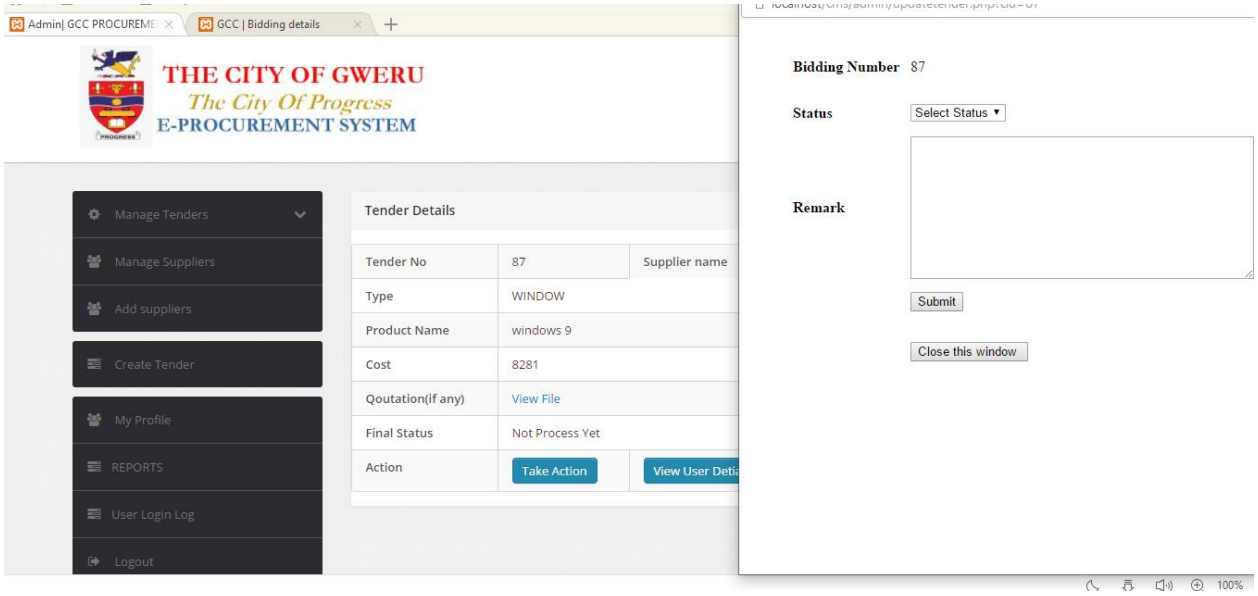


Fig 5.10: Bid status

4. To create a system that allow advertising of tenders to the public through GCC website i.e (open tenders and their due date)

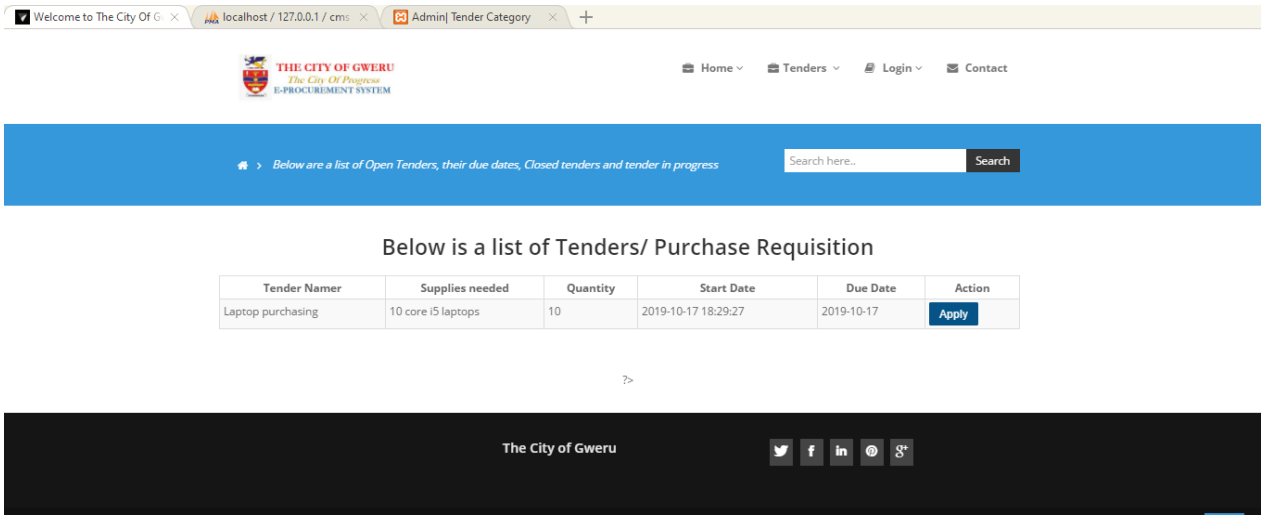


Fig 5.11: Tender adverts

5.4 Installation

According to Rozanski and Woods (2012), installation refers to a process of establishing or introducing the developed system to the organisation so that it starts its intended purpose. This implies that the users of the old GCC e procurement system will now be required to utilise the introduced new system. The system installation process is done on the production site where the system is supposed to be operating on, that is its operational environment. This process is done after the final system has been produced and all the errors are attended to and corrected. The

installation process consists of the following strategies to be carried out that are system changeover and user training.

5.4.1 User Training

According to Limaye (2009), user training involves the introduction of the developed system to the endorser so as to allow and promote familiarisation. This implies that the users of the system are shown the system so that they can make use of the modules and the programs that are relevant to them. The daily operations of the organisation are not supposed to be disturbed and therefore user training is vital so as to improve the productivity of the proposed system. In the development of the GCC e procurement system, the user training exercise arranged by the GCC Human resource department. The elements as well as the combined modules were discussed and explained making it clear to the user how the modules actually function so as to avoid error in using the system.

5.4.1.1 Data migration

According to Chang (2005) data migration is the process of transferring data between storage types, formats or computer systems. Whilst moving from the manual system to the automated system there was need to load data into the system. There are high risks of losing data during data migration so one should make use of security controls measures to reduce the risks. Proper validation helped to ensure data integrity.

5.4.2 System Changeover

After the system has gone through the testing stages and all the errors found in the testing stages were identified the system moves next to the installation process. System changeover has got four alternate strategies which follows.

a) Direct Changeover

According to Shelly and Rosenblatt (2011), the direct changeover technique is when the old system is stopped and the new system starts to work immediately. This approach involves phasing out the current system so as to pave way for the developed system when it is ready for use.

b) Pilot changeover

According to Lancaster (2001), pilot changeover refers to a technique whereby the developed system is implemented on a lower scale that is implementing the system only to a certain part of the organisation and also the modules that are relevant to that section. This technique just like the direct changeover, switches to the new system but only on the selected section of the organisation. That is the old system is totally phased out due to the introduction of the new system. The pilot

technique is less risk as compared to the direct changeover strategy but however this also has got its own limitations

c) Phased changeover

This refers to a step by step technique whereby the developed system substitutes the old system module by module at any given time (Shelly and Rosenblatt, 2011). This approach is the slowest but it tends to be a safer approach. The phased changeover strategy in the event of a failure only affects that specific module and the whole system operations is not crippled as seen in the direct changeover strategy.

d) Parallel changeover

Parallel changeover implies that the new system is introduced to the environment and works simultaneously with the old system for a certain period of time (Shelly and Rosenblatt, 2011). This strategy is done so as to compare the results produced by both systems and also as a counter measure in the event the new system fails. Therefore the parallel changeover is the less risk of all the other changeover strategies.

5.4.2.1 Recommended changeover strategy

After full analysis of the above changeover strategies, and also considering the system that Gweru City Council is currently using that involves manual adjudication, direct changeover was seen possible and therefore adopted by the analyst and management. Direct changeover proved to be the best because the system moved from manual adjudication to automatic system. Users copied their data under supervision of skilled personnel for assistance and then phased the old system.

5.5 Maintenance

According to Ramesh and Bhattiprolu (2006), maintenance is a stage where the system is regularly monitored and tested for errors. According to Kelly (2006), Maintenance phase involves making changes to hardware, software in order to improve the performance of the system, enhance security and correct defects. The main objective of this strategy is to find and correct these errors so that the system functions as intended. The maintenance process can be done in four ways include corrective, adaptive, perfective and preventive maintenance.

5.5.1 Adaptive maintenance

There is need for a system to adapt to changes in the operating environment. Changes may occur in both the external and internal environment. User needs and requirements might change or increase. This will occur in the e procurement system as it will be constantly updated to meet new user requirements. Adaptive maintenance involves making modifications to a system to change its functionality to changing business needs.

5.5.2 Corrective maintenance

This looks at correcting errors that might have been identified and reported during the operation of the system (Cashman 2010). When an error is reported, investigations are carried out to establish the root cause of the error and solutions as to how to correct the error are designed. To avoid introducing new problems, all maintenance work requires careful analysis before making changes. The corrective maintenance technique is usually done just after the system is implemented. Errors in this case are reported through feedback from clients and they are attended to instantly before the bugs complicate the whole operation of the system. This is recommended in the implementation of the GCC e procurement system in order to correct all the errors which could have been omitted in the testing stages.

5.5.3 Perfective maintenance

According to Kelly (2006) perfective maintenance involves adapting software to the user's wishes for example supply new functions or enhancing performance. Users request for changes while the maintenance team initiates perfective maintenance. Perfective maintenance involves making enhancements to improve processing performance, interface usability, or to add desired, but not necessarily required, system features.

5.5.4 Recommendation for maintenance

The system developer recommend the use of adaptive maintenance. This system was developed due to technological changes to automate the judgement process as well as collaboration among users hence to stay ahead, adaptive maintenance should be implemented.

5.7 Recommendations for further/ future developments

The systems development is an iterative process whereby the system has to be continuously improved and thereby keeping in track with the gradually changing operating environment. Therefore enough resource has to be allocated in the continuous development or improvement of

the system. Also additional features can be added on the application. This can at the same time reduce the workload on the employees thereby they will focus on other specifications. Future developers should also focus more on the process of black mailing the supplier who might for instance failed to meet the delivery date upon delivery of items for future plans. As part of appreciation certain suppliers for good service, the developers should also consider the promotional aspect, this will boost supplier morale as well creating strong relationships in terms of business. The implementation of an effective payment system that will motivate suppliers to deliver raw material within the specified delivery dates.

5.8 Conclusion

This phase focused on the implementation of the new procurement system. Different testing strategies were done to help access if the system met all the system specifications. It also focused on deciding the right change over strategy to be implemented. All test done were successful and errors were identified and corrected. The vital techniques all necessary to determine the viability of the system were carried out. Other techniques like testing were also carried out to determine the usefulness of the system to the users. After successfully going through the testing phases the system maintenance also takes over this was done be done so as to ensure that the system continuously operates smoothly eliminating errors. The system also has to be adaptive to the environment it is operating on so as to ensure its continuous relevance in the industry.

BIBLIOGRAPHY

Ambler .S.W, (2004), **The Object Premier: Agile Model-driven Development with UML 2.0**, Cambridge University Press, United Kingdom.

Ambler .S.W, (2004), **The Object Premier: Agile Model-driven Development with UML 2.0**, Cambridge University Press, and United Kingdom.

Biafore .B and Stover .T, (2012), **your project management coach: Best practices for managing projects in the real world**, John Wiley and sons, United States.

Bjorn .A, (1999), **Business Improvement Toolbox**, AQS Quality Press, United States.

Carzo and Yanouzas, (1969), **Effects of Flat and Tall Organization Structure,**

Cavanagh .G.F, (1998), **American business values**, Prentice- Hall, United States.

Copeland .L, (2004), **A practitioner's guide to software test design**, Artech House, United States.

Culley .S, Mileham .A, McIntosh .R, Owen .G, (2001), **Improving changeover performance,** Butterworth-Heinemann, United Kingdom.

Date .C.J, (2010), **An introduction to database Systems**, Addison- Wesley, United States of America.

Dennis .A, Wixom .B.H, Roth .R.M, (2012), **System Analysis and design**, John Wiley and Sons, United States of America.

Dorian .C, Heiberger .E.L, Karsten .K, (2003), **the backup book: Disaster Recovery from Desktop to Data Center**, Worcestershire, United Kingdom.

Duncan .W.R., (1996), **A Guide to the Project Management Body of Knowledge**, Project Management Institute, United States.

Ebert .C, (2011), **a guide to distributed development, projects and outsourcing**, Wiley, USA.

Edward .J and Bramante .R, (2009), **Networking Self-Teaching Guide**, John Wiley and Sons, United States.

Erdogan .B, Carpenter .M.A, and Bauer .T, (2010), **Principles of Management**, Flat World Knowledge, L.L.C, United States of America.

Goel .A, (2010), **Computer Fundamentals**, Pearson Education Inc., United States of America.

Grady .O.J, (1997), **System validation and verification**, CRC press, United States.

http://www.netone.co.zw (accessed 21 February 2014).

Jordan .E, (2011), **Process modelling: Context Diagrams and Data Flow Diagrams (DFDs)**, McCombs School of business, United Kingdom.

Jordan .E, (2011), **Process modelling: Context Diagrams and Data Flow Diagrams (DFDs)**, McCombs School of business, United Kingdom.

Kendall .K.E, (2011). **Systems analysis and design**, Pearson education.inc, United States.

Latifah .A, (2010). **Ethical Acceptance of Intra and Trans-Species Gene Transfers: # Perspectives. Proceeding of the International Conference on Ethics and Professionalism. Pp. 36-47**. ISBN 978-967-5878-28-2.

Limeback .R, (2008), **Simply SQL**, Site Point, Australia.

Linz .T, (2014), **testing in Scrum: A Guide for Software Quality**, Rocky Nook, United States.

APPENDIX A: USER MANUAL

The following is the website and home page of e procurement which is accessed through typing localhost/gcc_procurement: The user will click login in order to access the system

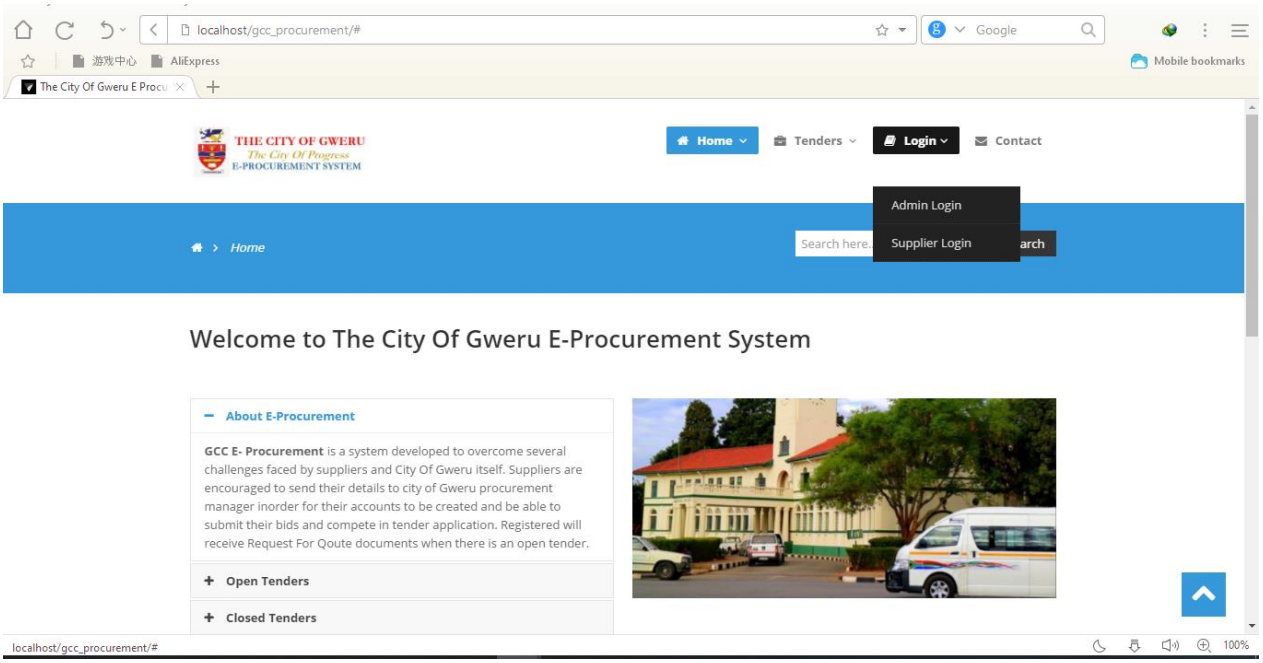


Fig A 1:Home Page

Below the user click Tenders in order to see tenders that are currently available

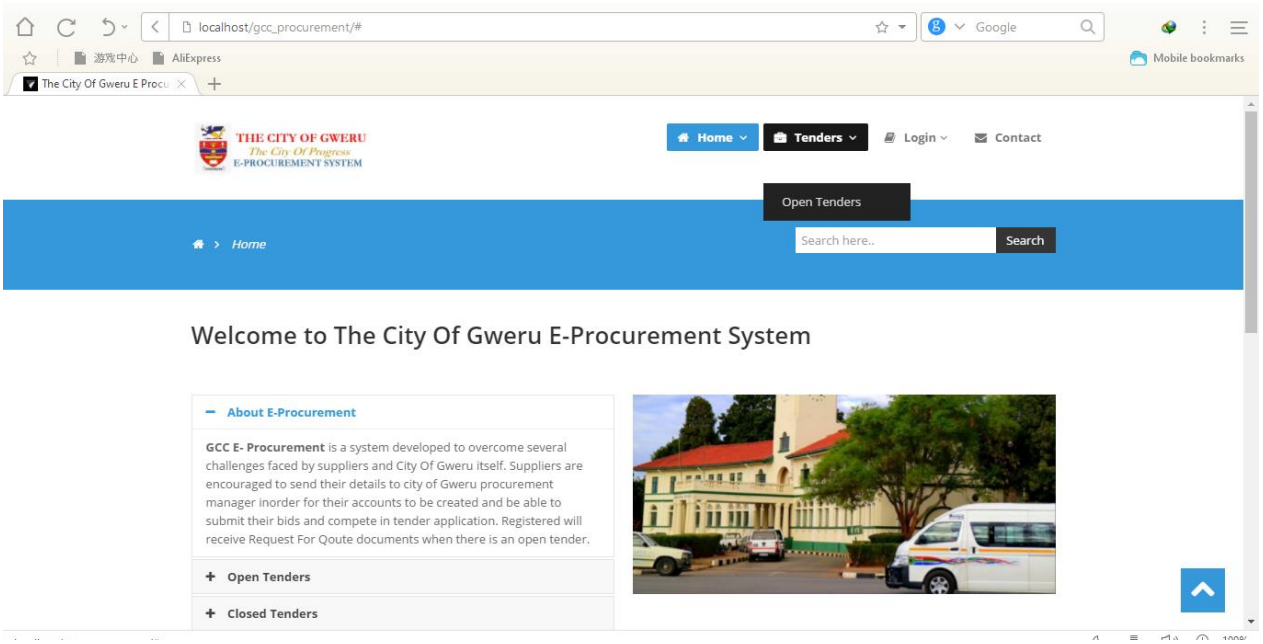


Fig A 2: Tender Page

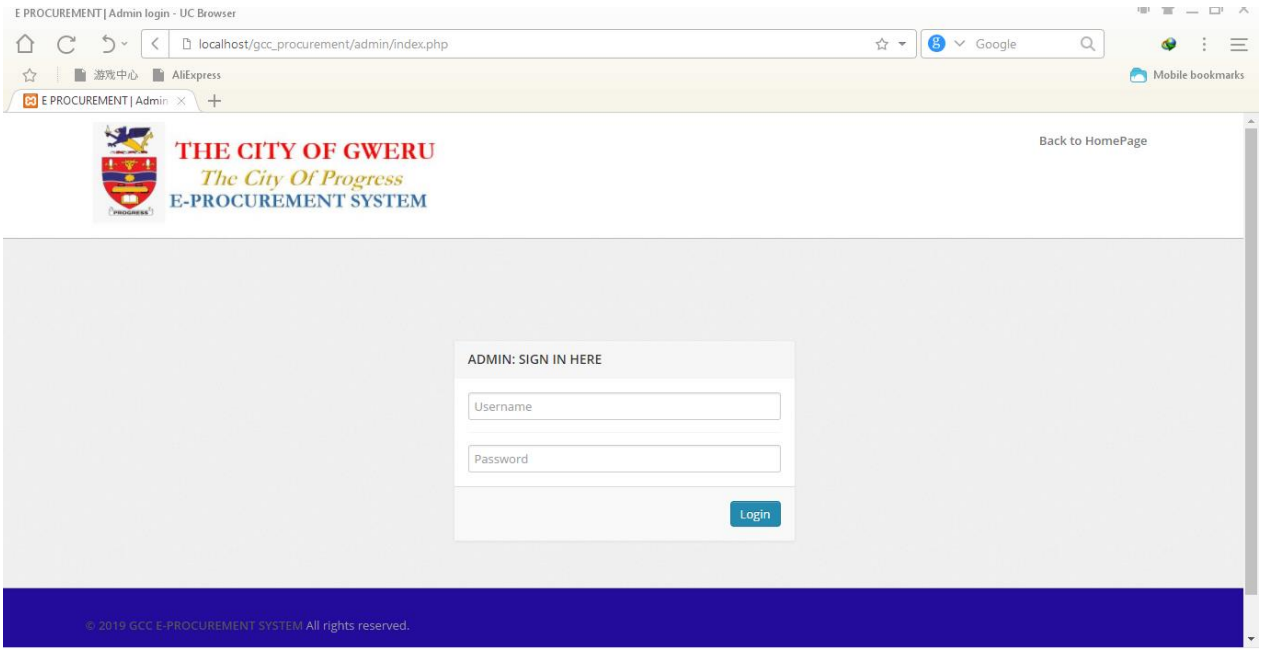


Fig A 3: Admin Homepage

The above page is for the procurement manager to login into the system and perform all operations

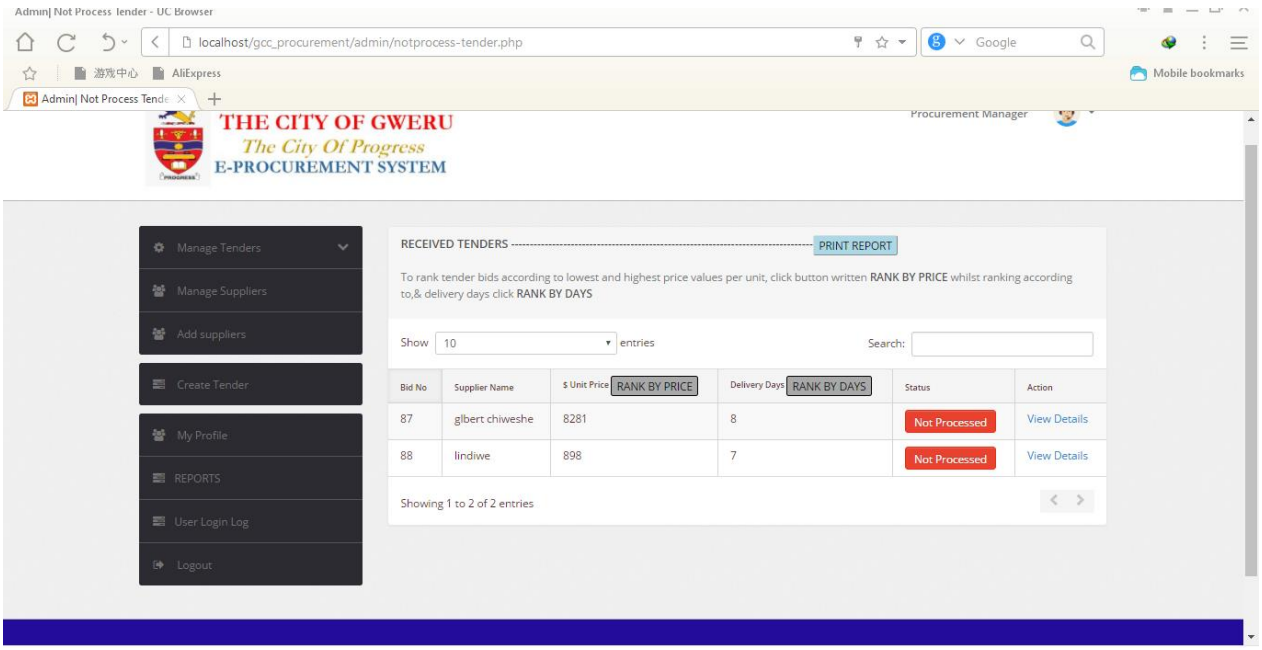


Fig A 4: Procurement manager dashboard

The above picture is the home page for the procurement manager

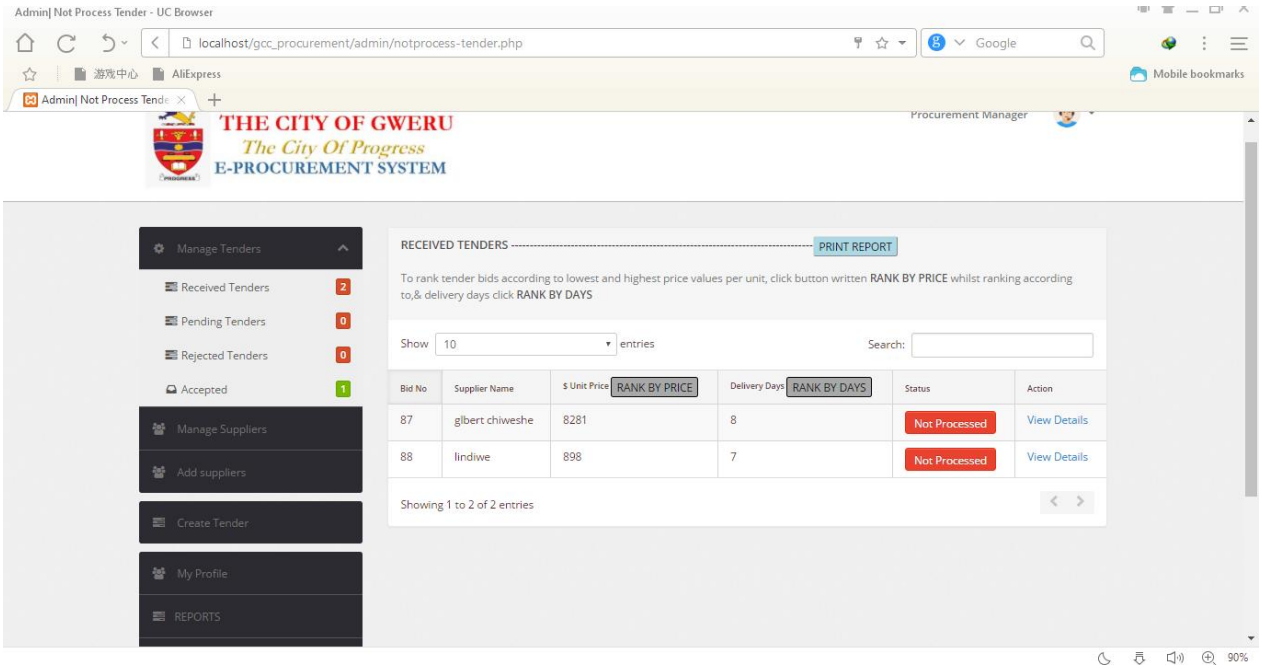


Fig A 5: Tender status

Procurement manager click manage tenders in order to see those tenders accepted, rejected and with pending status

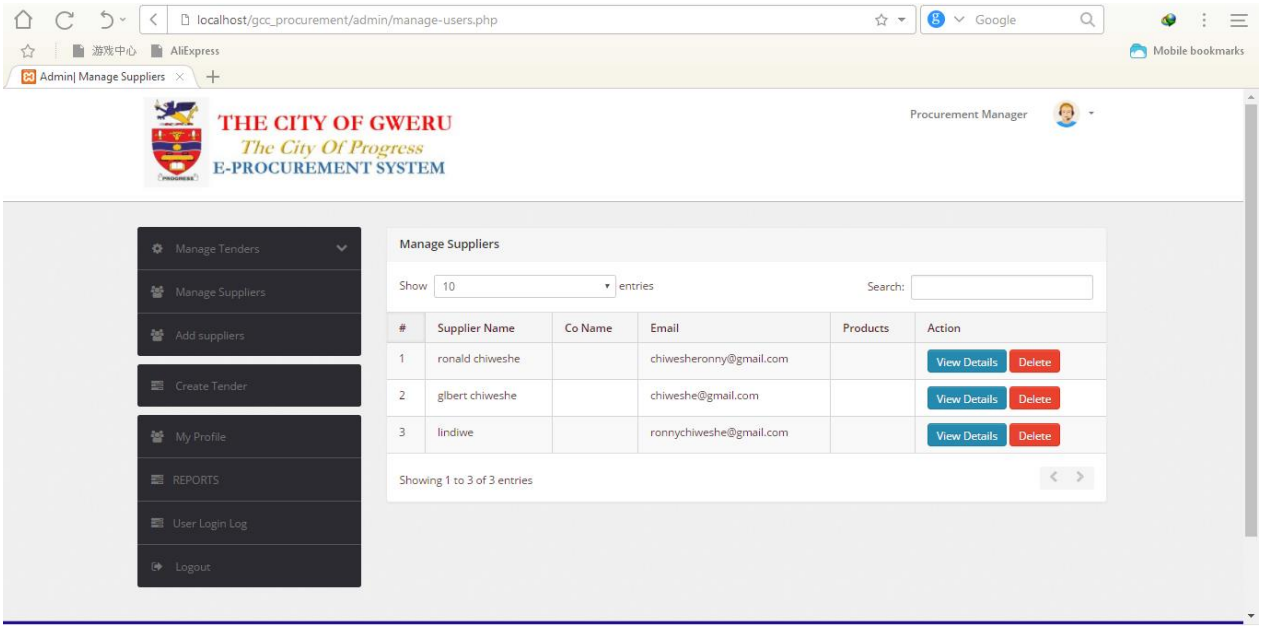


Fig A 6: Registered Suppliers

Procurement manager here manage suppliers

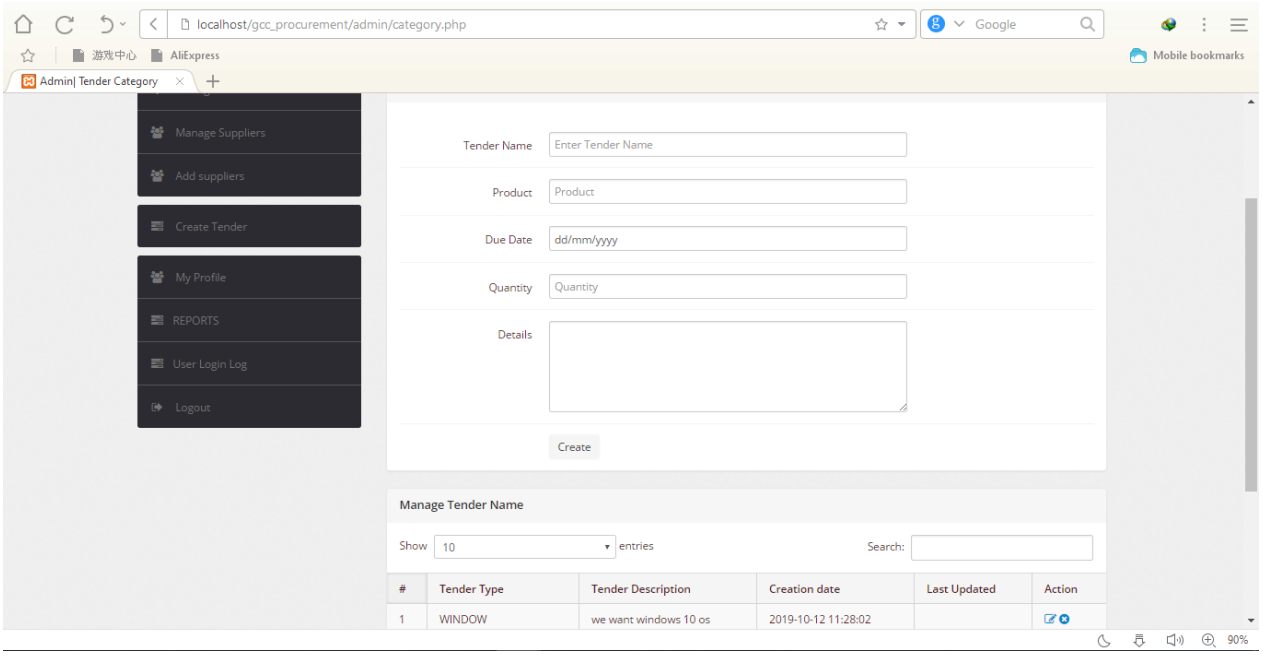


Fig A 7: Create Tender

The above is used to create tenders that will appear on the website

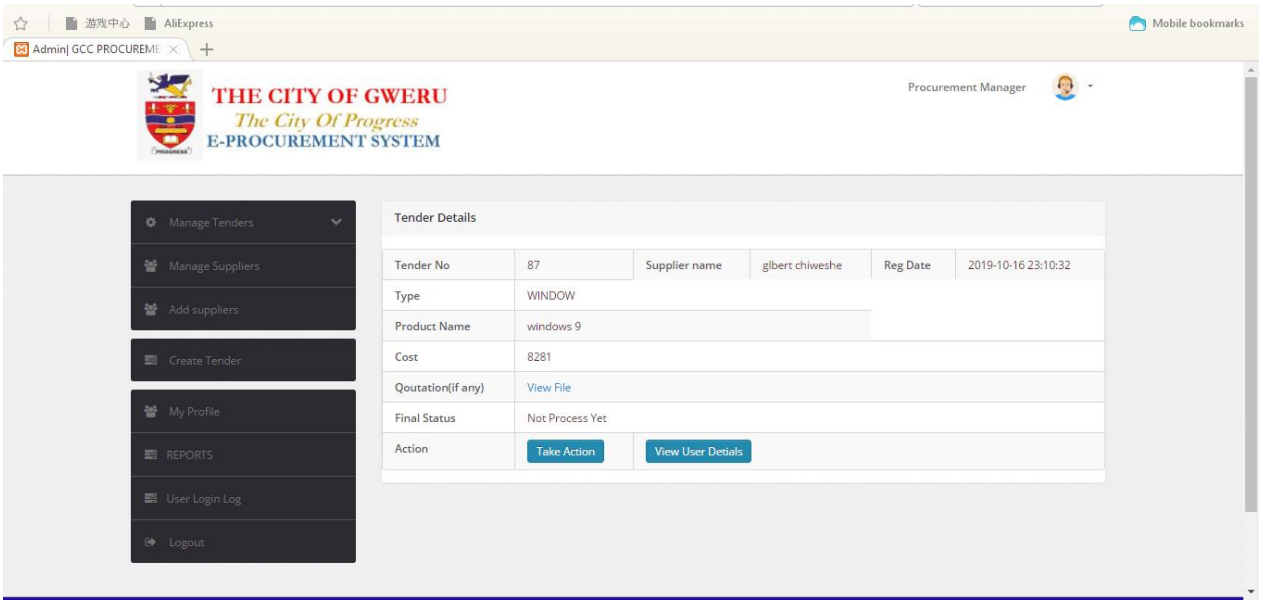


Fig A 8: Tender updates by procurement manager

The procurement manager click take action in order to update suppliers' tenders

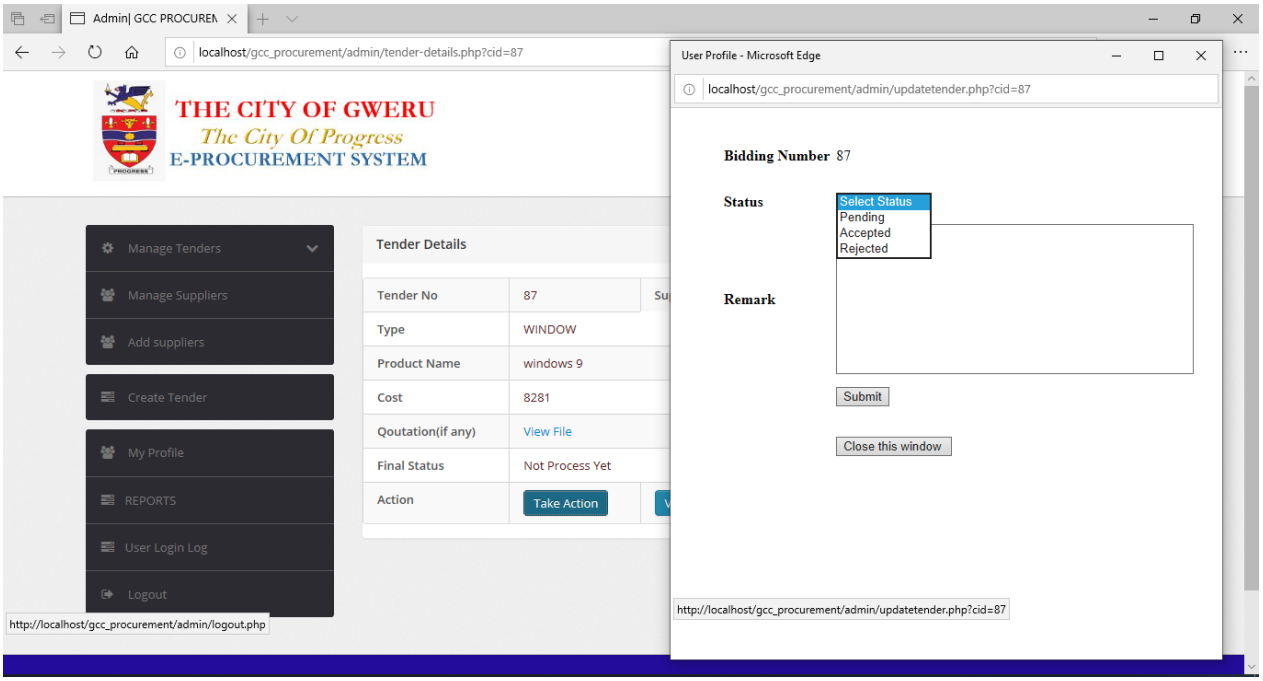


Fig A 9: Add tender status

The above page is used by the admin to update suppliers' tender status

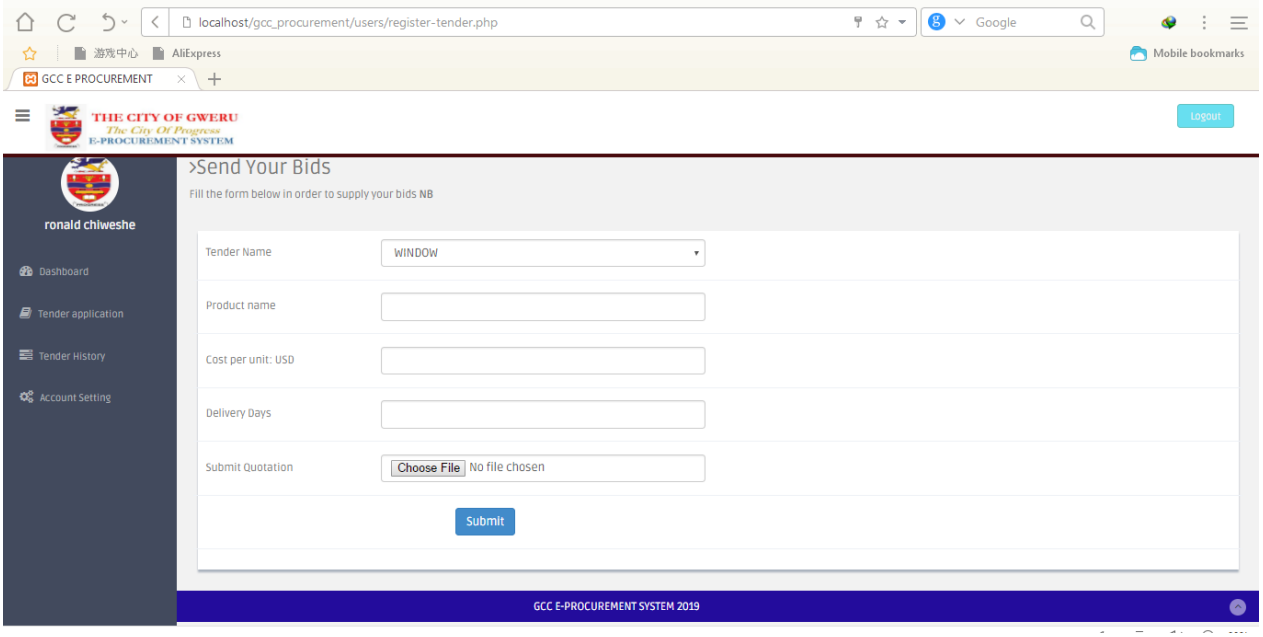


Fig A 10: This page is used for supplier to apply for a certain tender

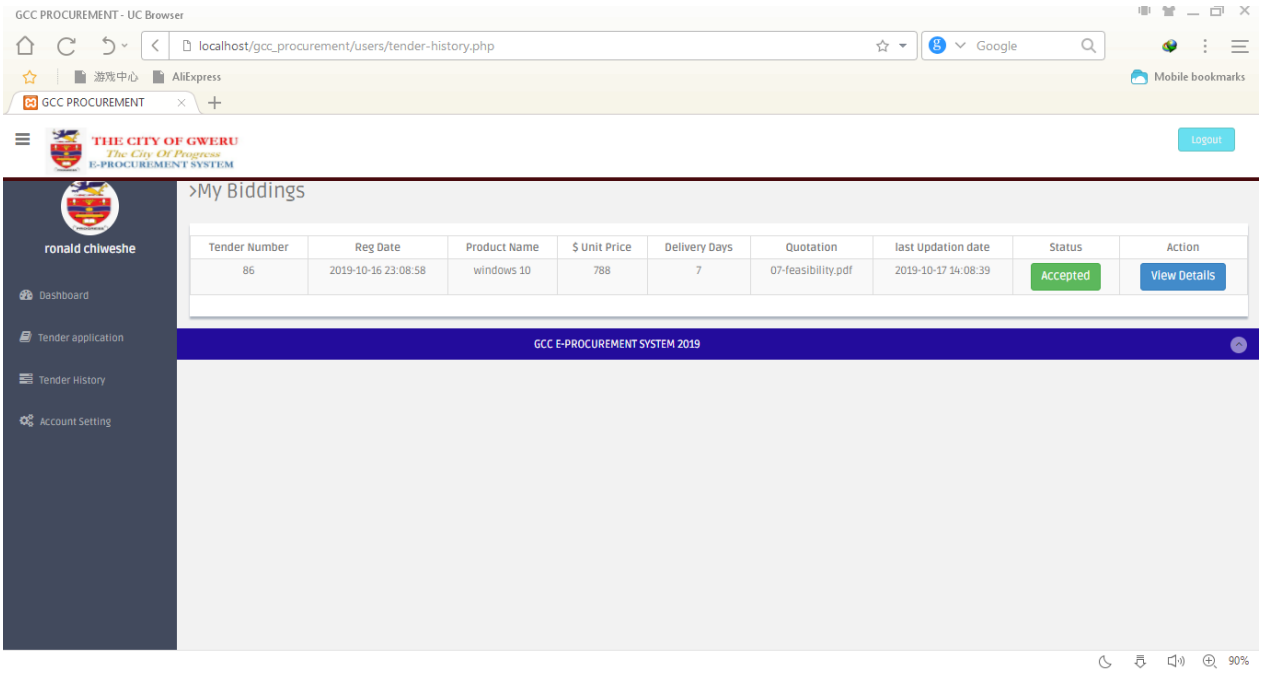


Fig A 11: Supplier send bid

Supplier checks his or her status on bids send

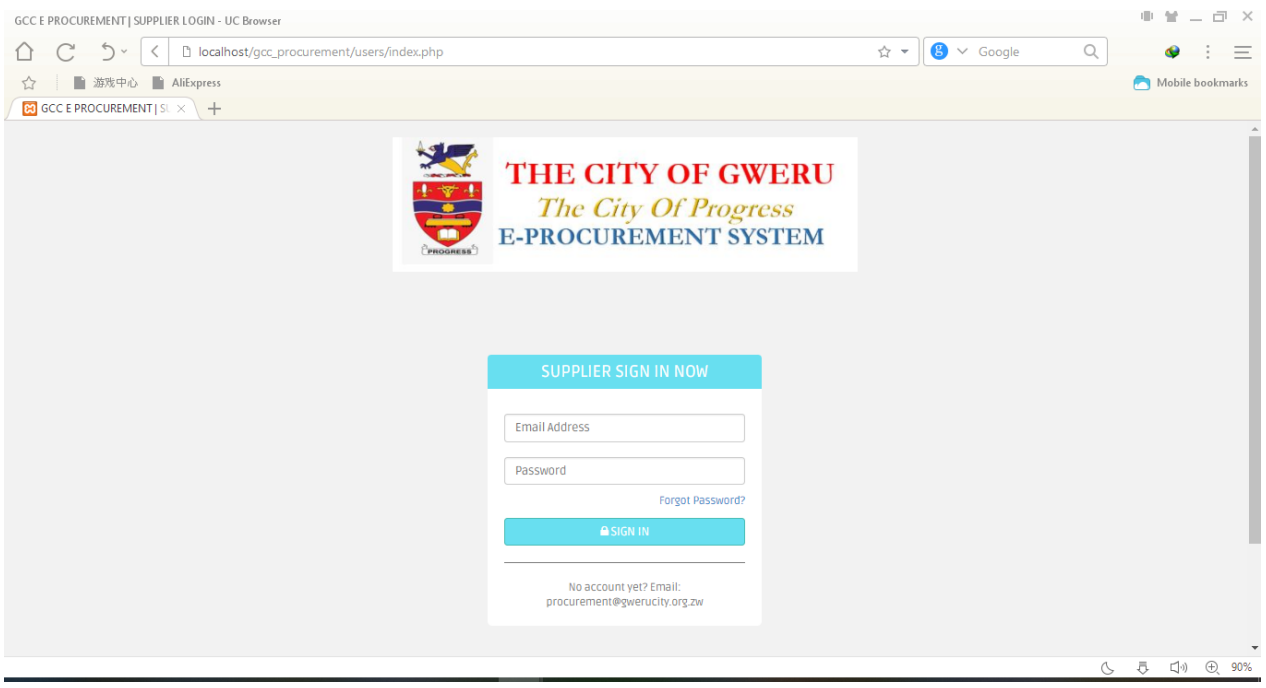


Fig A 12: Supplier Login page

The above page is used by the supplier to login into the system

APPENDIX B: QUESTIONNAIRE

My name is Ronald Chiweshe, I'm studying BSc Information Systems degree (Hons) at Midlands State University. I am doing my final year project (name mentioned above) which requires a detailed study of the user requirements of the system. So this questionnaire is designed to gather all information pertaining to the system under study.

Therefore I kindly ask you to assist me with the required information in this questionnaire.

QUESTIONNAIRE CHECKLIST

Gender Male: ☐
Female: ☐

(Please tick where appropriate above)

1. Give a brief of how the current procurement 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 manual procurement 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: SNIPPET OF CODE

```
<?php
session_start();
error_reporting(0);
include("include/config.php");
if(isset($_POST['submit']))
{
        $username=$_POST['username'];
        $password=md5($_POST['password']);
$ret=mysqli_query($con,"SELECT * FROM admin WHERE username='$username' and password='$password'");
$num=mysqli_fetch_array($ret);
if($num>0)
{
$extra="notprocess-tender.php";//
$_SESSION['alogin']=$_POST['username'];
$_SESSION['id']=$num['id'];
$host=$_SERVER['HTTP_HOST'];
$uri=rtrim(dirname($_SERVER['PHP_SELF']),'/\\');
header("location:http://$host$uri/$extra");
exit();
}
else
{
$_SESSION['errmsg']="Invalid username or password";
```

```
$extra="index.php";
$host  = $_SERVER['HTTP_HOST'];
$uri  = rtrim(dirname($_SERVER['PHP_SELF']),'/\\');
header("location:http://$host$uri/$extra");
exit();
}
}
?>
```

User Login

```
<?php
session_start();
error_reporting(0);
include("include/config.php");
if(isset($_POST['submit']))
{
        $username=$_POST['username'];
        $password=md5($_POST['password']);
$ret=mysqli_query($con,"SELECT * FROM admin WHERE username='$username' and password='$password'");
$num=mysqli_fetch_array($ret);
if($num>0)
{
$extra="notprocess-tender.php";//
$_SESSION['alogin']=$_POST['username'];
$_SESSION['id']=$num['id'];
$host=$_SERVER['HTTP_HOST'];
```

```
$uri=rtrim(dirname($_SERVER['PHP_SELF']),'/\\');
header("location:http://$host$uri/$extra");
exit();
}
else
{
$_SESSION['errmsg']="Invalid username or password";
$extra="index.php";
$host  = $_SERVER['HTTP_HOST'];
$uri  = rtrim(dirname($_SERVER['PHP_SELF']),'/\\');
header("location:http://$host$uri/$extra");
exit();
}
}
?>
```