RIOZIM EXTRANET PROCUREMENT SYSTEM

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BY

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Submitted in partial fulfilment of the requirements for the degree of

BSc Honours in Information Systems

Department of Computer Science and Information Systems

in the

Faculty of Science and Technology

at the

Midlands State University

Gweru

October 2016

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ABSTRACT

This research gives a detailed overview of the Extranet Procurement System with the main thrust of identifying problems, summarizing facts, identifying and analyzing alternatives. Riozim has suffered data redundancies problems, human errors, fraud and biases in terms of choosing the best supplier, costs of employing much labor to manage every activity that was involved in the process, the system is rapacious thereby time consuming and may affects production and stimulates costs and also when providing periodic reports for administrative purposes among other problems. Commonly the orgnasation had endured late conveyance times and some of the time low quality products because of the current manual process of signing in a record by pen on paper particularly when they need to see the historical information of suppliers in accordance with the choice to choose one. Operating in this contemporary environment characterized by ever changing technology requires an orgnasation to adopt to new efficient technologies so as to remain competitive and ensures sustainability. This had contributed to the development of an automated system that is less prone to errors, do the systematic adjudication of suppliers price and delivery days ranking them accordingly, cost effective as well as evaluating supplier performance. PHP and MySQL was used to develop the system, utilizing the objectives as a guide to the development of the system together with the user requirements. During implementation of the system various testing strategies were done to check system functionality against user requirements. The organisation had fully implemented the system involving all the users from different departments and were being trained on how they interact with the system. The analyst developed maintenance schedule for the system so as to account for any changes that may arise. Recommendations were also documented for future development or system upgrade.

DECLARATION

I, **Dadwell Mandiya (R132727J),** hereby declare that l 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 "**RIOZIM Extranet Procurement System**" by **Dadwell Mandiya (R132727J)** meets the regulations governing the award of the degree of BSc Honors Information Systems at Midlands State University, and is approved for its contribution to knowledge and literary presentation.

Supervisor Mr P Denhere

Signature ……

Date …….

ACKNOWLEDGEMENTS

I want to thank my supervisor Mr P Denhere for his guidance and assistance in putting this dissertation together. I am grateful for his commitment, patience and knowledge he 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.

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LIST OF ACRONYMS

CAM (Cam And Motor)

ZSE (Zimbabwe Stock Exchange)

HSE (Health Safety and Environment)

ENR (Empress Nickel Refinery)

PHP (Hypertext Pre-processor)

SQL (Structured Query Language)

IS (Information Systems)

GB (Giga Byte)

HDD (Hard Disc Drive)

RAM (Random Access Memory)

ROI (Return on Investment)

CBA (Cost Benefit Analysis)

Systems Development Life Cycle (SDLC)

Data Flow Diagrams (DFD)

High Level Design (HLD)

Entity Relationship (ER)

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Unified Modelling Language (UML)

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Online Extranet Procurement system is the efficient methodology utilized for purchasing goods and services required for an orgnasation to stay supportable (Farrell, 2007). In the event that procurement is managed effectively well it will include all organisations practices and empower the orgnasation to spare both time and cash and in addition cutting expenses. Extranet procurement is an information system that do the systematic adjudication of suppliers, cost effective and ensures organisational sustainability. It manages all the activity from sourcing of quotations, adjudication processes, payments up until the delivery of items. The system functionality is to provide an environment that is transparent, ensures sustainability, efficient and effective procurement process, price not being only the determinant of the supplier as it contain manual adjudication that can be biased and risky. The system will make use of e-signatory to authorize every purchase of an item.

1.2 ORGANISATIONAL BACKGROUND

On the 29th of August 1956, the orgnasation began as Rio Tinto PLC which was outside claimed with its central command in London. Rio Tinto PLC began with an aggregate number of nine mines in Zimbabwe which are in particular Peerless, Perseverance, Brompton, Patchway, and Renco, Zinca Cam and Motor Empress Mine and Peak stone. The organisation was set up to create and mine the Empress Nickel stores in the Midlands province and it was the principal mining operation set up inside of Africa by Rio Tinto plc.

In 1960 Rio Tinto now known as RioZim obtained an offer capital from Cam and Motor Gold Mining Orgnasation situated in Eiffel pads. In 2004 RioZim nearby broke operational ties with Rio Tinto PLC to end up a freely Zimbabwean possessed and controlled association. The rebuilding of the organisation did not influence the workers, their employments, the organisation's operations, working practices and guidelines. The centre action of the organisation is mining thus the organisation has been dynamic in the investigation of potential new assets and the advancement of the current assets. With time the organisation turned into an entirely claimed Zimbabwean organisation that focused on the generation of gold, coal and toll refining of (toll refines) nickel and copper. The organisation is listed on the Zimbabwe Stock Exchange (ZSE).

Since its transmission from Rio Tinto plc, RioZim has had a productive time of four years in which it propelled another vision, mission and worth proclamations and in addition having some of its operations affirmed for quality and adherence to world class norms in word related wellbeing, security and ecological administration.

1.2.1 Riozim organisational structure

According to Aquinas (2008) an orgnasational structure is described as the organized arrangement of all orgnasation activities such as supervision, job allocation and coordination as they are linked according to the attainment of company's goals and objectives.

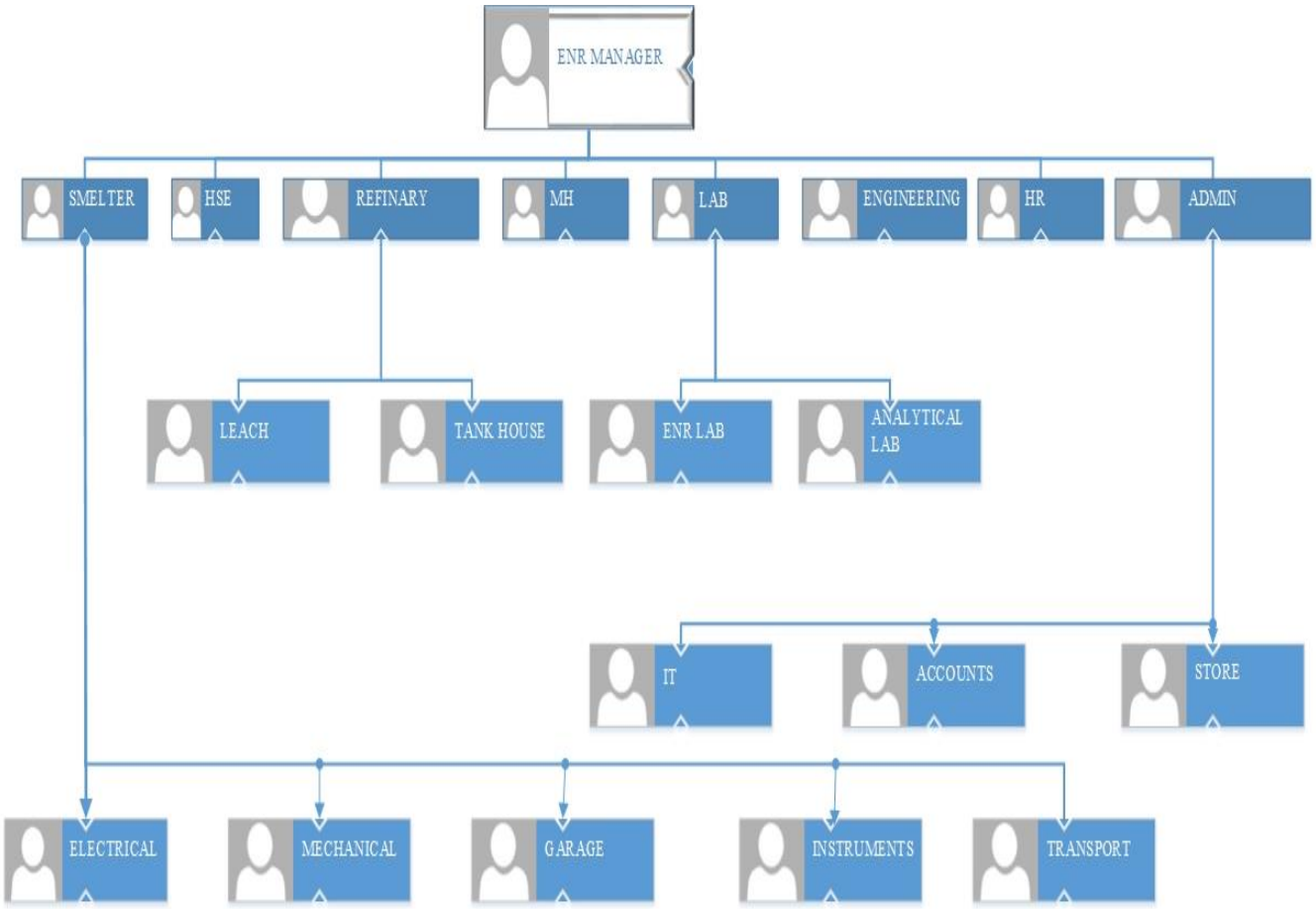


Fig 1.1 Riozim organisational structure

1.2.2 Vision

To be a large diversified regional orgnasation delivering sustainable shareholder wealth from natural resources.

1.2.3 Mission

Abramowicz (2009) states that a mission statement is a strategy that defines the nature of the orgnasation and how it will position itself in the market that it operates in.

The mission of Riozim is to achieve success through:

- A culture of success
- Exploration for opportunities
- Good corporate governance
- High standards of HSE management
- Implementation of world-class operating standards
- Optimization of existing business
- Recognition of our employees and communities

1.2.4 Guiding principles

- Accountability
- Commitment
- Diligence
- Fairness
- Integrity
- Professionalism
- Reliability
- Team Work
- Transparency

1.3 PROBLEM IDENTIFICATION

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. A problem definition clearly written down provides a shared understanding of the problem and its relevant aspects.

Riozim has endured information redundancies issues, human errors, misrepresentation and biases as far as picking the best supplier, expenses of utilizing much work to deal with each action that was included in the process, the system is rapacious consequently time consuming and might stimulates costs and also when providing periodic reports for administrative purposes among other problems. This is due to the current procurement system that is being used which is affecting the company's sustainability. Lead time was not taken into consideration when selecting the appropriate supplier, price not being only the determinant of the supplier as it contain manual adjudication that can be biased and risky. Commonly the orgnasation had endured late conveyance times and some of the time low quality products because of the current manual process of signing in a record by pen on paper particularly when they need to see the historical information of suppliers in accordance with the choice to choose one.

1.4 AIM

Research aim usually include a desirable quality and an intended modification to that quality (Barnes and Xu, 2001). The main aim of this project is to develop and implement an automated system that is less prone to errors, do the systematic adjudication of suppliers eliminating manual adjudication that can be biased and risky, reduce bureaucracy in the process, make use of e-signatory system to authorize every purchase of an item, cost effective, evaluate supplier performance and ensures the organisational sustainability as well as reducing data redundancies. The system should also include an effective email messaging system to request and receive quotations from suppliers as well as continuously updating the buyer the status of an order.

1.5 SYSTEM OBJECTIVES

According to Basu (2004) an objective is a specific result that a system analyst aims to achieve within a time frame and with available resources. He goes on to say that objectives are measureable and provide a direct indication that progress is being made towards the goal.

- To develop an online system that does the systematic adjudication, evaluation of quotations by suppliers and advice the most preferable one based on delivery time and price, ranking them accordingly.
- To develop a system that automatically determines re-order levels when the stock reaches the buffer level.
- To develop a system that automatically updates the supplier immediately when requests have been approved or rejected
- To develop a system that makes use of an e-mail messaging system to send invitations and receive bids from suppliers.
- To develop a system enforces security by allowing generation of random passwords upon account creation

1.6 INSTRUMENTS

Brandon (2008) these are the developments tool used to develop a system.

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: Relational Database Management System (RDBMS) that uses Structured Query Language (SQL). SQL is the most well-known language for including, getting to and managing content in a database. It is most noted for its speedy preparing, demonstrated unwavering quality, simplicity and adaptability of utilization.

SQLite: an in-procedure library that actualizes an independent, serverless, value-based SQL database engine.

XXAMP: a multi-operating system open source Application Server

1.7 JUSTIFICATION

Chang (2005) says project justification entails determining the degree to which the business value of the system will be enhanced. Promoting procurement efficiency, accountability and transparency is a top priority for ENR Stores department. However, an excess of organisations remain strapped to procurement systems that stovepipe the process and depend on manual and other inefficient processes. Organisations require a procurement solution that increases purchasing power, streamlines processes, expands accountability and energizes more decision making. Extranet procurement system is vital for RioZim as it brings several benefits contributing to the success of the organisation. Some of the benefits are as follows:

***Reducing costs**:* Expenses can be reduced by utilizing volume, having organized supplier relationships and by using system enhancements to diminish external spend while improving quality and supplier performance. E-procurement eliminates paperwork, amend and errors. Following the vast majority of the work is done efficiently, this reduces the quantity of works required in the system, and thus work expenses are decreased

Productivity: Interior customers can acquire items they need from a catalogue of affirmed things through an on-line demand and requesting system. Procurement staff can be discharged from processing requests and taking care of low esteem transactions to focus on vital sourcing and improving supplier relationships.

***Visibility of spend**:* Centralized tracking of the transactions empowers full providing details regarding requisitions, items obtained, orders processes and installments made. E-procurement points of interest reach out to guaranteeing consistence with existing and built up contracts

***Controls**:* Standardized approval procedures and formal work processes guarantee that the correct level of approval is connected to every transaction and that spend is coordinated to draw off existing contracts. Compliance to approach is enhanced as clients can rapidly locate products and services from favored suppliers and can't make free thinker purchases since re-request will be systematically appeared.

1.8 CONCLUSION

This chapter has highlighted the issues in the present system and opportunities that can be acknowledged, and in addition the business targets of the proposed system. It is fundamental for the orgnasation to automate the current manual system in operation in order for them to cope up with the dynamic changes in the technology and gain a competitive advantage among its competitors. The system designer can now begin to work towards the planning phase of the project.

CHAPTER 2: PLANNING PHASE

2.1 INTRODUCTION

According to Dennis, Wixom and Roth (2012) planning phase is defined as an administrative capacity that requests assessment of the organisation's surroundings and its assets keeping in mind the end goal to set up an arrangement of authoritative objectives. This chapter will give insight on business value of the proposed system which legitimizes why the system should be executed, technical feasibility, economic, organisational as well as schedule feasibility. It likewise summarizes the project plan, which will be important to empower management and observing of the advancement of the undertaking (Mall 2004).

2.2 BUSINESS VALUE

Business values alludes to the success of the orgnasation in utilizing data to accomplish its key targets (Boehm, 2004). The system should increase organisational sustainability as well as reducing data redundancy, human errors and fraud or bias since they will be systematic adjudication of suppliers based on the company historical data, the system will select the appropriate customer with the lowest lead time to delivery, price being not only the determinant. This will as well add to the overall productivity of the orgnasation since the best supplier will be chosen and will supply quality products just in time.

2.2.1 Organisational value

According to Buchman and Huczynski (2004), an organisational value is a belief that a specific mode of conduct is preferable to an opposite or contrary mode of conduct. It leads to increased productivity and sustainability of the orgnasation since the resources will be provided proactively way before available stocks is finished. Cost reduction due to elimination of file based system and other labour cost of paying other employees which was involved in the manual process of record keeping and supplier selection. Increased control because instant placement of orders with extranet procurement can also reduce the shipping time significantly.

2.2.3 Managerial value

Decision making will be done simple as they rely with the information from the system which is accuracy, since the adjudication process is carried out automatically by the system and the selected

supplier to win the bid will be advised accordingly based on historical data that lead time and price. It also enhances communication and coordination among all involved in the procurement process.

2.2.3 Employee value

According to Lynch (2009), employee value is defined as an understanding between an orgnasation and its employees on what the business will provide experientially in exchange for the productivity, dedication, and engagement of its employees. The system enforces security through generation of random password upon creation of user accounts that is unique to each and every user. Thus users might feel that their person data and work information as well is secured and confidential. Employees will be motivated as some tasks are done easily. The system will also satisfies the user as it reduces work effort and produces efficient results.

2.2.4 Client value

According to Jewell (2000), Customer value is the value received by the end-customer of a product or service. The difference between what a customer gets from a product, and what he or she has to give in order to get it. The system ensure increased productivity thus improved quality products for customers.

2.3 FEASIBILITY STUDY

According to Munsaka (2013) defines feasibility as a process that is used for identifying problems, opportunities, determining objectives, describing situations, defining successful outcomes and benefits associated with several alternatives for solving a particular problem. Mall (2004) characterizes a feasibility study as an evaluation of the operational, technical and economic benefits of the proposed project that is expected to be a preparatory audit of the realities to see whether it is commendable for a project to continue to the analysis phase. This study involves building up the organisation's capacity to embrace the task in order to give rules on continuation or cessation. This initial step attempts to analyse the issues that will make the project feasible or unfeasible, and at times to decide the best methodology for continuing with the project. This is accomplished through a cautious analysis of the technical, operational, economic, social and organisational resources at its disposal.

2.4.1 Technical feasibility

This figures out if a proposed solution can be actualized with the accessible specialized, programming and hardware resources. Technical feasibility looks at if there is the technical ability to empower the system to be constructed. Rodger (2005) depicts technical feasibility as a thought of the specialized prerequisites of the proposed project which are then contrasted with the technical capacity of the organisation, the system project is considered in fact practical if the inward technical ability is adequate to bolster the undertaking's necessities. This study looks to assess Riozim Enr creativity relating to resourcefulness, programming, data innovation ability and other data innovation infrastructure that is required to actualize the proposed system. It is critical at this stage to ascertain the abilities of the technical work force to handle the project straightforwardly or by implication. This will help in figuring out if the undertaking is technically feasible or not.

2.3.1.1 Availability of technical expertise

A study on the availability of the technical skills needed to develop and use the system after implementation was carried out. The system developer possesses cascading style sheets skills, a deep understanding of the PHP programming languages as well as java and MySQL knowledge that will be required to develop a complete system. The study found out that the users of the system are trained in both elementally and intermediate computer application used basically in global communication skills. This in turn signifies that present workforce are equipped with minimal computing skills that will enable them cope up fast with simple to understand and user friendly.

2.3.1.2 Hardware and software requirements

For the best results in building this Information System the following are hardware and software components specifications which are recommended.

Table 2. 1 Hardware and software requirements

Item	Item Description	Qty Required	Qty Available
I5 Laptops	8-12GB RAM, 4GB Graphics Card, 500GB HDD	3	2
Network Gateway	USSD Gateway	1	0
Firebase IO Server	Real Time Back-end Database	1	1
Uninterrupted Power Supply	5500watts	2	1
Operating System	Windows 10 Professional	3	3
Web server software	Wamp, Apache web server	2	1
Connecting cables	UTP CAT 35 fly leads patch codes	6	0
Hard disk drive	50 G	2	1
Backup	300 HDD	1	1

From the analysis the project was technically feasible because it could be developed within the limits of technology given software and hardware constraints. Manpower- programmers, testers and debuggers are readily available and some software and hardware is available on the local market. Current technical resources are not sufficient enough for the new system. It could be upgraded to provide the level of technology necessary for additional changes.

2.4.2 Economical feasibility

Economic feasibility is an essential piece of speculation examination, managing components that can be evaluated, measured, and analysed in monetary terms (Harland, 2000). It answers the inquiry ought to the framework be manufactured and on the off chance that it is to be fabricated, would there be prepared fund to cover it. This will likewise include every one of the costs that will be associated with the procedure of really building the new system. In order the conduct the

economic feasibility different appraisal techniques are used. The techniques used in this chapter are the cost benefit analysis, payback period and the return on investment (ROI).

2.4.2.1 Cost Benefit Analysis

CBA is a financial strategy or a metric that evaluates the expenses that are to be brought about as a result of the proposed system contrasted with the likely advantages to be picked up from the system to figure out if the planned action is great or awful (Bryman and Bell, 2007). Not at all like different costs can't most advantages be communicated in money related esteem thus the greater part of these advantages will be quantifiable using appropriate estimation approaches as a part of request to give a financial quality to examination purposes.

3.4.2.2 Costs

They are those expenses or cash outflows that would have been incurred through the development of the application and refinement. Lucey (2005) did explain cost as total cash or service that has been forgone and is likely to benefit the organisation in the near future. He further went on to explain that it should be expressed in monetary term and should be accredited to a specific activity or item.

2.4.2.3 Cost and benefits of the proposed system

Tangible costs- These are expenses to which particular financial worth can be attached and they include: hardware costs, software costs, training costs, payments to installers, improvement (development) cost.

Intangible costs- These expenses can't be quantified as far as cash and they include: decrease in laborer assurance because of occupation frailty, Duplication of endeavors where direct changeover to the new system is actualized, reduction of employee fulfillment since they may not be contented with computers.

Tangible benefits- Enhance data accessibility to all levels of management through exhaustive reports, Enhance data trustworthiness to all clients using secure password policy, Keep records and spare time in information capturing and decrease of pay rates that is the compensation, increased productivity, elimination of human errors, data redundancies as well as cost reduction.

Intangible benefits- These can't be effortlessly measured in financial terms. The system will enhance/upgrade work execution in all business operations, the system will ensure good supplier and employee relationship through effective communication and collaboration, transparent and responsibility, precise and speedier access to information for opportune choices, spares gigantic time and exertion in information passage more controls in this way bringing down the danger of mis-usage of assets and improved strategic planning.

2.4.2.4 Development costs

McBride (2002), explains development costs as costs brought about amid the developmental stage of the system. Developmental expenses are the ones that are incurred in the course of the development, for example the costs that are incurred during the research exercise and in acquiring the hardware requirements.

Table 2. 2 Developmental costs

Item	Quantity	Amount USD $
Software		
Microsoft windows 7 operating system 64 bit	4	500
Microsoft word	1	30
Dreamweaver 9.0	1	80
Microsoft office	1	75
Hardware		
Pentium 5 computer	4	1200
Printer	1	80
Application Server	1	190
Database Server	1	185

Backup Server	1	170
Uninterruptible power supply	8	960
Network Switch	2	240
Total		3710

2.4.3.4 Operational costs

According to Lucey (2005), operational costs are costs that are continuously incurred after all the expenses have been accounted for. With reference to Riozim Extranet Procurement System, operational costs entail cartridges, bond paper and maintenance

Table 2. 3 Operational costs

Operational costs	Value/USD $
Computer consumables	200
Software maintenance	450
Labor	2000
User training	600
Other expenses	120
Total cost	3370

Table 2. 4 Tangible benefits

Item	Monetary Value/ USD $
Reduction in processing errors	500
Automatic report and adjudication	300
Reduced workload	4000
Total benefit	4800

Table 2. 5 Intangible benefits

Item	Monetary Value/ USD $
Faster data processing	450
Enhanced collaboration and communication	6000
Boost decision maker moral	230
Total benefit	6680

Table 2. 6 Cost and benefits analysis

Cost type	Year
Costs	USD $
Development costs	4800
Operational costs	4200
Total costs	9000
Benefits	
Tangible	4800
Intangible	6680
Total benefits	11480
Net benefits and costs	2480

Net benefit = Total benefit-Total cost

11 480 – 9000

= $2480

2.4.3.5 Cost benefit evaluation techniques

The accompanying surely understood techniques have been utilized to contrast the expenses with advantages of the proposed system

- Payback period
- Return on investment

2.4.3.5.1 Payback period

The payback technique decides to what extent as far as years it will take in operation to pay back the investing so as to underlying expense brought about in the proposed venture (Kendall, 2011). Using this strategy you can evaluate the relationship between the expenses brought about advantages picked up and if the advantages exceed the costs the project being referred to might keep on being developed. This methodology results in one year four months

Table 2. 7 Payback calculation

Year	Cash flow($)	Cumulative($)
0	(9000)	(9000)
1	4800	(4200)
2	6680	-

Payback period = 1 year + (4200/6680) x12

= 1 year 8 months

2.4.3.5.2 Return on Investment (ROI)

This is characterized as a money related measure of the return from an investment typically expressed as a rate of profit delivered by a resource for the sum invested resources into the advantage (Stoner, 2000). The yearly return of profitability is computed as follows:

YEAR 1

R.O.I = (Total Benefits - Total Costs) * 100 %

Total Costs

R.O.I = (11480-9000)*100 %

9000

= 27.56%

Comment: Given the calculations above it can be shown that the project is going to return $0.28 per each dollar invested hence it favourable and can be concluded that the project is economically feasible.

The outcomes from the economic feasibility study demonstrated the value of the proposed project, advantages exceed the costs it takes for advancement. The outcomes demonstrated numerous benefits of the system when contrasted with the conceivable costs it brings about, which is viewed as ideal. Also and on a positive note, this pattern demonstrates that there are various opportunities accruing to the orgnasation coming about because of doing without the manual system.

2.4.3 Social feasibility

The principle objective of this feasibly study is to recognize how the personnel or the workers will associate after the usage of the system. It is imperative to incorporate the interaction of the laborers after implementation since they are the ones who will work utilizing the system (Kendall, 2002). The proposed system will expand productivity in the orgnasation between the employees.

2.4.3.1 Management

The orgnasation top management viewed the development as an aid in achieving their long term plans of improved and more effective services**.** Management has always been working towards the vision of the organisation to be a large diversified regional orgnasation delivering sustainable shareholder wealth from natural resources. The system is therefore is seen as a step towards the vision as this will support and enable the organisation to serve their clients more effectively

2.4.3.2 Employees

The employees are the main stakeholders how they view the system is of paramount importance. Some might view the system as a threat to their jobs hence their actions should be monitored

closely. Some employees might view this as an aid to reduction of work load and enhancement of their personal knowledge**.** Hence, they have been in support of the system since there will be an effective adjudication process as well stock levels will be automatically monitored by the system and those involved will be notified.

2.4.3.3 Community

The end user might view the new system as an aid in improved services by the organisation. Since there will be an effective procurement process, the orgnasation will be in a position to increase more production, hence profit margins also tend to increase and the community might benefit from getting employed as the orgnasation expands. Infrastructure development is another benefit that the community might view the system will bring.

In order for the project to be socially feasible users should be involvement in each and every stage of project development. Effective training also helps users understand how the system functions thus making it easier to use. This will aid the operations department who inputs data on a daily basis. In this way the proposed system is socially possible (feasible).

2.4.4 Operational feasibility

Brien and Marakas (2011) characterizes operational feasibility as the eagerness and capacity of management, representatives, clients and suppliers to work, utilize and bolster the proposed system. The proposed system is operationally achievable in that, it can be coordinated into the organisation's everyday operations and users as administration will require training on implementation of the system. Operational feasibility has looked into the readiness of the orgnasation to bolster the proposed system. With a specific end goal to decide this possibility, it is critical to comprehend the management obligation to the proposed venture. On the off chance that the solicitation is initiated by management, it is likely that there is management support and the system would be acknowledged and utilized.

The users of the system should understand that the system is developed for them and there are to contribute to its operational functions. If there are any recommendations to be made the users should be advised to communicate to them to the project team. However, it is likewise critical that the employee base will be tolerating of the change.

Different appraisal techniques were used to help analyse the feasibility that led to decisions on whether the proposed system is viable or not. The project is feasible according to the feasibility study as well as the time frame given. With all the activities done in this phase the developer is now in a position to continue with the system development project

2.4 RISK ANALYSIS

As indicated by Allen and Liebenau (2001), this involves, recognizable proof of conceivable negative outside and inward conditions to diminish instability of the results and related costs, liabilities or losses. Risk analysis is very critical to many projects failure to identify them may harm the project so time has to be always taken to undertake this analysis. These risks could be schedule related, budget related or even stuff related.

2.4.1 Technical Risks

These are risks that are related to the users not having sufficient skills and knowledge to use the developed system which might result in them not accepting the system (Anderson, 2011). Different network threats which are computer viruses, breach of security and denial of service attacks are the technical risks identified by the researcher. To carter for the risks the system users should be taught on how to secure the system from network threats. There should also be a backup up system in case data is destroyed.

2.4.2 Management risks

As project manager, the risks you should be most concerned with are those that will have an impact on one of the three project parameters which are time, cost and quality. Problems range from lack of planning, experience, training and communication.

2.4.3 Operational risks

The risks that are encountered as a result of operating the system are failure to produce desired output and slow performance due to high data demands. These risks affect the performance of the system and tarnish organisational image therefore should be catered for before they occur.

2.4.4 Monetary risk

Economic risks-Due to the instability of the economy the budget may change hence making it impossible for the new system to be feasible and therefore risking the termination of the project. So a supplementary budget must be prepared to ensure the project continuation.

2.5 STAKEHOLDER RISK ANALYSIS

According to Hoffer, George and Valacich (2002) analysis of each stakeholder's attitude toward your project, and degree of influence within it can be a useful part of the process by which a team is put together and managed. Stakeholder analysis allows one to identify the most important people in your project and decide where to invest time and resources. It should lead to a communication plan aimed initially at canvassing opinion and then providing the right people with timely information throughout the project's lifecycle.

2.5.1 Primary stakeholders

These are directly affected positively or negatively by the implementation of the proposed Extranet Procurement System. The stakeholders are departmental managers, buyer, suppliers and customers. For the project to be successful the input from the operations staff is vital since they are responsible checking inventory details so that the orgnasation cannot run out of stock and these stakeholder should be satisfied. Primary stakeholders are going to benefit positively from the proposed system as shown in business value identification

2.5.2 Secondary stakeholders

These are intermediaries, that is organisations and persons who are affected by the proposed system indirectly for example society and competing organisations. Social feasibility shows that the society is going to positively benefit from this project

2.6 PROJECT WORK PLAN

Systems Development Life Cycle (SDLC) is a solid and exhaustive programming project management device to demonstrate the errands to be attempted in adding to the Riozim extranet procurement system. The decision is essentially in light of the fact that this tool is seemingly the most utilized instrument as a part of this society with amazing demonstrating of errands in advance. This linear tool normally includes comprehensive documentation of activities of the particular

phases of project improvement and their separate approximate time of finishing (Kelly 2006). This trademark gives an establishment to surveying the project's advancement stage by stage. The project time designation for every individual stage is appeared underneath in the work plan table and after that took after by the Gantt diagram.

2.6.1 Project schedule

Somerville (2004) defines Project scheduling as the process of deciding how the work in a project will be organized as separate tasks, and when and how these tasks will be executed. You estimate the calendar time needed to complete each task, the effort required, and who will work on the tasks that have been identified. Projects must be done within a specified approximate time span and the following Gantt chart presentation shows the approximate time – scales allocated to different system development phases

Table 2. 8 Work plan

Phase activity	**Duration (weeks)**	**Start and completion dates**
Background Research	4	04/01/16-26/02/16
Planning	4	27/02/16-26/03/16
Analysis	4	27/03/16-22/04/16
Design	6	23/04/16-13/05/16
Implementation	4	14/05/16-12/08/16
Maintenance	13/08/16	1++
Documentation	04/01/16	1++

2.6.2 Gantt chart

According to Kendall (2011), Gantt chart is defined as an instrument which gives time elements on a bar chart as simple as possible. It as well Gantt chart shows the approximate time – scales allocated to different system development phases.

Phase		Time(Weeks)											
		2	4	6	8	10	12	14	16	18	20	22	24
1	Background Research												
2	Planning												
3	Analysis												
4	Design												
5	Implementation												
6	Maintenance												
7	Documentation												

Fig 2. 1 Gantt chart

2.7 CONCLUSION

This phase focused on what inspired the development of the project and the risks associated. Different appraisal techniques were used to help analyse the feasibility that led to decisions on whether the proposed system is viable or not. The project is feasible according to the feasibility study as well as the time frame given. With all the activities done in this phase the developer is now in a position to continue with the system development project. The next stage is the analysis phase which is aimed at identifying the shortcomings of the current system to concoct the prerequisites that must be met by the proposed system.

CHAPTER 3: ANALYSIS PHASE

3.1 INTRODUCTION

According to Kendall (2002), System analyses is a processes of gathering and interpreting facts, diagnosing problems and the information to recommend improvements on the system. The main objective of this stage is to establish what has to be done in order to satisfy the objectives of the system under investigation. The analysis phase can be subdivided into two categories namely data analysis and process analysis. Data analysis is concerned with identifying the different entities within the system and the relationships between those activities. Process analysis on the other hand is whereby a logical model of the processes that takes place and the data flows in the system modelled in data flow diagrams and context diagrams. An analysis of the current system has been carried out to gain some insight into the way the system operates as well as establish some of the expected user requirements. It outlines who is currently using the system, what data, how and where the data is handled in the current system. It also involved the process modelling, that is, how the current processes are modelled.

3.2 INFORMATION GATHERING

Below is a summary of relevant information gathering methodologies which are interviews, physical observation and questionnaires. A number of strategies were implemented with the aim of finding out:

- More about the current system.
- Problems with the current system.
- More about what the new system should be able to do.
- Requirements and limitations.
- The expectations of the new system from various stakeholders.
- To find out the best way to approach the solution to the problems

3.2.1 Interview

According to Bryman and Bell (2007), an interview is an information gathering technique that allows a one on one between the interviewee and the interviewer. It is a conversation between two or more people, were question are ask by the interviewer. It is a method or acquiring qualitative

information with the aim of understanding the meaning of what the interviewer says and also their experience. The choice of the interviewee is based on the interviewers' discretion, (Hay, 2003).These are conducted to fully understand the impressions and experiences of the system users.

When conducting interviews there are a various types in which the interviewer can chose from. There are structured interviews in which there are pre-determine questions in which the interviewer cannot deviate from the schedule or either can the interviewer probe beyond responses received whereas unstructured interviews are more casual and unrehearsed. The analyst managed to conduct some interviews at Riozim ENR which is located in Kadoma in which management and a few employees from different departments selected. The motive was to get an insight and understanding on how the current system works and also the problems that users are facing in their day to day activities and use of the system. The analyst was given the opportunity to interviewee users of the system in different departments and the responses were recorded. It proved effective since the analyst had the opportunity to ask the interviewers to give further clarification where he would not have comprehended or grasped the given response.

3.2.1.1 Advantages of interviews

The analyst was in a position to communicate directly with the people who manage and operate the current system as he found it best to work with a small number of individuals who are selected for the interview. First-hand information and a clear picture of what is happening in the current system was also provided During the interview people participates more freely in person and may request for question interpretation or elaboration. Vocal responses and facial expressions enable the interviewer to determine the validity of the responses given The researcher managed to identify that through interviews more personal and familiar issues will be clarified since is very private and confidential and therefore practical thoughts from selected individuals were also obtained.

3.2.1.2 Disadvantages of interviews

Sensitive and strategic information could not be released because some interviewees were hesitant as they feared to violate organisational ethics. These pose a limit to amount of information gathered by the interviewer. Outcome from interviews may be broad and may cover a lot of areas that may be difficult to analyse and as well because it requires much time some respondents may be reluctant to participate fully.

3.2.1.3 Findings from the interview

Out of the targeted population only 65% responded to the interview questions. The researcher did not manage to 35% of the targeted population as they were busy on duty. The researcher managed to know the duties of each worker. This information helps link the processes from different related department as per their expectations. Users tend to forget to update their management of their given tasks since they will be busy on other delegated tasks thereby failing to give their management progress in time which is usually presented by management at Executive meeting which are done weekly.

3.2.2 Observations

According to Bentley (2004) observation is a data gathering technique that is often applied for case studies and often involves the researcher in observing, recording and scrutinising events of concern. Observations are regarded as a good way or the best method to check the rationality of the data gathered from indirect sources such as questionnaires and interviews and this allows the researcher to have a personal view of the existing system in question(Shelly, 2010). Observations were undertaken as some of the members of staff did not open up easily because they feared victimisation.

From an onsite observation that was carried out at RioZim Empress Nickel Refinery to compliment on information obtained from the interviews and questionnaires it was seen that the manual adjudication that was used by the current procurement system to select a supplier proved to have data redundancies problems, human errors, fraud and biases, rapacious thereby time consuming and may affects production and stimulates costs.

3.2.2.1 Advantages of observations

It allowed the author to discover relevant information on his own without probing for it from somebody else as it does not interrupt the work of those being observed. The analyst was able to see how the system operates practically when in use. Staff members transacted business operations well and this eliminated bias portrayed by interviewees. All information gathered using this method is interpreted correctly and is more accurate.

3.2.2.2 Drawbacks of observations

There was a possibility that the observer can miss some vital activities as it is subject to bias if the users find out that they are being observed. There was a possibility that the observed personnel could change their normal way of doing business if they became aware that they were being observed and this could result to wrong and biased conclusions from the observer and not all activities were observable.

3.2.2.3 Findings from observations

Results observed reflected that a lot of paper work is involved thereby increasing the risk of losing data. The orgnasation has a manual adjudication process that was used to select the supplier for raw materials which tend to be risky and biased thereby most of the times affect the orgnasation sustainability

3.2.3 Questionnaires

According to Sharan (2009), questionnaires are designed so that the general public could say what they feel about the current system, in a non-threatening way. The drafted questionnaires will be precise, simple and straight forward. This fact-finding technique was employed to obtain information that might have been deliberately left out by the interviewees for fear of the unknown (Whitten 2003). This methodology allows the analyst to study the behavior and beliefs of the current system users in the orgnasation who might have been affected by the existing system or who might be affected by the proposed system.

There were well-structured questionnaires drafted for the key stakeholders of the system who interacted with the system daily. Upon designing, fact-finding questionnaires were drafted other than the usual formal unvarying questionnaires. This was done so as the data that was going to be collected was qualitative for the purpose of understanding the problem definition and possible functionality of the new system. For the record of the research there were eight questionnaires that were printed and given to the system users on random basis. Each questionnaire had five exploratory questions and this was so limit the time that an individual can spend to answer this is so because theoretically the number of questions should be few enough that it takes the average user five minutes or less to complete.

Though a good overview of the current system was obtained when directly observing the daily operations of the workers, the developer felt that the workers were not being natural as they appeared to be more effective than usual. They may have feared the loss of their jobs if they appeared otherwise. A variety of brief and user-friendly questions dominated the questionnaire. (Refer to Appendix B). For the research study a total of fifteen questionnaires were distributed across the different departments and the response rate was eighty per cent.

3.2.3.1 Advantages of questionnaires

The analyst managed to identify that data collected using questionnaires are easy to compare and analyse since most answers are similar and some of the questions need a yes or no. They can be administered to a lot of people depending on the size of the sample causing much relevant information was collected in a short space of time. Anonymity proved to be very fruitful because almost everyone responded to the questions without fear. The researcher also came up with an understanding that questionnaires tend be standardized therefore the information gathered is more objective Response was given at will without being coerced or being rushed a phenomenon, which brought success. Through questionnaire anonymous input was allowed and therefore precise information was obtained

3.2.3.2 Disadvantages of questionnaires

They are inadequate for the researcher to comprehend some forms of information which include changes in behavior and emotions. Some questions were left unanswered especially those raising concern or negative issues. The respondents of the similar questions seemed to have discussed how to answer some questions leading to bias. There was reasonable suspicion in some instances to think that a question may have been misinterpreted.

3.2.3.3 Findings from questionnaires

After compiling responses form the questionnaires it showed 85 % of the respondents were in support of the extranet procurement system. 5% were too busy to respond to the questions. 10 % believed that the system will bring in any positive changes. The answers from the questionnaires indicated that the staff felt that the current decision making process was too slow and recommended the researcher to carry on with the system development.

3.3 ANALYSIS OF THE EXISTING SYSTEM

Bringing forward the research findings from the above mentioned methodologies it was evident that RioZim Empress Nickel Refinery was still using a manual system in most of its operations though it seems to have been computerized in some way. The orgnasation is suffering from data redundancies problems, human errors, fraud and biases in terms of choosing the best supplier, costs of employing much labor to manage every activity that was involved in the process, the system is rapacious thereby time consuming and may affects production and stimulates costs and also when providing periodic reports for administrative purposes among other problems. This is due to the current procurement system that is being used which is affecting the company's sustainability.

Lead time was not taken into consideration when selecting the appropriate supplier, price not being only the determinant of the supplier as it contain manual adjudication that can be biased and risky.

Many times the company had suffered late delivery times and sometimes poor quality products due to the current manual process of logging in a file by pen on paper especially when they want to see the historical data of suppliers in line with the decision to select one.

3.4 PROCESS ANALYSIS

A process analysis is used to convey inputs, processes and outputs. (Kendall and Kendall, 2002). It helps improve determine improvements and remove wastages by giving a full description of the process's operations.

Inputs of the existing system

Inputs incorporate the capture and gathering of raw data (Vermaat, 2012). According Valacich (2012) insinuates that inputs needs to sufficiently and appropriately be enough so that they can be able to produce valuable outputs that make sense and valuable to a user. The present system has the following inputs:

- Procurement documents
- Qualified sourcing lists
- Supplier details

Processes

Satzinger (2012) resounded that processes involves any modification or alteration made to change of information into useful output. Valacich, George and Hoffer (2012) went on further to define it as actions which can executed to convert and disseminate data and stored in a certain location. The following are the process in the present system:

- Manual adjudication
- Sending invitations to suppliers
- Recording of supplier details
- bidding process

Output

Duffy (2011) this is when a system should be able to communicate the results of the data that has been processed. The data would have been transformed into some useful information and presented to a user. The following outputs are produced from the existing system:

- Approved confirmation to purchase
- Tender details
- Won or lost bids

3.4.1 Activity diagram of the current system

Dennis, Wixom and Roth (2012) say an activity diagram is basically a flow chart to represent the flow form one activity to another. The activity can be described as an operation of the system. Each activity can be labelled as an operation of the system clearly stating the sequence of these activities, thereby giving a clear representation of the direction and order of activities in the system (Sommerville 2011).

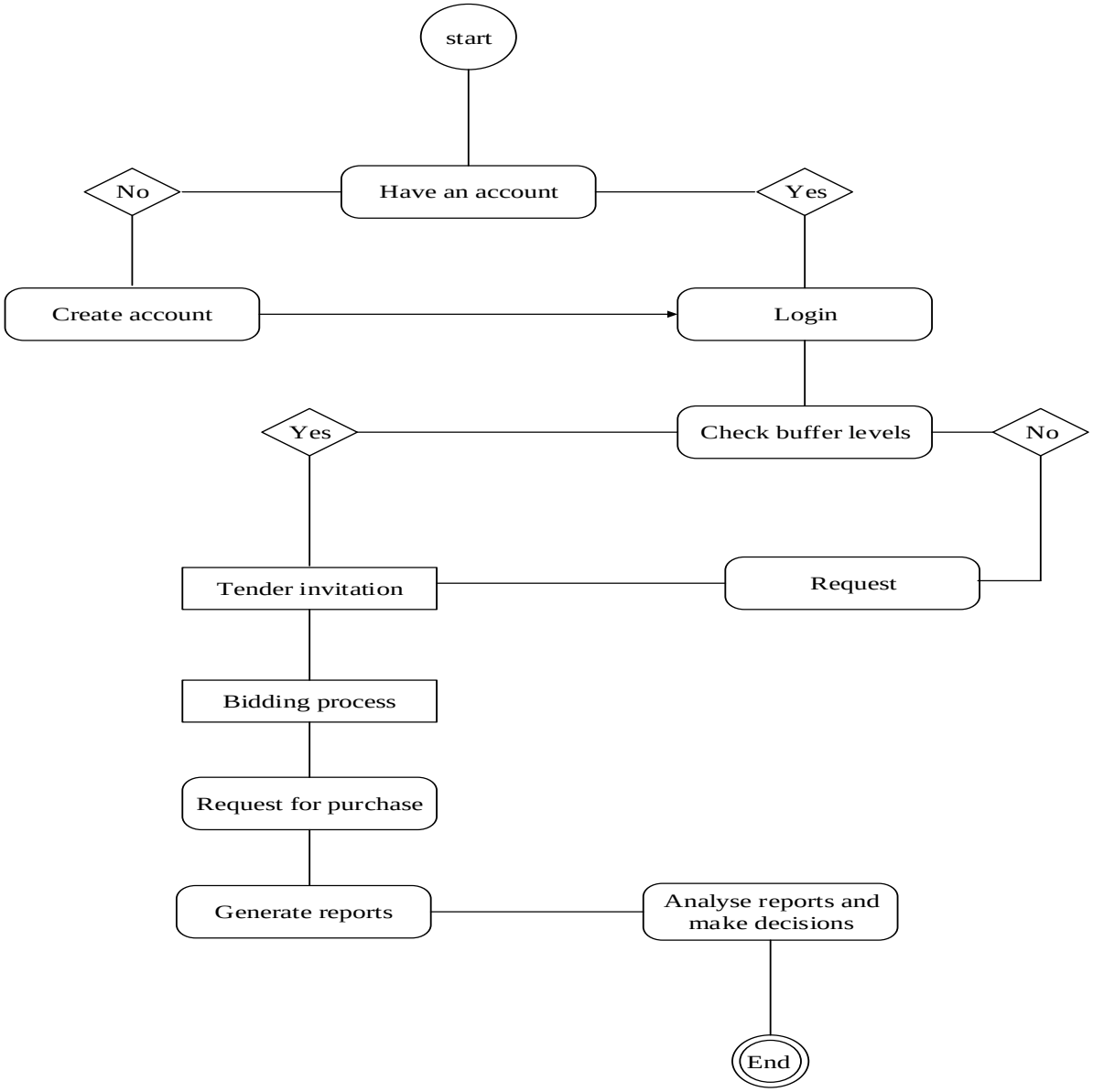
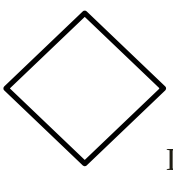


Fig 3. 1 Activity diagram

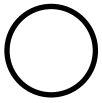
Key



Decision Mode

Control

Action Flow



Initial Mode

3.5 DATA ANALYSIS

The process of data analysis involves scrutinising, cleaning, converting or transforming and modelling data with the objective of highlighting beneficial information (Dennis, 2012). Data analysis is used in business, administration and in all policies and so that they come up with realistic an accurate information, the following part of this section has used different methods that comprises Data Flow Diagrams (DFD's) so as to have a deeper thoughtful meaning of how the existing system is operating. An examination was made on the current system to take note of its inputs, processes and outputs and this helped in coming up with data flow diagram.

3.5.1 Context diagram of the current system

Kendall (2002), did defined a context diagram as a graphical representation of a system characterized by data processes and flows of an organisation. It is an outline of the system borders thus it reflects the point to which it is connected to the external environment. Therefore a context diagram portrays a high level design (HLD) of a system and it shows the common inputs and the linked outputs of the system. The following context diagram depicts the related entities and how they are connected and how data is being exchanged between them.

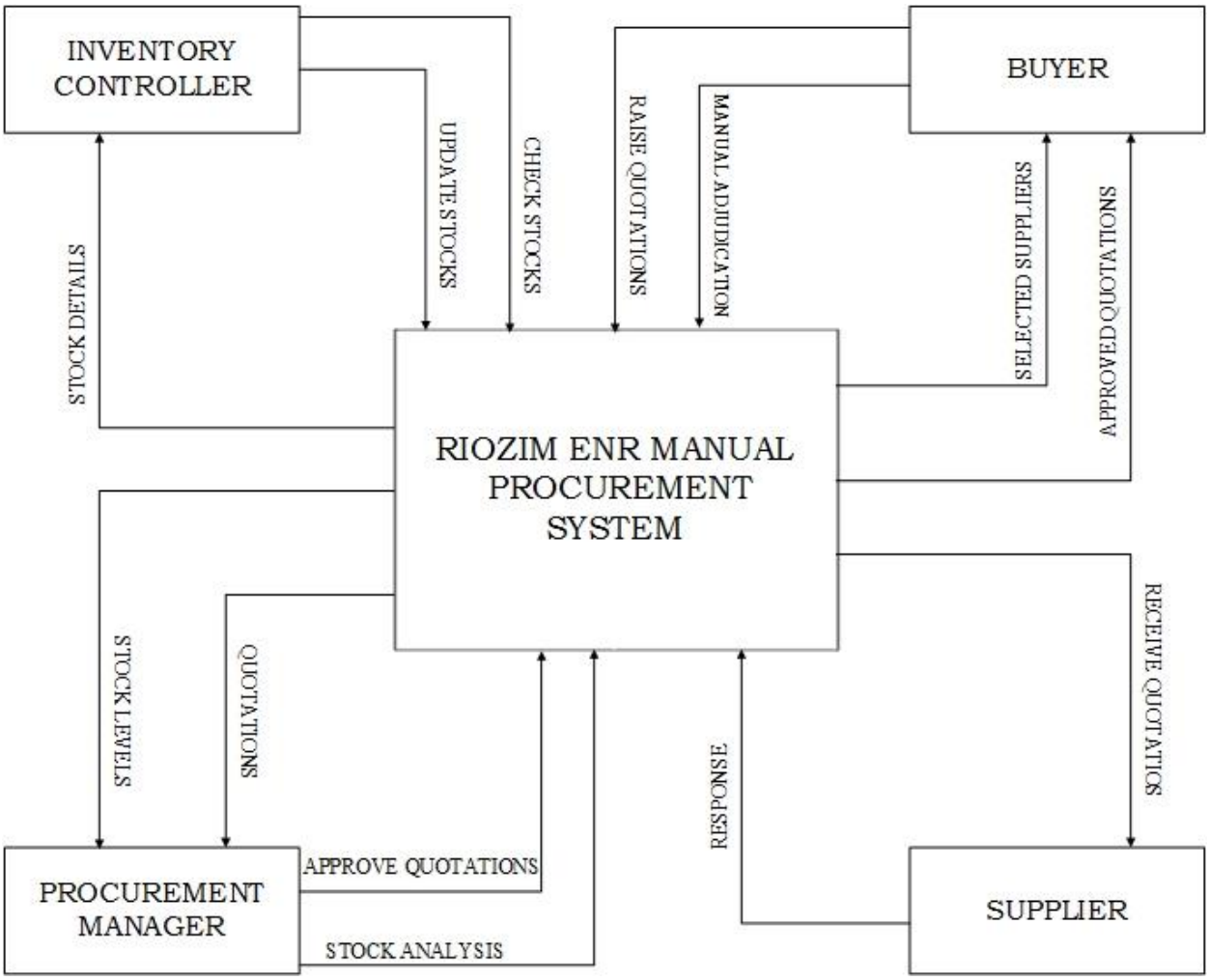
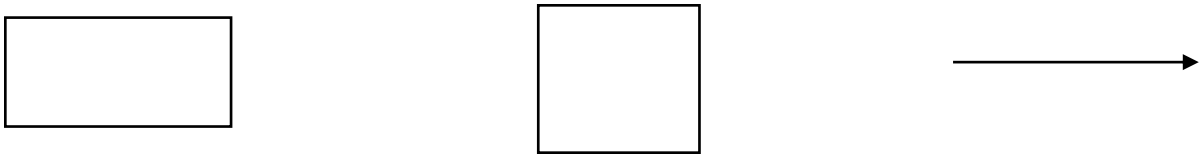


Fig 3. 2 Context diagram of the current system

Key



Entity **System** **Dataflow**

3.5.5 Data flow diagram of the current system

According to Whitten (2003), a data flow diagram is a graphical representation of the system component processes and the flow of data among them. It shows how data flows to and from and the processes that transform data among these processes.

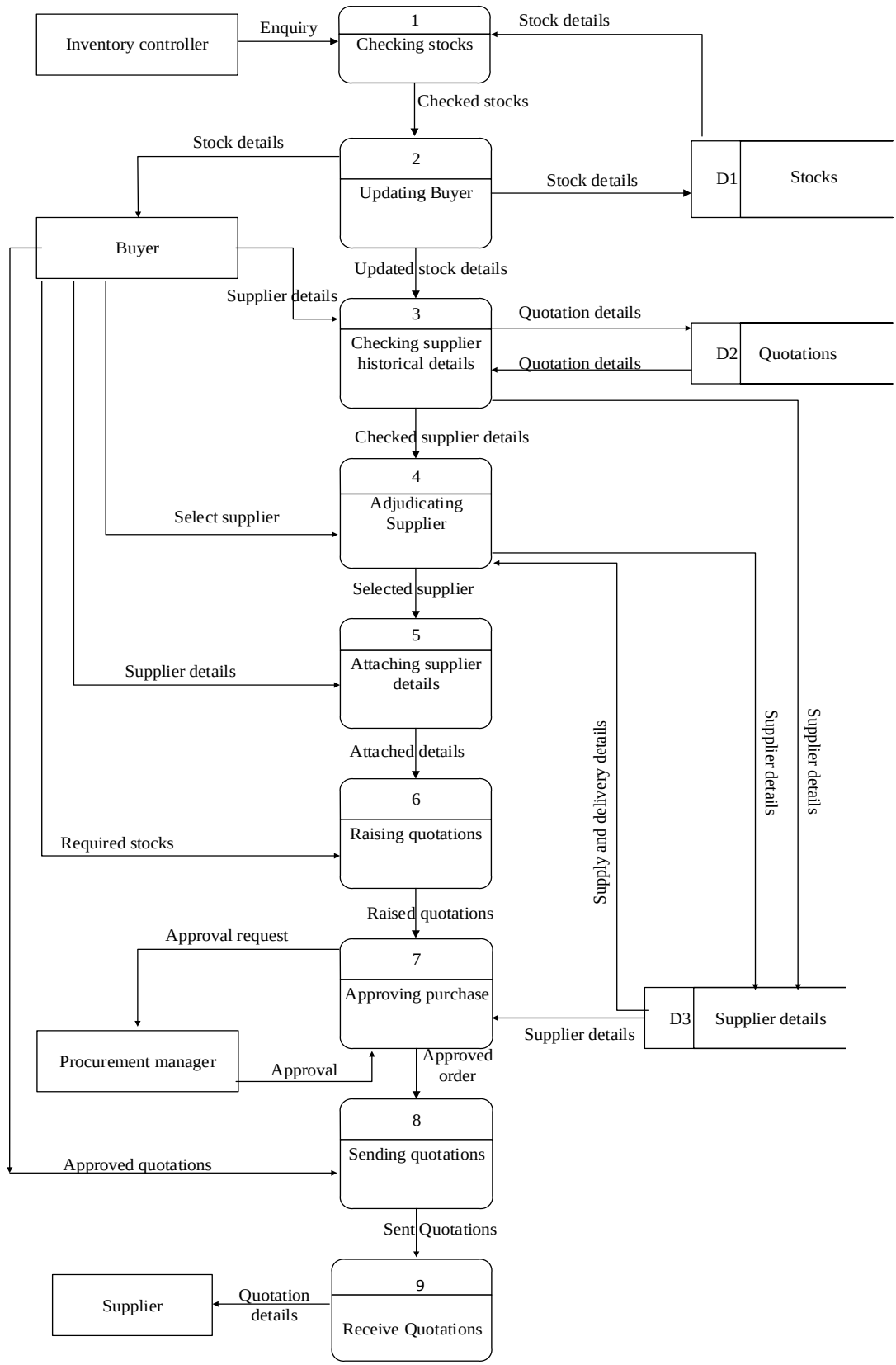
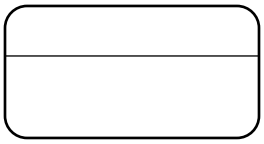


Fig 3. 3 Dataflow diagram of the current system

Key

ENTITY [This is an external entity symbol which can show a person, department and the other external entities]



PROCESS [modifies/ changes data from one form to another]

FROW OF DATA [A pathway which data moves from one part of information system to another]

DATA SRORE [Data depository which stores data for later use]

3.6 WEAKNESSES OF THE CURRENT SYSTEM

- Manual adjudication used to select the supplier contained biases since the buyer cannot have enough time to go through all the historical data that might be piled as it will consume more time
- Data redundancies problems as well as human errors since the system is based on paper work
- Costs of employing much labour to manage every activity that was involved in the process
- The system is rapacious thereby time consuming and may affects production and stimulates costs and also when providing periodic reports for administrative purposes among other problems.
- Lead time was not taken into consideration when selecting the appropriate supplier, price not being only the determinant as it contain manual adjudication that can be biased and risky.
- Late delivery times and sometimes poor quality products due to the current manual process of logging in a file by pen on paper

3.7 EVALUATING ALTERNATIVES

Various system alternatives that are available for developing a computerised system were weighed. A system can be outsourced, improved and developed in-house. After gathering all the information the researcher presents the report and a meeting is held with the management who will there after decide on whether to outsource, improve or internally develop the system. This process assists in choosing the best alternative that minimises development costs. The alternate solution should be economically and technically feasible. The Cost Benefit Analysis figure are going used in order the choose the best evaluation alternative

3.7.1 Outsourcing

Stellma and Greene (2006) defines outsourcing as a strategic use of outside resources to perform activities traditionally handled by internal staff and resources. Outsourcing can not only refers to skills and resources but an entire completed software solution can be outsource.

The analyst conducted a research at G-Soft programming company concerning the costs of outsourcing extranet procurement system and had proved to be expensive and difficult to maintain in the long run so it cannot be used. Cost of licenses might be high as the system grows as well as start-up costs is the highest compared to the other two alternatives.

3.7.2 Improvement of the current system

According to Krugman (2009) viewed improvement as a procedure in which the user requirements of the system to be built are scrutinised and then used to modify the current system. As for the existing system it has been proved that it was very slow and biased when it comes to supplier selection due to manual adjudication involved, therefore there is need to computerised the whole system as well as enhancing communication capabilities.

The system analyst did a research internally as well as consulting external programming companies in order to come up with the costs required to improve the existing system. However, improvement can be ruled out as well because it is expensive and difficult to update and there is limited control over features interface and features. As the business continues to expand, the weaknesses of the current system will tend to resurface in the long run hence it will be a short term solution.

3.7.3 Developing an in-house software package

This is where the orgnasation develops its own tailor made software package using their employees and other resources to solve the problem at hand (Sommerville, 2011). The system can be easily maintained and modified to suit any requirement or technological changes. Users of the system are involved from the initial stages so as to come up with the correct system that can be accepted by all users at the end.

Table 3. 1 Cost evaluation

	Development	Improvement	Outsourcing
Operational costs			
License fee	$250	$250	$200
System maintenance	$450	$750	$600
Ongoing training	$400	$600	$700
Development cost			
Software package	-	-	$6000
Development charge	$4000	$4500	-
	$5100	$6100	$7500

As illustrated by the table below it is much cheaper to develop a system from scratch. The system development charge and the maintenance have the lowest value because engineers can easy to maintain in house developed. There is user involvement in almost every phase of the implement that makes it cheaper to train the users. The process normally incorporates staff from all departments, which greatly helps in coming up with a system that solves the problem at hand and meets all user requirements.

3.7.4 System development choice

From the above analysis documented, the benefits that are to be gained vary in accordance with the kind of method that is going to be used in acquiring the system. It is wise and worthwhile for RioZim Empress Nickel Refinery to acquire the system that is needed through in-house development due to some of the reasons noted below:

- User requirements are easily met using this method
- The method proved to be less costly as well as enhancing the organisational sustainability since the supplier selection will done systematically by the system.

3.8 REQUIREMENTS ANALYSIS

According to Pressman (2005), Michigan University professor document that requirement analysis is the evaluation of the requirement features of a proposed system or the system's function used to fulfil the related system purpose. The evaluation focus on client's needs and problem, not on the solutions. To clearly identify the related requirements, there is need to distinguish them based on their type that is functional and non-functional.

3.8.1 Functional requirements

Functional requirements are general utilities that the proposed system that will be developed must deliver (Sommerville, 2007). Computer system which uses a database maintained in real time with concurrent access and update capability is the major requirement.

The following functional requirements were noted are:

- The system does the systematic adjudication of suppliers, cost effectives, delivery time and ensures organisational sustainability.
- The system automatically updates the buyer when requests have been approved or rejected.
- The system makes use of an e-mail messaging system to request and receive quotations from suppliers and should be fast and quick to response
- The system automatically determines re-order levels when the stock reaches the buffer and allows the inventory controller attach an email to the procurement manager
- To system continuously updates the buyer the status of an order.

3.8.1.1 Use case diagram

A use case is a description of a specific user interaction with the system (Stellman and Greene, 2006). The use case describes the system behavior and the ways the user can work with the system's interface.

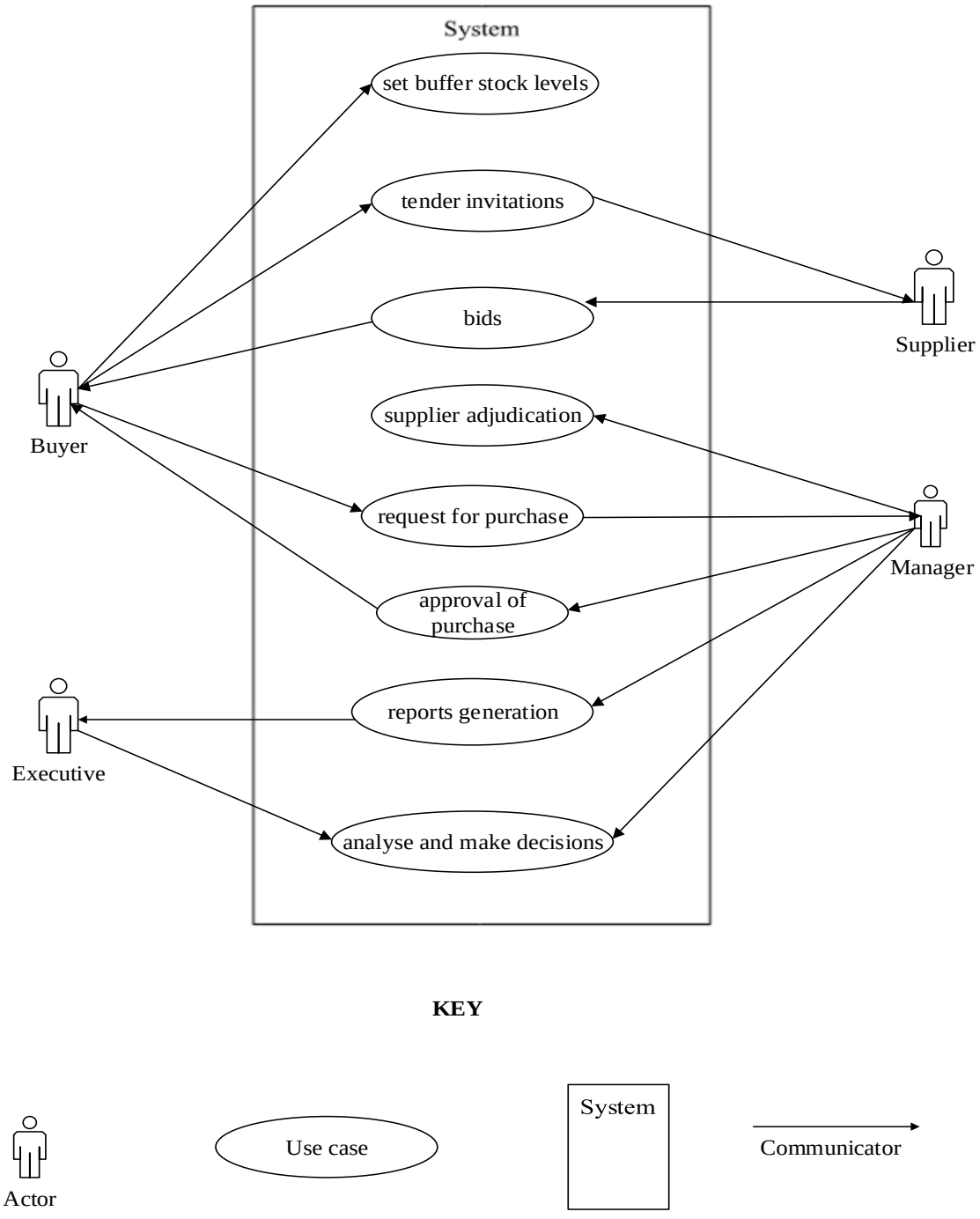


Fig 3. 4 Use case diagram

3.8.2 Non-functional requirements

Sommerville (2011) defines non-functional requirements as requirements that are not directly concerned with the specific services delivered by the system to its users. The non-functional requirements describes the aspects of the system which are ease of use, quicker execution time, reliability and its behavior under unexpected conditions.

Basic properties offered by the system include:

- The system authorizes purchase of items using an e-signatory (e-signature) system that that will be highly protected in the system
- The system will have a high level of security which will be maintained through firewalls, encrypted data and backup files.
- The system should be user friendly and the interface should be self-explanatory
- Efficient throughout the system. Allow quick retrieval as well as availability of data whenever needed. Improvement of the services provided in terms of response time, efficiency and reliability.
- Automatic generation of periodic reports for administrative purposes as well as proper documentation which will be intended especially for the system users.

3.9 CONCLUSION

The analysis phase has given us a complete understanding of the current system through effective information gathering methods while at the same time it has created a real understanding of what the proposed system should be able to do by analyzing also its functional requirements. The dataflow diagram, context diagram and the activity diagram were used to help improve the understanding of the current system operations. Therefore the next stage now is to proceed to the actual design of the proposed system.

CHAPTER 4: DESIGN PHASE

4.1 INTRODUCTION

The phase will focus on the design of the proposed system through the use of different design methods namely the architecture design, physical design, database design, interface design and program design (Sommerville, 2007). The methods provides the simple way of ensuring that everything needed to complete the system is included. The dataflow and context diagram are going to be used to illustrate the flow of information in the proposed system. The functionality of the system is supposed to meet the requirements of the users and stated objectives.

4.2 SYSTEM DESIGN

According to Harland (2009), System Design is defined as the process of applying various techniques and principles for the purpose of defining a process or a system in sufficient detail to permit its physical realization. Thus, the phrase system design means the realization of the whole system architectural design. Therefore it consists of the various components that range from processing elements to overall entity communication (Mall, 2004). System engineers analyse and understand the business of the proposed system by studying the user requirements document. They figure out possibilities and techniques by which the user requirements can be implemented. If any of the requirements are not feasible the user is informed of the issue. A resolution is found and the user requirement document is edited accordingly.

A well designed system should at least have a set of 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 or rather eradicate most of 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 How the system works

The system will allows managers from different departments to set buffer stock levels for their products, then system will automatically compare the available stocks against the buffer level thereby notifying the buyer in terms of color changes whether there is need to purchase new stocks.

The system will also allow does the systematic adjudication, evaluate quotations by suppliers and advice of the most preferable one based on delivery time and price ranking them accordingly based on price and delivery times, then the supplier will be notified whether had won or lost the bid soon after the approval of the purchase.

The system allows administrator as part of enforcing security, automatically generate a random password that will be unique to each and every user that will be send to their email account upon account creation, users will then change the password and put a new one.

The system will allows the buyer to view stock history as well as receiving notifications from stock buffer levels in order to create tender invitations to the suppliers specifying estimated delivery days and price, once the suppliers have been submitted their bids, the system will provide another menu for buyer to request for purchase since the adjudication process had already taken place. The procurement manager will then approve the purchase request.

4.2.2 Context diagram of a proposed system.

According to Kendall (2002), the context diagram of the current system is an outline of the system boundaries; it reflects the degree to which the system is related to the external environment. It only contains one process node ("Process 0") and the entities which are the data sources. The process node generalizes system’s functions in relation to entities

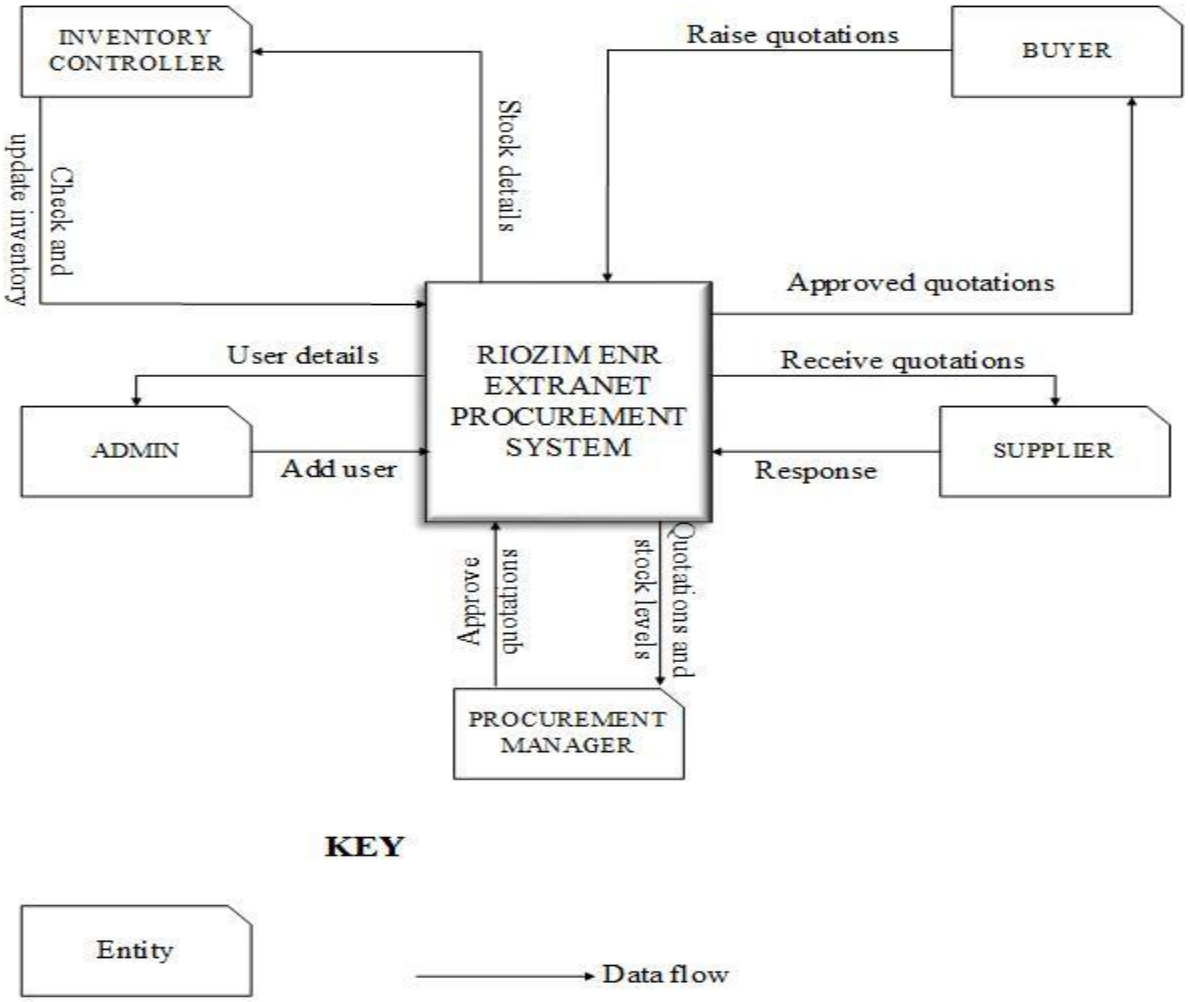


Fig 4. 1 Context diagram of the proposed system

4.2.3 Dataflow diagram of the proposed system

According to Whitten, et al (2004), Data Flow Diagram is a graphic representation of the system's component processes and flow of data between them. They show how data flow to, from and within and the process that transform the data.

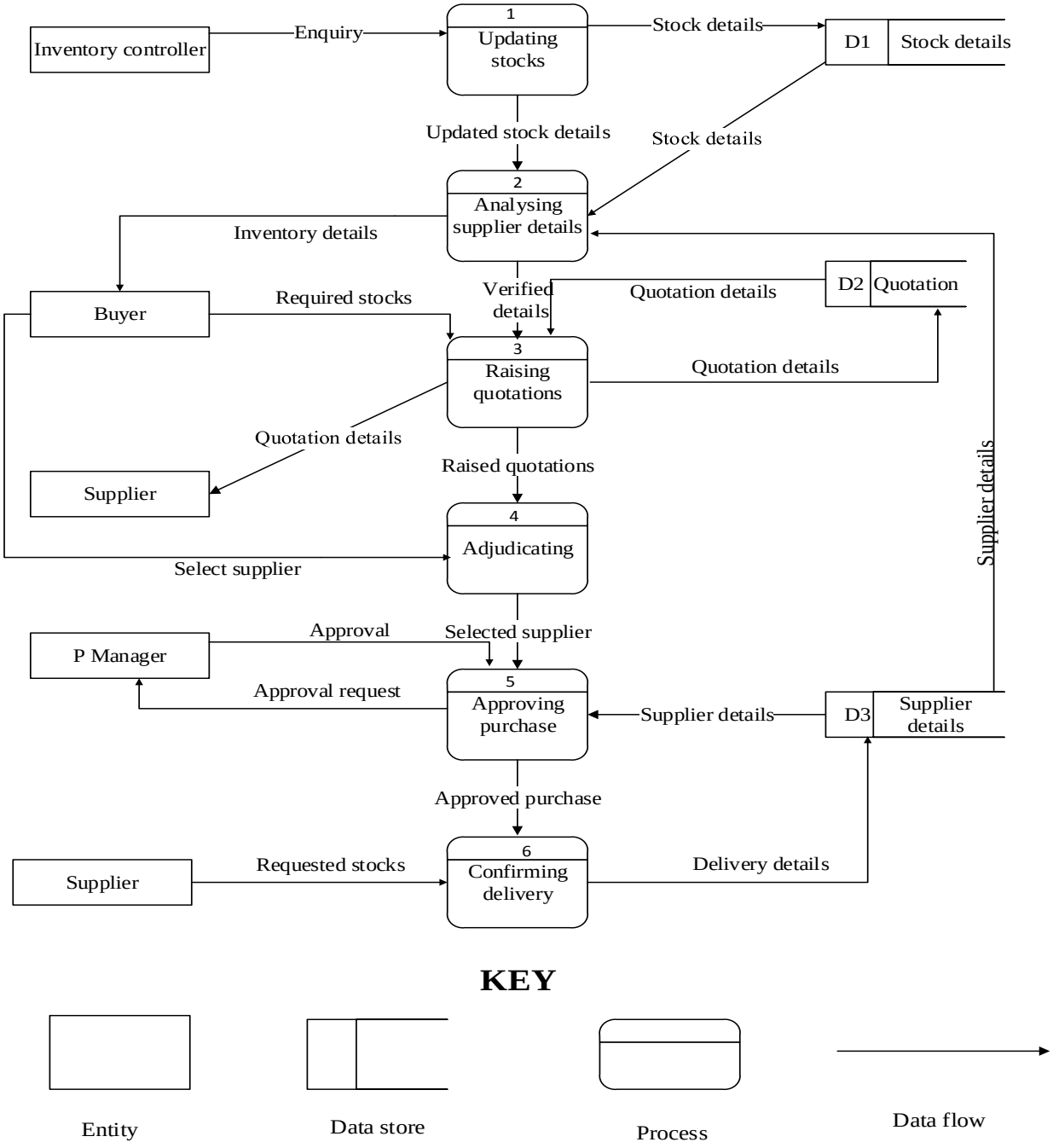


Fig 4. 2 Dataflow diagram of the proposed system

4.3 ARCHITECTURAL DESIGN

Bass (2012) argued that systems architecture is the fundamental and unifying system structure defined in terms of system elements, interfaces, processes, constraints, and behaviors of the

system. Systems Architecture is a generic discipline to handle objects (existing or to be created) called "systems", in a way that supports reasoning about the structural properties of these objects. Forouzan (2007) identifies architectural design as the highest-level breakdown of a system into its important parts**.** Systems Architecture is a response to the conceptual and practical difficulties of the description and the design of complex systems.

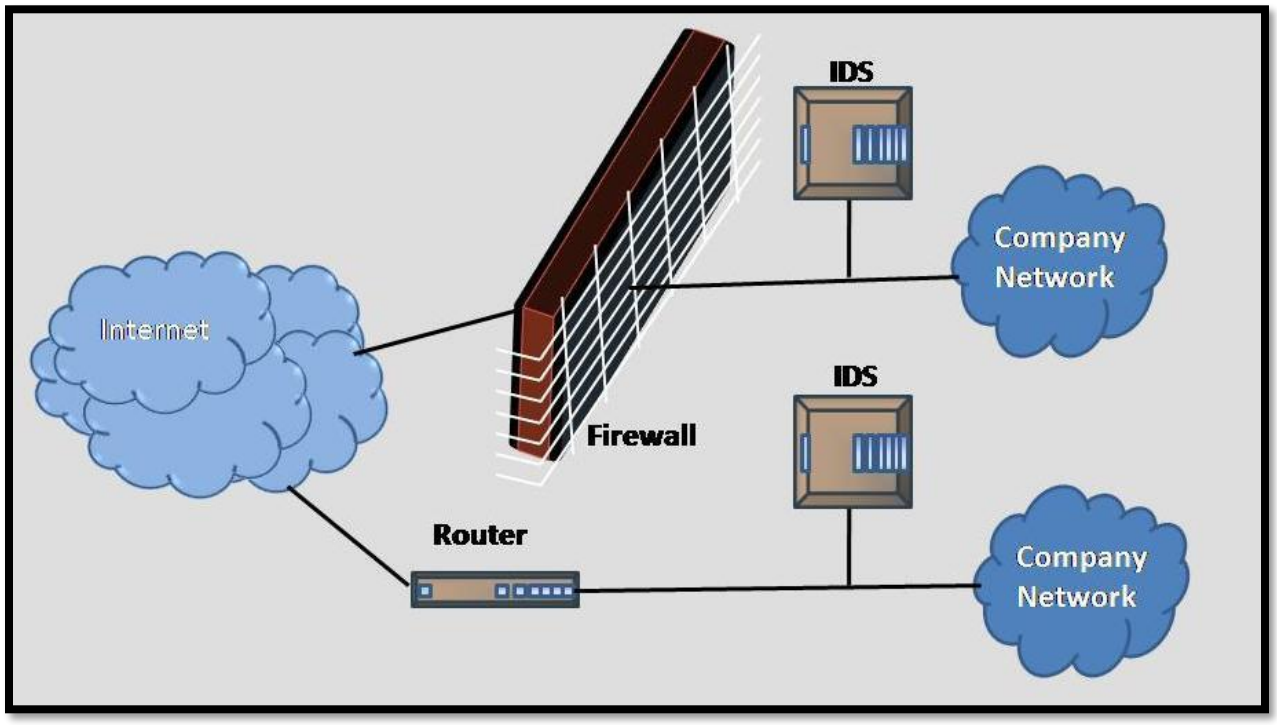


Fig 4. 3 Architectural design

4.4 PHYSICAL DESIGN

This shows the architecture by which the physical or hardware components of the system are to be laid out how they will communicate (Valacich et al, 2012). All client machines will be connected to the site server via the internet and the main server and the database will be located at Riozim Empress Nickel Refinery Company's head office in Harare. This is a conversion of an abstract logical model into a precise technical design. It tries to shoe how the hardware components of the new system are going to interact and be arranged.

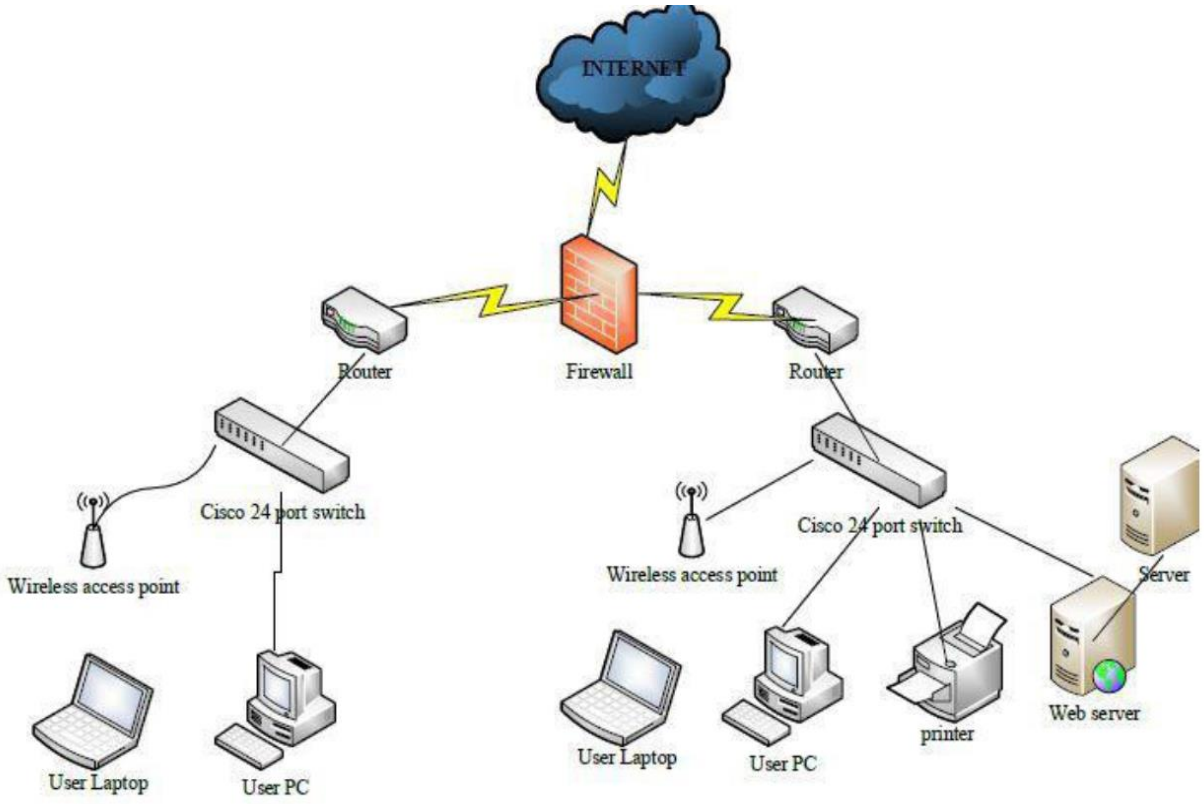


Fig 4. 4 Client server

4.5 DATABASE DESIGN

The success of the proposed system in its ability to meet user information requirements is largely going to depend on the structure and functionality of the data repository (Saleh, 2013). The technique involves conscripting established rules, specifications and processes that can command how data is stored in the data repository and database architecture engineered also illustrates data retrieval on modules of the application that uses it. To ensure success the data repository should ensure data integrity, consistency and reduce data redundancy. Characterized by all these necessities, the database also needs to be efficient in its processing thus the need for some serious Database Designing.

4.5.1 Database architectural design

The architecture design tries to identify the schemas within the system and gives a detailed description of all the schemas (Satzinger et.al, 2005). The architecture's main focus is on

designing, developing and maintaining of programs that are responsible for storing and organising required information for the organisation. Software is developed and implemented by the architecture with the main reason of meeting user needs. Architecture will show the various entities that will directly and indirectly link to the database schema. Below is a diagram showing the schemas that describe the all system levels.

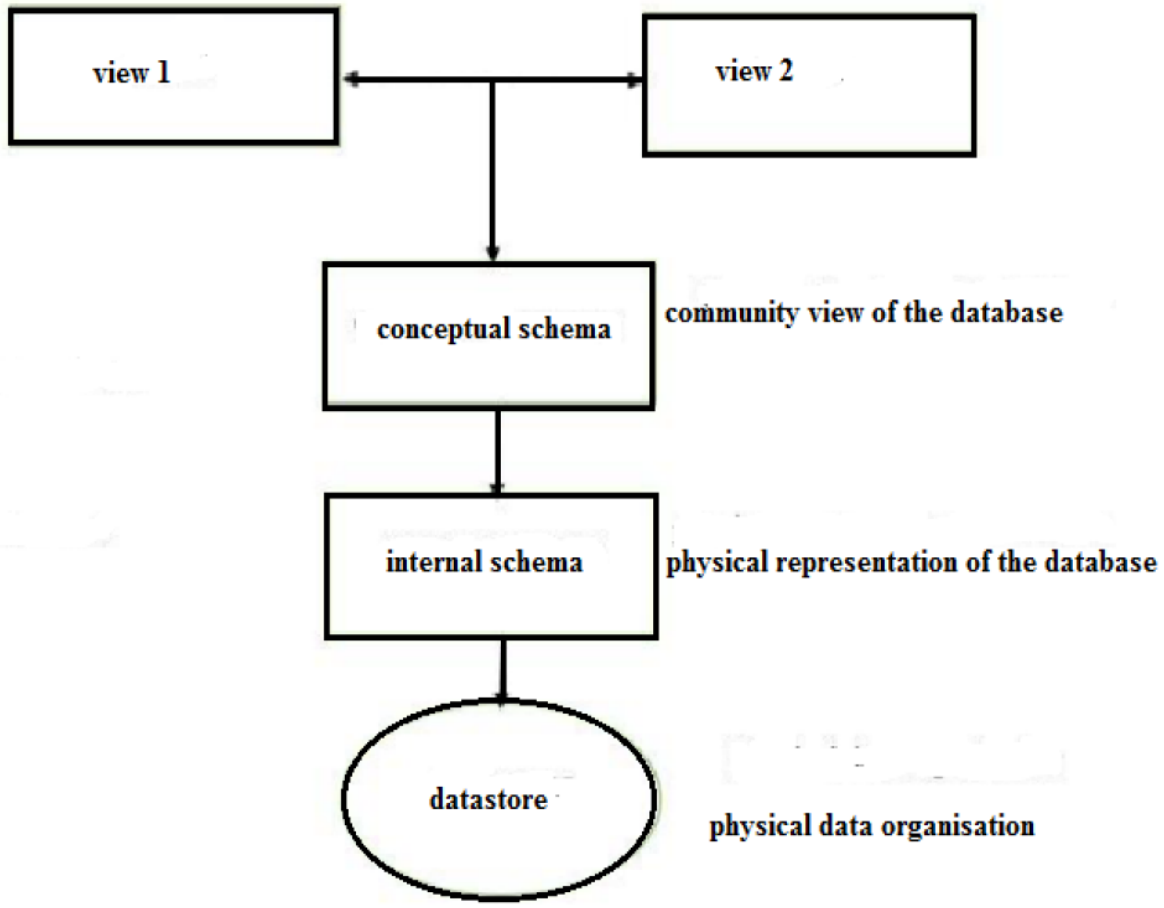


Fig 4. 5 Database architectural design

Physical Level

This level represents the database itself. It is the lowest level of abstraction and defines how data is actually stored.

Conceptual level

Also known as the community view of the database. It represents the following: all entities, their attributes and relationships; the constraints on the data; security and integrity information. It supports each external view in that any data available to a user must be contained in or derivable from the conceptual level

External level

It represents the user's view of the database. It describes that part of the database that is relevant to a particular user. The records can be viewed using forms, reports and tables. Structured Query Language (SQL) is used to manipulate data in the database. Possible relationships between tables in the given database are many-to-many and one-to-many.

Database

This is the actual database or repository to which all the information will be stored and retrieved from.

4.5.2 Entity Relationship Diagram

An entity relationship diagram is a data modelling technique that graphically illustrates an information system's entities and the relationship between those entities (Joey and Jeffrey, 2012). An ER is a conceptual and representational model of data used to represent the entity framework infrastructure. According to Hazra (2013) an ER has 3 main components which are entities, objects which have data stored about them and also cardinality which define the relationship between entities in terms of numbers.

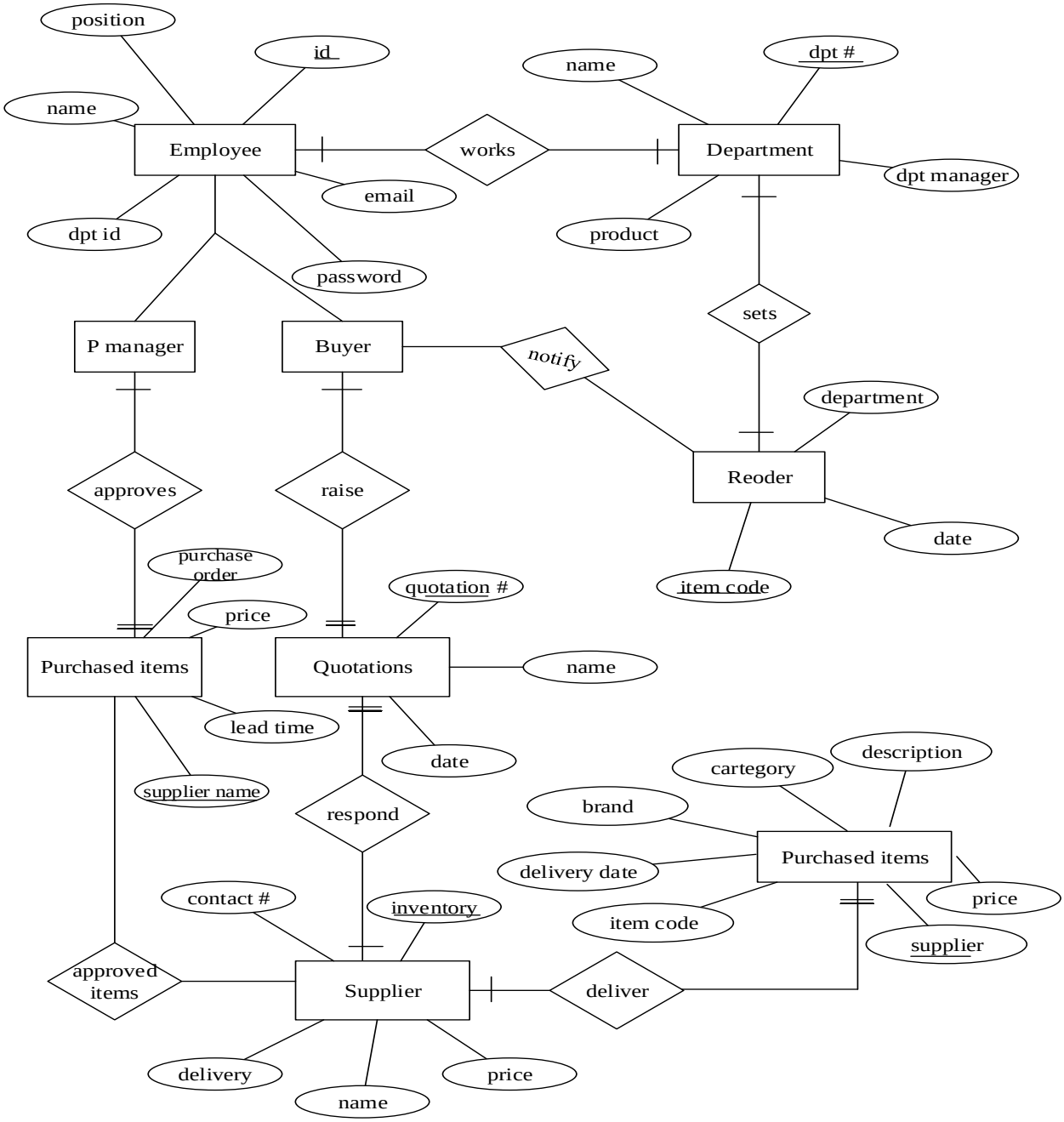
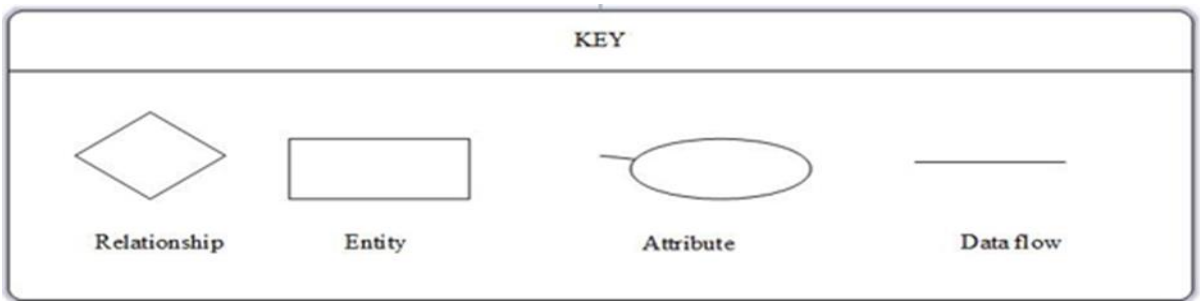


Fig 4. 6 Entity relationship diagram



4.5.3 Enhanced entity relationship

Vermaat (2012) defines EER as specialized model that includes concepts introduced by the Enhanced diagram. The diagram make use of several concepts that are closely related to object-oriented design programming. It includes the concepts of a subclass and superclass concept of a union type or category, which is used to represent a collection of objects that is the union of objects of different entity types. The EER was designed to show all the complex relationships that are between objects in a relational database. According to Dennis (2012) the EER model resulted from extending the ER model with new modelling concepts. The diagram over leaf shows the EER of the proposed system.

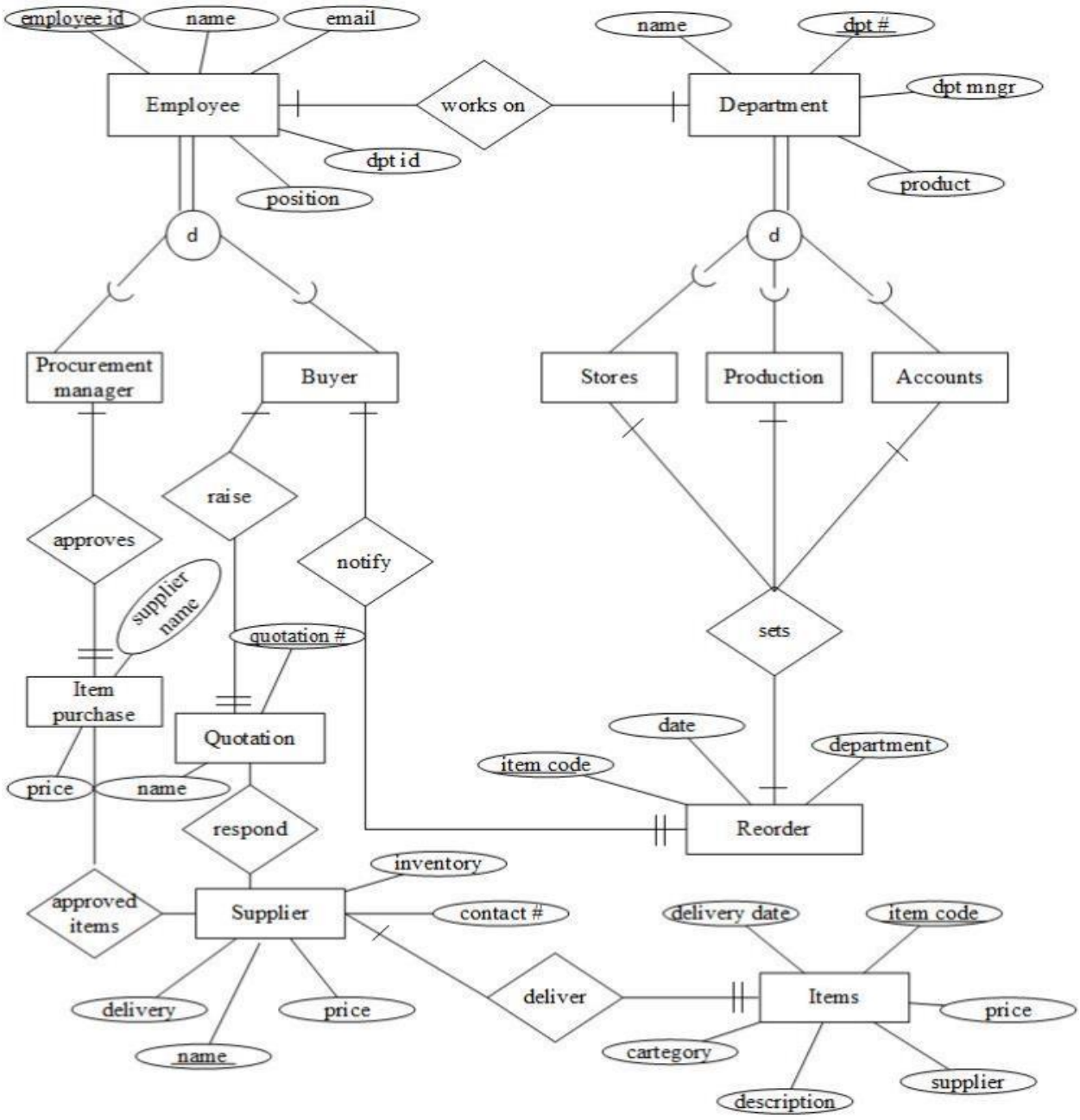
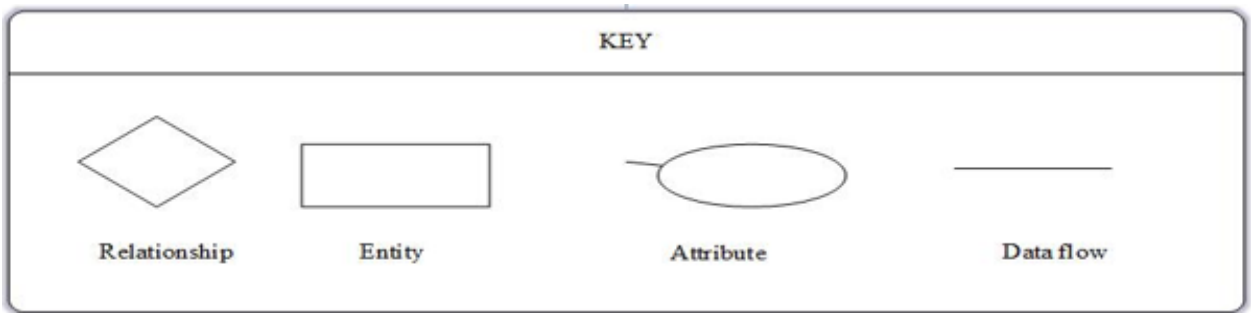


Fig 4. 7 Enhanced entity relationship diagram



4.6 PROGRAM DESIGN

Lester (2014**)** defined program design referencing to computer software as that phase where the developer has to describe what programs are supposed to be written and how they be written, describing also how these various pieces of code are going to be integrated to form programs and modules. It is a process of designing the system using the flow of processes and it encompasses the class diagram and the sequence diagram that will help the system to have a correct sequence or order (Stephens, 2015). For system development the developer uses the class diagram and sequence diagram to clearly show the design.

4.6.1.1 Package diagram

The developer has to understand and use a Unified Modelling Language (UML) in order to come up with a package diagram. As indicated by Chonoles and Schardt, (2011) they give an approach to picture conditions between parts of the structure and are utilized to focus accumulation request. These components are as a result of breaking down the whole large system into smaller system components. Duffy (2011) further defined it as a group of logically connected software components.

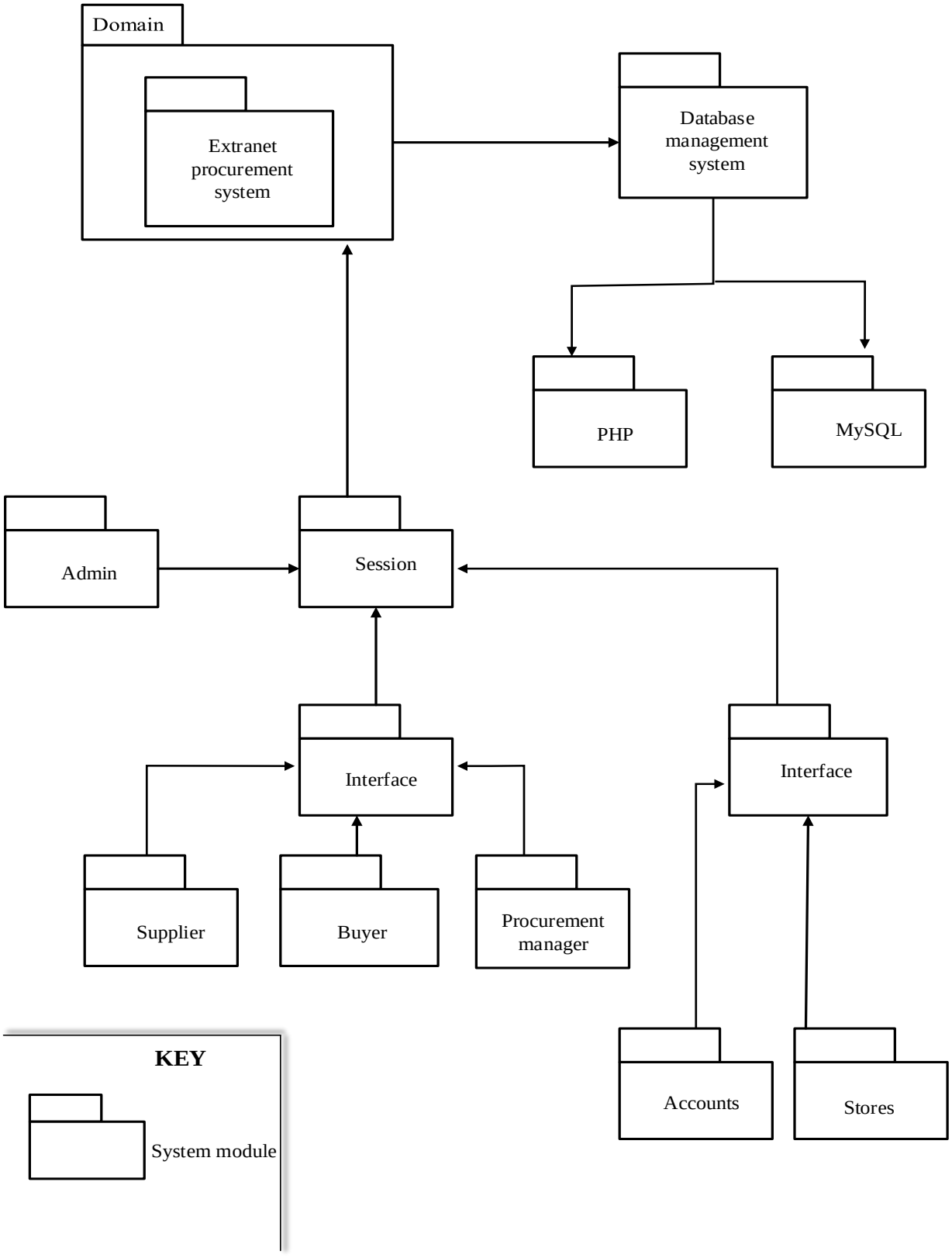


Fig 4. 8 Package diagram

4.6.1.2 Class diagram

Pratt and Last (2014) define a class design as a representation that indicates the relationship between relative attributes and entities. They are therefore used to precisely express what is called the object oriented model and the associations that are participated in the internal structure. The system components and their relationship are shown by the Figure below.

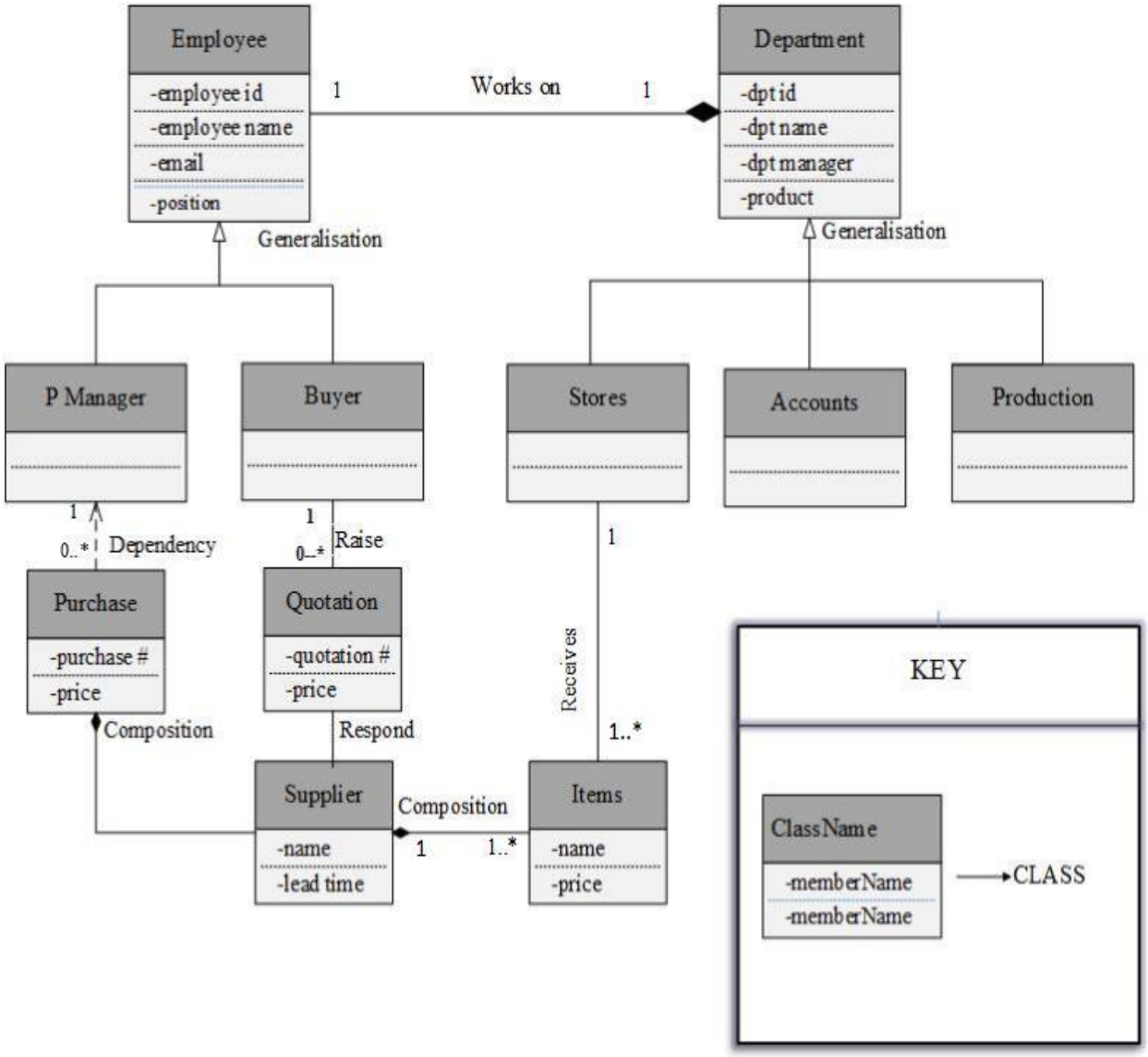


Fig 4. 9 Class diagram

4.6.2 Sequence diagram

According to Pratt and Last (2014), sequence diagrams are interactive diagrams that deal with information resulting from different performing objects. It is also known as the timing or event diagram because it defines sequences of events between objects over a given over time to meet a given target.

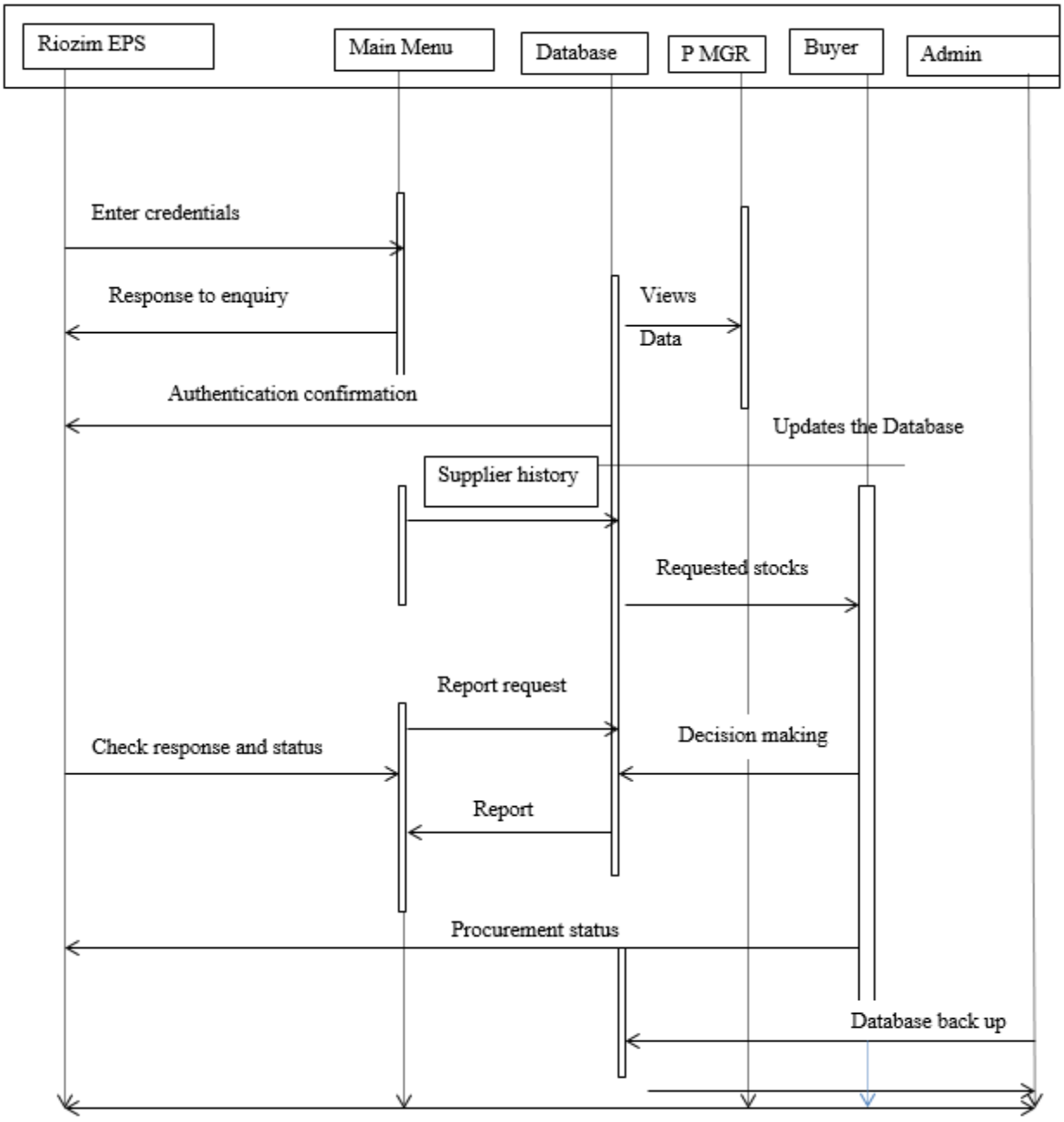


Fig 4. 10 Sequence diagram

4.7 INTERFACE DESIGN

The interface will provide a link between the back end system and the frond end users. The interface of the system has to be friendly and must also ensure that the data should entered simply and properly (Whitten 2004). It defines the way in which the system users will communicate with the system and the nature of inputs and outputs that the system will be associated with. In this case interface refers to the graphical controls that the user is going to interact with in order get the proposed system to process as desired. The user interface provides interaction between users of the system and the system. It provides a channel of communication between the two entities. The user interface will mainly consist of the input and output. This also includes output media such as reports, and other utilities such as on line help. Interface design outlines the design for the menus, forms, reports, and the help screens. A Graphical User Interface will be used in the proposed system. It will be designed in a way that will allow easy navigation of the entire system. Drop down menus and command buttons will be used for navigating the system. This was done in order to follow the general standard used by international software hoses like Microsoft.

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.

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

Home page

This platform provides a one stop center for tender invitations, tender bidding, purchase order requests, purchase order processing and the tracking of the stock inventory. It is customized to suit a given environment but can be used by any orgnasation in any department to manage their procurement and stock operations

Fig 4. 11 Home page

4.7.1.2 Sub menus

After login in successfully a user is directed to the sub menu which contains all functionalities of the system depending on the rights that user has been given.

Supplier page

Upon logging on the supplier will see the interface below in order to perform functionalities like viewing open tender invitation (Only for products that the supplier has been assigned), submit tender bid for the above invitations as well as process purchase order only if the supplier have won the tender invitation

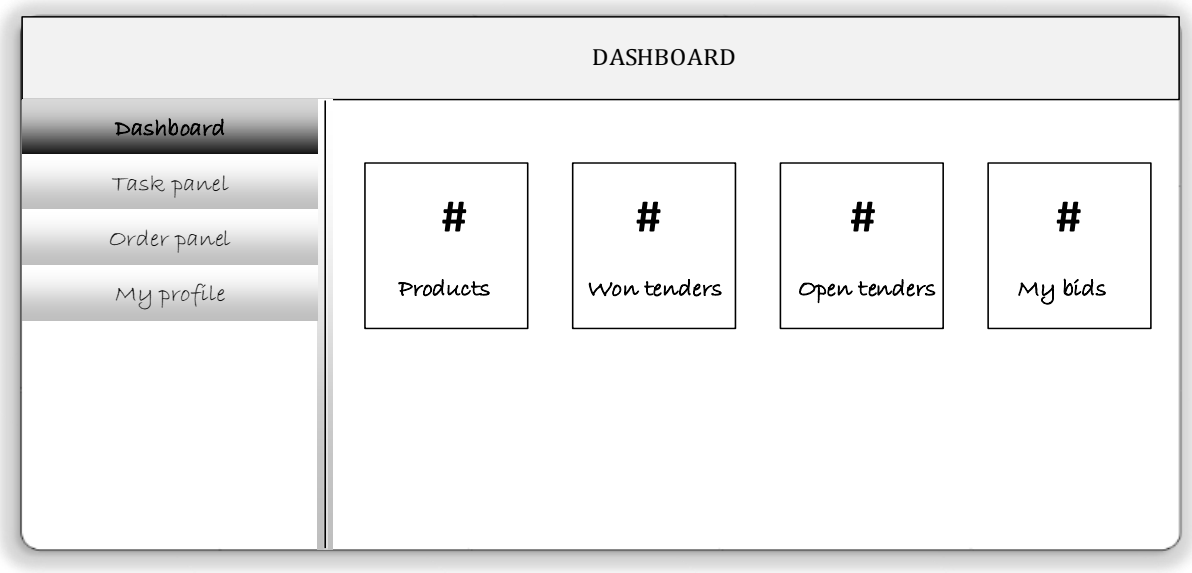


Fig 4. 12 Supplier page

Admin page

This platform allows the administrator to add department, activate and deactivate department, add employees, edit employee details generate a random password for employees, activate and deactivate employees and assign roles to employees. Admin can as well add suppliers, make tender invitations provided the manager is not available.

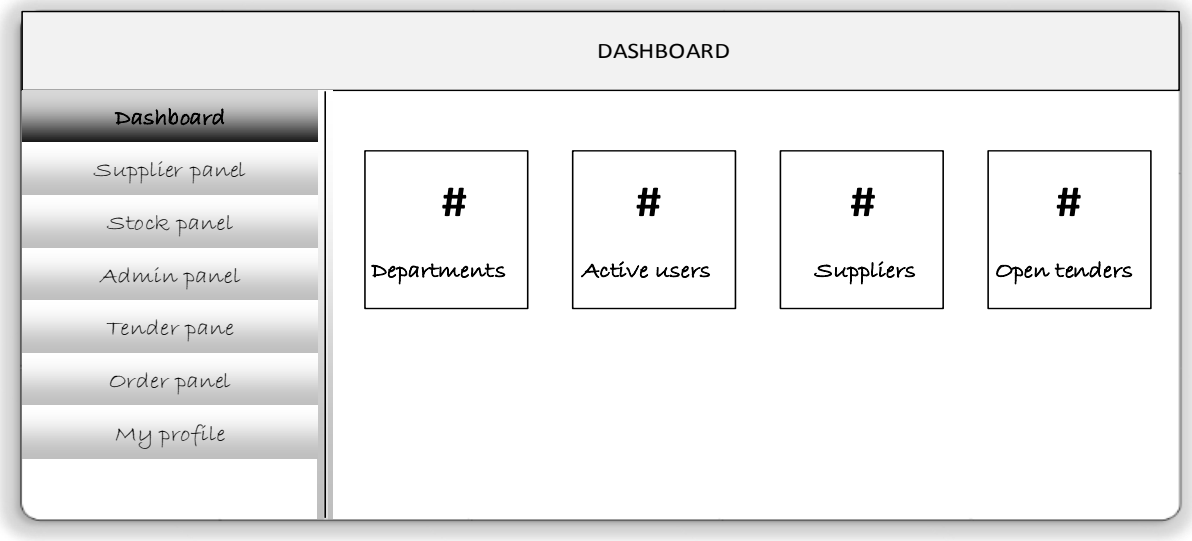


Fig 4. 13 Admin page

Manager's page

This platform provides manager with the rights to add products (only for the same department) activate or deactivate product, view stock history add suppliers, edit supplier details, assign products to suppliers, create tender invitations, approve purchase requests, activate and deactivate purchase order (only if the supplier have not started processing the order).

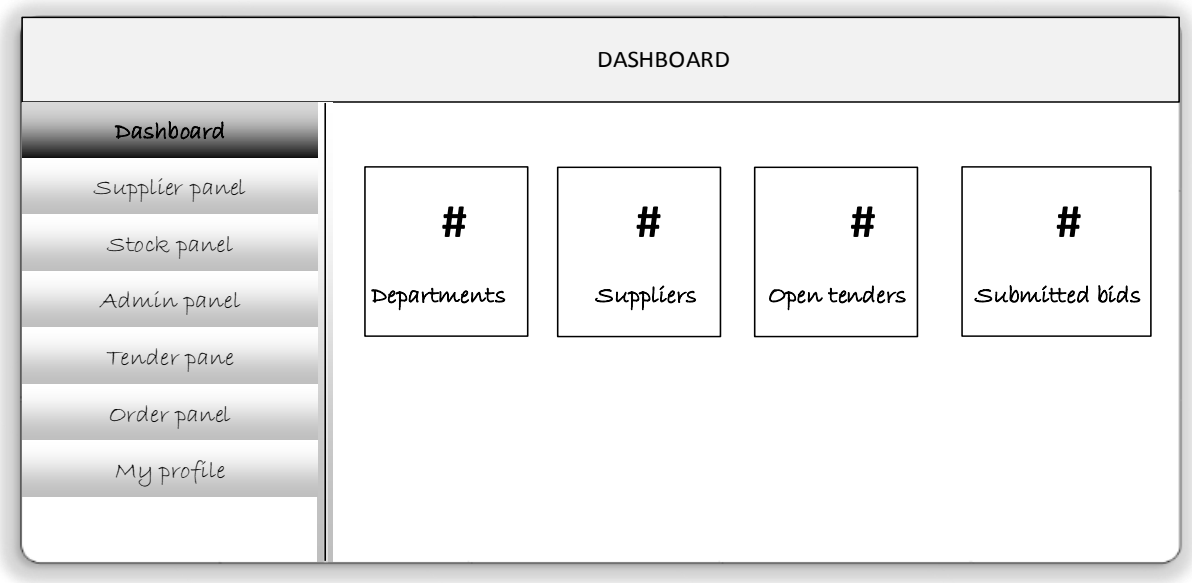


Fig 4. 14 Manager's page

4.7.2 Input design

The overall goal for input design is to produce a user-friendly interface, and to ensure input processes. The new proposed system will contain input forms that will allow users to enter all the necessary details. All the input forms will have a logout button for closing the particular form so as to return to the main menu of the system.

The following guidelines for Input Forms will apply.

- You cannot open two or more forms at once.
- The tab key on the keyboard will be used to move to the next field for data input and not the enter/return key.
- Appropriate captions/titles are to be used.

- Where input is known or if constant, month for example, users are not to input the data from scratch, but to select from calendar.
- To reduce input errors (thus improving data quality) data validations are to be taken care of during the input process
- As each user inputs data it is ensured that only valid data is input, where possible, for example the email format should contain the sign "@exe.com"… and enforce data uniformity.

Below are sample designs of the input data forms for the proposed system:

Login form

Fig 4. 15 Login page

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.

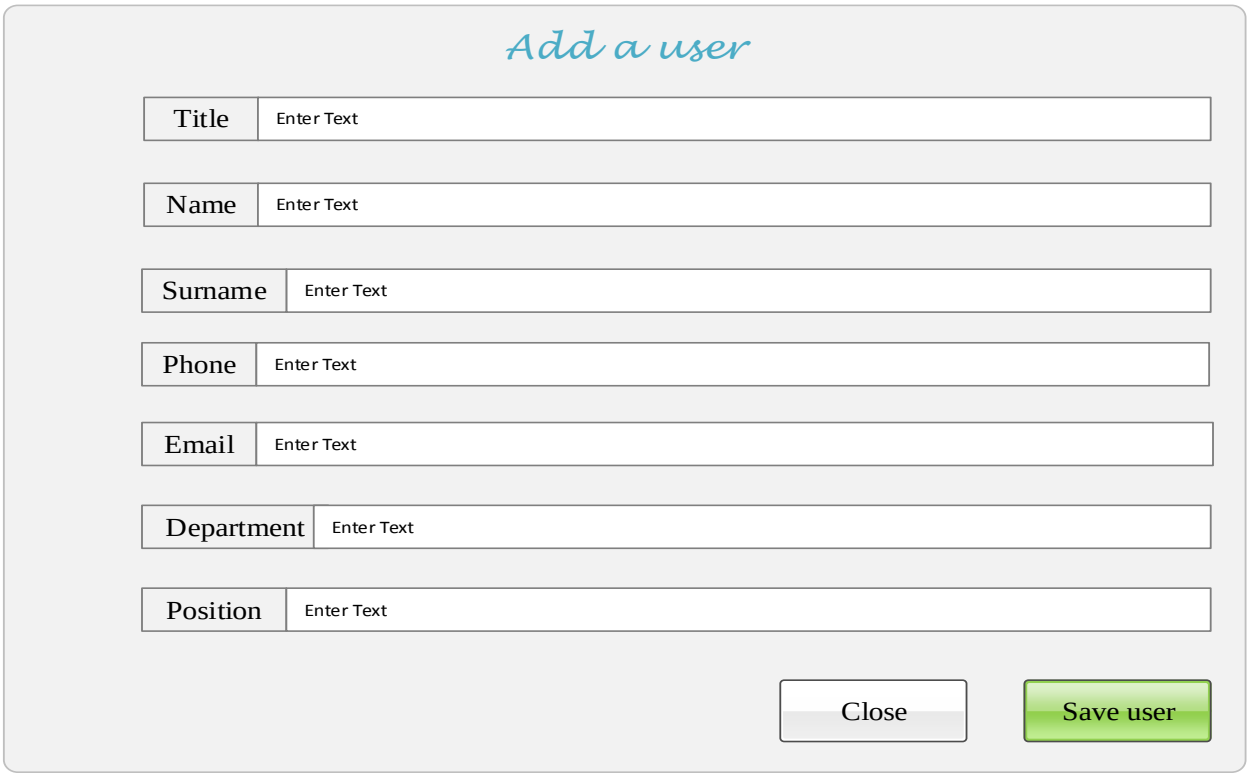


Fig 4. 16 Add new user

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. 17 Add new supplier

The above platform as well show details required upon adding new supplier to the system and a random password will be created and send to the supplier email account upon account creation.

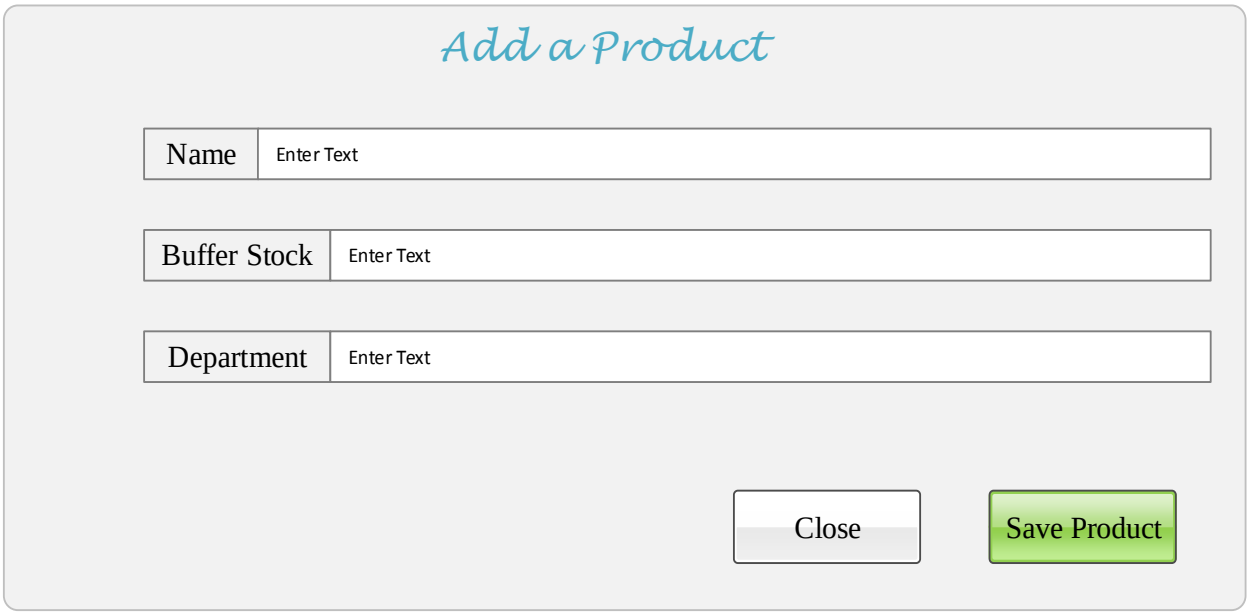


Fig 4. 18 Add new product

The above platform allows the buyer to add new product into the system as well as determining the buffer stock levels required for every department for each product added.

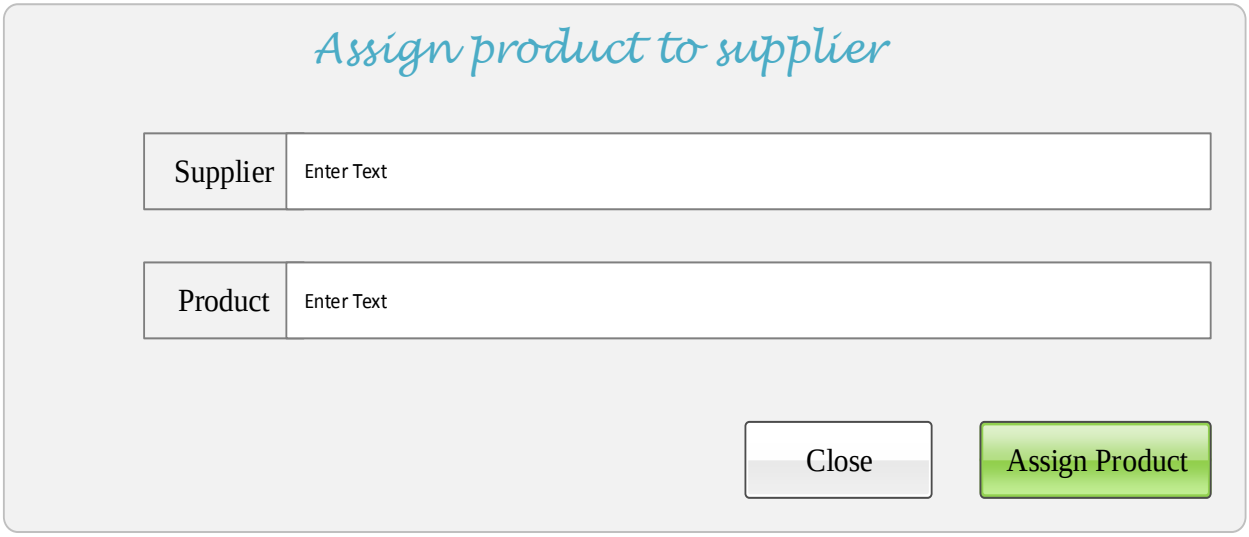


Fig 4. 19 Assign product

Above is a platform that will be allowing the buyer or manager to assign suppliers against the products that they are able to supply the orgnasation to easier the process of sending invitations. One invitation will be sent to them all at the same time.

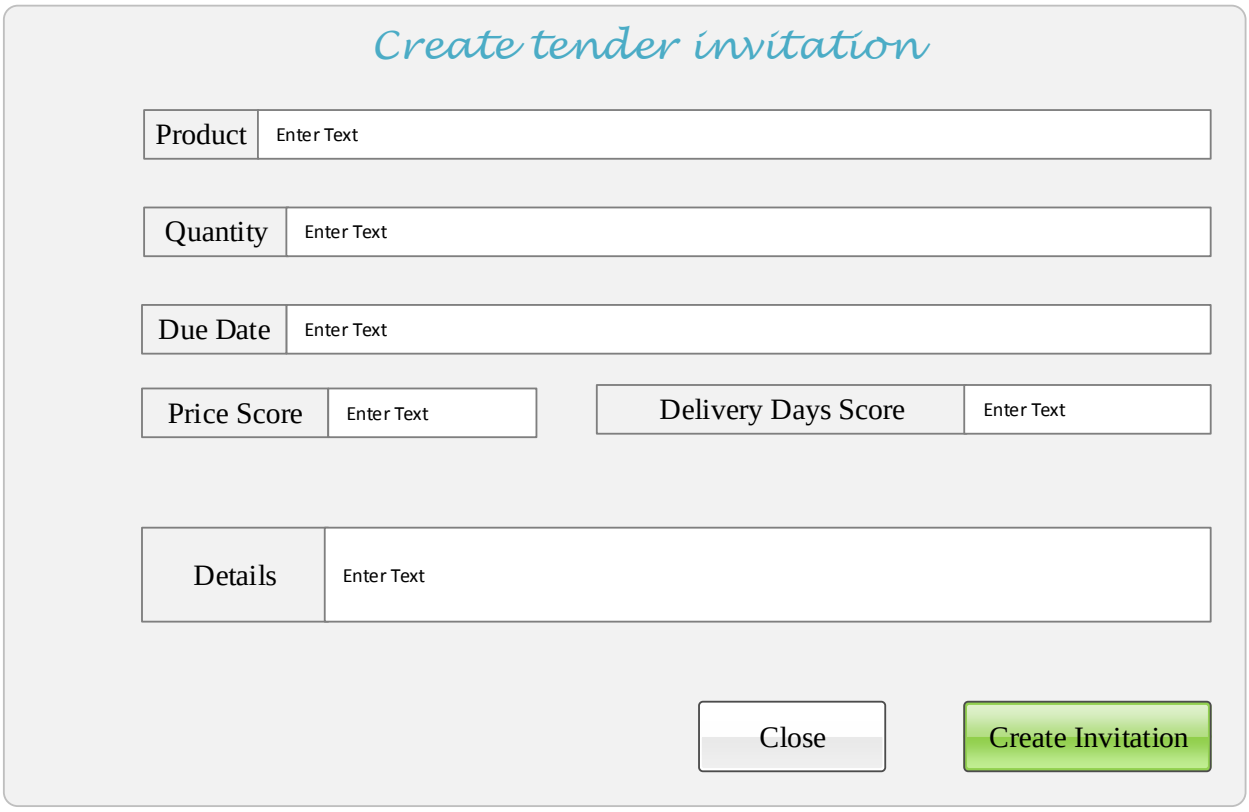


Fig 4. 20 Create tender invitation

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.

Fig 4. 21 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 Output design

After inputting of data the system processes the data and produces output. The outputted information is then shown to the user in the form of a message or a form. Below is a sample of the output design of the system.

- Updated buffer levels

The below platform shows how the buffer stock levels are being determined using different colour changes to illustrate how much percentage above or below the buffer and when to order new stocks.

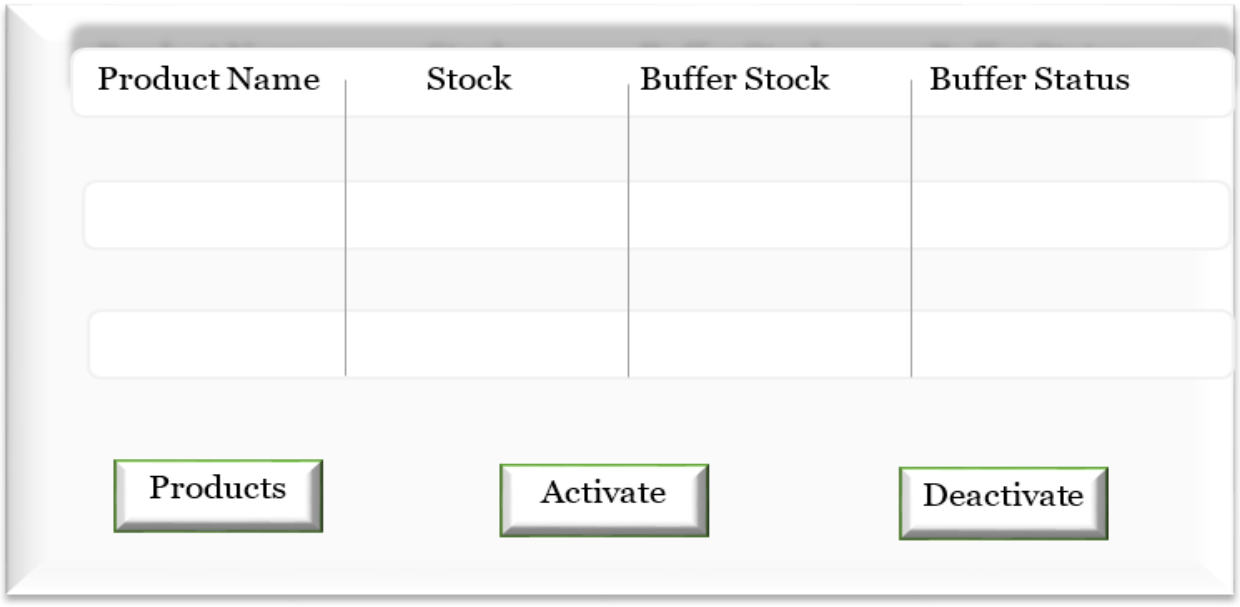


Fig 4. 22 Updated buffer level

- Stock history

The platform over leaf shows all the stock history that might have occurred during a specific period of time. All new products added, products removed as well as all other major changes made will be shown.

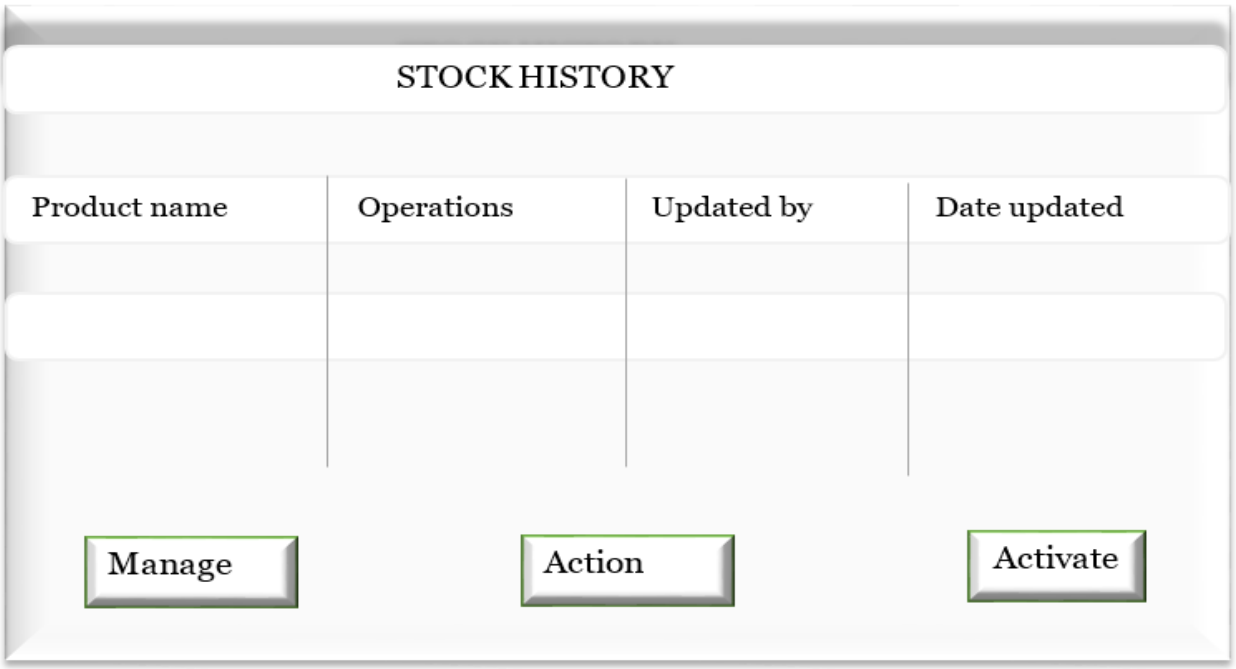


Fig 4. 23 Updated stocks

- Invitation bid

This platform displays bid invitations made and suppliers that had summited the bid specifying the expected delivery dates as well as the quantity and price scores

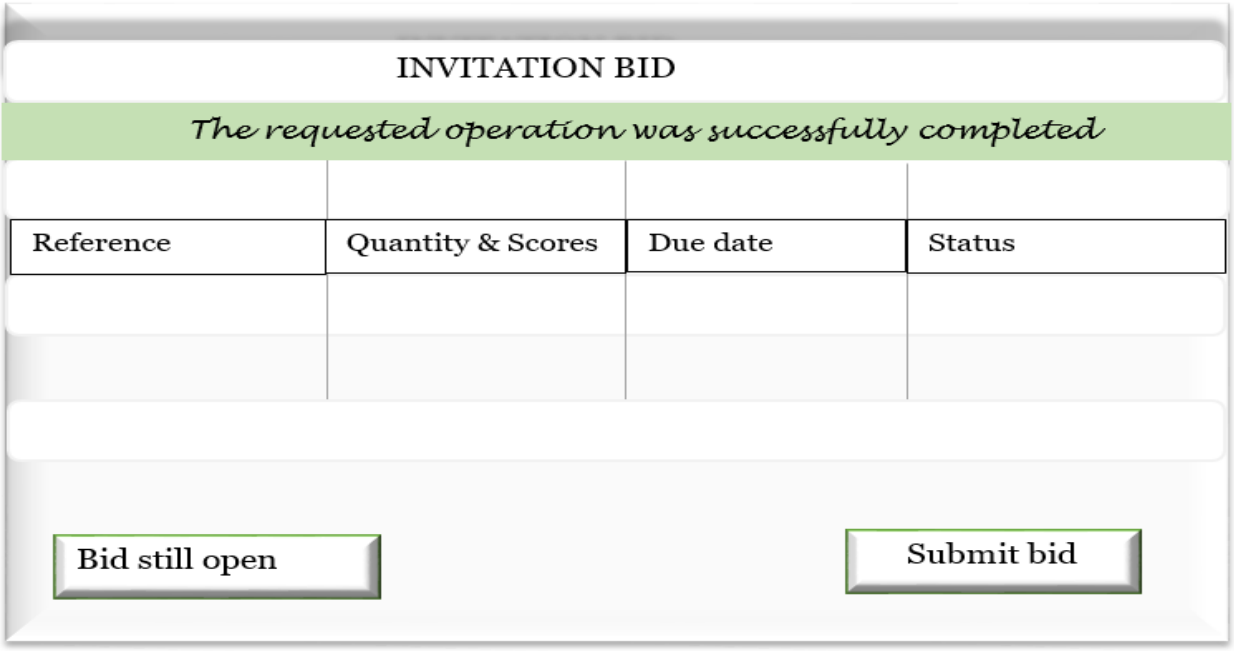


Fig 4. 24 Summited bid

- Supplier bids

This platform will be displayed at the supplier page to view if he or she have won the bid or not

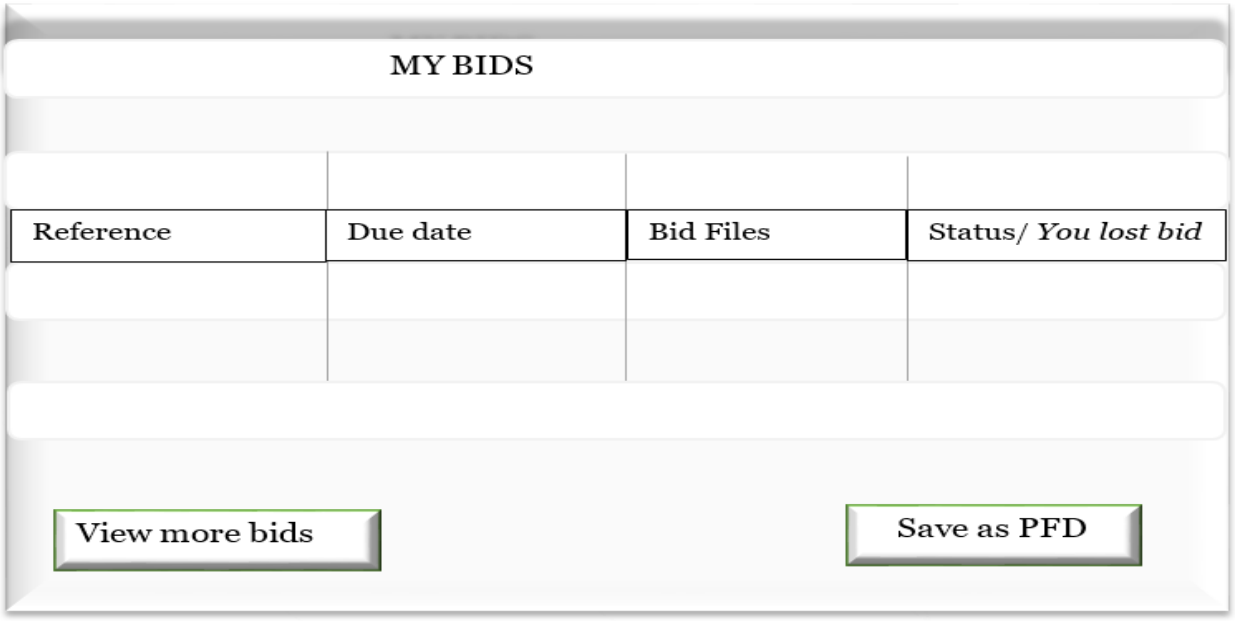


Fig 4. 25 Supplier bids

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

Perform database backup

Specify backup location

Generate backup file

Store file in specified location

Restore backed up data

Locate backup file

Extract data from backup file

End

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 orgnasation 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.

CHAPTER 5: IMPLEMENTATION PHASE

5.1 INTRODUCTION

This phase consists of coding, testing, installation, evaluation and maintenance of the new system. System analysts determine the overall design strategy and work with programmers to complete design, coding, testing, and documentation (Whitten 2004). This phase looks at the actual activities that are undertook for the system to be ready for presentation to the final user including testing for user requirements, functionality and identifying the stakeholders. Different testing strategies were used to ensure quality assurance. Maintenance stages will be highlighted that help ensure that the system accommodates changes and new user requirements.

5.2 CODING

Statements written in a particular programming language - the source code, and a term for the source code after it has been processed by a compiler and made ready to run in the computer - the object code. According to George et al (2012) coding is what makes it possible for us to create computer software, apps and websites. The programming language that is going to be used is PHP.

5.3 TESTING

Graham et al (2012) defines testing as the process that consists of all life cycle activities both static and dynamic concerned with planning, preparation and evaluation of software products and related work products to determine that they satisfy specified requirements to demonstrate that they fit for purpose and to detect defects. It can also be referred to as the type of testing to check the behavior 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.

The diagram below represents the testing process, which consists of five stages that are:

- Unit testing
- Module testing
- Subsystem testing
- System testing

- Acceptance

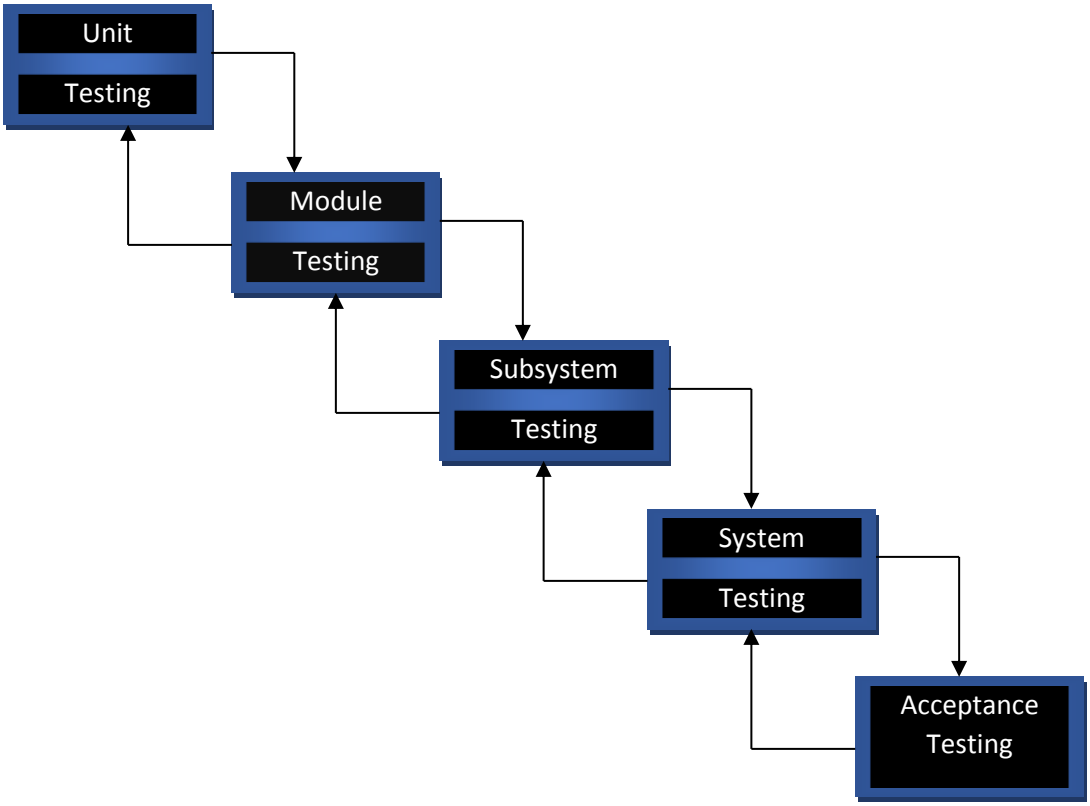


Fig 5. 1 Testing process

5.3.1 Unit testing

Unit testing is a software development process in which the smallest testable parts of an application, called units, are individually and independently scrutinized for proper operation (Yeates and Wakefield 2004). Unit testing is often automated but it can also be done manually. Through this type of testing all the errors were identified by the programmer. Dennis et al (2012) identifies two approaches to unit testing which are black box and white box testing. Each item in the program specification becomes a test, and several test cases are developed for it.

5.3.1.1 Black box testing

Black-box testing is a method of software testing that examines the functionality of an application without peering into its internal structures or workings. This method of test can be applied to virtually every level of software testing: unit, integration, system and acceptance. In this context

the researcher tested the functionality of adding the new supplier in the system and showed the success page

Adding new supplier

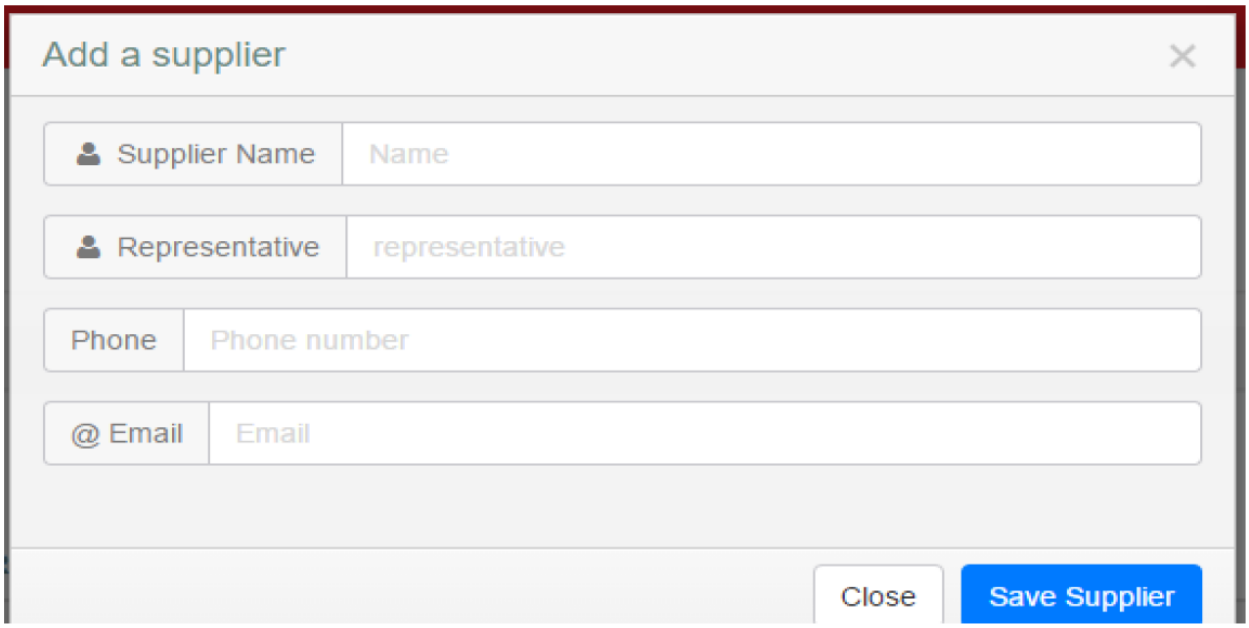


Fig 5. 2 Supplier successfully added

5.3.1.2 White box testing

Desikan (2006) states that white box testing tests the internal structure of the application. White-box testing (also known as clear box testing, glass box testing, transparent box testing, and structural testing) is a method of testing software that tests internal structures or workings of an application, as opposed to its functionality that is black box testing.

5.3.2 Module testing

A software unit is a low level component of a software system with its own specification. A unit may be as small as a commercial block of code or as large as a set of coupled routines. In some cases a unit is referred to as a module. A module is sometimes used to describe a small subsystem composed of several units. The techniques described, however, have greater applicability to testing outside of the unit or module. Testing directed to a single module or unit is called module or unit

testing. It consists of test planning, test data development, test monitoring and execution, and evaluation of results.

5.3.3 Sub-system testing

Saleh (2013) Subsystem testing, also known as the integration testing is an intermediate between testing each program in isolation and the whole system. It ensures that job streams are correct. There is detection of interface mismatches between programs. The modules, which are linked together, were tested. A collection of modules integrated into subsystems was tested for functionality and the result would review some errors that had been ignored before.

5.3.4 System testing

This involves integrating all the subsystems including the ones tested and assembling them into an integrated system (Graham et al, 2012). It then goes on to involve testing of the entire information system and includes all processes. Tests are carried out to find out if there are any errors that might hinder functioning of the system. System tests examine how well the system meets business requirements and its usability, security, and performance under heavy load. Verify that all system components are integrated properly and that the system will handle all input data properly.

5.3.5 Acceptance testing

This marks the final testing stage done before the system is presented and accepted for full use. Acceptance testing, a testing technique performed to determine whether or not the software system has met the requirement specifications. The main purpose of this test is to evaluate the system's compliance with the business requirements and verify if it is has met the required criteria for delivery to end users (Graham et al, 2012).

There are various forms of acceptance testing:

- Alpha Testing
- Beta Testing

- **Alpha testing**

Alpha testing takes place at the developer's site by the internal teams, before release to external customers. This testing is performed without the involvement of the development teams.

Developers observe the users and note problems. If errors are present they are corrected and further release of system is carried out until it meets all functional requirements.

- **Beta testing**

Beta testing also known as user testing takes place at the end users site by the end users to validate the usability, functionality, compatibility, and reliability testing. Beta testing adds value to the software development life cycle as it allows the "real" customer an opportunity to provide inputs into the design, functionality, and usability of a product.

5.3.6 Testing strategies

A strategy for software testing integrates software test case design methods into a well-planned series of steps that results in the successful construction of software. The researcher used testing strategies in trying to ensure the correct functionality of the system as a whole. Syntax errors and logic errors were identified and corrected through the use of code reviews.

5.3.6.1 Validation

According Engel (2010) validation checks that the product design satisfies or fits the intended use (high-level checking), i.e., the software meets the user requirements. Addresses the following question: ***"Are we building the right product?"*** The main aim is to ensure that the system supports the sustainability of Riozim ensuring continuous production of quality raw materials following the efficient systematic adjudication involved in the procurement process.

5.3.6.1.1 Test cases

Test cases are built around system specifications. Valid and invalid data input is used to determine the quality of output.

Test case 1: User login validation

A user is prompted to enter email and password, if a user tries to login into system without filling the password or username field or both, a pop message appears to notify the user as shown below.

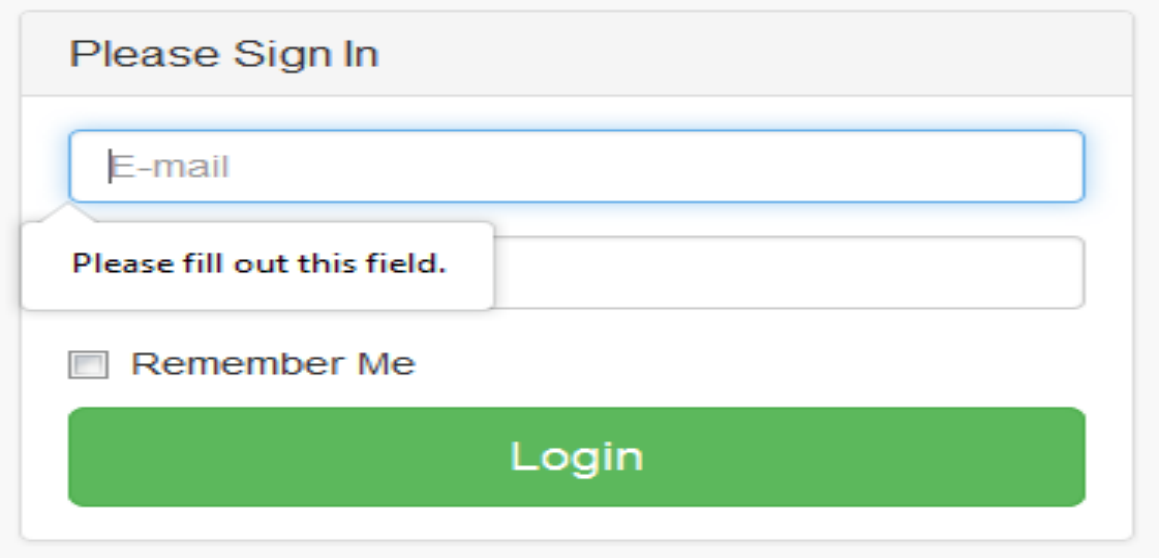


Fig 5. 3 Login validation

When a user input incorrect password, username or both the system notifies the user as shown by the diagram below.

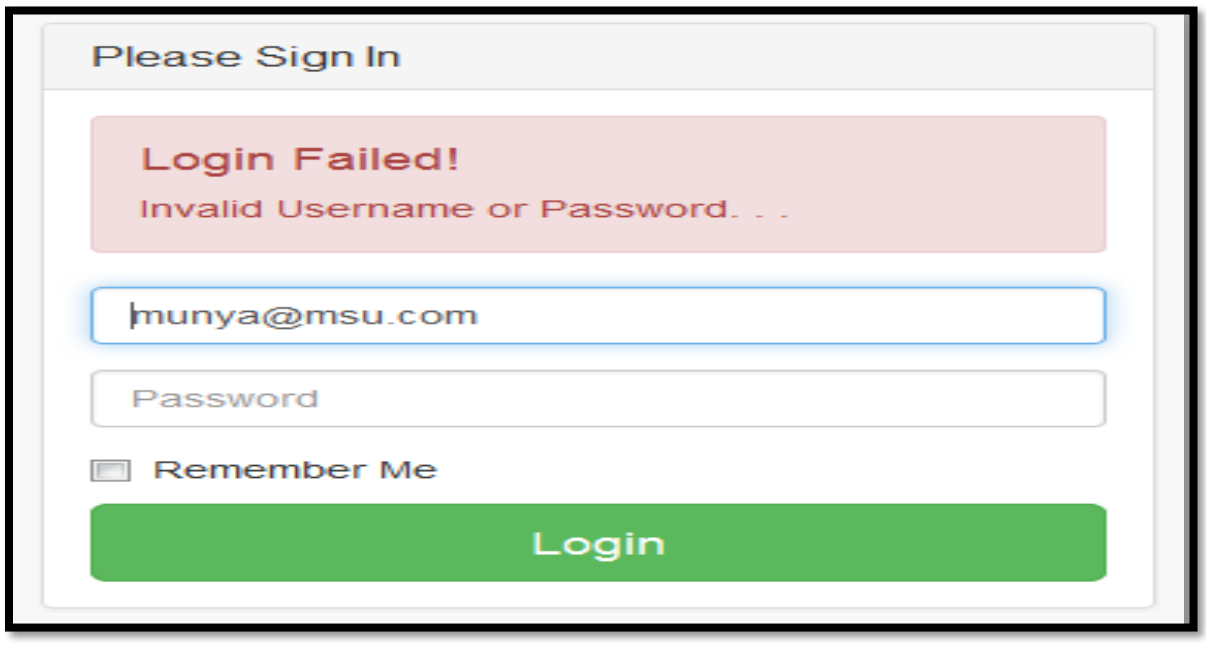


Fig 5. 4 Login validation

Test case 2: Adding user

The manager is allowed to add employees, products, edit supplier details but only for the same department. The manager can also activate, deactivate purchase orders, products department employees as well as assigning products to suppliers.

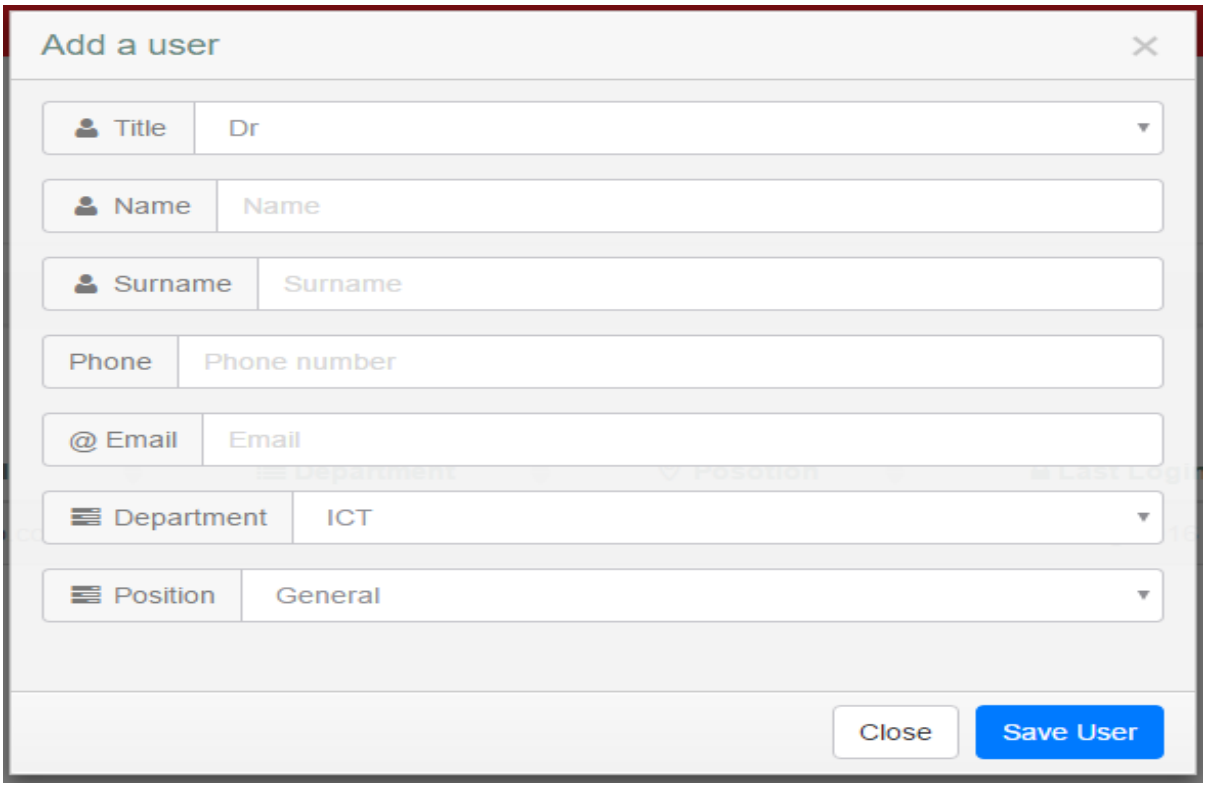


Fig 5. 5 Adding user

Once a user has being successfully added a message notification is displayed and a password is assigned as shown by the figure below. The password is sent to the new user's email account.

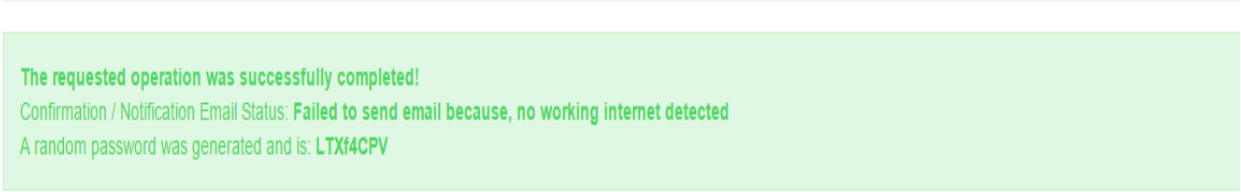


Fig 5. 6 Account created

Test case 3: Deactivating user account

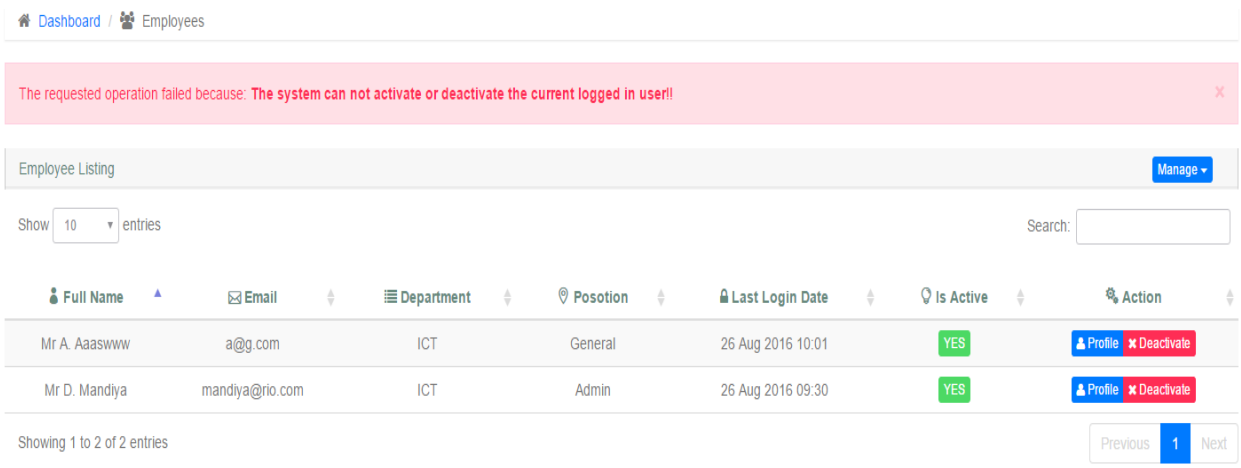


Fig 5. 7 User deactivation

5.3.6.1.2 Security

Solomon (2010) define system security as measures to verify that system protection mechanism prevent improper penetration or data alteration. The system make use of passwords, user access level and encryption to ensure integrity. The following are the security measures implemented by the system:

- Views were used to isolate other users from accessing a menu that they are not supposed to access. The manager can make modifications such as activate or deactivate purchase as well as adding employees.

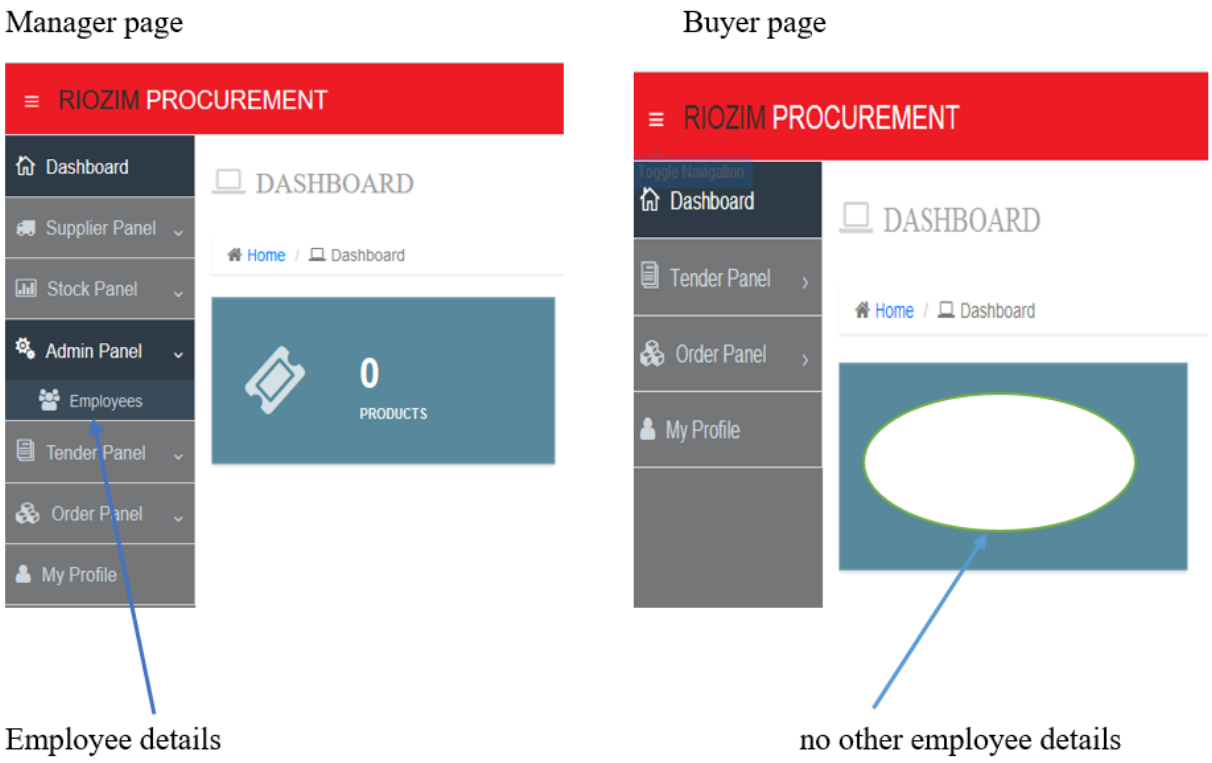


Fig 5. 8 Access level testing

- A manager can only be able to set buffer levels to the products of his or her department

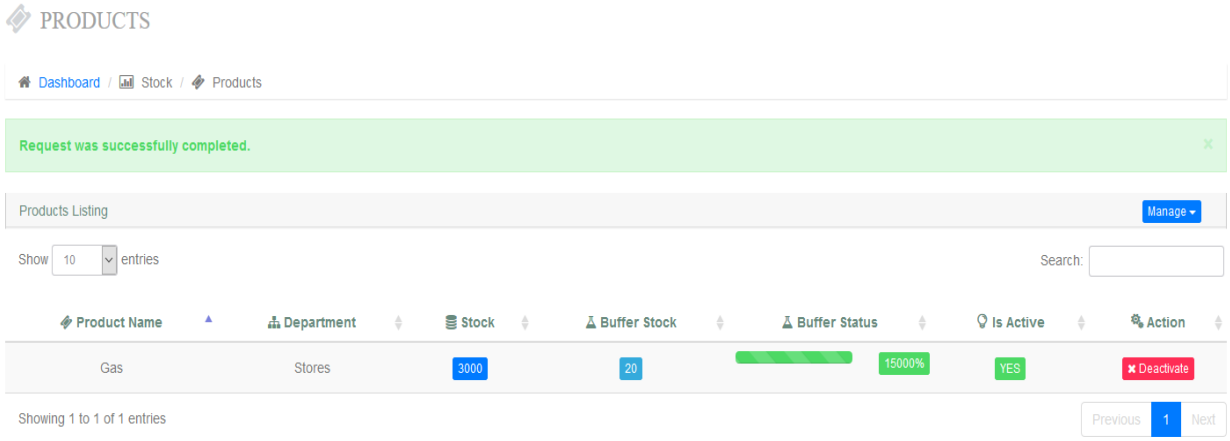


Fig 5. 9 Buffer testing

- The use of drop box to help prevent erroneous input. It guides how data is input into the system

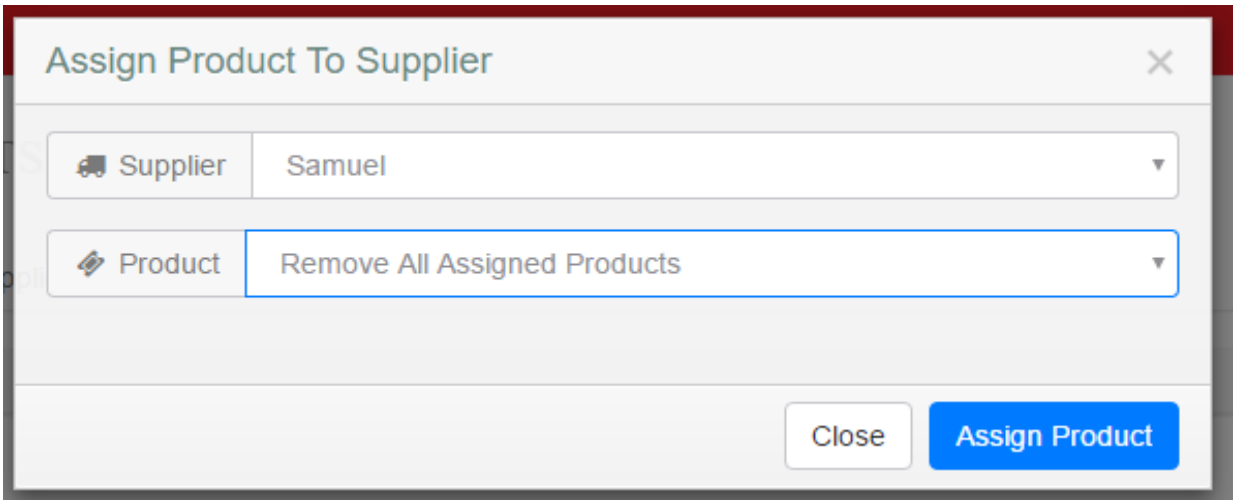


Fig 5. 10 Data input testing

5.3.6.2 Verification

Addresses the following question: ***"Are we building the product right?"*** This involves to a set of activities that ensure that the developed software correctly implements some particular function (Engel, 2010). It is a process that is used to evaluate whether a product, service, or system complies with specifications enforced at the start of a development phase. The actual system was compared with the user requirements (requirements specification) and it proved to be exactly what the management wanted

5.3.6.2.1 System versus objectives

Comparing system functionality and documented objectives as per user request

Objective 1

Automatic detection of re order levels when stocks reaches buffer

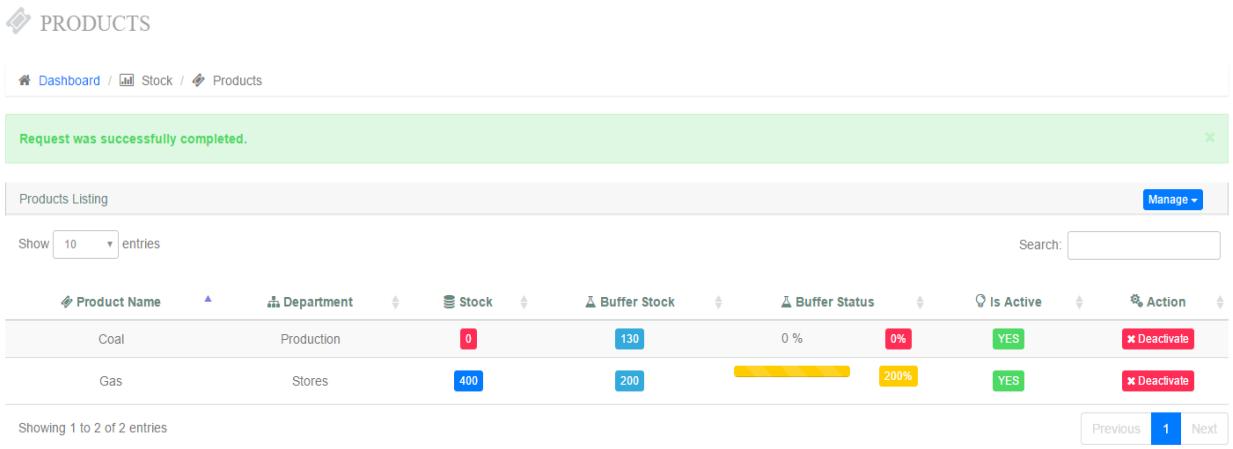


Fig 5. 11 Buffer status

Objective 2

Systematic adjudication, evaluate quotations by suppliers and advice of the most preferable one based on delivery time and price ranking them accordingly.

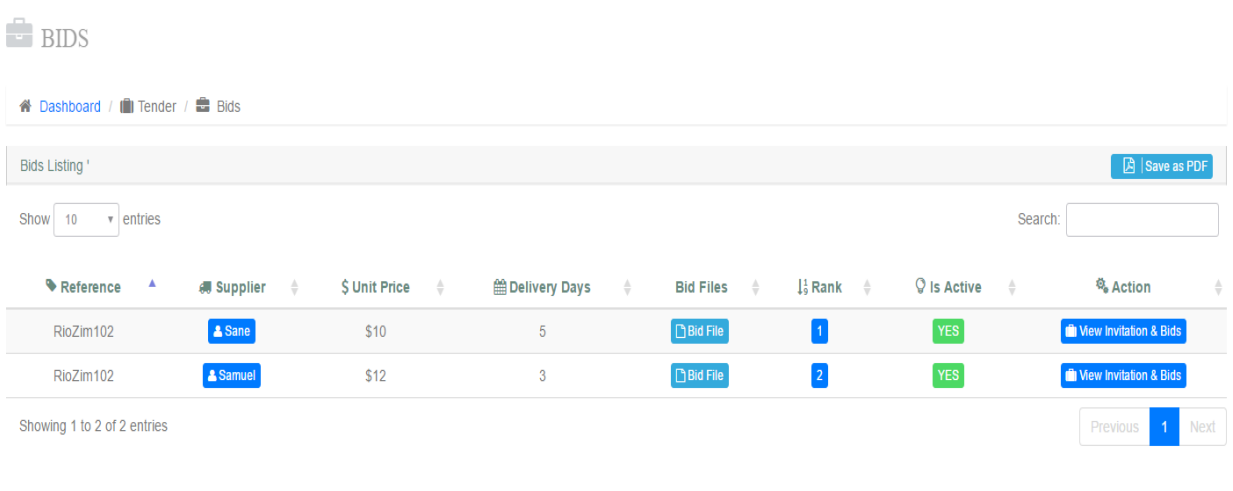


Fig 5. 12 Supplier ranking

Objective 3

Automatically updates the suppler immediately when requests have been approved or rejected

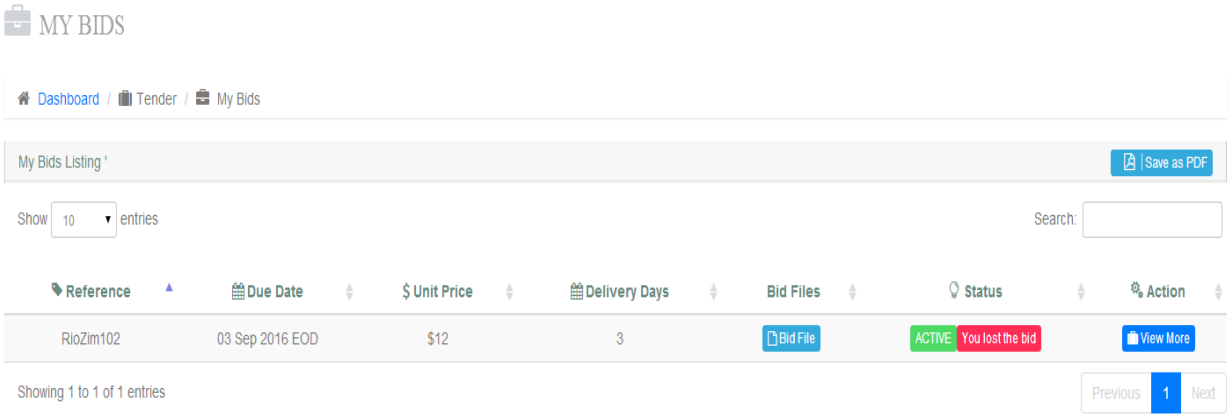


Fig 5. 13 Tender notification

Objective 4

Enforces security by allowing generation of random passwords upon account creation

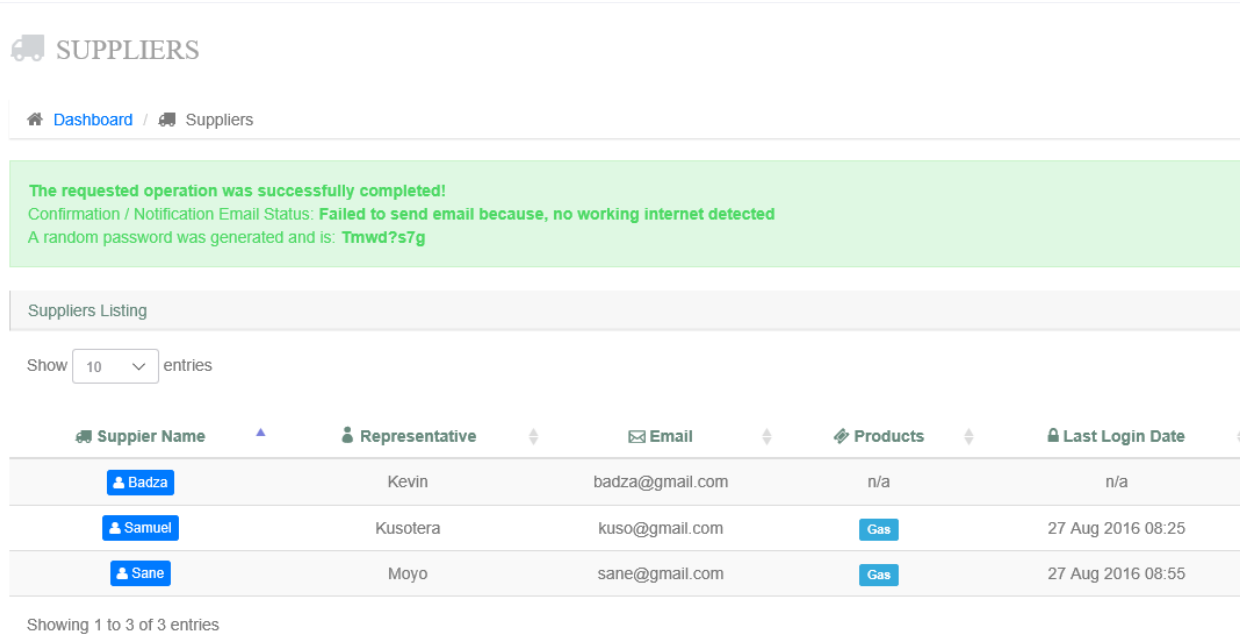


Fig 5. 14 Random password generation

Objective 5

Use of an e-mail messaging system to send invitations and receive bids from suppliers.

Fig 5. 15 Email confirmation

5.4 INSTALLATION

The process of moving from the current information system to the new one is called installation. (George et al, 2012). In the installation phase system analyst make sure end user are fully trained and decide the appropriate changeover strategy preparing to turn over the system to the users.

5.4.1 User training

According to Chang (2005 a successful information system requires training for users, managers, and IT staff members. It is important to provide the right training for the right people at the right time during the installation phase.

Valacich (2012) goes on to says training budgets are business decisions, and IT staff sometimes has to work with the resources that are available, rather than the resources they wish they had. Less expensive methods were used and these include training user manuals, printed handouts, and power point presentation. As part of training, Microsoft Power Point was used to prepare presentations with different designs. The slides designed contained actual system screen shots that were more realistic and easy to understand. On hands training was the second stage of training where by tasks are given to trainees using typical daily work.

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. After logging into the new system, results were subjected to data verification to determine whether data was accurately translated, is complete, and supports processes in the new system.

5.4.2 Changeover strategies

System changeover is the process of putting the new system into operation (Dennis et al, 2012). There are four changeover strategies that have emerged over the years which are direct changeover, phased change over, parallel changeover and pilot changeover.

5.4.2.1 Pilot changeover

Hazra (2012) states that pilot conversion is a selective implementation method. Installation of the new system is only to those departments that require the use of the system. Cost is relatively moderate since only one location runs both systems. Risk is also relatively moderate as risk of failure is reduced to the pilot site.

5.4.2.2 Direct changeover

Roberts (2001) defines direct changeover approach as a mediate changeover from the old system to the new system as soon as the new system becomes operational. It is the quickest of them although there ae risks to the orgnasation in the event that the system fails.

5.4.2.3 Phased changeover

The new system is installed in different stages. This is done while the old system is being slowly phased out (Roberts, 2001). Users can easily adjust to the new system as there is no rush in implementing it. In the extranet procurement system can be implemented in the accounts department and then the sales and stores department. The old system will be slowly eliminated until the new system is fully implemented.

5.4.2.4 Parallel changeover

This involves running the two systems together at the same time (Dennis et al 2012). This gives the users a better background and backup to refer back to if the new system fails to live up to the expected standards. Both systems work together until the project development team and the users

agree to switch over to the new system after satisfaction that the new system will run independently without complexities.

5.4.2.5 Recommended changeover strategy

After full analysis of the above changeover strategies, and also considering the system that Riozim 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 Kelly (2006), Maintenance phase involves making changes to hardware, software in order to improve the performance of the system, enhance security and correct defects. Maintenance monitors system performance, manages changes to suite user requirements and security activities. Appropriate change management procedures ensures that changes made does not disrupt or degrade a system. The type of .maintenance that will be implemented to this system will be corrective, adaptive and perfective 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 extranet 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.

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 adjudication process and determination of re-order levels as well as collaboration among users hence to stay ahead, adaptive maintenance should be implemented.

5.6 RECOMMENDATIONS FOR FURTHER DEVELOPMENT

Future developers should 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.

5.7 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.

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APPENDICES

Appendix A: User manual

Online Extranet Procurement system is the efficient methodology utilized for purchasing goods and services required for an orgnasation to stay supportable. In the event that procurement is managed effectively well it will include all organisations practices and empower the orgnasation to spare both time and cash and in addition cutting expenses. Extranet procurement system users must at first undergo at least one training exercise to be able to use the system. Web pages that are found in this system are shown below:

Home page

Upon opening Riozim website, users should click procurement link and they will be redirected to the login page.

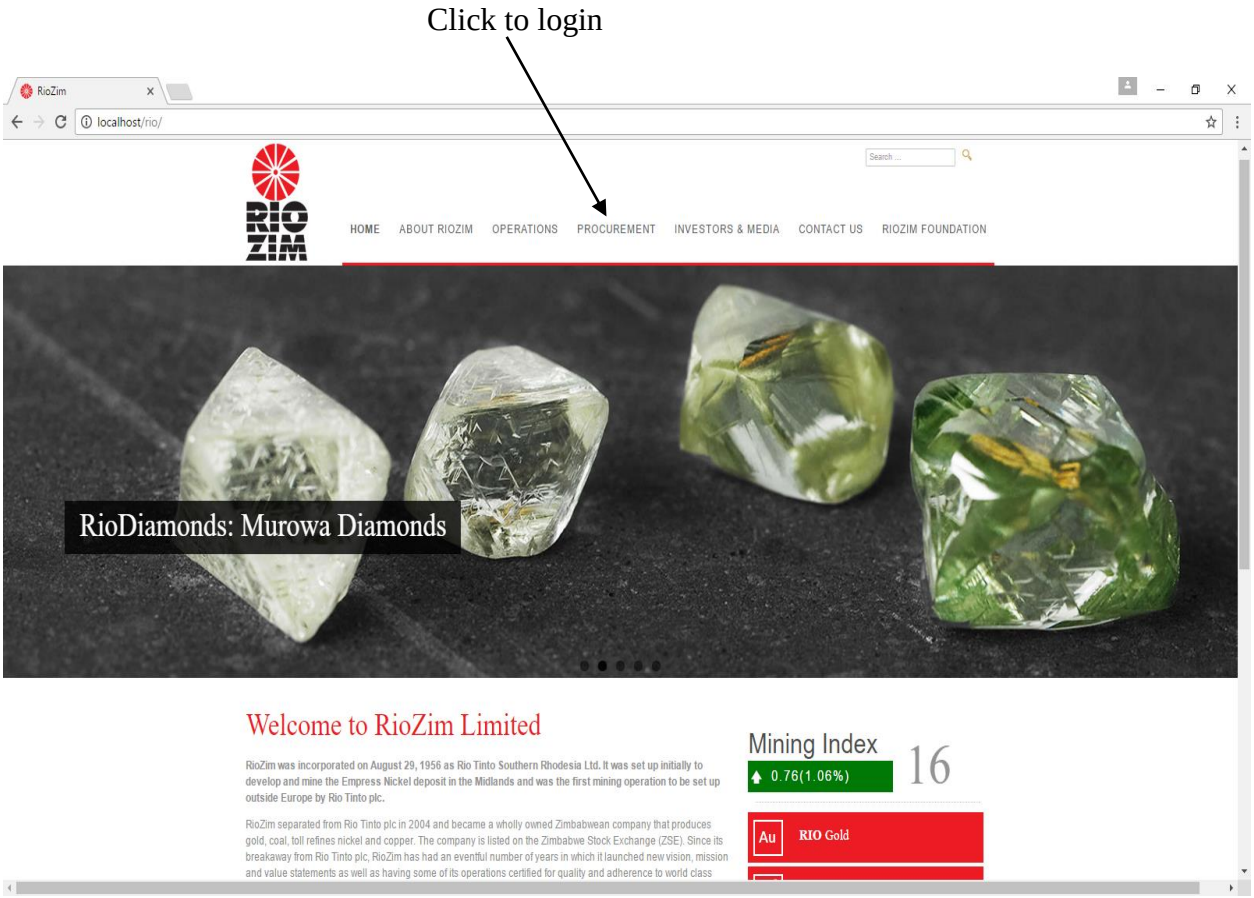

Fig A. 1 Home page

Login page

Enter email and address to login

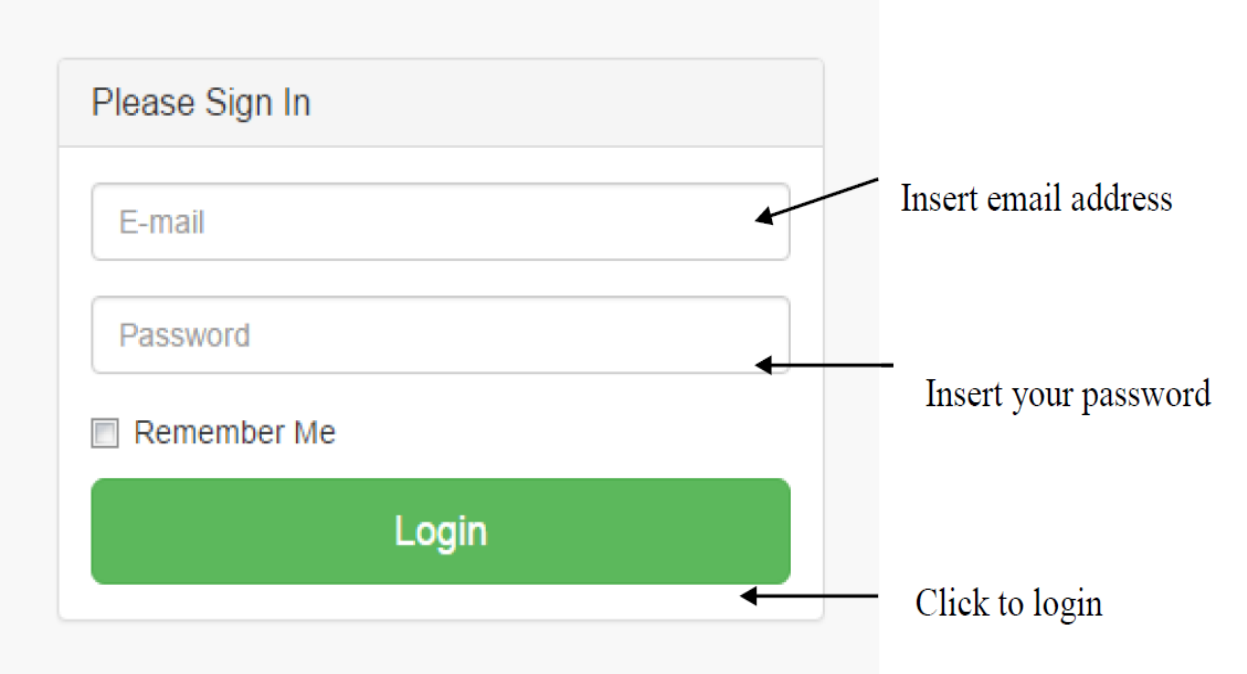

Fig A. 2 Login page

Admin page

When you logged on as an administrator you are referred to the page overleaf. The system will then allow the admin to add department, activate and deactivate department, add employees, edit employee details generate a random password for employees, activate and deactivate employees and assign roles to employees. Admin can as well add suppliers, make tender invitations provided the manager is not available.

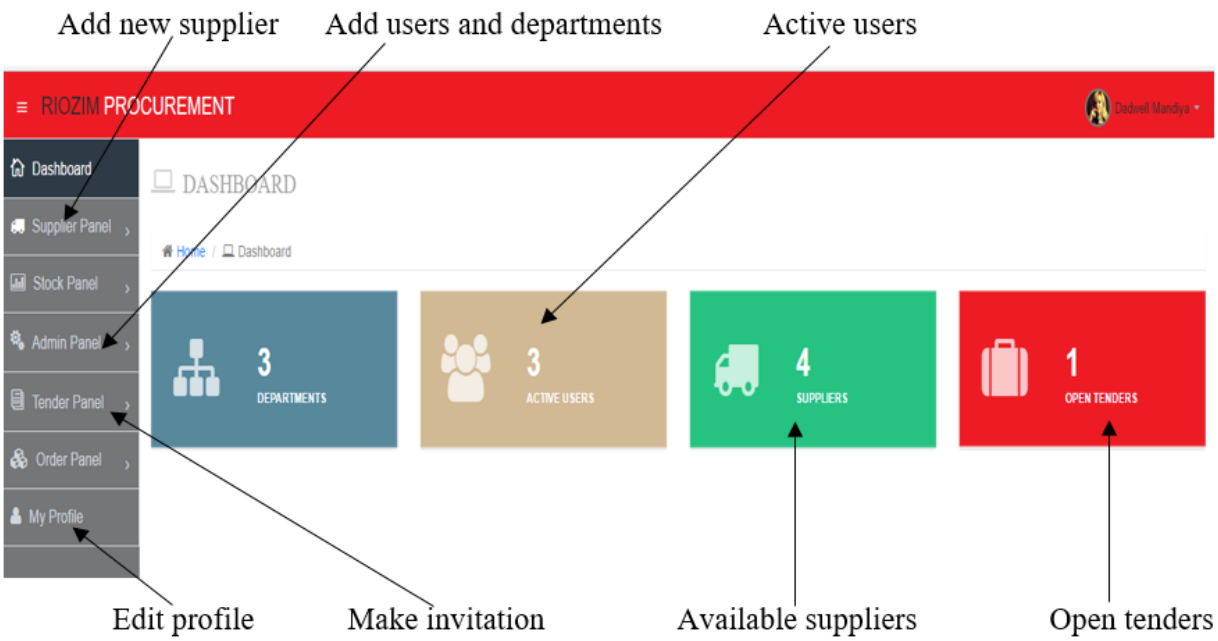

Fig A. 3 Admin page

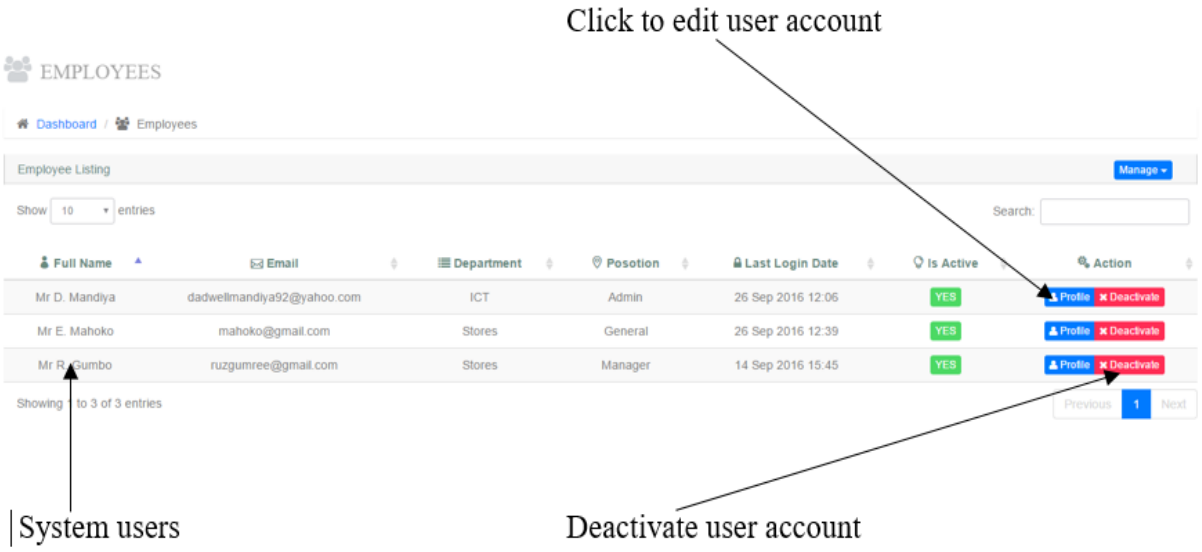

Fig A. 4 System users

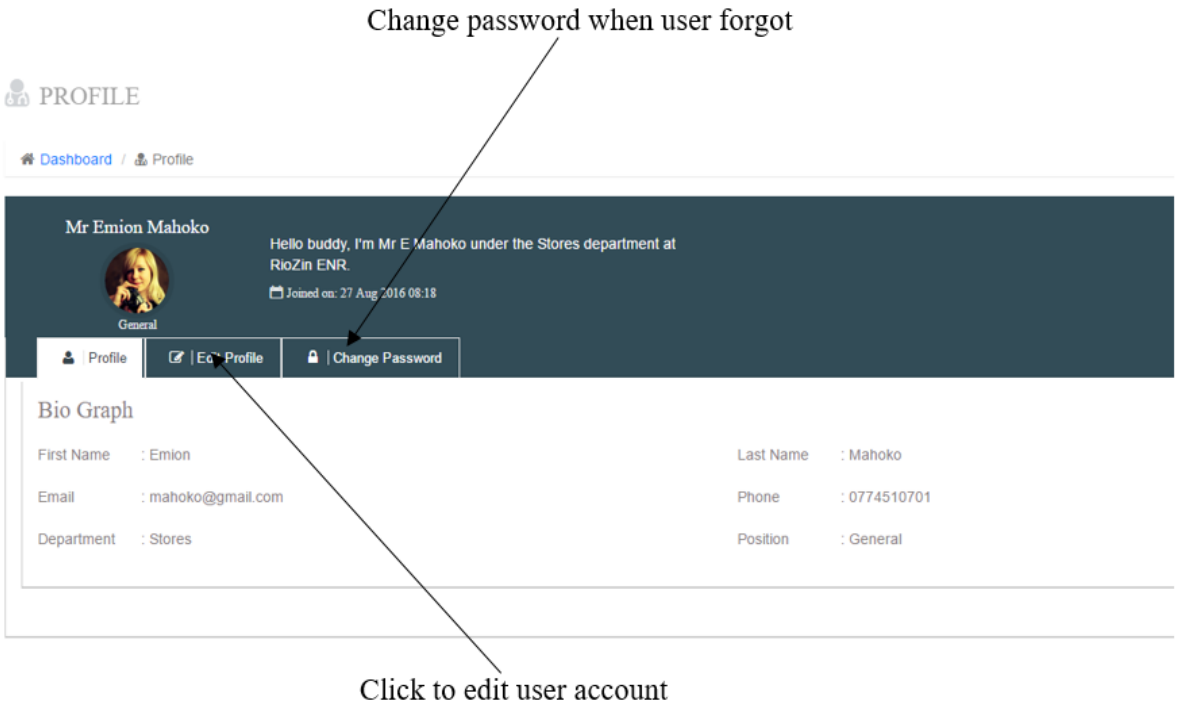

Fig A. 5 Edit user profile

Fig A. 6 System products and suppliers

Buyer page

When logged in as buyer one will be directed to the page overleaf. The buyer will be allowed by the system add products (only for the same department) activate or deactivate product, view stock history add suppliers, edit supplier details, assign products to suppliers, create tender invitations, request for item purchase as well as set buffer stock levels for the products.

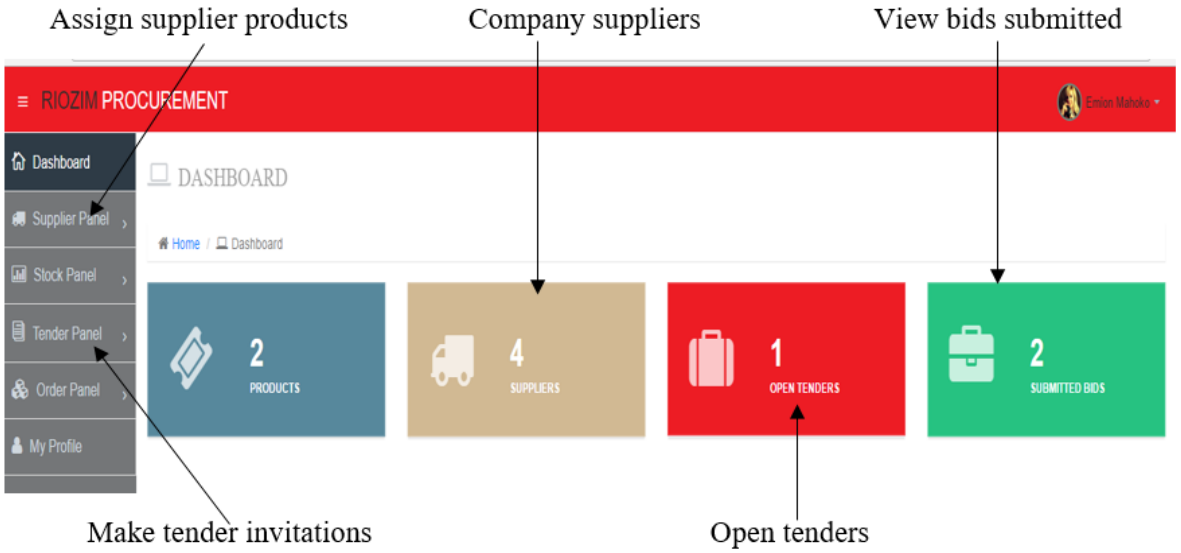

Fig A. 7 Buyer's page

Suppliers in the system must be assigned to the products that they have to supply to the orgnasation and this can be shown on the fig overleaf.

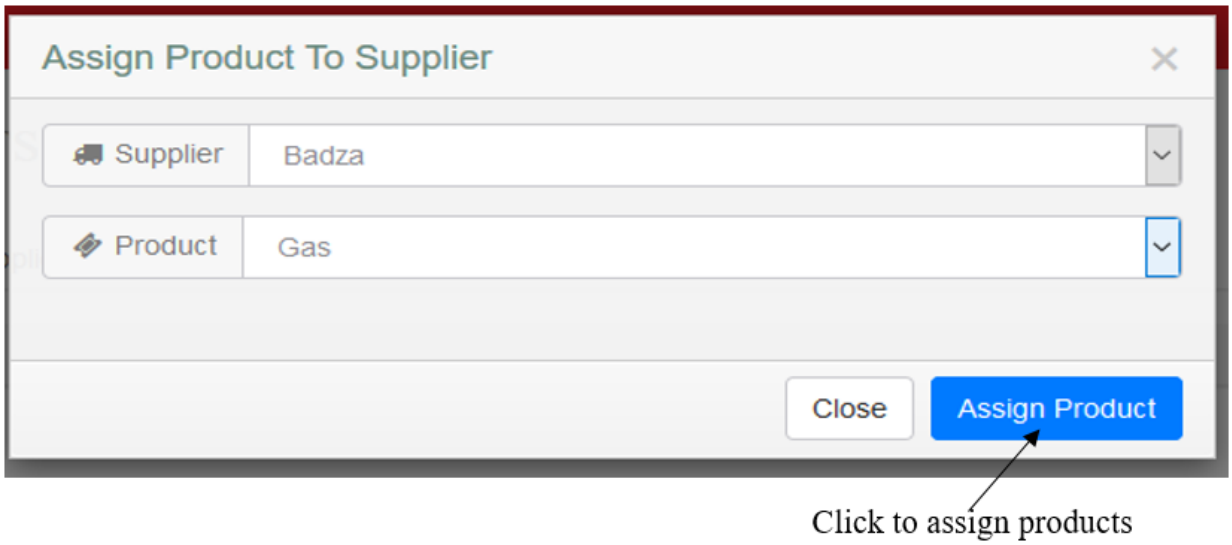

Fig A. 8 Assign supplier products

The buyer has to specify the product, quantity, due dates as well as price and delivery days score when making a tender invitation to the suppliers. Upon clicking create tender invitation all the suppliers that are attached to the selected product will see the invitation and start to bid

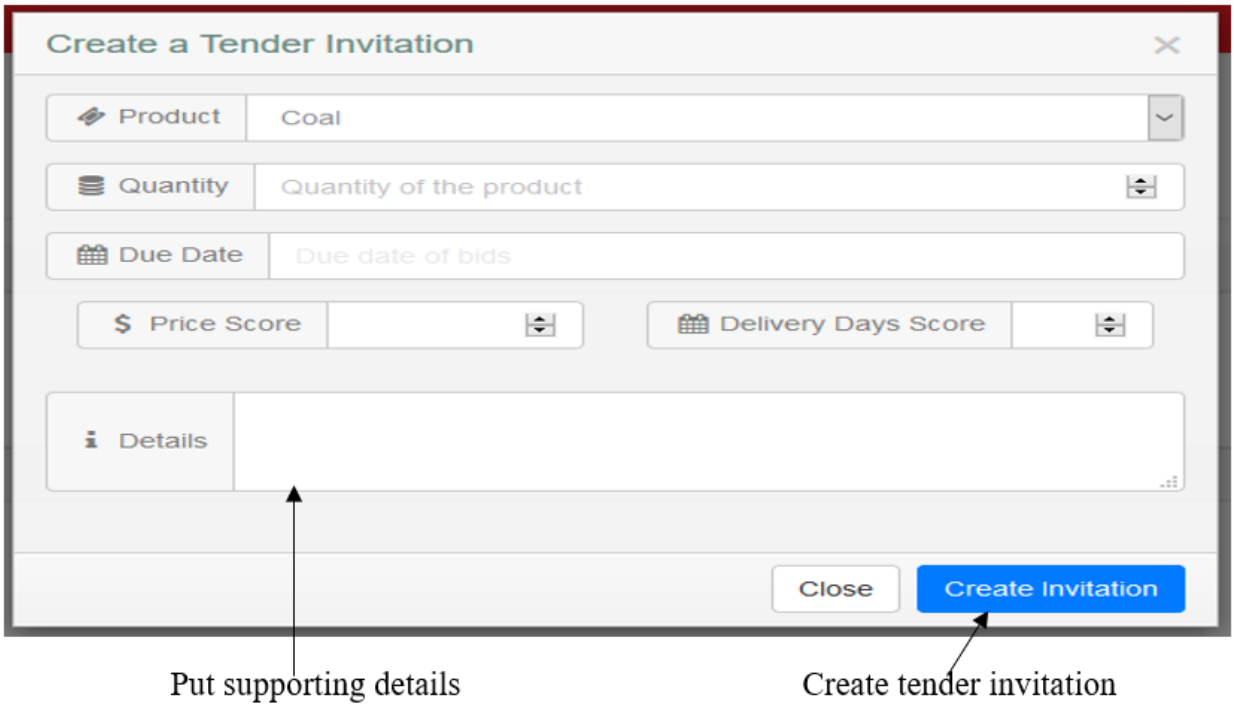

Fig A. 9 Create tender invitation

When suppliers had submitted their bids they will appear at the buyer's page showing the adjudication process that is the selected supplier as shown below and the buyer will then request for purchase of an item which will then be approved by the procurement manager

Fig A. 10 Supplier ranking

Fig A. 11 Request for purchase approval

Supplier page

Upon logging on the supplier will see the interface below in order to perform functionalities like viewing open tender invitation (Only for products that the supplier has been assigned), submit tender bid for the above invitations as well as process purchase order only if the supplier have won the tender invitation

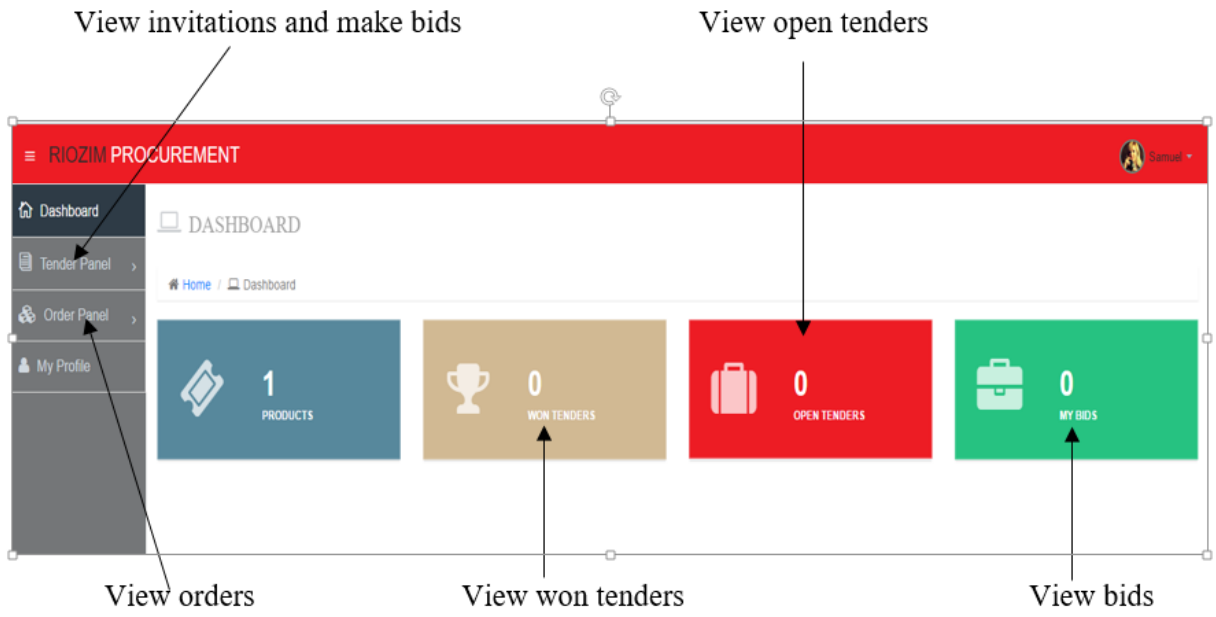

Fig A. 12 Supplier page

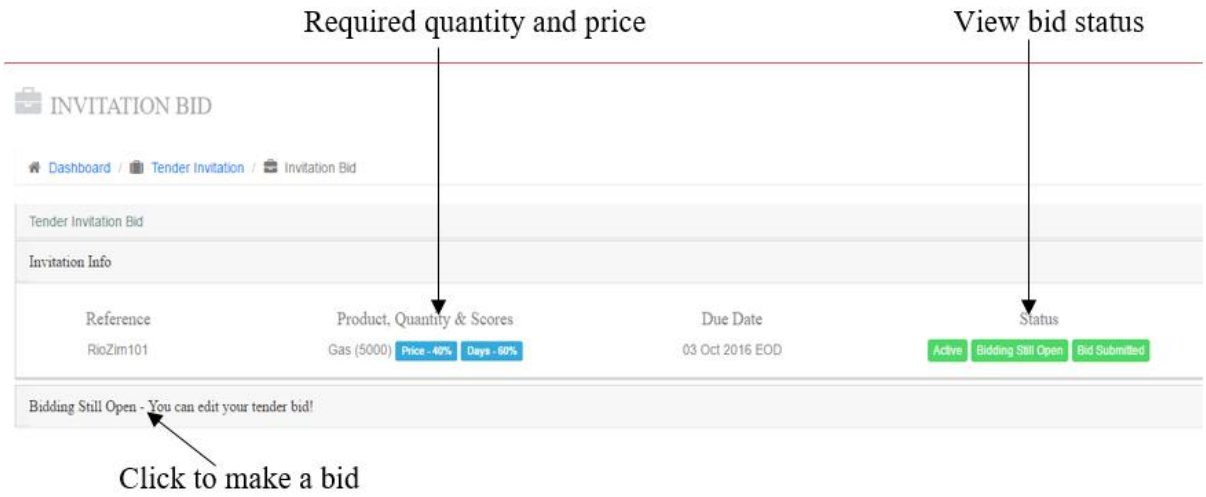

Fig A. 13 Invitation details

Upon making a bid the supplier is supposed to specify clearly the expected delivery dates as well as price per unit as among the bid files.

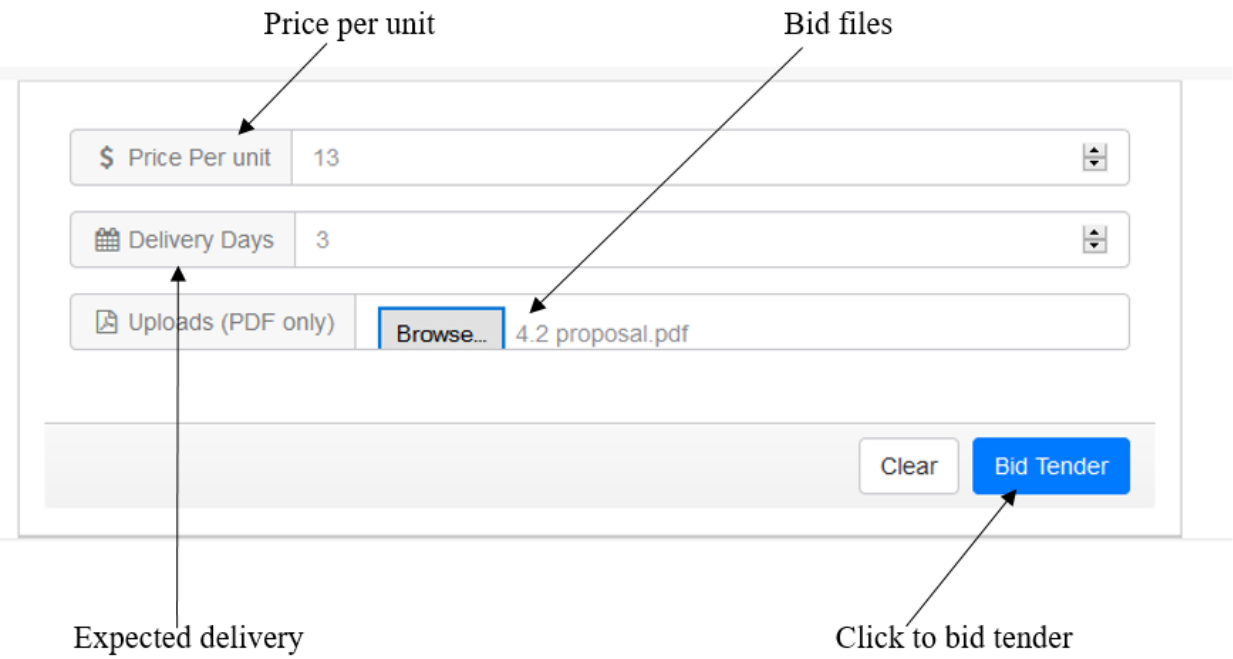

Fig A. 14 Send tender bid

The system will rank the supplier bids based on historical evidence then select one on the bases of lead time and price. The selected will receive a notification to deliver goods after the manger had approve the purchase request.

Fig A. 15 Bids notification message

Manager's page

Upon logging on the manager will be redirected to a page that allows him or her to add products (only for the same department) activate or deactivate product, view stock history add suppliers, edit supplier details, assign products to suppliers, create tender invitations, approve purchase requests, activate and deactivate purchase order (only if the supplier have not started processing the order). The manager can as well add employees into the system provided that the admin might not be available. All the manager functionalities will be shown on the fig overleaf.

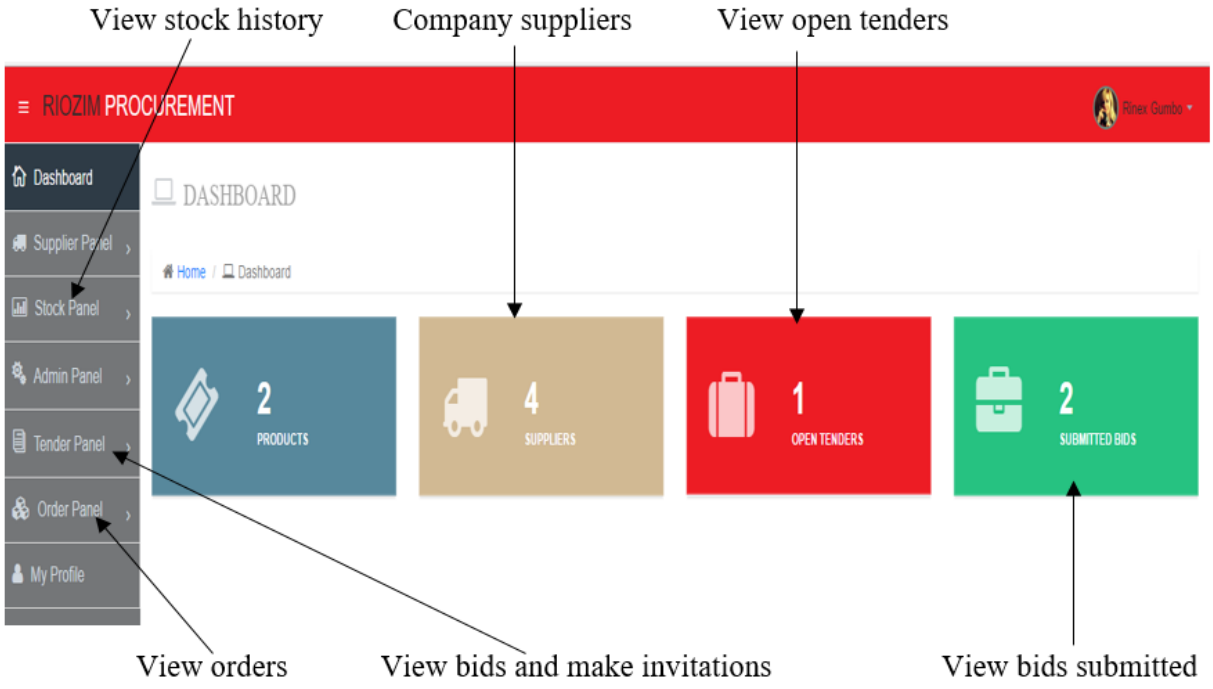

Fig A. 16 Manager's page

The manager has to approve the purchase on an item after the system has done the systematic adjudication and the buyer had requested for approval.

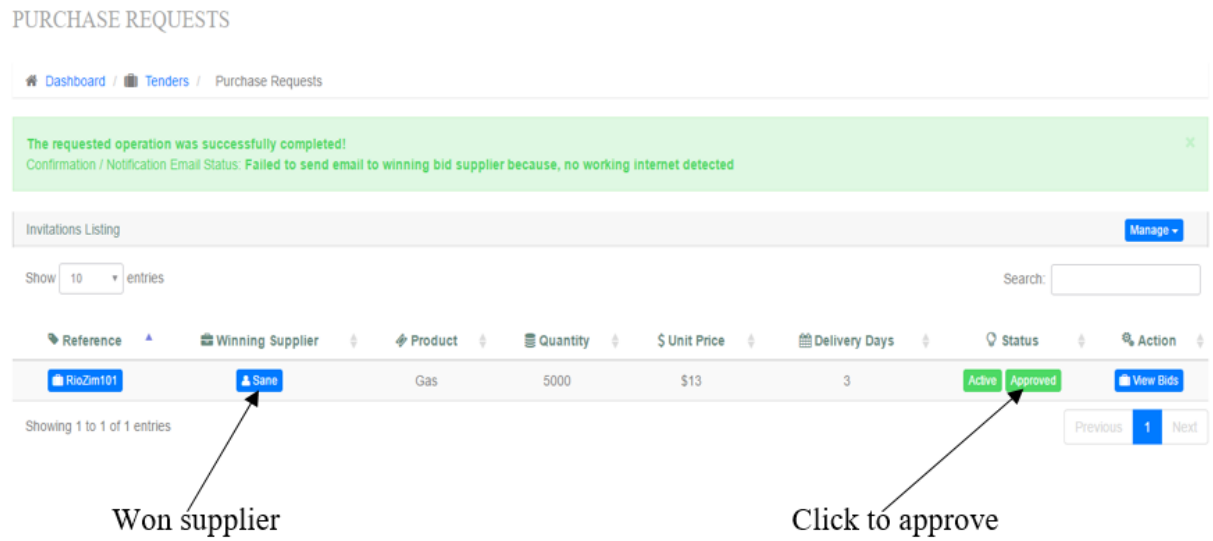

Fig A. 17 Approve purchase

The buyer add set buyer levels for the products in the system so as to avoid late ordering that might hinder production.

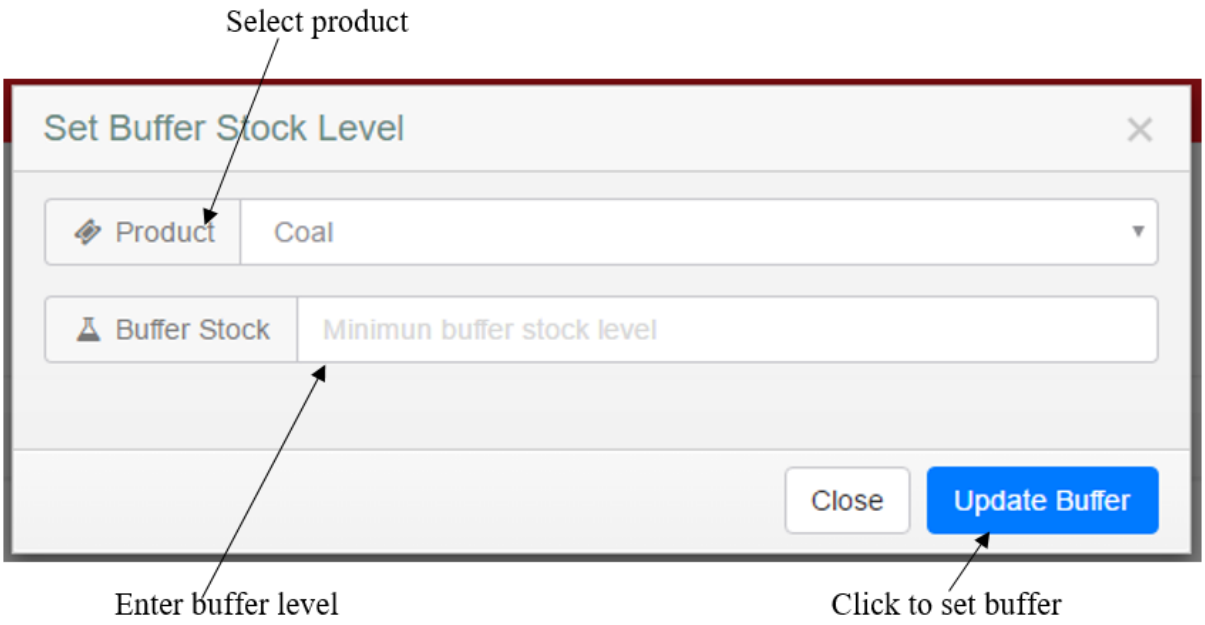

Fig A. 18 Set buffer level

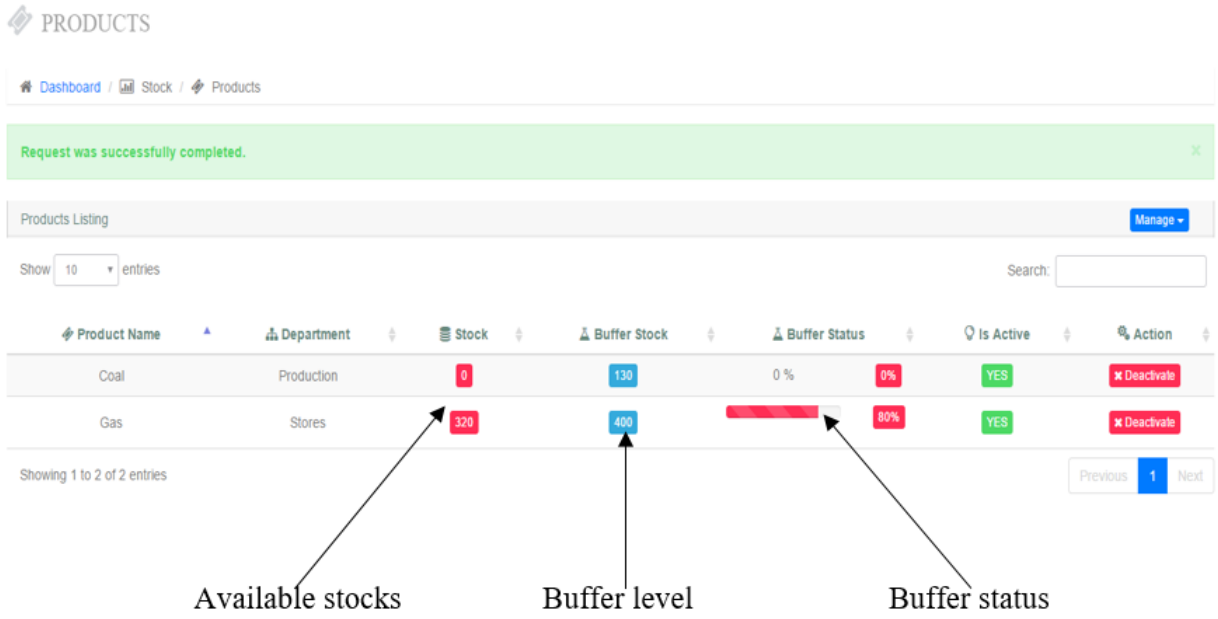

Fig A. 19 Buffer status

Appendix B: Questionnaire

My name is Dadwell, Mandiya. I'm studying BSc Information Systems degree (Hons) at Midlands State University. I'm doing a computer 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.

Please tick where appropriate and fill in spaces provided

Occupation……..

1. How would you rate the current system?
   Poor ☐ Moderate ☐ Good ☐
2. Are you satisfied with the current system?
   Yes ☐ No ☐
3. Would you opt for an extranet procurement system if considered as a candidate from migrating from the current system?
   Yes ☐ No ☐

If No, what might be the reason …….....

4. Are there any challenges with the current system?
   Cost ☐ Time ☐ Security ☐

Other (please specify)……...

……..

Recommendations ……...

……..

Date:……/……/……...2016

Interviewer ……

Interviewee…….

Appendix C: Observation guide schedule

DATE ..... OBSERVER .....

TIME ..... DEPARTMENT .....

OBSERVATION

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CONCLUSION

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STAMP

Appendix D: Interview script

Extranet procurement system

Interview script for management

My name is Dadwell Mandiya. I'm studying BSc Information Systems degree (Hons) at Midlands State University. I'm doing a computer project (name mentioned above) which requires a detailed study of the user requirements of the system. So this interview 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 interview**.**

1. What system do you use to carry out procurement process?

……

2. Can you give a description of how it works?

……

……

……

3. How do you take an idea of bringing a new procurement system?

……

……

4. What features would you expect to be incorporated in the proposed system?

……

……

……

……

5. What problems do you expect the proposed system to solve and, if you may, be specific?

……

……

……

Interview script for operation staff

1. Can you give an outline of the operation that you perform?

……

……

2. Where is the information stored pertaining to:
   i. Supplier complaints and suggestions?

……

   ii. Orders?

……

   iii. Stock received?

……

3. How effective is the manual adjudication when selecting the appropriate supplier?

……

4. Do you think you are doing your tasks effectively and efficiently using your current system? If not, why?

……

……

5. What do you think about introducing extranet procurement system?

……

6. If a system has to be put in place what do you expect of the system?

……

……

……

Appendix E: Letter of approval to conduct research

January 28, 2016

The chairman

Midlands State University

Department of information systems and computer science

P Bag 9055

Gweru

Dear Sir/ Madam

It is my understanding that Dadwell Mandiya will be conducting a research study at RioZim ENR Pvt Limited on “ENR Extranet Procurement System”. The Student has informed me of the design of the study as well as the targeted population and access required from RioZim network. The project will help RioZim to automate the entire procurement system.

I support this effort and will provide any assistance necessary for the successful implementation of this project. If you have any questions, please do not hesitate to call. I can be reached at +263 774101282.

Sincerely,

RioZim ENR

Senior IT Officer

Tapiwanashe Machaya

Appendix F: Snippet of code

User login

```
<?php
   //Start the session
   session_start();

   //Auto Loading all the required classes
   spl_autoload_register(function ($class_name) {
      require_once 'includes/' . $class_name . '.php';
   });

   // Redirect the user if he is logged in
   if (isset($_SESSION['userInfo']['email']) && isset($_SESSION['userInfo']['userId'])) {
        //Check if the user was redirected to login to access a certain web page
        $nextUrl = (isset($_SESSION['nextUrl']) && !empty($_SESSION['nextUrl']))
        ? $_SESSION['nextUrl'] : 'dashboard.php' ;

        $location = "Location: " . $nextUrl;

        unset($_SESSION['nextUrl']);

        //Redirect to the next page
        header($location);
   }

   //The temp variable to store login result
   $loginResult = '';

   //Process a login request
   if (isset($_POST['submit'])) {
      $email = Helper::cleanData($_POST['email']); ;
      $password = md5(Helper::cleanData($_POST['password']));

      //Creating an object for authentication
      $authenticate = new Authentication();

      //Authenticating the user
      $loginResult = $authenticate->loginUser($email, $password);
```

```
    if(is_bool($loginResult) && $loginResult == true){
      //Check if the user was redirected to login to access a certain web page
      $nextUrl = (isset($_SESSION['nextUrl']) && !empty($_SESSION['nextUrl']))
      ? $_SESSION['nextUrl'] : 'dashboard.php' ;
      $location = "Location: " . $nextUrl;

      unset($_SESSION['nextUrl']);

      //Redirect to the next page
      header($location);
    }
  }
?>
        <?php
          if (is_bool($loginResult) && $loginResult == false) {
            echo '
              <div class="alert alert-block alert-danger fade in">
                  <h4 class="alert-heading text-center">Login Failed!</h4>
                    <p class="text-center">Invalid Username or Password. . .  </p>
              </div>
            ';
          } elseif (isset($_SESSION['unauthentic'])) {
            echo '
              <div class="alert alert-danger">
                 <h4 class="alert-heading text-center">Access Denied!</h4>
                  <p class="text-center">Login to access the resourse . . .</p>
              </div>
            ';
            unset($_SESSION['unauthentic']);
          } else{
            echo '
              <p class="login-img"><i class="icon_lock_alt"></i></p>
            ';
          }
        ?>
```

Invitation bid

```
<?php
                        echo $_SESSION['invitationDetails']['reference'];
                      ?>
                    </div>
                    <div class='col-lg-3'>
                      <h4>Product, Quantity & Scores</h4>
                      <?php
                        //Get product details
                        $productDetails = $products->getProductDetails($_SESSION['invitationDetails']['productId']);
                        $name = '';

                        //Getting the product name if productDetails is an array else assign the returned error
                        if (is_array($productDetails)) {
                          $name = $productDetails['name'];
                        } else $name = $productDetails;

                        //Get the score display html
                        $scoreDisplay = " <span class='label btn btn-social btn-info btn-xs'>Price - " . $_SESSION['invitationDetails']['priceScore'] . "%</span>";
                        $scoreDisplay .= " <span class='label btn btn-social btn-info btn-xs'>Days - " . $_SESSION['invitationDetails']['deliveryDaysScore'] . "%</span>";

                        echo $name . ' (' . $_SESSION['invitationDetails']['quantity'] .') ' . $scoreDisplay ;
                      ?>
                    </div>
                    <div class='col-lg-2'>
                      <h4>Due Date</h4>
                      <?php
                        echo Helper::getCustomDate($_SESSION['invitationDetails']['dueDate']) . ' EOD';
                      ?>
                    </div>
                    <div class='col-lg-2'>
                      <h4>Bids Submitted</h4>
                      <?php
```

```
                    echo (count($invitationList) <= 0)
                        ? "<span class='btn btn-social btn-danger btn-xs'>" . count($invitationList)
."</span> "
                        : "<span class='btn btn-social btn-primary btn-xs'>" .
count($invitationList) ."</span> ";
                    ?>
                  </div>
                  <div class='col-lg-3'>
                    <h4>Status</h4>
                    <?php
                      //Active status display
                      echo ($_SESSION['invitationDetails']['activeStatus'] == '1')
                        ? "<span class='btn btn-social btn-success btn-xs'>Active</span> "
                        : "<span class='btn btn-social btn-danger btn-xs'>Not Active</span> ";

                      //Tender still open or closed display
                      $currentDate = strtotime('now');
                      $closingDate = strtotime($_SESSION['invitationDetails']['dueDate']);

                      //Get the tender winner
                      $tenderWinner = 'n/a';
                      $tenderBidRanks                    =                    $tenders-
>getBidRanks($_SESSION['invitationDetails']['invitationId']);
                      if (count($tenderBidRanks) > 0) {
                        $supplierId = $tenderBidRanks[0]['supplierId'];
                        $supplierDetails = $suppliers->getSupplierDetails($supplierId);
                        $tenderWinner = (is_array($supplierDetails)) ? $supplierDetails['name'] :
$supplierDetails;
                      }

                      if ($currentDate <= $closingDate){
                        echo "<span class='btn btn-social btn-success btn-xs'>Bidding Still
Open</span> ";
                      } else {
                        echo "<span class='btn btn-social btn-danger btn-xs'>Bidding
Closed</span> ";
                        echo " <span class='btn btn-social btn-info btn-xs'>Tender Winner: " .
$tenderWinner . "</span> ";
                      }
                    ?>
```

Purchase request

```
<?php
        //Include the required files
        include_once 'includes/phpHeader.php';
        include_once 'includes/Tenders.php';
        include_once 'includes/Purchases.php';
        include_once 'includes/PurchaseRequest.php';

        //Only Admin and manage are allowed to view this page
    Authentication::AdminStoresStaffAccessOnly();

    #Getting the assert id from the URL and redirecting back on invalid parameters
    if (isset($_GET['ai']) && isset($_GET['no'])) {
                $invitationId = Helper::cleanData(substr($_GET['ai'], 5));
                $requestedBy = Authentication::getUserId();
                $tenders = new Tenders();
                $bidRanks = $tenders->getBidRanks($invitationId);
                $bidId = " ;

                if (is_array($bidRanks) && count($bidRanks) > 0) {
                    $bidId = $bidRanks[0]['bidId'];
                } else {
                    $_SESSION['requestResult'] = 'Invalid Request or no winning bid found for the
tender';
                    $url = 'Location: tender-invitations.php';
                        header($url);
                        exit;
                }

                            $purchases = new Purchases();
                            $request = new PurchaseRequest('', $invitationId, $bidId, $requestedBy);
                            $_SESSION['requestResult']                =                $purchases-
>savePurchaseRequest($request);
        } else {
            $_SESSION['requestResult'] = 'Invalid Request';
        }

        $url = 'Location: tender-invitations.php';
        header($url);
```

?>

Approve request

```
<?php
        //Include the required files
        require_once 'includes/phpHeader.php';
        require_once 'includes/Purchases.php';
        require_once 'includes/PurchaseOrder.php';

        //Only Admin and stores manager are allowed to view this page
    Authentication::AdminStoresManagerAccessOnly();

    #Getting the assert name from the URL and redirecting back on invalid parameters
    if (isset($_GET['ai']) && isset($_GET['no']) && isset($_GET['q'])) {
                $requestId = Helper::cleanData(substr($_GET['ai'], 5));
                $invitationId = Helper::cleanData(substr($_GET['q'], 26));
                $submittedBy = Authentication::getUserId();
                $request_type = Helper::cleanData(substr($_GET['no'], 0, 1));
                $supplierId = Helper::cleanData(substr($_GET['no'], 15));

                        $purchases = new Purchases();
                        $result = $purchases->approveRequest($requestId, $request_type,
$submittedBy);

                        if ($request_type == 1 && $result == true) {
                                $order = new PurchaseOrder('', $requestId, $invitationId,
$supplierId);
                                $_SESSION['requestResult'] = $purchases-
>savePurchaseOrder($order);
                        } else $_SESSION['requestResult'] = $result;
                } else {
        $_SESSION['requestResult'] = 'Invalid Request';
      }

      $url = 'Location: purchase-requests.php';
      header($url);
?>
```