PUBLIC ONLINE PROCUREMENT SYSTEM

By

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Submitted in partial fulfilment for the degree of

BSC (HONS) INFORMATION SYSTEMS

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Gweru, Zimbabwe

June 2018

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CHAPTER 1

INTRODUCTION

1.1. Introduction

The procurement of goods and services has been at the heart of many organizations as they procure to allow for work to run smoothly. This Chapter lays the foundation for the research that was undertaken to create a Online Public Procurement System. It spells out briefly the stimuli that triggered off this research. The target organization which is the Sanyati District will be examined, its background, organisational structure, vision, mission and method of operation in relationship to procurement will be given. The current challenges bedeviling the system are identified and objectives which meet the specified aim are crafted. Instruments and methods being employed to solve the problem at hand are described. They specify the planning, data collection procedures, design and development of the system and its implementation. The reasons behind the carrying out of this research will be given including the benefits of this research on on-going operations within the district.

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1.2. Background of the Study

The Parliament of Zimbabwe introduced the Public Procurement and Disposal of Public Assets Act [Chapter 22:23] in 2017 to allow for the purchase of goods by government entities and departments. The issue was to centralize the procurement and tendering procedures. There are tendering rules and regulations which require strict monitoring and evaluation and hence the need for a new electronic system. The boarding schools within the District have challenges when it comes to procurement, resulting in them being short-changed. Procurement processes has been dogged by many inconsistencies in-so-far as buying of goods and services is concerned. The need to increase efficiency, effectiveness and provide transparency as enshrined in the Act is the major target of this research.

1.2.1. Background of the Organisation

The Sanyati District Education Public Procurement system is a software application designed for the District's schools to convert the current manual procurement of goods and services as

organizations travel to suppliers, get quotations and make purchases. The system will make it possible for schools to contact suppliers using a supplied database of verified and certified suppliers

This study is going to be conducted in Sanyati District Education is situated in Mashonaland West Province. It derives its modus operandi from the Regional Offices and Head offices. Sanyati District is made up of primary and secondary co-educational schools which cater for pupils aged between 4 – 19 years that is from kindergarten to Advanced Level. The schools are both public, council and private owned. They vary in terms of fees, enrolment, subjects offered, infrastructure and facilities available. There are four boarding schools namely Sir John Kennedy Primary, Ultimate College, Jameson High School and Sanyati Baptist. Each of the schools carries out purchasing functions in order for it to be able to meet organizational objectives. Every school gets income from tuition and levy fees which are approved by Provincial accountants. The total enrolment for the District gets up to 19000 pupils. From the huge numbers, it is evident that the level of service provision is high and suppliers through bursars are fighting to gain entry into the schools to provide goods and services.

1.2.2 Organizational Structure

An organizational structures depict hierarchy and show clearly communication lines that do exist within organizations. Hunter III (2015:1) describes it as a, hierarchical pattern of authority relationships that varies along key and measurable structural dimensions such as centralization, formalization, vertical and horizontal differentiation, span of control, and specialization. The reporting structure states who reports to who, showing subordinates and managers are also shown. *It clearly points out the correlations that exist amongst management and employees in a nutshell. The o*rganogram on next page shows the Sanyati District Education department.

Figure 1.0. Organizational structure
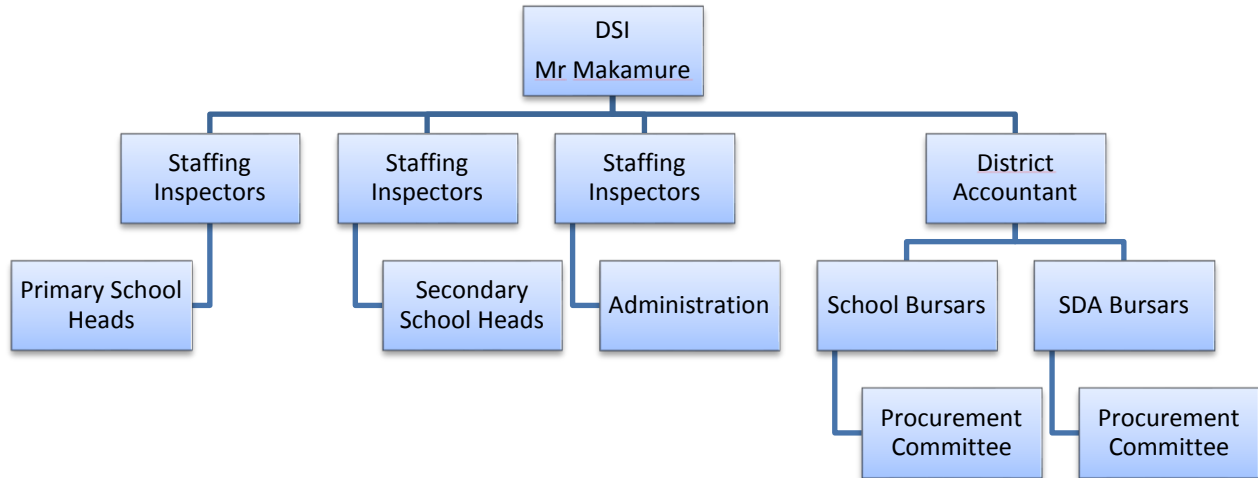
Adapted from Sanyati District Organisational Chart

1.2.3. Vision

Basically a vision for an organization is a preferred futuristic state which an organization deems ideal. Taiwo et al (2016) state that a vision explains the desired future and levels it seeks to attain for a company. It becomes a roadmap which motivates, drives and inspires employees. They further explain that a well crafted vision prepares a company for changes, innovation whilst factoring in internal and external environments. It separates one organization from another. Thus the vision for Sanyati District is, "to be the lead provider of inclusive quality education, for socio –economic transformation by 2020."

1.2.4. Mission Statement

Processes and functions of an organization are defined in one statement called the mission statement. Taiwo et al (2016:128) describe a mission statement as explaining, "…what organizations want to be and whom they serve?". The core existence of a business entity is summarized in the mission statement. The mission of the District is, "to provide equitable,

inclusive, quality, relevant and competent – driven infant, junior and non-formal education in the District."

1.3. Problem Definition

Problem definition is about explicitly identifying the actual problem. The website https://education.nova.edu specifies that a problem should be an area of concern which at times maybe controversial. It identifies where the organization should and where it currently is. This provides a gap for the researcher to exploit and explore. Problem definition should not be ambiguous and also it must warrant researching. The system is analysed, flow of data examined, flaws identified and conditions of the current system noted so that a zeroing in on problems can be done. The industrial attachment provided an insight into how material and equipment is bought. This was a tedious process with red tape bureaucracies that result in slow acquisition of materials, acquisition of low quality supplies from sources which are not credible.

To purchase any product, the cycle begins with a requisition document which is issued at departmental level. This is a request for procurement of goods/ services. The requests are brought before a procurement committee chaired in every school by the Deputy Head, in the presence of the Government bursar and SDC bursar. The bursar checks in departmental folios if there are sufficient funds and then gives a green light. The green light gives a department an opportunity to source for quotations from various suppliers. Departmental personnel most of the times travels to solicit for quotes from local and outside companies. A departmental meeting is held upraising departmental members of the approved purchase requisitions. The system is decentralised according to departments and they request for at least three quotations. A comparative schedule is prepared from supplied quotes which states the supplier taken for that product and reasons for taking the supplier. These reasons can vary from sole supplier, cheapest, credible and so forth. The bursars do not verify the quotes neither question reasons for selection but simply give an process an order. An official order is given to the supplier and they are then able to send the goods together with a delivery note. This delivery note and the goods are checked for consistency and functionality. This is when a transfer or payment is made through the bank. On receiving payment, supplier then issues a receipt for the subsequent payment.

Analysing the scenario above it is clear that:

- ❖ Supply of goods and services is delayed owing to a long process where people go back and forth.
- ❖ The current system can be abused by officers at any institution as it lacks confirmations and verifications. Greasing and back hand deals may take place to be able to win a certain contract.
- ❖ Procurement meetings are time consuming and tiresome as some products are required as a result of repair and maintenance and cannot be ordered before they malfunction.
- ❖ Departments go through a long and tedious process when procuring goods and services.
- ❖ Too much paperwork is involved.

1.4. Aim

The aim of the project is to develop a centralized, transparent online procurement system for Sanyati District.

1.5 Objectives of the study

- • Reduce and avoid the cost of purchasing by 15% and introduce cost saving measures at purchasing within a period of two years.
- • Register and deregister suppliers within the District within 1 week of submission of adequate documents.
- • Monitor stock levels and alert management real timely when a product has reached reorder level.
- • Allow procurement teams approve tenders within 48 hours of the closure of the tender
- • Provide transparency, efficiency and effectiveness in the procurement and approval processes when adhoc reports are required.
- • Foster competition and prevent abuse of market power by dominant operators.

1.6 Instruments and Methods

Four stages will be used in order to accomplish this project from start to finish.

Initial planning was done which involved a submission of the project proposal. The approved project proposal was used to analyse the current system through the use of various data collection procedures. This was done in a bid to actually ascertain if the problem(s) do actually exist. Several studies on feasibleness were also conducted to find out whether the system will be

successfully implemented. An analysis of requirements of the system and data needs was done which resulted in the design and development of the new system using PHP and MySQL. The new system was tested, implemented and documented.

Research methodology as described by Babbie (2016) is an analysis of fields of study using systematic means. The website http://libguides.usc.edu states that methodology is about the procedures, "taken to investigate a research problem and the rationale for the application of specific procedures or techniques used to identify, select, process, and analyze information applied to understanding the problem". In this project, qualitative and quantitative methods were employed so that actual problems are examined. Thus a deeper understanding of the subject at hand is given.

Etikan et al (2016) describe a population as the quantity or total amount of people contained within a research. The population for this research is three hundred (300). The population consists of Sanyati District Education heads of schools, current bursars and teachers. Questionnaires will be handed out to bursars and heads of departments simply because of the large numbers that are involved and the ease of administration associated with the instrument. Observation on procedures that are used during procurement will be done as well so that day to day operations can be examined at first hand.

Sampling is a method that is used to choose elements or people from a field of study, Etikan et al (2016). A number of participants are required in order to support this study. The sample population size is about forty (40) people. Random sampling will be used for selecting suppliers and non-random or purposive sampling will be used to select bursars and heads of schools. Purposive sampling is used so that a population that exhibits desired characteristics is picked and can provide adequate answers according to Etikan (2016).

Initially, observations, secondly questionnaires and finally interviews were used to collect data. These three methods augmented each other to progressively provide pertinent information from the data gathering process. Not all instruments mentioned were used on all respondents given the limited time and expenses that are involved with interviews especially. Thus interviews were conducted on a six heads of schools and bursars. Bursars and teachers were also given questionnaires.

Questionnaires

Data collection required respondents to filling in information. Questionnaires used appropriately gave respondents flexibility in terms of filling in time, lack of intimidation on subjects. The researcher was able to cover widely the population. Questionnaires consisted of structured questions with check boxes and semi structured questions with open ended questions that required respondents to move out of the box and contribute openly. Questionnaires allowed the researcher to reach out to as many people as possible within a short period of time. Abawi (2013) describes them as a prelude to interview.

Interviews

An interview as an instrument has oral questions whose format maybe structured on not structured. Abawi (2013) states that interviews are able to solicit oral responses from respondents during a session. There was direct and personal contact between the interviewer and interviewee. Interviews could not be administered to the whole population but to a selected sample of the target population. Much time was spent during one interview, approximately 20 minutes. Interviews were costly in terms of materials for gathering data and travelling and time costs. However, they were essential in providing both parties the opportunity to probe further when they have not understood. As answers were given by respondents, they are jotted down for further summarisation and categorization of these answers and to assist the researcher in condensing the information to a required format.

Observation

During observations, personnel was watched from a distance. This provided the researcher a natural setting so that the existing system can be examined and system flows and flaws can be identified. The processes and procedures that are used within the organization could be seen from first-hand experience. People under observations were not aware that they were being observed. Observations if done properly do not mislead the researcher. Rajasekar et al. (2013) adds that interactional patterns within the employees can be determined. Observations had a challenge in that they consumed a lot of time as the researcher has to be present to conduct them and also wait for incidences to record required patience.

Feasibility analysis

Edwards and Holland (2013) describes feasibility as a degree to which a given project can be executed to completion. There are internal and external factors that affect a project's feasibility. Feasibility is like the skeleton or the frame to which we base the project at hand. The success of the project is hinged on the feasibility study done. When done, a report is produced that spells out important information for shareholders and stakeholders. A make or break decision is mainly done after the report has been produced. Feasibility studies should have minimum bias as any bias could impact on the organization negatively.

Technical Feasibility

The researcher has the technical know-how and experience to competently design and develop the required system. Programming in PHP possible and a website can be hosted at cost-effective prices. The hardware needed to load programs and run the system is available from local shops and does not require importing. The project can be fully implemented successfully.

Operational – user friendliness of system

When a company moves from a manual system, the new system should provide ease of use, perceived benefits and also ease of maintenance. A new system should not be seen to complicate the working environment but to solve current problems and provide a once off solution. The new system should be able to cut on time taken for processing a purchase. From the log in screen to the log out facility, users should be able to follow through a user friendly system.

1.7. Justification and rationale

Sanyati District Education schools currently have manual procurement systems. The system to be developed will help in several ways:

- To create a centralised yet decentralised system in terms of giving independence and flexibility to procurement committees within public entities.
- The study is going to benefit and cut down of transport as people will no longer have to travel up and down looking for quotes but will sit on computer and provide the background information to the system which will provide feedback from suppliers. This

is a cost cutting measure given tighter budgets that organisations have to embrace in the face of the liquidity crunch.

- Increased transparency and accountability within schools given the background of many fraud cases that have arisen within schools in Zimbabwe.

- Reduction in printing and stationery costs.

- Collecting feedback through KYC (know your customer forms) and reports on discrepancies can be quickly disseminated and corrective action taken. When feedback is collected through KYC, the system becomes organic and dynamic and can adapt to client's needs and can become more dovetailed to the demands of the day.

- The system will reduce transaction costs at procurement, schools will benefit from e-management whereby by all procurement details and contact are available at the click of a button using category.

1.8. CONCLUSION

This chapter gave insight into the project. It highlighted the background of the study, the motivational aspects that guided the researcher in selecting the topic and the organization. The organization under study was examined from a perspective of its organizational structure, mission statement and vision. The problems existing were explicitly described and a panacea was given in proposed objectives. The methods and instruments that were specifically used for this project were given and the reasons for selecting them. A justification of the research was given and the benefit that will emanate from this research project were given. The next chapter is going to further examine the current system by looking at value that can emanate from implementing a new system. Feasibility studies, risk and stakeholder analysis will be carried out and recommendations provided.

CHAPTER TWO

PLANNING PHASE

2.1. Introduction

Chapter 1 gave a background of the study. The problems that led to this research were spelt out and objectives which are the focal point of the research were given. The methods to be used and the impetus behind the research were spelt out. The planning phase is critical in examining the current project with a view of improving it. Once completed, it gives the developer a clearer picture on whether or not to proceed with the project provided business value addition, ability to meet objectives spelt out and product delivery. Feasibility studies will be conducted to provide management with a clear picture of the direction of the project. Feasibility studies will involve socio-economic and technical issues. This is done early on during the project to avoid committing too many resources before embarking on a project. A synopsis of existing challenges is carried out in order to help understand the problems. System weaknesses, strengths which can buttress the project, opportunities that can be exploited and threats that may be avoided should all be examined during this stage. The researcher's aim is to understand the system better, its key components, needs that will add business value to the organisation. A comparison of alternative solutions available will be done and eventually provide the best course of action. An analysis of risk and stakeholders is going to be conducted. The potential risk is going to be scaled and priority levels given to each risk. Risk analysis is critical in software projects and if not carried out properly, a project can terminate prematurely owing to risks. Ways of mitigation will be delved into. Finally documentation will be produced and a work plan provided that will spell out the modus operandi for tacking the project.

2.2. Business value

The main purpose of operating a business is for it to be of benefit to the owners, customers, stakeholders and the community at large. Its impact should be felt and its effects seen. Business value according to the Sloman et al (2015) is about quality delivery and they state that every business must be able to deliver business value so that approval from the board and management can be given. In the scenario for the District, business value is what the project's aggregation of

efforts is able to contribute wholesomely to the success of the currently manual process. Its value contribution when weighed should exceed the costs of establishing the project and running costs.

Business value should provide utility to customers and users alike. Sloman et al (2015) states that a utility is the satisfaction that emanates from a consumer after the consumption of certain good or service at a specific time. In economic terms, the utility value to be gotten after consumption should exceed the costs of creating the utility then the intended business project should be undertaken given other considerations.

Kadoma District needs the new procurement system in order to unlock potential and value to business processes and procedures that are currently being done. Users, suppliers, stakeholders and management require the additional. Magill et al (2013:2) states that "…corporations, like all institutions in a modern society, would need to democratize and serve the interests of the wider base of all stakeholders with whom they deal on a regular basis" Business value is going to be hinged on the wider society of stakeholders and stockholders or shareholders.

Shareholder value

Shareholders value is when a company strives to provide increased satisfaction. Sloman et al (2015) describes it as a process of growing money and unlocking potential. The shareholders identified in this project are the Ministry of Education (District Office), parents, accounts clerks, bursars, retailers and departments. Shareholder value seeks to increase a company's net worth and effects of different stakeholders. The Ministry is in charge of the district office and overall corporate governance and financial management and mismanagement hampers the delivery of quality education. This project will have an ability to unlock value for its shareholders mainly the Ministry of Primary and Secondary Education which currently has manual system which consumes time and lead to corrupt tendencies of procurement. Time lost can be utilized for more productive means. Parents are the main income providers for schools. Parents' money is saved as journeys are not made to get quotes or buy but online procurements from reputable suppliers can save the ministry substantial amounts of money. Public coffers can be protected and issues of corporate governance can be better managed as stated by Magill et al (2013).

Accounts clerks and bursars are the custodians of the finances of public institutions. They give a go ahead to departments to make purchase and give advice. Their work will be less burdensome as suppliers are approved online and purchases done online. This increases efficiency and provides good time management. Retailers as stakeholders are the suppliers of goods and services to institutions. They have to be approved to make sales and the system will enable quick approval and provide online shopping services which are up-to-date.

Departments are the main consumers of goods and services being offered by the retailers. They will be able to do goods comparisons online and shop for products that they require at a touch of button. The project also equips employees with new IT skills during the training process. Employees have less burden, they no longer have to travel near and far looking for quotations. A paperless environment will be created that is less expensive, smarter and easier to work with since it uses standardized software procedures.

There are however some areas which may not from the onset will not be able to benefit from this system. Areas where network is a challenge will not be able to access the system. IT proficiency is also required in order for employees to be able to utilize the system more appropriately.

Customer value

Zeithaml in Paananen and Seppänen (2013:711) define customer value as, "the consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given." Customers for the procurement service are the pupils, departments and retailers. The website http://www.engr.colostate.edu further stresses that value is not only in monetary terms but time spent in acquiring a service, customer service given, back up and after sales service. It thus sums the experience a customer gets from the consumption of a service. School pupils are customers who are suppose to get their supplies in time. They will get value in that quality products can be delivered on time using this procurement system. Customer value also includes price and quality. Retailers will be able to make their sales online. They can use the system for demand forecasting and purchase planning. Departments expect to make online quotes and purchases. They will be able to order online and have goods being delivered in short turnaround times. The new system can bring better processes and procedures ultimately providing customer value.

Employee knowledge

Employees are the workhorse of any organization. Their input cannot be undervalued. Thus in order for a company to grow and provide business value to its customers, employee knowledge is required Laudon and Laudon (2014). Employee knowledge for this system provides pertinent information concerning training needs, worker motivation required, product innovations and service initiatives that overally improve efficiency and increase effectives of a system to meet the demands of customers. Bursars, clerks and department personnel will be able to share information, network through the system. This reduces transactional costs as formal and non-formal methods can be employed. Management will go out of their way and deliberately programme training, grow an organisation's portfolio and provide adequate products and services. The online procurement system will be able to provide employees with additional Information Technology knowledge and skills, employees will be better able to use computers and the internet productively.

Channel partner value

Business partners are key in fostering development in an organization. They help prop up an organisation through symbiotic relationship that exists between an organization and its partners. Laudon et al (2013) says it enhances collaboration between a company and its selling partners. Partners are not static players in the business but are dynamic in that where partner value does not exist, they are free agents and hence can move away. It is the duty of the channel manager i.e. administrator to find out the needs of partners and dovetail products to individual needs. The system is going to provide web portal services, training and partner sharing services and quality service delivery. Intra and inter-District collaboration will be able to take place as partners share notes on suppliers and to provide the right supplier for a school and the District as a whole. Increased communication through targeted KYC forms can create specified information for partners. Promotions can be flighted on the websites and targeted marketing and sales can take place amongst suppliers and retailers. The system will allow the best partners (suppliers) to get the support they need through ratings and therefore increase sales and promote quality delivery.

Supplier Value

Suppliers of products are the ones that will benefit from the procurement system as turnaround times are cut short during procurement in a supply chain. Laudon et al (2013:314) describes the importance of an information system to facilitate supplier value. They state that when all supply chain members "share dynamic information from inventory levels, schedules, forecasts and shipments…helps members of the supply chain make better purchasing and scheduling decisions." Their input into the desired format and the process that they deem necessary to sell goods online is required. Suppliers gain by having technical knowledge about the new online procurement process and through association with the organization they get reputation that they can transact online. Partners can extend their horizon and there is a locking in of customers and standardization of forms and procedures for procurement. Suppliers can benefit greatly from the system as it offers 'free advertising'. Supplier compliance to systems is increased. This gives people quicker service instead of going round looking for suitable customers. There is reduced risk for partners, customers and management. There is increased visibility through several factors like financial health, segments, innovation and many more. Doing so can help manage each supplier relationship based on its importance to the organization and identify the most strategic partnerships, vulnerabilities and areas for improvement." This adds business value to the partner – organization relationship.

Managerial value

Management is key in providing a clear vision which the organization should follow. Management also provides the mission which is to be religiously pursued. Organizational culture emanates from management and has a capacity to give the new system the icing it requires. Management expects employee productivity, effective time usage and management, production reports and cost reduction procedures, Laudon et al (2013). The system is able to provide adhoc queries. Through analytical graphs in the form of bar graphs and doughnut graphs, the system can communicate with management about current status and levels of production, purchases. Prediction and product knowledge acquisition is important in strategic management issues. Managerial value results in informed decision making which clearly points out organizational identity and gives purpose to employees, suppliers and partners at large.

Societal Value

Society requires that organizations contribute meaningfully to the growth of the environment by closely looking at issues that pertain to society. Through the procurement system, a paperless revolution is set in motion which results in a reduction in usage of paper which ultimately conserves the environment since most papers used for transactions are derived from wood. The procurement system is going to be used in a school which already is a corporate social responsibility function of saving public funds and reduction in public expenditure. Societal value can be added by the system.

2.3 Feasibility Study

Laudon and Laudon (2014:528) describe a feasibility study as that which, decides whether or not "that solution is feasible, or achievable, from a financial, technical, and organisational standpoint." Therefore, the project at hand should be seen to worth pursuing at an early stage. Organisational resources, human, technical, economic and a myriad of external forces are put under the radar with a view of critically examining the system. The study goes on to pinpoint a project's requirements and see if there are adequate human, technical and economic resources to see the project through. Feasibility study is a way of managing risk and minimising the impact of risks at an early stage. Thus risk is avoided and preliminary losses are easier to swallow than outright failure at the end of the project. The website https://www.cs.cornell.edu states that a feasibility study leads to three important decisions, proceed, do not proceed or reconsider the project. Thus a feasibility study should be properly done since it supplies essential information which hinges upon the success or failure of the whole project. The costs (tangible and non-tangible) are weighed over the benefits which maybe material or non material. When the benefits outweigh the costs, then the project is worth pursuing.

There are four categories of Feasibility that will be examined namely:

- Technical
- Economic
- Social
- Operational

2.3.1 Technical Feasibility

The readiness of an organization to undertake new IT projects is mainly centred on its technical aptitude and adaptability to new environments. Its current human technical resources are the one that gives direction on the route to be taken by the organization as a whole. The human technical resources according to Laudon and Laudon (2014) are that enable an organisation to advance its course of action. Its contributions determine the ceiling to be reached by the organization. Technical feasibility entails hardware and software aspects of IT projects. The role of the former and latter cannot be overemphasized. Hardware has to be rightly priced and made available in order for the software to be developed and loaded onto the hardware. Users will accept a system which is user friendly, easy to use and is of benefit to them. The availability or nor non availability of these technical aspects will be considered.

Human Resources

People will work on the system initially to design, develop and test, secondly to work on the system and maintain the system are needed. The technocrats should be sought for if not available through human resources department. https://www.cs.cornell.edu states that costs will be incurred in head hunting the right technical personnel. Training needs are always present with any new IT system. Technical know-how of software and hardware issues will be dealt with. The designing and programming part is going to be covered by the developer who has experience in working with software and hardware projects. There is also adequate knowledge of web designing, network management and administration. The government has now made it possible for bursars and accounts clerks to learn how to use computers. Thus users of the system are technically competent to perform the tasks at hand.

Hardware and Software aspects

Adequate hardware and corresponding software should be acquired and developed in order for the company to be able to meet its requirements. The hardware should be able to work hand-in-glove with the system. Input, processing, output and storage capacities need to be examined. Usage of a computer should ultimately result in easier to use computers, easily managed data stores and ensure safety and security of IT equipment.

Systems software to be bought should ensure security of the system and at the same time allow for user friendly user interfaces. Applications software to be designed should be able to meet user requirements and provide a solution that meets objectives of the system. Usage of MySQL will help in maintaining the database, whilst PHP will be used to design the web-based portal running on a Dreamweaver 8 XAMP server which are both available.

Table 2.1. Hardware requirements

Item	Description	Status
Laptop	Core i7 fast processing	Available
Uninterruptible Power supply	Power back-up	Available
External Hard Disk Drive	Data back-up	Available
Optical Keyboard	Text based operations input and programming	Available
Optical Mouse	Graphical user interface operations	Available
8GB DDRAM	Memory for faster online processing	Available

Table 2.2. Required Software.

Item	Description	Status
MySQL SERVER	Creates databases provides OLE functions to PHP.	Available
XAMPP/ WAMP	Uses Apache to provide internet connections. Acts as server	Available
PHP	Open source script language and interpreter	Available
Macromedia Dreamweaver 8	Builds web development applications	Available

2.3.2. Economic Feasibility

An organisation's ability to finance all activities related to a given software project is key in unlocking business value and delivering key success factors (KSF). Financial commitment is required if any project is to be successful. Management has to be prepared to tow the line and release adequate funding to see a project through. The website https://www.cs.toronto.edu describes economic feasibility as a close examination of a company's financial resources and their ability to let go and fund a pending project. In software development, there are a few pertinent issues that require financial input namely:

- Software, hardware and maintenance costs.
- Training and travelling costs
- Software developers costs (effort cost)

A thorough cost and benefit analysis is required to be carried out so that management knows from the beginning what it will lose and the benefits that emanate explicitly from undertaking the project. External sources of funding may be used to boost financial capacity. These maybe short or long term loans, joint ventures, shares and so forth. Financial accounting measures such as Internal rate of return (IRR), payback period, net present value (NPV) and Return on Investment methods will be used to ascertain and guarantee that the decision being taken is financially sound. Management commitment is required and they have to be convinced that the project is worth every penny in their coffers in order to undertake the venture.

2.3.2.1 Development costs

Development costs are those that are involved from system initiation to system implementation. They are a once off payment and hence have no recurring factor as stated by the website https://www.cs.toronto.edu. They encompass software costs estimations, developmental team costs, hardware costs, facilities, installation, training and conversion costs. Wide research is required so that all estimates are realistic and variances can be minimal given time factors of establishing the project. The feasibility studies themselves costs money and all costs director indirect need to be penned down from collection of data to program testing and implementation.

Table 2,3, Software costs

Item/ Description	Quantities	Costs (US$)
Macromedia Dreamweaver	1	240
XAMPP/ WAMPP	1	0 (open source)
MySQL	1	709
High level language PHP	1	150
ESET antivirus	**1**	**25**
TOTAL		**1124**

Prices quoted from the https://www.amazon.com

Table 2.4. Hardware costs

Item/ Description	Quantities	Costs (US$)
HP Laptop Core i7 server	1	1300
External Disk Drive 1 TB	1	165
Uninterruptable Power Supply(UPS)	1	300
Optical Keyboard	1	25
Optical Mouse	1	16
DVD	60	12
Total		**1818**

Prices quoted from https://www.classifieds.co.zw

2.3.2.2 Operational Costs

These are routine costs that are involved in the daily running of a business. They vary from one business entity to another. Some of the operational costs maybe fixed i.e. they are the same month in month out like rentals, whilst others change or are variable as stated by the website https://www.cs.toronto.edu.. The costs are ongoing and vary from system maintenance, software licenses and contracts, operation, support and training courses. The costs may include costs to help vendors, software and data back-up, data entry effort costs, rates, rent and so forth. Fixed costs are those which remain the same despite levels of activity as stated by Wood and Sangster (2016). They go on to describe variable costs as those which change in proportion to the levels of activity or production. An example would be raw materials costs which change as level of production increases or decreases.

Table 2.5. Operational Costs   Adopted from Computec Pvt Ltd.

Activity/ Item description	Estimate Cost (US$) (yearly)
Hardware and software maintenance	600
Rent	1200
Rates	360
Ongoing training costs	480
Software licenses	150
ADSL internet connection	300
Total	**2790**

2.3.2.3. BENEFITS

What a company stands to get as a result of an investment is its benefits from the venture. These gains can be monetary or non-monetary. Intangible cannot be immediately quantified but may provide quantifiable benefits will have estimate costs assigned to them so that the total effort or cost and benefits can be weighed Laudon et al (2013). This will aid in making adequate calculations in ratios so that management can give a thumbs up or terminate the project owing to lack of benefits.

2.3.2.4. Monetary benefits

Monetary benefits have an appearance on a company's profit/ loss account and have positive effects on the balance sheet. Profit increases and losses are reduced as a result of these monetary benefits as stated by Laudon et 1l (2013).

2.3.2.5. Tangible Benefits

When benefits are quantifiable but at the same time dollar values cannot be assigned to them. Their gains can be felt and changes seen for example cost reduction, increased efficiency and effectiveness of a system, timely operations. Laudon et al (20130 states that tangible benefits have a physical existence and affect an organisation in terms of operation efficiency and effectiveness.

Table 2.6. Tangible benefits estimates

Item or Description	Amount (Estimates) (US$)
Reduced transport costs	2 500
Consumables usage decrease	1000
Stationery usage decrease	600
Repair and maintenance decrease	1 700
Total	**5800**

2.3.2.6. Intangible Benefits

Benefits that have no monetary value and are invisible in nature since they are not physical, you cannot touch them but you can see their effects. They result in an overall improvement in the work place, produce positive mental attitude on workers and encourage innovation, initiative and creativity amongst employees. Laudon and Laudon (2014) further state that these could ultimately result in an increase in tangible benefits. These benefits border on morale boosting, motivation and increased job satisfaction amongst employees. There is increased effectiveness and efficiency as a result of the new system. Timely procurement can result and goods also arrive on time.

2.3.2.7 Return on Investments (ROI)

This is a measure of profitability of a project or business venture. Commonly, the total net profit of the business is divided over the total assets and this is expressed as a percentage. Thus there is a relationship between amounts invested and the financial returns gotten from the business. It is different from profit. Laudon and Laudon (2014) stresses that ROI deals with money invested and the returns realised.

Table 2.7. Summary of costs and benefits

Item Description	Costs (Estimates) (US$)
Development costs	
Hardware	1818
Software	1124
Operational Costs	3090
Total	**6032**
Tangible Benefits	5800
Intangible benefits	0
Total Benefits	**5800**

Table 2.8. Cost and Benefits of the new Online Procurement System

YEAR		0	1	2	3	4	5
COSTS							
Hardware	Server	1300					
	External HDD	165					
	Uninterruptible power supply (UPS)	300					
	DVD	12	12	12	12	12	12
	Peripherals	41					
Software	Dreamweaver	240					
	MySQL	709					
	PHP	150					
	XAMPP	0					
	ESET antivirus	25	25	25	25	25	25
Operational costs	Hardware and software maintenance	600	600	600	600	600	600
	Rent	1200	1200	1200	1200	1200	1200
	Rates	360	360	360	360	360	360
	Ongoing training costs	480					
	Software licenses	150	150	150	150	150	150
	ADSL Telone connection	300	300	300	300	300	300
Maintenance	Hardware upgrades		20	20	20	20	20
	Software upgrade		20	20	20	20	20
Yearly Total		6032	2687	2687	2687	2687	2687
Total costs – 5 years		19467					
Benefits	Reduced transport costs		2500	2500	2500	2500	2500
	Consumables usage decrease		1000	1000	1000	1000	1000
	Stationery usage decrease		600	600	600	600	600
	Repair and maintenance decrease		1700	1700	1700	1700	1700
SUB-TOTAL			5800	5800	5800	5800	5800
NET CASH FLOW		-6032	3113	3113	3113	3113	3113
TOTAL BENEFIT OVER FIVE (5) YEARS		29000					

Using figures from tables 2.8 for cost benefit analysis, a few capital budgeting formulas will be considered. The return on investment, the payback period and the net present value. Laudon et al (2013) states that the cost benefit analysis is inadequate in determine certain financial attributes like time value of money and therefore other productivity indicators will need to be explored. An economic feasibility which is not exhaustive and a decision being made by a simple calculation may err in the process.

Return on Investment

This is profitability ratio which measures the gain or loss generated on an *investment* relative to the amount of money invested. ROI is usually expressed as a percentage

Return on Investment $= \frac{Benefits - total\ costs}{total\ costs}$ x 100

$= \frac{29\ 000 - 19467}{19467}$ x 100

$= 48.97\%$

The ROI for this project would be 44.18%. This figure is far above the current prime lending rate of 12% per annum according to the website www.chronicle.co.zw . Thus the project is reasonably profitable and is sound.

2.3.2.8. Net Present Value (NPV)

Wood and Sangster (2016) explain that the net present value is a summation of all present values of cash flow. NPV is able to provide figures with gains or losses when an investment is done. Positive NPVs have greater value addition to a company's future and present needs and therefore worth pursuing. There is shareholder equity maximization, if there is a positive NPV. Future earnings need to be estimated before one can embark or accept a project. What are the likely future financial benefits and loses. Thus a concept of a bird in the hand is worth two in the bush

comes into play. To help in calculating the NPV, a discounting rate is used. For this project, 7.17% will be used according to the website www.rbz.co.zw.

Present value $= \sum \frac{R^t}{(1+r)^t}$

R^t revenue invested in year t

r Discount rate

Σ Summation of yearly discounted earnings.

$t =$ time represented by number of years.

Initially, get discounting factor which is the multiplied by the cash flow to get the present value.

According to Sloman et al (2015) the NPV is this difference that is found between the present value of the benefits (PVb) of an investment and what the investment cost (C).

$NPV = (PV_b - C)$

PV_b is the present value of benefits

C is the cost of the investment

Present value $= \sum \frac{R^t}{(1+r)^t}$

Estimate cash flows

Year 1 - $5800   Year 2 - $5800   Year 3 - $5800   Year 4 - $5800   Year 5 - $5800

$= \sum \left(\frac{5800}{(1+0.1)^1} + \frac{5800}{(1+0.1)^2} + \frac{5800}{(1+0.1)^3} + \frac{5800}{(1+0.1)^4} + \frac{5800}{(1+0.1)^5} \right)$

$= \$5412 + \$5050 + \$4712 + \$4397 + \$4103$

Present value = 23673.

The NPV = Present Value – Cost of Investment

$= \$23673 - \$6032$

<u>NPV is \$17 641</u>

Project has a positive Net Present Value and will impact positively on the organisation and add value to the company's future plans and maximisation of shareholder's worth and wealth is possible.

2.3.2.9 Payback Period

The time that it takes for an investment, project or business venture to repay its initial is described by Wood and Sangster (2016) as the payback period. An investment with the shortest payback is deemed ideal in that it has a capacity to adequately service itself, a loan or other cash injection given to it.   The time spent in debt by a company, project or investment should be minimised.   This ensures that the company can easily breathe and also regain its capacity. Cashflows are used to calculate the cash back. There are even and uneven cash flows. For this project, uneven cash flows will be used.

$$\text{Payback Period} = \frac{\text{Initial Investment}}{\text{Cash Inflow per Period}}$$

Initial capital investment - $6032

Even cashflow of $3113 per annum.

$$: \text{Payback Period} = \frac{\$6032}{\$3113}$$

= 1 years 11 months.

Economic feasibility shows that the project is positive in terms of cost benefit analysis, financial accounting methods used for payback, net present value and return on investment.

2.3.3. Social Feasibility

When projects are established, they impact society positively or negatively. Social feasibility addresses the impacts of a given project on society. The website *www.ktgss.edu.hk* states that this is the effect that the software project will have on customers and employees.

The influences that will emanate from project implementation and its repercussions on society's processes and procedures. Jobs will be created in the form of technical people to man the website. Amongst the employees, deskilling will take place amongst the workforce as old work practices no longer apply and they have to be retrained and adopt new work ethics and practices according to Bradley (2014). Workers and management may need to embrace information technology more as they will undergo training in the system. This will change their lives and the way they work.

This procurement system will create jobs in the form of website maintenance officer, database administrator and data capture clerk. It is a user friendly system, socially acceptable and preserves existing employees.

The project has more advantages than disadvantages when it comes to social feasibility as workers do not lose their jobs. It is worthwhile to proceed with the project.

2.3.4. Operational Feasibility

The effectiveness and efficiency of a system and its ability to meet stated objectives is its operational capacity. What the system is capable of doing and at what rate? The website https://www.cs.toronto.edu describes operational feasibility as a process responsible for critically viewing a system's capability of meeting user specifications and to give solutions to the problem defined. As a feasibility study, it seeks to refine all other feasibilities. Having bought the hardware, having seen the benefits, given social acceptance, can the project still work to meet its designed objectives or it falls far short. Is there a tight fit between employees, hardware, software and the employees? How does the software fall short, what are the challenges associated with hardware and how do people adapt to the new system are all pertinent question to be asked according to the website https://www.umsl.edu . It states that the system should be assessed the system can work but also if it will work. The website http://www.cs.toronto.edu uses the PIECES framework to simplify operational feasibility.

Performance

This is an indicator of an organisation's success in a given activity. During performance indicator settings, quality standards are established such as 100% procurement, procurement within 4 days and so forth. These indicators within the system can measure the throughput coming from a system, its response times to clientele inferences. The system should be able to provide useful, accurate and up-to-date information as and when the need arises. Report, forms, input and output screens should be user friendly and easy to navigate with colour codes to assist users quickly identify their shortcomings if lost.

Economy

When operating a system, it should deliver cost-effective solutions. The cost of a procurement transaction should relatively low as compared to a manual system. When new systems are introduced they should bring about fewer costs, with regards to money and time. Such cost cutting measures should be seen clearly by all and sundry. As users log on to the procurement system, they should see economy of time, economy of finances as benefits which emanate from the system. Management is more interested in how much money can be saved from a business venture in order for total commitment and support in term of funds release.

Control

Every system should ensure control of all information. Thus management is more interested on how their finances are secure. Passwords, firewalls, user levels of access are all important issues that a system should be able to address. Processes and practices that enhance security of IT system should thus be employed from the onset so that management can get a peace of mind.

Efficiency

Resources within an organisation should never lie idle. Once they are idle, they are not being adequately utilised and hence are not necessary in an organisation. The worth of any system is the periodicity of usage and lack of idleness. Utilisation results in achieving organisational goals. Work ethics, document flows from one work station to another and from one department

to another is important. Turnaround times for a transaction depict efficiency. Data stagnation and information clogging should be avoided.

Services

Procurement services being offered need to be above board and provide a safe haven for stakeholders and stock holders. The services that come from the system should be pleasing, reliable, consistent and trustworthy. Thus the system should have a 24 hour presence since it is online. The system should offer services that are stated as being offered in its objectives. After sales services should be maintained and customers should have a flexibility to contribute towards the creation of a new better system through Know Your Customer (KYC) forms which as feedback to the system concerning service delivery.

The online procurement system is relevant, reliable to the District and schools in particular. Its ability to serve clients within a short period of time is commendable. The system thus has operational efficiency and should be utilised by schools. Users need training to help them familiarise with the system. An easy to use interface will go a long way in simplifying user's concerns and at the same time provide the much needed security.

2.4. Risk Analysis

Every project and work environment faces possible threats which may jeopardize its efficiency and effectiveness of deliverables. These hazards if not anticipated from the onset can jeopardise the whole project and result in financial, technical losses. Thus risk analysis looks at possible hazards, their impacts and ways of mitigating their effects on the working place, project. Risk analysis seeks to minimise impacts by providing a route of escape from a risk way before the risk occurs. The risk may or may not happen but all the same a plan should be put in place to mitigate it. The website www.csse.usc.edu states that risk management gives management menaces along their paths way before they reach them. Thus management anticipates these perils and plans for them. So it means it is not caught off guard by the risk and the time of occurrence. Proper risk analysis and management ultimately results in successful project implementation.

Risks firstly have to be recognised, weighted and later ranked according to level of danger they pause to the project. This project will mainly focus on technology, scope, scheduling and resource risk as stated by the website https://www.nap.edu.

2.4.1. Technology Risks

Technical expertise is required. The level of technical expertise if not adequate can jeopardise the whole project https://www.nap.edu. Software such as Dreamweaver, XAMP, PHP and the MySQL server require technical aptitude to synchronise. The risk of not completing the system is there. The system may exhibit certain function challenges to users who are not yet versed with the system. Thus initially, users may face challenges and the system may be dumped due to user frustration. The interface may fail to please the users due to complexity issues. New technology risks being rejected. Schools may lack technical personnel to see through the project.

The system will be simplified with easy to use interfaces which are appealing to users. Consultation with lecturers, other students is an on-going process during project development so that a white elephant is not created. Research and development is being done to simply the process. Training and information, education and communication material is being created so that users are able to appreciate the system beforehand.

2.4.2. Resource Risks

There are two main types of resources namely human and financial. Financial constraints may jeopardise the project. Money is not always available to carry out a project given the current liquidity crunch in the nation of Zimbabwe. So the risk is equipment may never be bought, tasks to be done may be abandoned. This is a new project with the District and users may be sceptical to embrace new technology. Users internal and external may resist change and not accept the new system. If the people are unskilled or incompetent to perform the task at hand or the project is under-staffed from the beginning then required results cannot be output. Therefore, a bottom-up approach will be more preferred so that that there is buy-in into the system by stakeholders. Funds are required to purchase hardware and software and also for training purposes. The project will not be able to take off.

Mitigation for resource is the mobilisation of capital equipment and the financing of the project so that funds are not in short supply. In addition, training of users and a creation of a user's manual is in place so that users do not reject the system.

2.4.3. Scheduling Risks

Deadlines and time schedules have to be adhered to. This project has to be done timeously to meet semester deadlines and supervisor deadlines. Deadlines can be missed as there is a risk that questionnaires may not be returned on time delaying the data collection process. Time constraints may limit the project. The developer has limited time to develop and finish. This project used a Gantt chart which guides the researcher in terms of weeks that processes and activities should happen. A work breakdown structures (WBS) as stated by the website https://www.nap.edu is essential in breaking down work into small, easily managed tasks with realistic time frames allocated to the components. During the WBS creation, holidays and semester breaks were not included as they would give unrealistic weeks if factored in.

2.4.4. Scope risks

These are risks as defined by the website https://www.nap.edu as having to do with the mutation of requirements as the project is running. In this project, it was identified that specifications and activities may be added in the course of running the project due to user involvement and testing and evaluation of the project. Thus inputs initially anticipated will not be the inputs used eventually. Defects amongst the software is another risk which was identified. The project at hand is huge in scope and encompasses many aspects and hence it brings with it several risks. Another risk identified is the integration of the project into existing platforms and also the loading of the software on hardware thus ensuring compatibility. This risk impacts negatively in that the software may not work on the existing hardware platform.

Mitigation of scope risks will include a clear definition of the project early. This will ensure that objectives are clearly defined. Change management will have to be done using strategic management techniques. Defects of software need to be managed through research and development and also working thoroughly to get relevant coding.

2.5. Stakeholder analysis

A stakeholder is any person, individual or entity which affects or is affected by establishing this software project Sommerville (2016). A stakeholder has an active interest in the goings on of the organisation. Whilst stakeholder analysis involves identifying the key stakeholders (both internal and external) in the project and determine their interests or requirements from the project; what the project needs from them, any perceived attitudes and/or risks the stakeholders may have and the actions to be taken to achieve this.

Table 2.10 Stakeholder analysis

Stakeholder	Internal/external	Interests/requirements
Lecturers	Internal	Consultants and content shaping, testing and providing guidance and direction to the project. The student worked to have the project on time, programmed, researched and produced.
District office Ministry of Education	external	Gives go ahead to continue with project Expect corruption free system that is timely and effective. Requirements collected were factored in the project. The project will result is better transaction and adequate savings as people login and search and purchase products.
Clerks, bursars	external	Users of the procurement system. Provide initial input. Require quick system with easy search facilities to quickly locate suppliers. The system will provide easy, quick procurement of goods which is cost effective.
Retailers of products	external	Selling various commodities. Need to establish websites and online presence They will be able to showcase their products, advertise even new products and have a wider reach to all registered schools.

2.6 Work Plan

According to the website www.me.umn.edu, there are two components of a project plan; the Work plan or Work Breakdown Structure (WBS) and the Gantt chart. The work plan specifies estimated time duration for the completion of the project including its key tasks. It has starting and ending dates which initiate and terminate a phase.
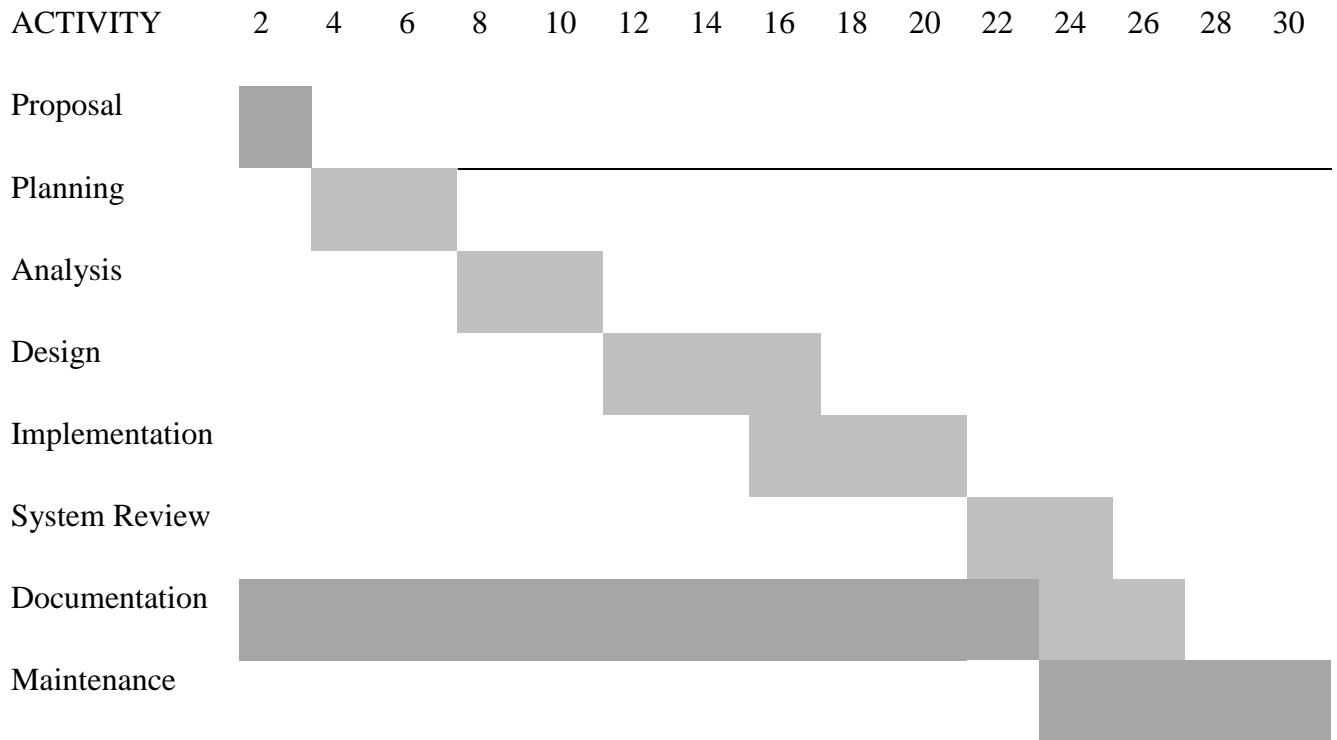
Table 2.11. To show propose work plan

ACTIVITIES	STARTING DATE	ENDING DATE	NUMBER OF DAYS	WEEK(S)
Proposal	02/12/2017	16/12/2017	14	2
Planning	17/12/2017	13/01/2018	28	4
Analysis	14/01/2018	10/02/2018	28	4
Design	11/02/2018	17/03/2018	35	5
Implementation	18/03/2018	21/04/2018	35	5
System Review	22/04/2018	19/05/2018	28	4
Maintenance	20/05/2018	Continuous		**2++**
Total			**168**	**26++**

2.6.1 Gantt chart

Work plans can be converted into a graphical table called a Gantt chart for ease of reading and illustration of the work breakdown structure (WBS). The Gantt chart gives activity and duration for the project. The Gantt chart as postulated in the website According to the website www.me.umn.edu should have a list of important milestones and must factor in delays when planning the chart. This gives the project enough time which is realistic and ensures that deadlines are met on time.

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Figure 2.1. Gantt Chart

ACTIVITY	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Proposal	■														
Planning		■													
Analysis			■												
Design				■	■										
Implementation						■	■								
System Review									■	■					
Documentation	■	■	■	■	■	■	■	■	■	■	■	■			
Maintenance												■	■	■	■

2.7. Conclusion

This chapter focused on the business value addition of the project to intended beneficiaries. It highlighted various business value aspects from shareholder value to societal value. A feasibility study was carried out to see how technically, economically, socially and operationally feasible the proposed project is. Cost and benefit analysis was dealt with in details. Risk analysis was also done to find the current hurdles that may hinder the project to complete properly and mitigatory measures suggested. An analysis of stakeholders was done to indentify people with a vested interest in the project and determine their interest and what they stand to lose or benefit from the success or failure of the project. Finally a work plan was given which constituted of a work break down schedule and a Gantt chart. The project is feasible and has cost which outweigh its benefits. The next chapter will deal with the analysis of the current system. This will be carried out using data collection instruments and data flow diagrams. Several ways of solving the issue at hand will be suggested and evaluated appropriately.

CHAPTER 3

ANALYSIS PHASE

3.1. Introduction

The previous chapter dealt with the planning phase which dealt with values that emanate from the implementation of the project. A feasibility study was also carried out to determine how feasible the system is. Risk analysis and stakeholder analysis were done in order to identify the risks that may hamper the project and the mitigatory measures. This chapter will look at the analysis of the system. It looks at system entities, their interaction with one another and subsequent dependencies that exist between them. During the process, facts are gathered about the current system. These facts enable explicit problem isolation so that when the system is designed, a dovetailed solution is produced. Recommendations and suggestions that emanate from this process help in improving system functionalities. Denis et al (2014) affirm that the importance of this phase is to understand business cycles and processes through information gathering tools such as the interview. An understanding of the current system is needed before one can come up with solutions. This avoids a wrong prescription to a problem which may have been imaginary. Relationships that exist within entities will be shown in Data Flow Diagrams (DFDs). The new system that will be created should be able to meet user specifications and requirements.

3.2. Information Gathering Methodologies

Several information gathering methodologies were considered so as to cover as much ground as possible so as to isolate the problem. Their usage would eventually lead to a thorough understanding of the system through knowing;

- Methods of operations
- Current system strengths and weaknesses
- New system user expectations.
- Provide an insight to assist the developer in coming up with the new system which is tailor-made for the problem.

Denis et al (2014) describes research methodology as a systematic analysis of the procedures which are applied when one is studying. A methodology looks at the phenomena that guides the research process. It encompasses procedures, processes, techniques which are used to arrive at a

solution. The methodology does not proffer a solution but is the roadmap towards the solution. Research methodology can be qualitative, quantitative or both. In order to understand the system, questionnaires, document observation and interviews were used to collect data for this project. The pros and cons of using these instruments in this project will be highlighted.

The population used for the research comprises of the bursars, suppliers of school products, stakeholders. Random sampling is used to get a fair representation of bursars and suppliers from a given list.

A pilot test on questionnaires and interview was done randomly amongst the population under study. Abawi (2013) states that by carrying out a pilot test, ambiguous meanings are removed from the questionnaires and interview schedules.

Questionnaires

Questionnaires as instruments of data collection solicit data through semi structured and structured forms. The subjects are handed out the questionnaires and they provide answers by ticking appropriate and most fitting answers on the structured section. Semi structured and unstructured sections require more user input. The respondent has to fill in and answer question and eventually provide recommendations. Accurate, up-to-date data can be collected by the researcher within a short period of time. They are mainly used as the first line of data collection instruments. Many respondents can use them with ease given our high literacy levels in Zimbabwe. Questionnaires used will contain both open and close ended questions. The former do not limit respondents in terms of their responses. Respondents can jot down their own thoughts without being narrow minded and blinkered as in the case with close ended questions.

School bursars, suppliers were handed out questionnaires on the 19th and 20th of January 2018. A total of forty questionnaires were handed out to Bursars, clerks and heads of departments. They were selected since they are the ones who are actively involved ion the procurement process. Clarity of questions and their meaning was carefully sifted and selected to avoid ambiguous questions. The thrust of the questionnaire was to examine the effectiveness and the efficiency of the current purchasing system, its flaws, drawback and different processes from the current users of the system.

There are several advantages which resulted in questionnaires being selected as data collection instruments such as less time was taken to distribute the questionnaires to respondents. Flexibility in terms of when to respond, respondents were able to answer as and when they wanted. The questionnaires contained an anonymity clause which guarded respondents from the disclosure of their information. Respondents were given an assurance that the information they fill will be used for the purpose of this research only and will not be divulged to anyone else. However, the flexibility of responding as and when gave respondents the latitude not to be positive. When the researcher went on to collect the questionnaires on the 5th of February 2018, only a few had been filled in and the researcher had to find more time to collect the questionnaires. Facial expressions and body language could not be seen which is key in giving vital information about one's perception of a system or process. Further probing for more information could not be done since one is looking a piece a of paper.

Interviews

To counter the weaknesses of questionnaires, interviews were used. Interviews are oral one on one, one to many question and answers sessions. The researcher is the interviewer and the respondent is the interviewee. In this research, one-to-one interviews were used. Contact details for respondents are looked for and an appointment is booked so that the respondent is fully aware of the interviewee's impending interview. Contact with respondents is direct and they are normally given to key people within the research project owing to time constraints. An interview builds a relationship which has a bearing on the system to be built. They inculcate trust, and if done properly result in openness and a buy-in by the interviewees so that there is co-ownership of the created system. Denis et al (2014) affirms that interviews are an important tool in as far as getting non-verbal cues from the respondents.

Interviewees who use the current accounting system were deliberately chosen since they face everyday challenges. Their input in this research hence becomes key and invaluable to the success of this research project. Their daily interaction with the buying and selection processes provides a deep insight into current problems and how the system could further be improved. Therefore questions posed to respondents have a bias towards system problems and suggested solutions. Interviews were done between the 6th and the 9th of February 2018.

An interview schedule is a document that is used during an interview. The schedule contains questions which are asked and agreed answers are then written down next to the question and then the next question is asked. Sticking issues from questionnaires help guide the interview schedule. Some issues skipped in questionnaires can be asked to buttress the research process. Summarisation of the interview process was done at the end of each interview session.

The administration of interviews was done on the District supervisors, District accountant, bursars and SDA chairpersons. The interviews gave the researcher a deeper understanding of the functionalities of the system. The current buying procedures from meetings held prior to quote, quotations, invoices, deliveries. Probing further was done to enable respondents to provide as much information as possible especially on grey areas.

The researcher motivated the interviewees so that they become free and open up since their invaluable input would ultimately result in the creation of a new system. During the process of interviewing, questions were modified to suit the respondent's preceding answers. This avoids duplication of answers. However, interviews can consume a lot of time though they are very effective data collection instruments. The estimated time for each interview was about 20 minutes which is a huge time cost. Financial costs are also huge given the travelling that had to be done from one station to another.

Observation

Denis et al (2014) describes an observation as a technique which involves watching a process so that reality of the situation is seen. A system is viewed from a bird's eye view by watching personnel go through their daily routines without their knowing. This system is able to look at documents which are used, processed and procedures which are employed to carry out the buying of goods and services. Bottlenecks into the whole process can be easily detected and mitigatory measures taken to improve the system. The observation was used to supplement interview information. An appreciation of the system becomes possible as one observes the system in action. The researcher observed documents at the District office and at a High School. The researcher had a privilege of getting into procurement meetings. Observations were done

between the 12th and the 16th of February. During this period, the researcher took advantage of the exercise of gathering questionnaires.

During observations, natural settings which are not doctored since respondents are not aware were seen. Observation is rather inexpensive since the researcher does not need to go out of his way to solicit for information and it requires little of the employee's time. Daily obstacles faced by bursars and buying clerks were seen and felt. However, time did not allow the researcher to observe as many systems in action. Procurement dates and meetings are normally at the beginning of the term and schools normally choose to have these soon after opening. Some people sensed they were being observed and ended up not behaving as naturally and acted differently.

3.3 Analysis of existing system

Denis et al (2014) describe the analysis stage as one which thoroughly examines the existing stage. It spells out the system in operation in detail. Turnaround times for documents are observed whilst process and procedure slack times and delays are observed. Thus with system analysis, dataflow diagrams, flow charts are used to create and observe the system in process. This is a critical stage of the project in that current operations which are going to be modified are examined.   Weak points and weaknesses are seen from process diagrams and these will enable a solutions to be reached once addressed. The improvements that are done on the system are done based on weaknesses, strengths, opportunities and threats.

3.3.1. Buying process – small orders

Small order are those that cost less than ten thousand United States Dollars (USD10 000). Currently, when departments within an educational institution want to make a small purchase, a departmental meeting has to be sat which approves the proposal to purchase. The meeting then gives the Head of Department (HOD) the mandate to go and sit in a procurement meeting and lobby for the purchase of products and services. Procurement meetings are normally done at the beginning of each school term, at every month end thereafter. Procurement meetings require a bursar to supply all funds allocated to a department through his or her folio. The procurement meeting is chaired by a Deputy Head as instructed by the procurement procedures in the Ministry

of Primary and Secondary Education. The meeting comprises all HODs whether or not they want to make a purchase but they approve through a quorum system. When funds are available, and the items to be purchased are approved, the Head of Department is given a go ahead to solicit for quotations from various suppliers. The minutes which give a go ahead to purchase are then submitted to each HOD.

HODs spend several days getting quotations from various suppliers. The suppliers are then contacted and they supply their quotes through an email or fax. The HOD carries out a comparative schedule which looks at the quotations basing on cost, credibility of supplier, product brand supplied. These have a bearing on the product to be selected. It therefore does not necessarily mean the cheapest quote will be picked but a multiplicity of factors will be looked at. The HOD then provides a comparative schedule with chosen or preferred supplier. This is then handed over to the bursar. The bursar then writes out an official order book which is legally binding. This is send to the supplier using terms specified on the quotation. The bursar further arranges a single day in which purchases will be made and in some cases HODs would need to travel for the purchase of specialist equipment. In some cases, suppliers are asked to bring the products. When products are brought, a delivery note is given to the bursar and the items are entered into an asset book using previous asset numbers for the department. Stationery is entered in its stationery lists and updates done on figures of stationery. The cycle ends with the payment of the product. Government institutions by law are not permitted to pay before delivery of the product. The payment once done, a receipt is provided by the supplier and the amount deducted from the folio of the department. The process normally takes about 5 working days from the sitting of the procurement meeting.

3.3.2. Large Purchases

Large purchases are those that are above ten thousand United States Dollars (USD10 000). There are basically two categories of these large purchases which are:

   a. those that require approval of the provincial office
   b. tendering procedures.

Provincial office approval.

All processes stated in the previous section are carried out. Once the figures quoted exceed the ten thousand dollar mark the chairperson of the procurement committee then writes to the Provincial Education Director through the District office to enable approval of these purchases. All documents pertaining to chosen supplier in the comparative schedule are sent to the Provincial office. The provincial office then gives an approval of purchases. Papers for approval are sent through the District office. The school then collects the papers from the District office. The company that supplies the products is then given an official order and a delivery is then done and payment for the product is then effected. This process takes about two weeks from the date of the first procurement meeting.

Tendering process

This constitutes capital projects which a government entity wants to embark on. These from the onset a capital intensive and hence they do not need to have quotations. A procurement meeting that involves parents, administration and HODs is arranged. The purchase of such products such as buses, motor vehicles, building of classroom blocks, purchase of IT equipment and the networking. A tender document is flighted in local daily newspapers. Suppliers respond and bring the requisite documents stated in tender document. A small non-refundable fee is charged. A deadline is given for submission of all tenders. A date is set for opening of the tender box and all tenderers will be present. The tender summary figures are initially written down and the procurement team then sits down and deliberates on which tenderer to select. The selected tenderer is then given a notice of award whilst those who will not have made it are also notified. A contract pertaining to provision of goods and services is then signed and the terms of the contract as specified in the tender documents are then adhered to. Finally payment terms are then agreed upon and products supplied. It is important to note that government institutions may not have the substantial amounts of money that are required for the huge purchases and hence terms of payments are suitable. At times, a loan maybe acquired from a financial institution. This process normally takes about a month from the date of the first procurement meeting.

3.4. Process Analysis

All systems consist of entities which emanate from activities, procedures and processes that take place within the organization. Process models can be used to depict these operations that occur

within the business system. The movement of information and data between several entities, their dependencies can be clearly seen. Thus the logical flow of data and information is seen so that decision can reasonably be reached.

Activity Diagram

```
                    ( Start )
                       |
                       v
              ( Departmental
                 meeting )
                       |
                       v
              ( Procurement
                 meeting )
                       |
                       v
              ( Enter available
                   Funds )--------+
                                  |
                                  v
                                <  >
        ( Search supplier     Sufficient
          Names and contact )<----+
                 ^   |
    Not found    |   v
       +---------+  < >
                     |
                   found
                     |
                     v
              ( Contact supplier )
                     |
                     v
              ( Do comparative
                  schedule )
                     |
                     v
              ( Send official order )
                     |
                     v                    No
              ( Delivery )------> < >--------->( Do not make
                     ^            |              payment )
                     |           Yes               |
              ( Make payment )<---+                 |
                     |                              |
                     v                              |
              ( Receipt )                           |
                     |                              |
                     v <----------------------------+
              ( End )
```
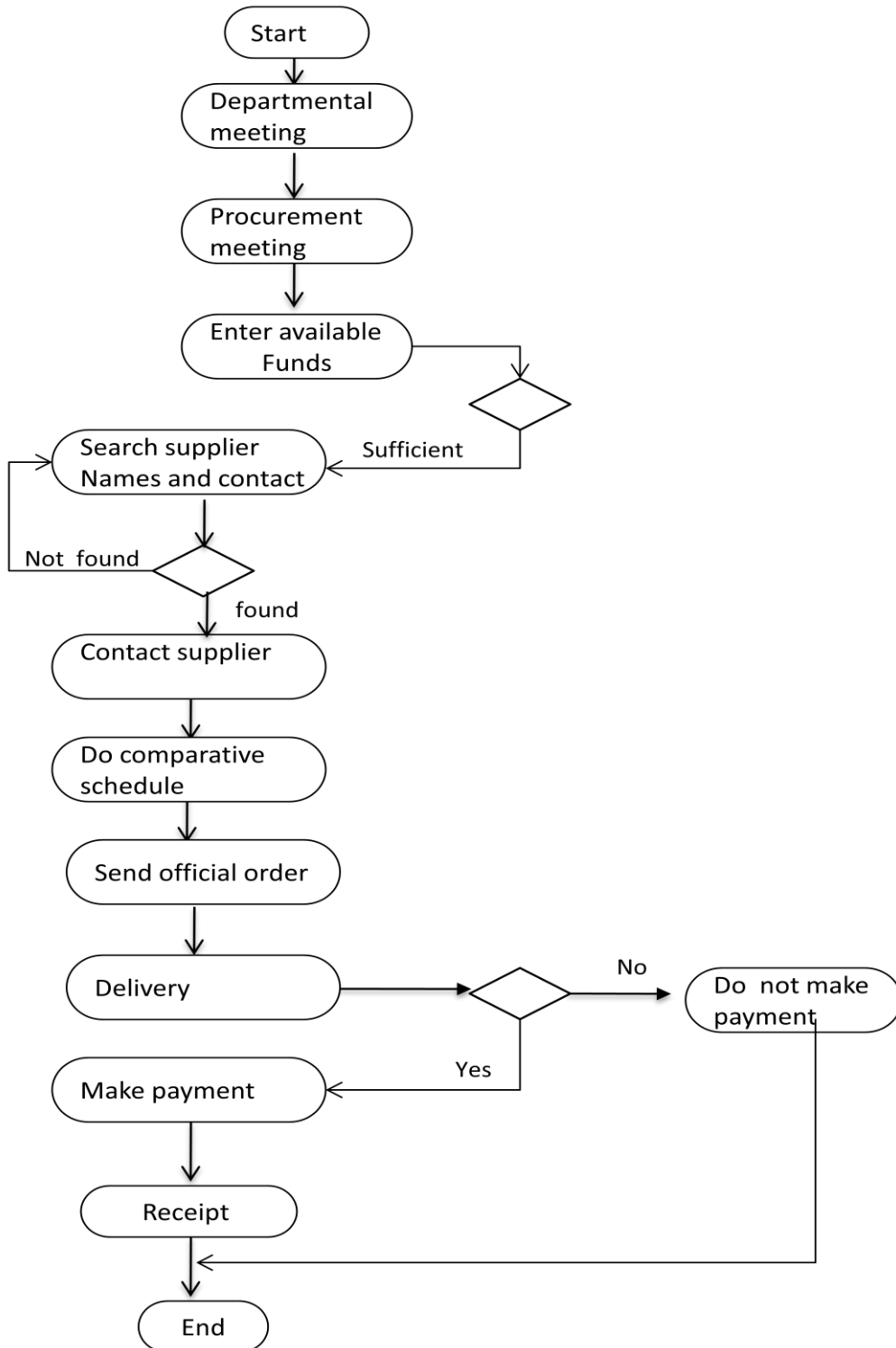
3.5. Data Analysis

Data movement in between entities is shown in data analysis. Processes receive data which after the process can come out as information or be fed into another process through use of turnaround systems. Context and data flow diagrams will be used to depict relationships giving a visual illustration of the purchasing and supply system. This brings reasonableness to the system so that useful information is extracted with regards to processes, procedures and methods that may need altering to that there is system improvement.

3.5.1. Context Diagram

Heathcote and Langfield (2007) describe a context diagram as that which depicts the interaction of a system with its external environment. It gives an overview of external agents which are data sources (input) and data sinks (output). System interaction with outside environment is modeled and data moves across boundaries through agreed channels. Internal entities and data flows are not seen as this is an overview of the system and its external entities. At the heart of the whole system is a control tower which commands operations of the whole system.

3.5.1.1. Current Procurement Context Diagram
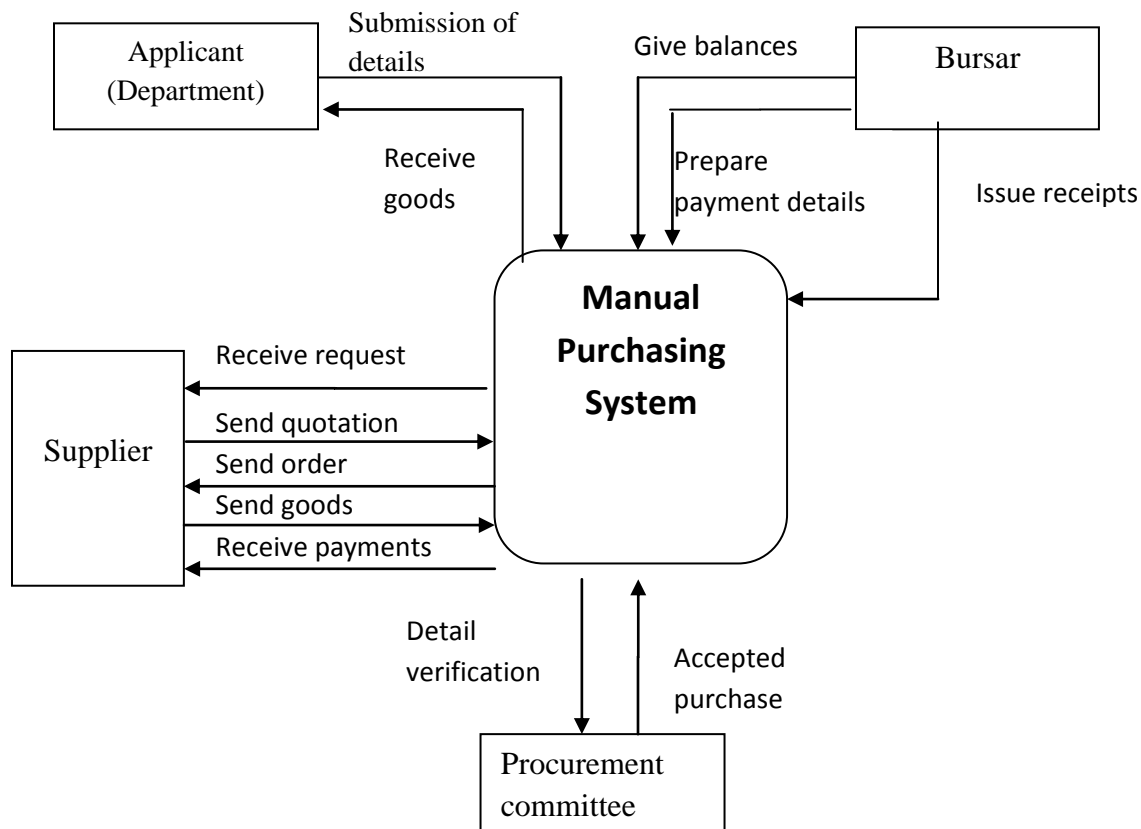
3.4.5 Data flow diagram

KEY

Entity

Process

Data Store

Data Flow
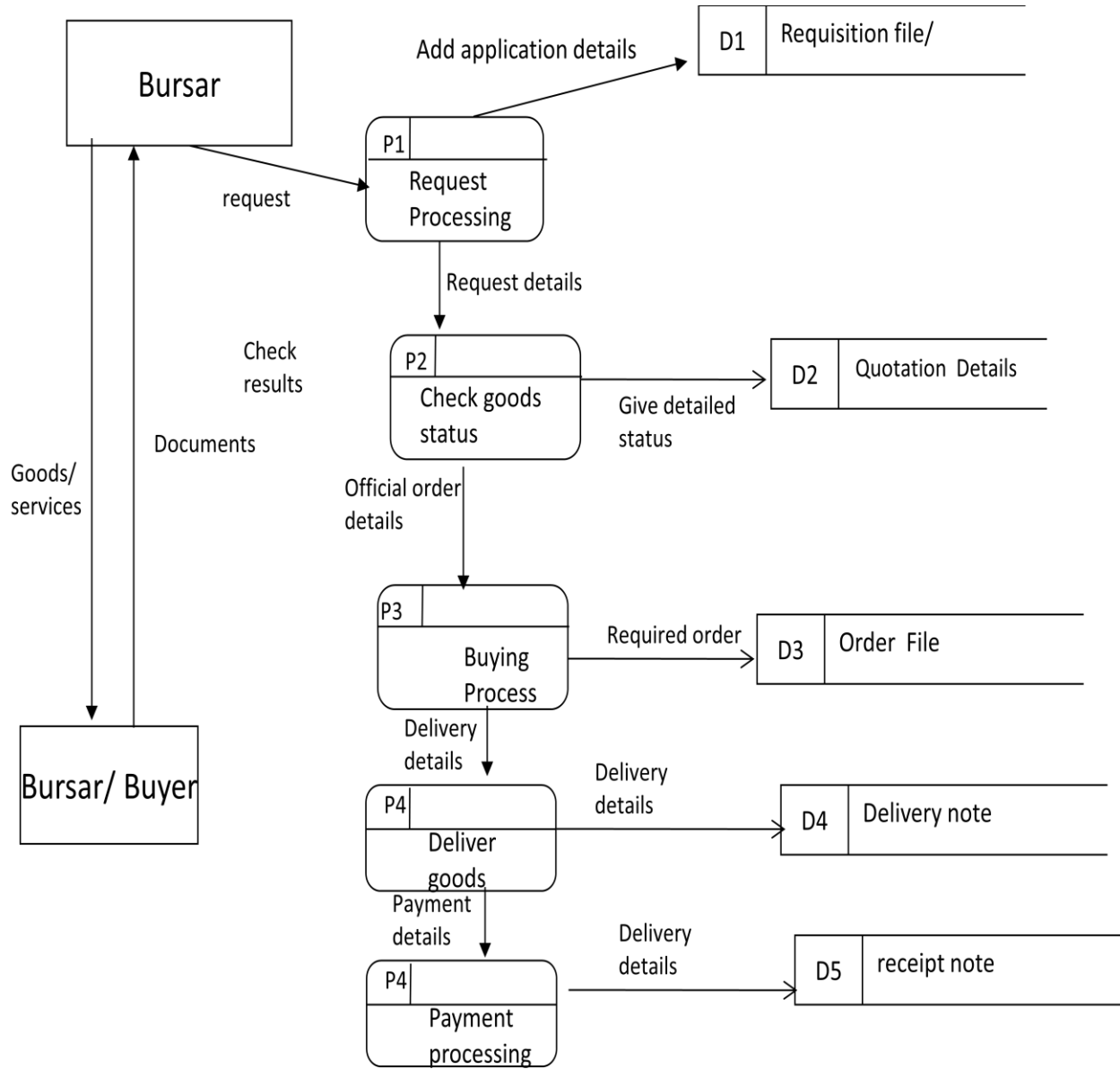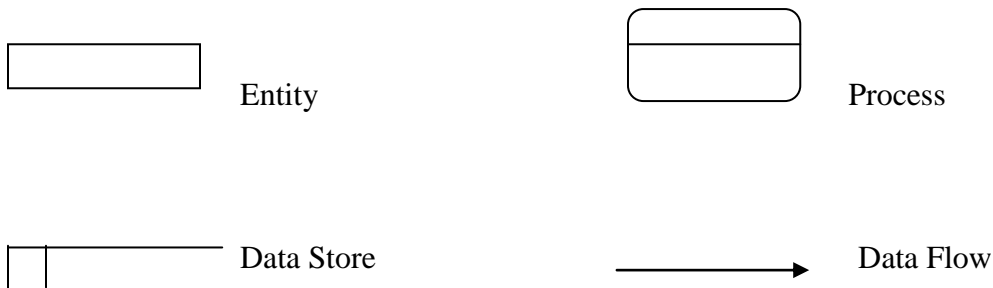
3.6. Weaknesses of Current System

The majority of systems that are manually operated have their fair share of inadequacies. The current purchasing cycle is thus not spared from the shortcomings. The system currently has huge inefficiencies and lacks in being effective in dealing with the purchase and supply of goods and services within educational institutions. Some of the challenges are:

- Time taken in between cycles is too long more so for a good or services that will have been exhausted.
- Highly bureaucratic in nature owing to the number of meetings and approvals that have to be done in order for any single good to be purchased.
- It lacks in cost-effectiveness as people need to travel to a supplier first to examine the goods and services available before making an order. Stationery costs, logistical costs are borne by the educational institution and making it more expensive to purchase and single good.
- Documents can get lost in transit. Files cabinets are responsible for storing all files which is bulky and can be prone to abuse.
- Queries to the stage of a transaction takes time thus the system is unreliable for adhoc queries.
- Duplication of work takes place as documents are moved from the HOD to the Deputy Head to the bursar. The lack of standardized frameworks and documents means it becomes difficult to work as there is no turnaround system.
- Errors can emanate from the system as work is done manually. Error detection can also take time since there are no audit trails that are left behind.
- Lack of back-up in the event of accidental data loss. The institutions will not recover if for example a fire breaks out.

3.7 Evaluation of alternative solutions

Successful implementation of the system can be done as stated in the Feasibility Study. The implementation of the system requires that several alternative be considered before embarking on a given solution. This analysis enables a best fit solution for the problems at hand. Alternatives considered are:

- Outsource Software.

- Improve present system.

- In-house developments.

3.7.1 Outsourcing of Software

Pressman (2001:44) defines outsourcing as a, "widespread practice of contracting software development work to a third party—usually a consulting firm that specializes in building custom software for its clients." A company in this case will sub-contract another institution to carry out the system development life cycle for it. This process will involve planning, managing, development, training and maintenance of the system including human technical issues. During system development, consultation takes place between users and management so that the system that is produced dovetails with user expectations.

Outsourcing brings a ready to use product and is brought from developers that according to Pressman(2001) can provide high quality software within the shortest possible time. There are pros and cons to using outsourcing as an option.

Merits

Software available immediately

Time saving process.

System bugs can be discovered and identified before usage by the organization

Experts are used to develop this software and hence the package to be used has high quality.

Reduced development costs

The company can major on its core business and leave the development of the software to the specialists.

Risk is reduced between the developer and the performing organization.

Demerits

On the negative side, a company loses some control over the software that it

needs. Since software is a technology that differentiates its systems, services, and

products, a company runs the risk of putting the fate of its competitiveness into the

hands of a third party.

- The organization ends up losing control over the software. There is a ceding of 'rights' as there is no guarantee on the ideals of the company like security, quality and confidentiality.
- Incompatibility may arise from the system as it becomes difficult to integrate and synchronise into the company network.
- Developer assumes importance in that you need to constantly refer to him to get his/ her output. Thus there is over-reliance on developer.
- Organisational needs may not be met.
- Chances are high that poor software maybe developed.
- Standard or general solutions do not fit precisely to the needs of the organizations.
- Very high maintenance costs as the organization keeps going to developer for updates and also charged for other services that maybe required.
- When the developer is busy or unavailable, it means the waiting time to get issues sorted out is uncalled for. You simply have to wait.

3.7.2 Improvement.

The modus operandi can changed vis-à-vis the user requirements. Work practices and procedures would require restructuring. One way would be to quickly approve quotations and minimize number of meetings that are sat before approving certain things. This cuts down on bureaucratic costs which are expensive in terms of time and money. Storage of file can be improved in that system through better filing techniques using alphabetical order. A register of suppliers can be established which are approved and have a proven track record. These suppliers are the ones that may supply to institutions.

An improved system would be good but it has its own shortcomings and benefits. The system can be altered but there are a few merits and demerits.

Merits of system improvement

- It works from a known position which people are comfortable with. Employees need little time to get used to the system.
- Minimisation of operational costs.
- Current employees are not retrenched
- There are low implementation and training costs.

Demerits of system improvement

- Data duplication will continue to exist within the system.
- Technology usage is minimized and the system will still not handle data and information in contemporary way.
- Security will still be missing
- Time taken to retrieve data will be too much

3.7.3 Developing an In-House system.

A third option would be to develop an in-house system. This entails that the current manual procurement system should be replaced by a totally new system. A new system will have human technical elements once installed. System development, design, installation and maintenance are done using local resources. The system will be tailor-made according to user specifications that emanate from system analysis. Fourth generation languages will be used as development solutions. These range from all learnt programming languages like PHP, C#, Visual Basic, C++. A Graphical user interface is ideally given by these fourth generation languages since it is user friendly and easy to use. Most people are familiar with graphical user interfaces and migration to the system becomes easier. However, time taken to develop a new system will approximately be about four (4) months.

In-house system benefits include:

- Little development and implementation costs. The budget is within reach for the organization owing to cost-cutting methods being implemented.
- Retraining is done on employees, this has an effect of upgrading their technical skills whilst at the same time making them competent.
- There is a retention of institutional memory and functional knowledge.
- The absence of middlemen simply means that users are directly involved in the production of the new system by providing system specification and through iterative prototyping techniques. The solution becomes homegrown.
- Back office system services can be provided more quickly because the technocrats that will have developed the system are locally available. Thus maintenance, upgrades and support is readily available.
- Searching for records is much quicker than before.

Demerits

- Time taken to develop the new system is a major challenge.

3.7.4 Chosen alternative

An In-house solution is the best. It will be able to bring a home grown solution to the current procurement problems. It will cost significantly less as compared to other software systems available on the market. The reduction on dependencies upon external entities for development, maintenance brings independence. Organizational goals will be met and there will be an improvement in the procurement system. The personnel have an opportunity of being part and parcel of the procurement process through the bottom-up approach.

3.7 Requirements Analysis

Users within a system have certain expectations. These expectations are factored in the requirements analysis which describes the desired state of the organization to developers. This becomes the benchmark for development. The process of development hinges on these requirements and seeks to fulfill the user requirements. System efficiencies and effectiveness of

data capturing techniques and storage capabilities of the system are defined. Requirements analysis is divided into two categories namely:

- Functional requirements
- Non-functional requirements

3.7.1 Functional Requirements

These are various practical services that the system makes available to its users. It includes services, functions and roles that the system is expected to perform. These functions are what make the system be appreciated and different. They are useful in providing effectiveness and efficiency within the system. Primarily, the system should :

- Enable online procurement
- Allow suppliers to be registered and accredited as per regulations.
- Produce an audit trail – so that when changes happen to the system, they can be traced.
- Provide summaries for purchases and amounts.
- Provide a user friendly environment and easy to use.
- Incorporate security through usage of usernames and passwords.
- Enable report generation on procurement issues.

3.7.2 Non-functional requirements

These are requirements that aid the functional requirements. They augment and add value to the functional requirements. They are part of the system and border around the usefulness of the system in providing ease of use and they provide usefulness with them. The following non-functional requirements are associated with the new system:

- Providing system reliability. Management and users can depend on this system to provide the desired results.
- Installation and maintenance is easy
- User interfaces are easy to navigate and understand.
- There is easy access to data within the system at the same time providing user access levels.

3.8 Conclusion

This chapter focused on how data was collected, it also gave user requirements. The current system was depicted pictorially using DFD and system flow charts. More detailed information was gathered through data collection methods. Alternative solutions to the project were suggested and analysed and the conclusion that was reached was that an in-house solution is the best though it takes times. Evaluations were made on the several alternative solutions. Finally, functional and practical requirements of the system were specified. Non-functional requirements were also identified. The developer will move on to the new stage which is the design stage.

CHAPTER 4

DESIGN PHASE

4.1 Introduction

The previous chapter examined the current system. Various data collection methods were mentioned that helped in gathering key data to use in the design of the system in Chapter 4. An evaluation of alternative solutions was done, which led to functional and non-functional requirements analysis. The construction of a feasible computer system hinges entirely on the database that has been designed to handle all data processing user needs and requirements Satzinger (2014). Hence the design phase is one of the most critical elements within the project. It anchors on the conceptual, logical and physical design. It focuses on bringing functionality by construction of appropriate data bases that are linked together. A detailing of activities that are involved is found using file structures. The system will need to be configured, implemented and finally deployed to work in practice. Entities were identified, relationships existing within them specified Valacich et al (2016). Modularity begins within the design phase, whereby the system is broken down into small manageable parts for purposes of reducing complexity. A technical solution was developed that meets the requirements of the Online Procurement System. The successful implementation of the phase required an analysis of the logical, physical, architectural interface and database design.

4.2 System design

The design of hardware and software in the new system is needed. According to Sommerville (2016), there are new components that will be included which are of a structural nature, these are dovetailed design methods, data within modules in order to produce a highly competent system. System functionalities are critically analysed. There are expectations of the new system that need to be met in order for the system to be penned functional. The proposed system should have a capacity to counter areas of weakness associated with the current system and then chart a way forward in the right direction.

There are certain attributes which are required from this system, which are:

Effectiveness

Usage of the system should result in tangible results in the form of output. Thus outputs from the Online Public Procurement System have a capacity to bring its usefulness to management, users and suppliers at the same time. Deliverables are a must from this system, and this emanates from the composite functions of the database. Valacich et al (2016) describe effectiveness as, an extent whereby a developed computer system meets the information demands of users. They stress that effectiveness brings better productivity within the organization. There are benefits that are associated with an effective system which range from social to economic. Users get satisfaction from the usage of such a system, turnaround times are reduced in order for one to carry out a certain transaction which all lead to overall productivity as user requirements are being met.

Sustainability

Medium to long term benefits of a system are associated with its life span in terms of ability to sustain it in the future is important. Longevity within software projects ensures that they remain useful past their shelf life. The system's future is not hinged on the current developer but on the ability of the users to be able to craft a way forward in overseeing operations Shelly and Rosenblatt (2014). Updates of the new system should be created through batch files which should easily be incorporated into the main project. Hence users should be able to effectively carry out a system upgrade without needing technical assistance. Adaptive and perfective maintenance should also be carried out when the system is now in operation in the field.

Dependability

The organization working on the new system should find the new system tenable and trustworthy. Once data has been input, they should expect results within the shortest possible time period. There is a basic assumption that underperformances that were associated with the old system are dealt with in the new system Broy et al (2013). The new system is a better version of the old. It has been modified, modernized and focus driven.

Dependability includes:

- Quick report generation

- Adhoc queries

- User friendliness

- Security

- Online access to transactions.

- Enabling quick transactions

- Documentation easy to go through the steps.

Efficiency

Efficiency is a productivity performance indicator of any system. It examines the costs that are incurred by the system which maybe monetary or non-monetary. According to Connolly and Begg (2015), efficiency is about managing costs with regards to finances and time spent to come up with the database. Resource utilization should be done with minimum figures and thus bring desired results within a predetermined time. Thus a level of performance is needed which augurs well with careful resource utilization thus using fewer inputs but at the same time getting a great output.

Security

Systems that are IT related in this day and age need strong security. This does not only safeguard the data, but it gives assurance to management and users to rely on the output of the data. Data is an exclusive entity which is purportedly generated by the system and hence once generated, it becomes a commodity of worth which requires protection from forced entry, hacking, viruses and other intruders Valacich and George (2017). A robust system should have privacy and ensure confidentiality of information and data. Only authorized people should be able to access the system at their different levels of usage.

Features stated above should be incorporated into the Online Public Procurement System.

4.2.1 Proposed System Overview

The new system should:

- Allow suppliers to apply and be registered online.

- Enable online vetting of documents and filled in information

- Give adhoc reports on procurement

- Promote sequential and systematic procurement within the shortest possible time.

- Minimise data redundancy and avoid data duplication.

- Permit users with different work credentials to access the system at differing levels.

- Seamlessly allow change over from a manual to a computerized system.

4.2.1. Context diagram for proposed system

Figure 4.2. Context diagram for proposed system
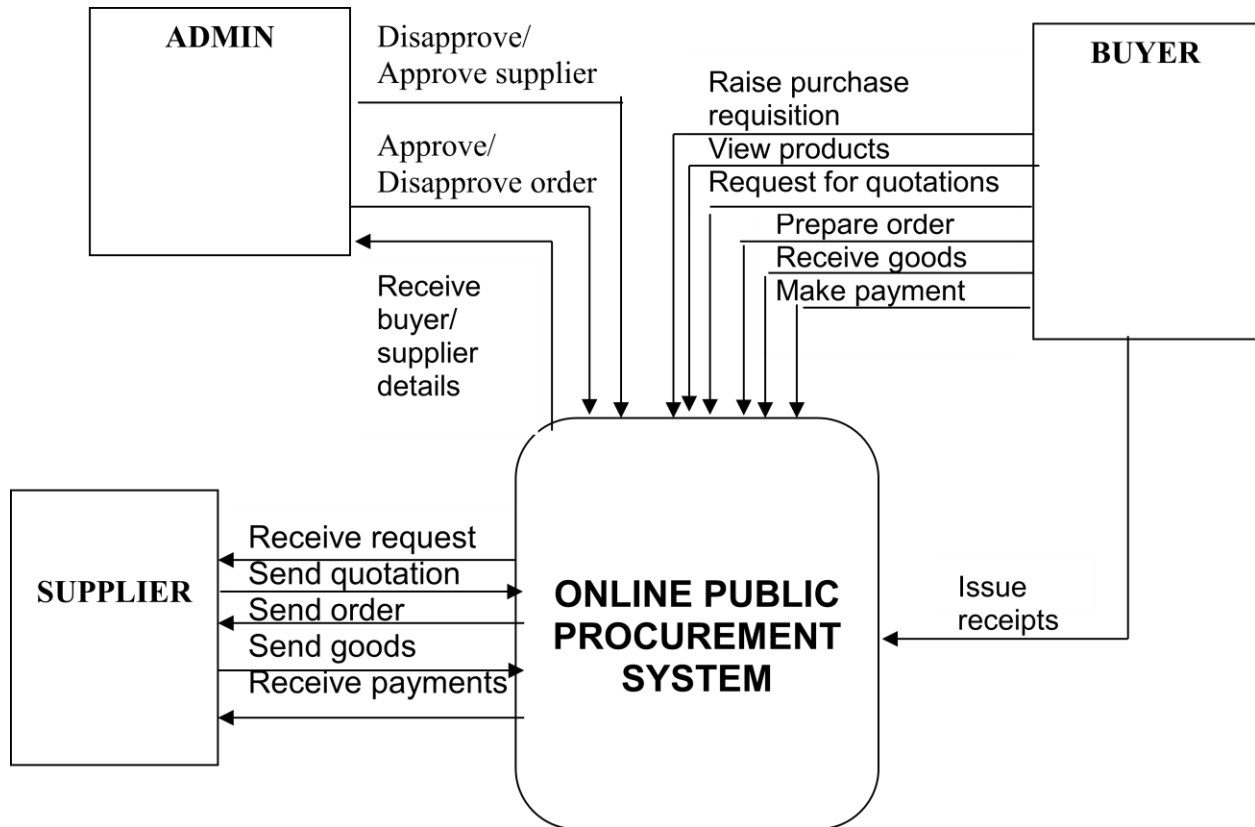
DFD FOR PROPOSED SYSTEM

Figure 4.3. DFD for proposed system
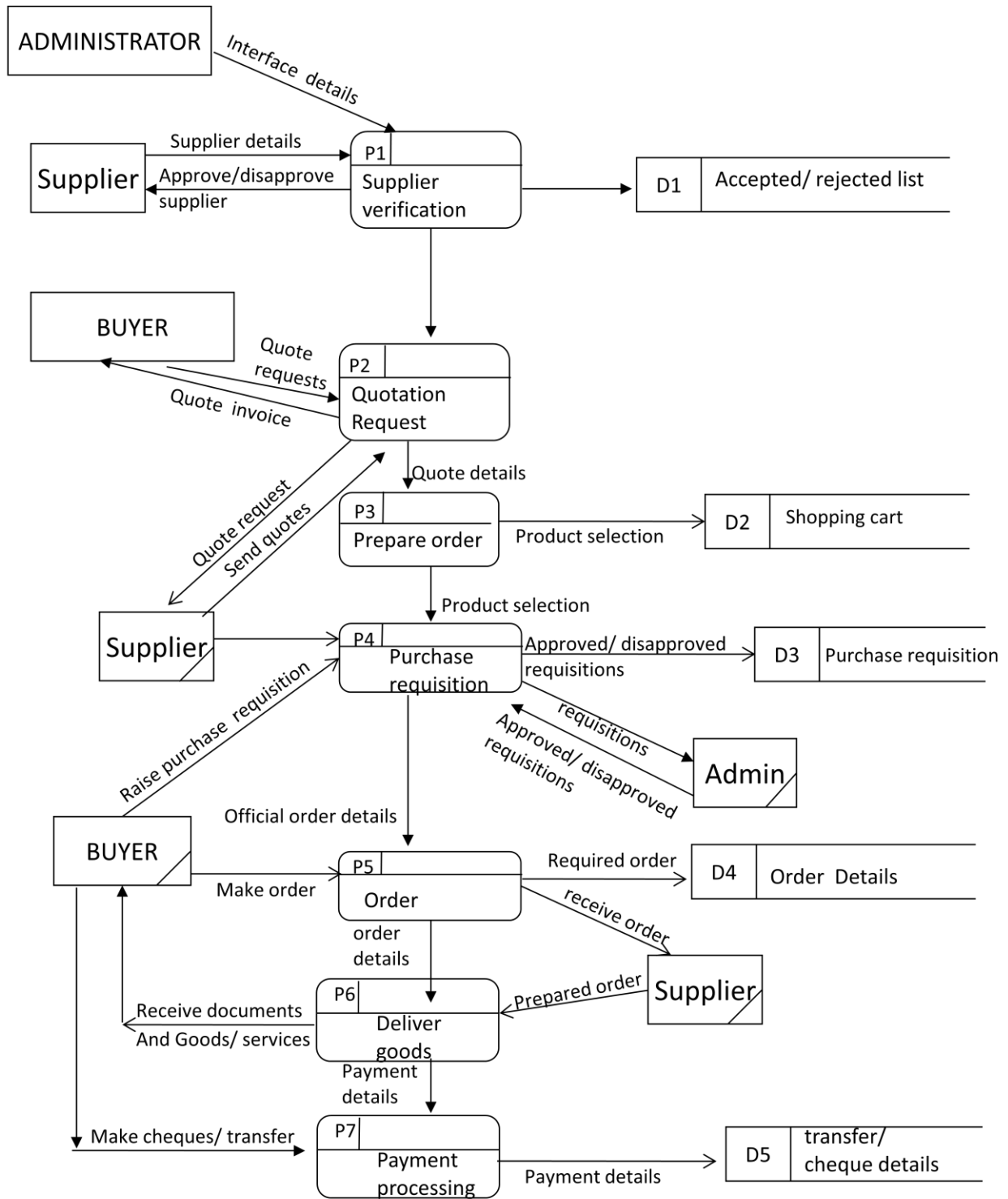
4.3 Architectural design

During the design stage, structural high level interconnections have to be defined. The architectural design is described by Sommervile (2016) as a process that describes hardware and software technical specifications and configuration settings for the system. The way software will be installed and its interfaces are given in a bird's eye view. Major hardware components are shown, the interactions between the components and the nature of interactions are specified. Hence, it describes the logical and the physical layout of the system, thus specifying practices, processes and procedures inherent in the system.

Architectural Design of System

Figure 4.4. Diagram to show Architectural Design
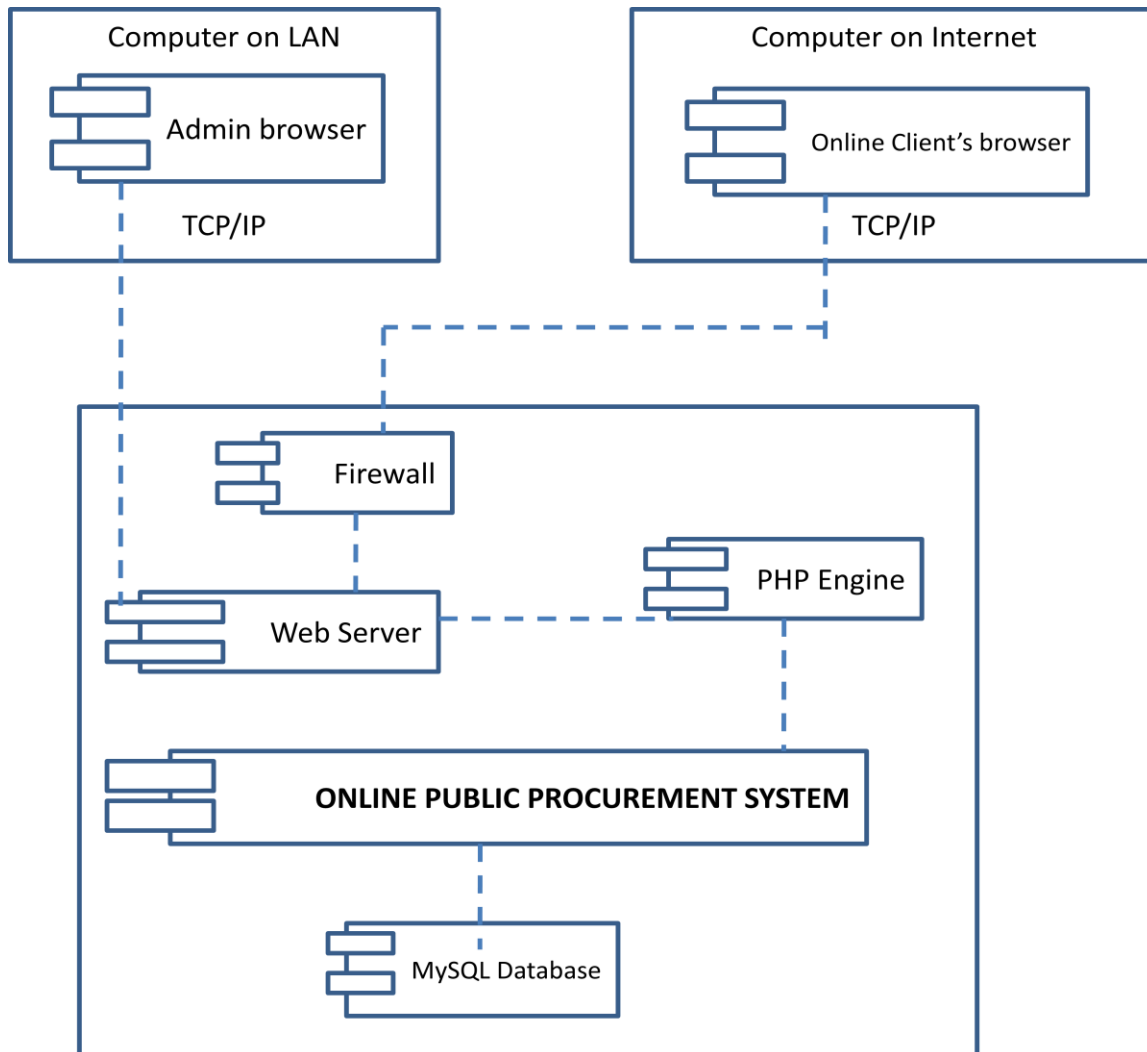
Users are able to gain access to the server's contents by passing through a password protected system. The password is an initial barrier which provides security by way of asking a user to supply a password to their username. This is used for authentication and verification purposes. When the user wants to gain access to the contents on the server, they must pass through a barrier provided by the system. Once verification has been done, the user gains access and are able to use the system for the several functionalities. The separation of the system into a server-side and a client-side provides clear cut access levels which are a barrier of entry for lower level users. The presence of the proposed firewall minimizes the corruption of supplied data and warding off unauthorized access by users.

Architectural Requirements

Hardware Requirements

Desktop Computer Core i5 (CPU)

TP Link Router

8 port Hub/ Switch

External USB HDD

Network accessories

RJ45 Connectors.

Switch Cabinet

CAT 6 UTP cables

UPS 22VA

Power cables

Software requirements

Windows 7

Hypertext Protocol PHP

Database server MySQL

Dreamweaver

ESET Nod 32 Antivirus (Professional edition)

Xxamp Server

MS Office Professional (2010)

4.4 Physical Design

A definition of hardware, technical environment it will operate in and the physical arrangement is the Physical Design. According to Connoly and Begg (2015:439), it is a, "process of producing a description of the implementation of the database on secondary storage; it describes the base relations, file organizations, and indexes used to achieve efficient access to the data, and any associated integrity constraints and security measures." The physical design is hence specific to a DBMS. The relationship that exists between the hardware and the tight cohesion which emanates from a dovetailed system as a result of networking is desirable. Spatial dispersion of hardware in various places so as to cover a local area through a local and wide area network will ensure that the system has adequate backup and is accessible to clients both near and far. Machines that require usage of the system will need to firstly gain access to the system and then fully utilize the procurement system. Key to physical design is the interaction of the hardware with users as a data driven process is set in motion within the network of computers.

4.4.1 Interaction of Hardware and Software

The database of the system can be accessed by the administrator. He/she has full access to both server and client side information. The other users are only given information according to their level of access within the system. Their level of access determines the windows that they access and the menus and data they are able to get to. In order for them to get access to the system, both users and the administrators will have to log on to the system. Transactions will be examined with a view of maximizing and exploiting relations that can exist in order for a database with reduced redundancy and duplication to be crafted. Disk size estimations stemming from the data dictionary descriptions will be given for the system. A configuration of the system is needed so that it is able to gain access onto the internet through web hosting tools. Thus internet security in the form of firewall and antivirus software have to be up-to-date and of a robust nature. Data is backed up regularly through back-up modules within the software to ensure data integrity and security of information.

Network setup of machines is as illustrated below.

Figure 4.5.Physical Design of the Proposed System
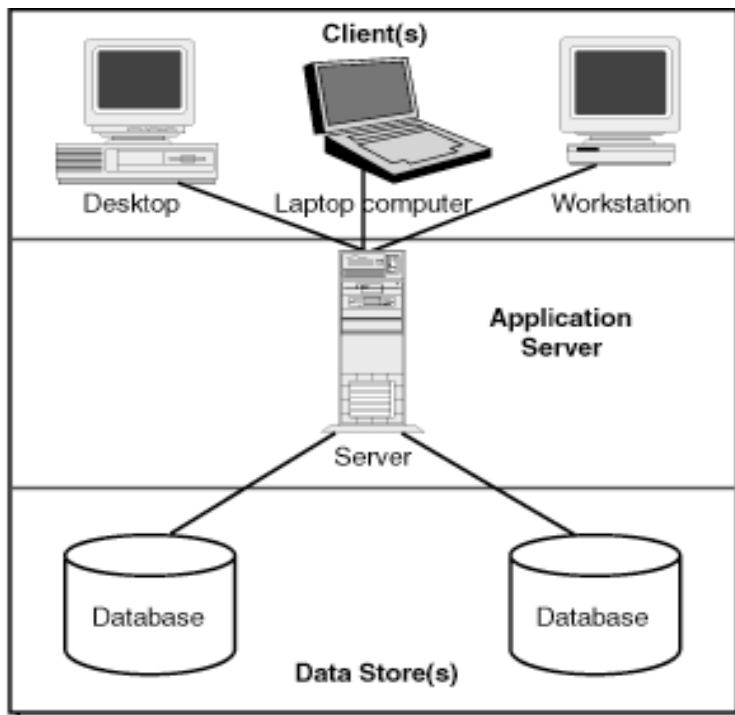
4.5. Database Design

Connolly and Begg (2015) describe design as a process of creating a design that will support the enterprise's mission statement and mission objectives for the required database system. The process details the database model that comprises of the logical design choices, physical design choices. Storage specifications that are expected within the system are given there. Sommerville (2016) states that the database design aims at accommodating informational needs of users within the organization.

An efficient and effective system that maximizes storage space and minimizes redundancy and duplication is created. A description of the data and its structure is given in the Data Dictionary. The procedures and processes that are used to be able to control and make changes to the data base through the Database Management System (DBMS) emanate from the Data Manipulation

Language (DML). The interface of the system is provided by the DBMS. This brings the database to a platform where a user can manipulate it using DML and basing on the structure of the database and relations that exist within it. Thus a reliable database is created whose effectiveness and efficiency and security hinges on the facilities offered by the DBMS.

The Database Schema (Three Levels)

User Views (External View) (state levels)

The external view only shows pertinent data and views to a specific user. It is termed the highest level of abstraction with the database. Ricardo and Urban (2017:38) specify that, "Each user has a model of the real world represented in a form that is suitable for that user." A user's individual needs are met at the external view. Garcia-Molina et al (2015) adds that access rights and user levels are also presented as a certain user interacts with aspects that pertain to him/her only. Thus any irrelevant data to the user is excluded from that view. The physical details, conceptual and internal details with respect to storage and security are hidden from the realm of the user. The user is limited in terms of the processes he/she is able to carry out i.e. update and read only mode are found.

Logical schema

This section of a database describes the data entities that are contained together with the relationships of the entities. Therefore attributes, cardinalities and constraints that are within the data objects are seen as described by Ricardo and Urban (2017). The whole structure together with data types, attributes is seen. Ricardo and Urban (2017:40) state that it is a, "complete description of the information content of the database." The level does not show the complex physical storage details. The Database Administrator and Application Developers are seen working at this level.

Internal Level

The level is also termed the physical level. According to Garcia-Molina et al (2015), it is the lowest data abstraction level which an internal view of the way data is stored on storage devices.

Method of file organization and file access are descriptively given. Ricardo and Urban (2017) state that the internal schema is written in DDL which is a complete description of the internal model which describes even issues like how the data is represented, record sequencing, index existence, pointers and hashing algorithms in use. Complex file and data structures are dealt with to provide a way in which data types can be appropriately stored on storage medium. Security components such as data encryption which use translation or transcription are used to hide the data structures from unauthorised entry. In addition, the physical level compresses data making the process of archiving possible.

Figure 4.5 Database Schema
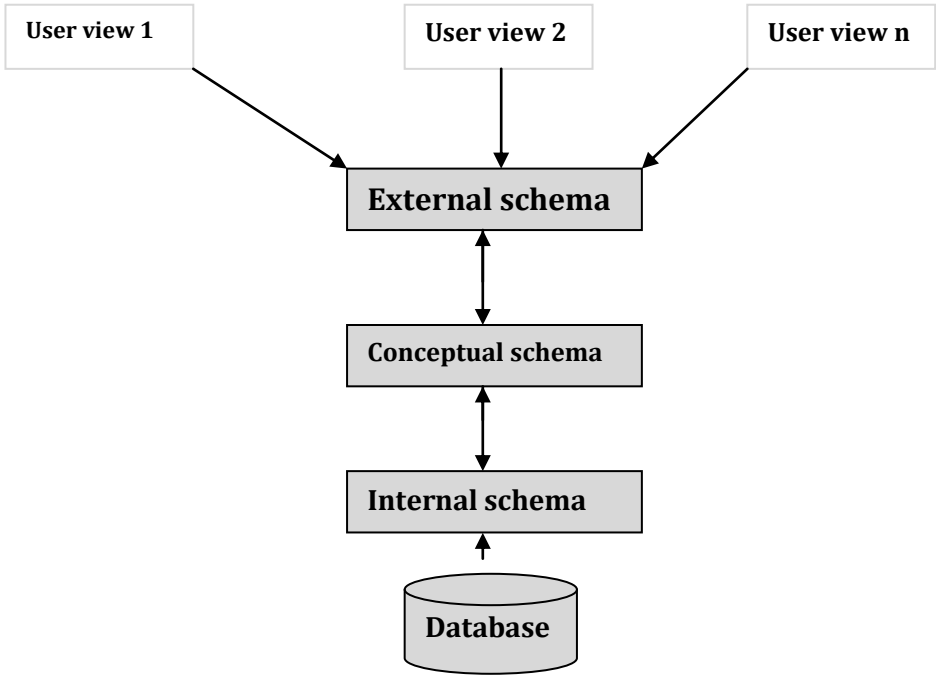
4.5.1 Entity Relationship Diagram (ERD)

An ERD is a diagram that shows objects that have an existence in real world situations. The objects contain attributes which are associated with them. The attributes that make up the object maybe identical to those of similar objects. Relationships existing between objects are specified given their cardinalities. The website *https://www.dlsweb.rmit.edu.au* describes, "The *cardinality* of a relationship is the number of instances of entity B that can be associated with entity A". Stephens (2015) states that an ERD was primarily developed to enable designers to have an overview of database design.

All entities associated with the database will be identified, attributes specified. Relationship between entities will be examined to give the nature of relationships.

Relationships Identification

The process of relationship identification requires specifying relationship in the form of verbs. They describe the kind of cardinality that exists.

Supplier - Accounts (m:1) supplies:- A supplier is provides certain commodities and services. There can be more than one supplier to a school.

Departments - Accountant (m:1) reports to :-There are many different types of departments, and only one accounts department.

Suppliers – Departments (m:m) hosts :-Each departments is associated to a number of suppliers who in term depend on several departments who may want the same product.

Inventory – Department (m:1) held :- Inventory is held at a department. More inventory is found in a department.

Table 4.1: Entity Relationship Diagram Attributes

| ENTITY	ATTRIBUTES
Users	Username, password, nat_id, email
Department	dept_id, username, inventory_list, requests, quantity, descr
Accounts	accountno username, supplierid, invoiceno, requests, balances, contact
Supplier	Supplier_id, product, category, username, password, quantity, contacts, address, payment_term.
Product	productid, prodName, Description, unitPrice, imageFile
Orders	orderid, prodname, productid, unit price, totalprice
Payment	Paymentid, datepaid, totalpaid, details, invoiceno, accountno.
Administrator	adminName, email
Tender	Tendereid, tendername, tenderdescrip, deadline
Bidding	Tenderid, username, bidamount, references, status

Figure 4.7. EER Diagram for system
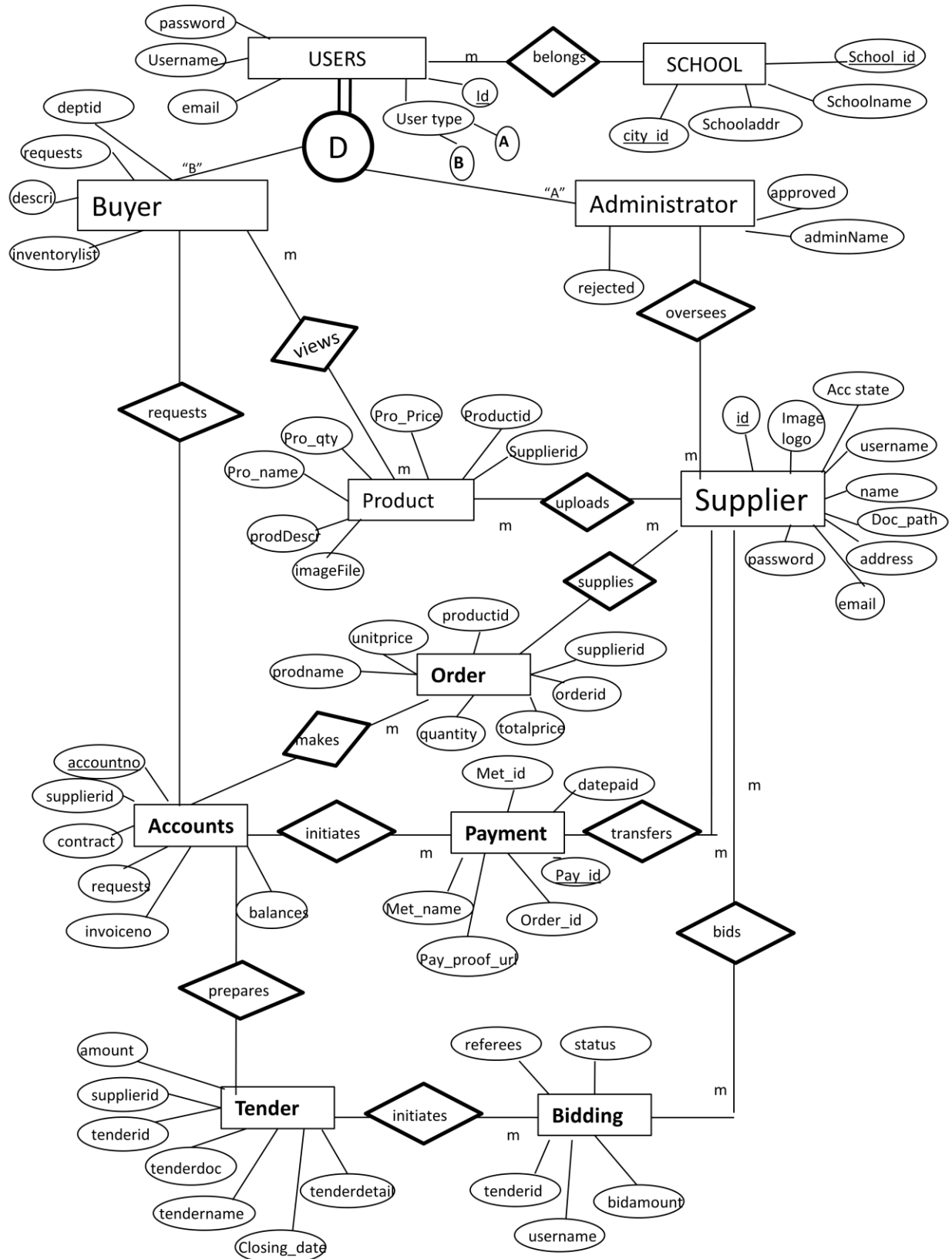
Figure 4.7. To show Tables to be used in the database

Table 4.xx Admin Structure

Field	Type	Size	Value format	Null
id	int	11	Unique identifier	Not null
Username	varchar	50		No
Password	varchar	100		No
email	varchar	200		No

Table 4.xx Bid Structure

Field	Type	Size	Value format	Null
bid_id	int	11	Unique identifier	No
tenderid_id	int	11	Foreign key	No
supplier_id	int	11	Foreign key	No
my_quotation	text			No
amount	decimal	6,2		No
Payed_for_tender	enum	3		No
pay_proof_url	varchar	200		Yes
payment_unique_id	varchar	200		No

Table 4.xxx Payment_Category

Field	Type	Size	Identifier	Null
type_id	int	11	Unique identifier	Not
type_name	varchar	200		Not

Table 4.xxx Payment_Method

Field	Type	Size	Identifier	Null
met_id	int	11	Unique identifier	Not
payment_category	int	11		Not
met_name	varchar	200		Not

Table 4.xxx Buyer

Field	Type	Size	Value format	Null
id	int	11	Unique identifier	Not null
school_id	int	11	Foreign key	No
name	varchar	50		No
username	varchar	50		No
password	varchar	100		No
email	varchar	200		No
profile_pic	varchar	100		Yes
account_state	varchar	200		No

Table 4.xxx City

Field	Type	Size	Value format	Null
city_id	int	11	Unique identifier	Not null
city_name	varchar	11		No
Latitude	decimal	10,7		No
Longitude	decimal	10,7		No

Table 4.xxx Order

Field	Type	Size	Identifier	Null
id	int	11	Unique identifier	Not
buyer_id	int	11	Foreign key	Not
supplier_id	int	11	Foreign key	Not
date	timestamp			Not
payment_id	int	11		Not
amount	decimal	6,2		Not
order_state	enum	Pending, complete		Not
is_Transportincluded	enum	Yes, no		Not

Table 4.xxx Ordered_Products

Field	Type	Size	Identifier	Null
id	int	11	Unique identifier	Not
order_id	int	11	Foreign key	Not
product_id	int	11	Foreign key	Not
quantity	int	11		Not
price	decimal	6,2		Not
effect	varchar	100		Not

Table 4.xxx Payment_Orders

Field	Type	Size	Identifier	Null
pay_id	int	11	Unique identifier	Not
pay_proof_url	varchar	200		Not
pay_unique_id	varchar	200		Not
order_id	int	200		Not

Table 4.xxx Products

Field	Type	Size	Identifier	Null
pro_id	int	11	Unique identifier	Not
category_id	int	11	Foreign key	Not
supplier_id	int	11	Foreign key	Not
pro_name	varchar	50		Not
pro_description	varchar	200		Not
pro_image_path	varchar	200		Not
pro_price	decimal	6,2		Not
pro_quantity	int	100		Not
pro_discount	int	3		Not

Table 4.xxx Product_category

Field	Type	Size	Identifier	Null
cat_id	int	11	Unique identifier	Not
cat_name	varchar	50		Not

Table 4.xxx School

Field	Type	Size	Identifier	Null
school_id	int	11	Unique identifier	Not
school_name	varchar	50		Not
school_address	varchar	200		Not
city_id	int	11		Not

Table 4.xxx Supplier

Field	Type	Size	Identifier	Null
id	int	11	Unique identifier	Not
name	varchar	50		Not
username	varchar	50	Foreign key	Not
password	varchar	100		Not
Email	varchar	200	Foreign key	Not
Phone	varchar	20	Foreign key	Not
address	varchar	60		Not
Account_state	enum			Not
image_logo	varchar	100		Not
document_path	varchar	200		Not
city_id	int	11		Not

Table 4.xxx Supplier Settings

Field	Type	Size	Identifier	Null
Supplier_id	Int	11	Unique identifier	Not
Tax_percentage	Decimal	3,2		Not
Delivery_cost	Decimal	6,2		Not

Table 4.xxx Tender

Field	Type	Size	Identifier	Null
Tender_id	Int	11	Unique identifier	Not
Title	Varchar	40		Not
amount	Decimal	6,2		Not
buyer_id	Int	11		Not
closing_date	Date			Not
suppler_id	Int	11	Foreign key	Yes
Tender_details	Text			Not
date_created	Timestamp	60		Not

4.6. Program Design.

Program design depicts the program in diagrammatic form as seen in the Unified Modelling Language (UML) diagrams. UML gives a visualisation of software projects through the use of several diagrams. As a tool, UML models software project developments so that appropriate software can be produced during the coding phase of the project. Through the use of UML, there has been an improvement in the integration found existing between structural models and behaviour models. This project will centre in on Package and class diagrams and the activity sequence diagram.

Figure 4.8. Class Diagram for system

Users

id <<PK>>
Username char (50)
password char (100)
Email char (200)

Add user ()
Verify user login()

*........ **Employed by**

School

Schoolid <<PK>>
Username char (30)
password char (50)
Email char (50)

Add user ()
Verify user login()

Disjoint complete

User type

Buyer

id int <<PK>>
Username char (50)
Name char (50)
Schoolid int
Email char (200)
Profilepic char (100)
Acc_state char(200)

Add description ()
update requests()

Administrator

Adminid: int <<PK>>
adminname char (20)
Approved bool (30)
Rejected char (50)

Add rejected ()
Edit approved ()

*........ *
views

1....... *
supervises

Product

Pro_id int<<PK>>
Pro_name char (30)
prodDescri char (200)
Pro_qty int
Pro_Price double
Proimage char (200)
Pro_discount int
Category_id int

Add productid ()
Delete productid()
Update availqty ()

1........1
requests

Accounts

Accountno int<<PK>>
Supplierid int
Contract char (50)
Requests char (50)
Invoiceno int
Balances int ()

Add invoiceno ()
Checkout balances()

....
uploads

Supplier

id int <<PK>>
Username char (50)
Password char(100)
Email char (200)
phone char (20)
Address char (60)
Acc_state char (20)
Iamge_logo char (100)
Document_path char(200)
City_id int

Add productcategory ()
Add payment()

1........ *
makes

1........1
prepares

Order

id int <<PK>>
Supplierid int
Productid (50)
price int ()
Order-id int ()
Quantity int ()

record order()
Placeorder()
Edit qty ()

bids

*
....
*

Tender

Tenderid int <<PK>>
Title char (40)
Amount double
Buyer_id int
Supplier_id int
Closing_date date ()
Tender_details char text

Add newtender()
Add tendername()

1........*
initiates

Bidding

tenderid <<PK>>
username char (30)
Bidamount int (50)
Status char (50)
Referees ()

Add bidamount ()
Edit status()

71

Figure 4.9. Package Diagram for system
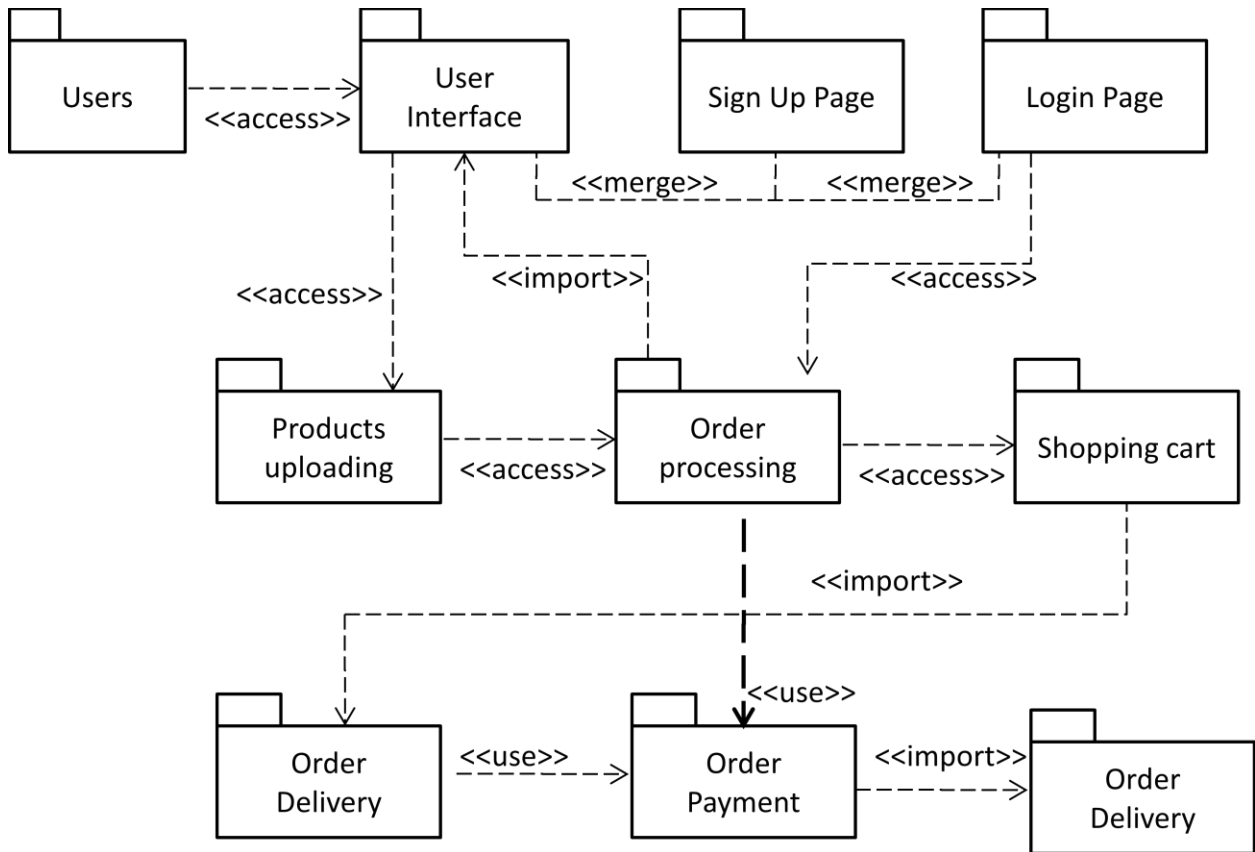
4.6.2. Sequence diagram.

The interactions that exists between objects at any given time period are shown in a sequence diagram. Object's life times and the subsequent message exchange between them is also depicted. Several sequence diagrams will be given for this project.

Figure 4.10. User Creation – Sequence Diagram
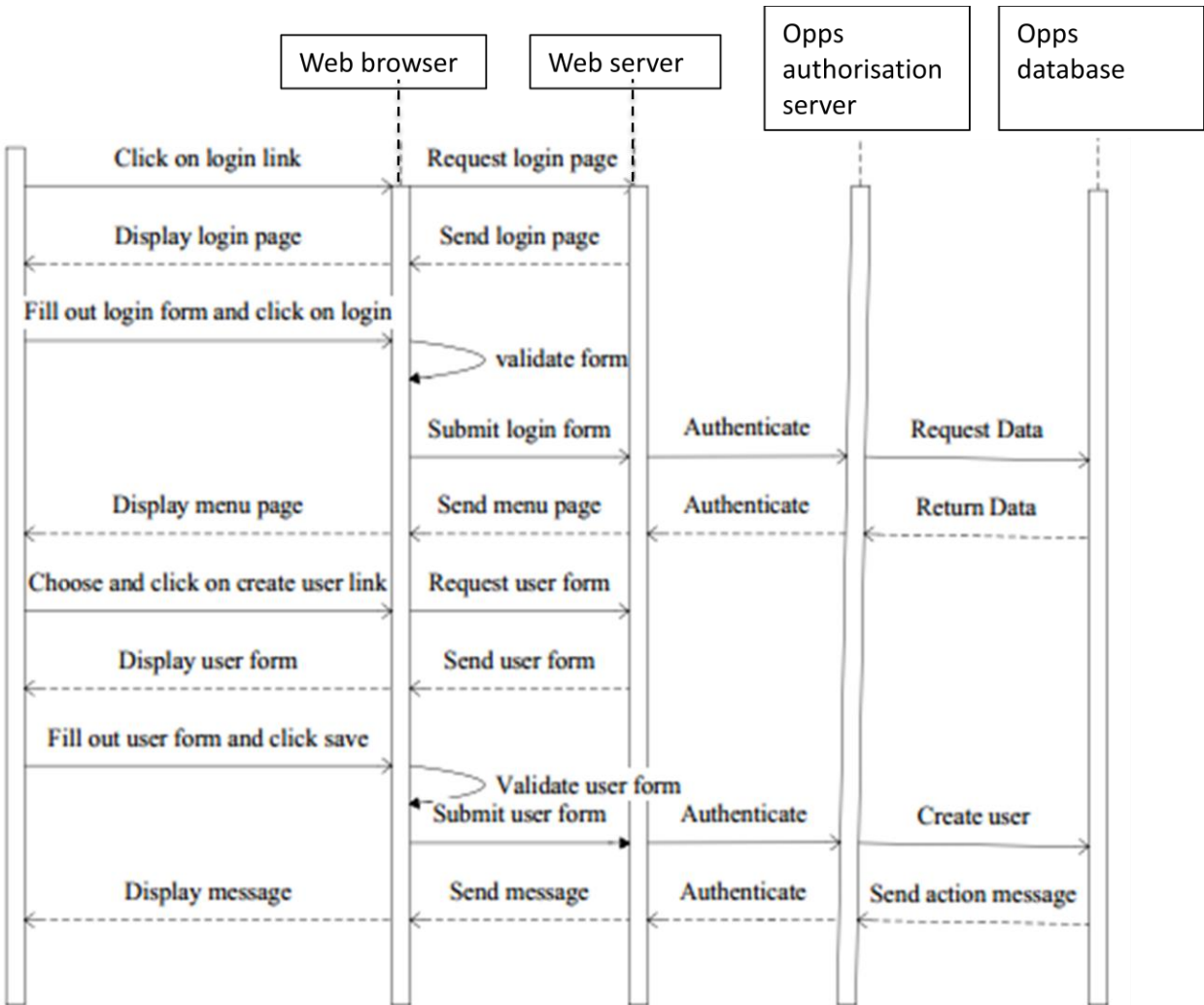
4.11. Sequence Diagram showing purchasing
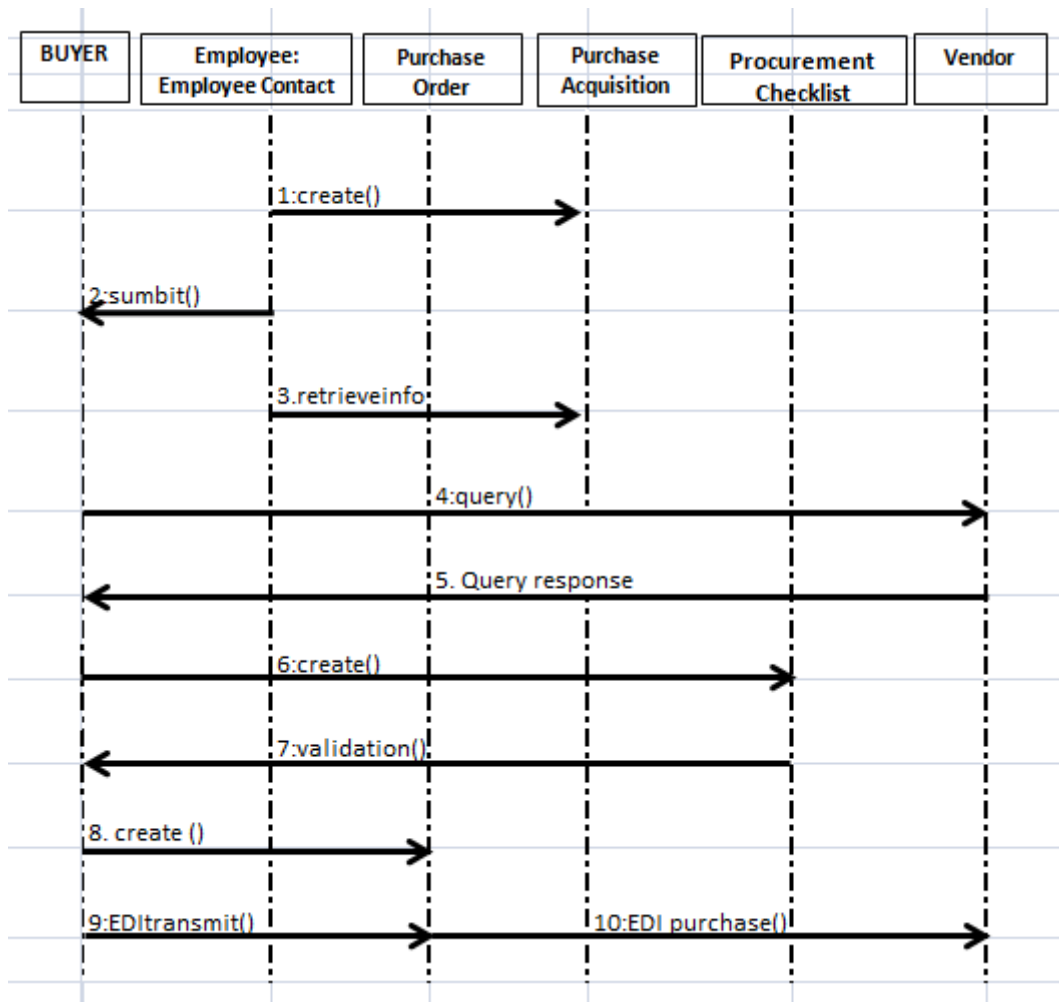
4.7. Interface design

A user needs to interact with the computer system through an interface. Interface is the part of the computer that interacts with the user. Interface design according to the website https://www.cs.umd.edu should take into consideration several aspects since users judge a system's functionality primarily from the user interface. It is the initial window that enables the user to interact with the hardware and software of the system. An interface should be user friendly, easy to navigate, appeal to the users of the system who will spend more time with it than the developer. Users should be able to provide reliable and relevant input to enable the design of the interface. Thus an interface is dove-tailed into user requirements and specifications. As described in Stephens (2015), certain guidelines need to be adhered to that

include the entry of data, its display, sequence of data and user dialogues. He further states that user guidance, data transmission and data protection should be incorporated in interface design. He emphasises that system failure should not only be associated with a crushing system but it should be attributed to an inability of users to fully utilize the functions of the system stemming to its 'hardness' and 'clumsy' effects on the user. In order for a user to continue to use a system, this perceived ease of use, perceived usefulness comes from the familiarity that is gained in total as the user uses the system. Any demands that the system poses on the user especially technical challenges are unnecessary, uncalled for and counter-productive. Users are quick to label system based on their experiences with an interface Valacich and George (2017). This can concretise and jeopardize or improve a project's success. Given the background, The Online Public Procurement System will be made easier through input and output screen, links which are useful will be found all in a bid to de-clatter the homepages and make it easier to navigate within the system.

APPLICATION STRUCTURE

Figure 4.1. Application Structure
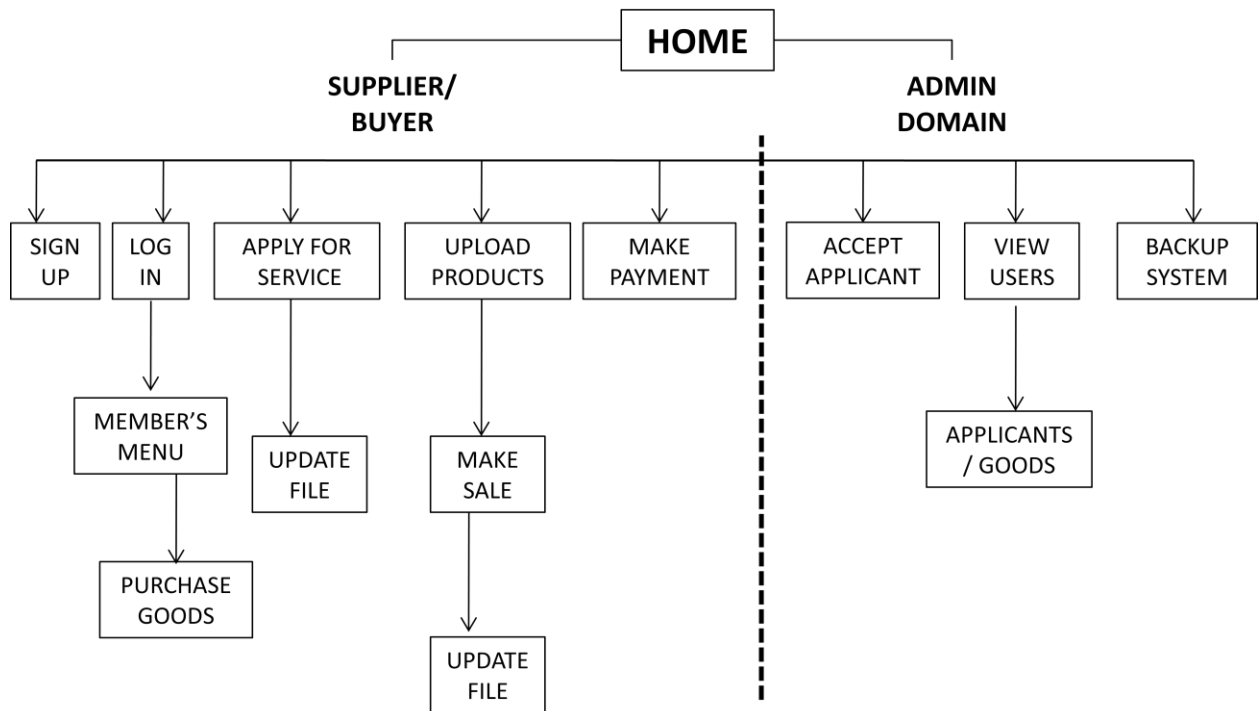
Signup

People with an interest in supplying goods and services have to be registered with the District through the Online Public Procurement System. They register using their company and provide a unique username and also a foolproof password consisting of a mixture of alpha numeric characters of an acceptable length. Once registration is done, the company awaits acceptance of the proposal.

Schools also sign up using buyer platforms in order to register a presence using their school names and passwords of choice. They become available to the online community and hence can make purchase on people who have been vetted and can now supply them with goods and services.

Login

Registered suppliers can access the system to track their application, manage transactions and see a community of users who may send requests to them. When logging in, they supply a user name and password which afford them the opportunity to work and be viewed by several customers.

Products

The products interface allows several products to be showcased by a supplier with a brief description of the product. This interface is a result of the uploading that will have taken place on the supplier side. A school is able to navigate through several products and be able to select their choice supplier based on the information provided. A comparison of products is done. The system has an ability to delisting a supplier. Accepting of a supplier is a prerogative of the administrator having taken due diligence.

Uploading products

The products as they are uploaded, go into several categories like stationery, sanitary, vehicle maintenance, electrical goods, food stuffs, IT equipment. In this database, schools can view at a glance and be able to select a product, see its supplier and request for a quotation for the selected

product. Quantities that are being sought for can be given and an initial inquiry can be posted. This initial inquiry initiates an online transaction if all necessary pre-requisites are met. The uploaded products are viewed by only registered schools. Suppliers supply quantities available which when bought, the system automatically deducts so that the current state of uploaded products is known by an interested party. When products are no longer available, an unavailable tag is put to the product before one can even examine further details about the product.

ADMINISTRATOR DOMAIN

Systems require to be administered in the astute ways so that unauthorized access is not done by intruders. The administrator is privileged to have access to the whole system. He/she is capable of viewing all suppliers and buyers although they may not be in a position to initiate a transaction of buying products. The administrator also needs create an account to be able to run the whole online procurement system. Once an account has been created, suppliers and schools can now create accounts and log-in to access or supply goods and services. The administrator can accept suppliers. The system gives the admin the certain functionalities which are stated below:

❖ Accept applicants (suppliers): This enables the administrator to grant buyers and suppliers access to the system once they have applied.

❖ Deny/ deregister applicants: this portion gives the administrator to deregister suppliers from the system of registered suppliers owing to a lack of ethical behavior as reported by several schools.

❖ View accepted suppliers and buyers It is the privilege of the administrator to view all suppliers and schools who are using the website.

❖ Backup of the database

Input Required

　　❖ Supplier details

　　❖ School's required goods and service details

Processing Required

- ❖ Process application request

- ❖ Process uploading request

- ❖ Delete applicant

- ❖ Backup

Output Requirements

- ❖ Display accepted suppliers

- ❖ Display buyers details

- ❖ File backing up on storage device

- ❖ Print purchased goods/ services.

4.7.1.Menu Design

Valacich and George (2017:383) describe a menu as a, "simply a list of options; when an option is selected by the user, a specific command is invoked or another menu is activated" The menu design is suitable for novices as it is easy to follow.

4.7.1.1.Main Menus

This is the first port of call for every user, existing or new. They enable users to navigate, discover the system and its available shortcuts as users continue to get used to the system. There are three core links which enable one to access a greater part of the system. The links are, Buyer, Supplier and Admin.

4.7.1.2. Sub menus

Sub-menus are created in the buyer and supplier tabs. Within the supplier is a category of products that schools normally purchase. The buyer tab enables one to initiate a purchase having selected products in the previous tab.

4.7.2 Input Design

A working platform is going to be created that will enable users to access the website. Users will go through provided menus. Once a user types in the link to access the page, they are prompted to enter log in details. They are then taken to a homepage consisting of important components of the system.

4.7.2.1. Input Screens

Data entry into the system is done through the input screens. Users can request information about prorducts from the system, solicit information. 'Back' icons should be contained in the input pages so that when users have made mistakes they can revert back. A calculatiion will be performed on selected products and this is then a users can accept or edit their quantities to suit their intended budget. As data is entered, it is validated so that invalid data is not accepted into the system. The data that is entered and accepted is found stored in the physical storage through the DBMS. The administration of created accounts is the domain of admnistrators. Thus users cannot delete their account but should approach the admnistrator to do it for them.

Input forms

Input form for users

Figure 4.12 Shows the home page

Figure 4.13: Shows buyer sign in

Buyer Sign in

Username:

Password:

Login

Sign up/ Forgot password/Home

Figure 4.14: Shows Registration of users

Registration/ Signup

Account Display Name:

Username

Password

Email

Organisation

address

City

Account profile picture

REGISTER

Figure 4.15: Shows buying screen

	BUYING SCREEN
Name	xxxxxx
Category	xxxxxx
Description	xxxxxx
Price per unit	$$$$
Available in Stock	999999
Discount	999999
Select Quantity	

Figure 4.16: Shows order proof of payment

	Order Proof Of Payment
Transaction Id	
Proof oF Payment Image	
	Upload Details

Figure 4.17: Shows buyer Administrator Adding new users

Buyer Admin Add New User

name	
username	
email	
phone	
password	
	submit

Figure 4.18: Shows buyer Feedback

Buyer Feed Back

Category	
Rating	
	submit feed back

Fig 4.19. Shows New tender being initiated

New Tender

Tender Title

Tender Closing date

Year   Month   Day

Description

Tender Amount

Add Tender

SUPPLIER INPUT SCREENS

Figure 4.20: Shows buyer sign in

Product Edit

Name

Description

Quantity

Price Per Unit

Discount

Select Category

UPDATE PRODUCT

Select image   Choose File

Figure 4.21: Shows Supplier joining a tender

Join tender

Description

Amount

transaction id

proof of payment

| join tender |

Figure 4.22: Shows buyer sign in

Add New Product

Name

Description

Quantity

Price Per Unit

Discount

Select Category

| UPDATE PRODUCT |

Figure 4.23 Shows Suppliers pending activation

Supplier Pending Activation

Supplier Name

Action

active   deactivate

Figure 4.24 Shows Data backup

database backup

link   xxxxxxxx

4.7.3. Output Design.

Once data is input, it requires to be output in a desired format for decision making of further processing. Thus using a turnaround system, a company can use the output of another process as an input of the next stage/phase. The Output design output forms, reports that the system is capable of producing. Once produced, they can be viewed, printed or saved for later use through backup of the systems.

REPORTS

OUTPUT SCREENS

BUYER

Figure 4.25: Shows Completed Transactions

		completed transaction		
Suppier Details	Amount (USD)	Date Time	Plus Transport Included	View Products Orders
xxx	xxxxx	xxx	xxx	xx

Figure 4.26: Shows Tenders open for bidding

		open tenders			
Tender Title	Amount (USD)	Closing Date Time	Date Created	Days Left	View Bids
xxx	xxx	xxx	xxx	xxx	xxx

Figure 4.27 Shows buyer Admin Approvals

		Buyer Admin Approvals			
Supplier Name	Buyer Name	Amount (USD)	Date Time	View Products Orders	Action
xxxx	xxxx	xxxx	xxxx	xxxx	xxxx

SUPPLIER OUTPUT SCREEN DESIGNS

Figure 4.28: Shows Products Sales Report

Product Sales Report

Month	Total Orders	Total Sales $	Total Quantity	rate	Amount
xxx	xxx	xxx	xxx	xxx	xxx

Figure 4.29: Shows Feedback Screen

Feed Back

Buyer Name	Buyer Email	Product	Efficiency	Out Look	Speed
xx	xx	xx	xx	xx	xx

Figure 4.30: Shows order awaiting Payment

Pending Proof of Payment

Buyer Details	Amount (USD)	Date Time	Plus Transport Includ	View Products Orders	
xxx	xxx	xxx	xxx	xxx	xxx

Figure 4.31: Shows Completed orders

	completed orders				
Buyer Details	Amount (USD)	Date Time	Plus Transport Includ	View Products Orders	
xxx	xxx	xxx	xxx	xxx	xxx

Figure 4.32: Shows Supplier's products

		Supplier Products			
Product image	Product Name	Product Category	Product Price	Product Quantity	Product Discount
xxx	xxx	xxx	xxx	xxx	xxx

ADMIN OUTPUT SCREENS

Figure 4.33: Shows Active Supplier users

Active Suppliers users

Active Users		Not Active Users		

Supplier Name	Supplier Phone	Supplier Email	Supplier City	Action
xxx	xxx	xxx	xxx	xxx

Figure 4.34: Shows deactivated Suppliers

De Actived Suppliers

Active Users		Not Active Users		

Supplier Name	Supplier Phone	Supplier Email	Supplier City	Action
xxx	xxx	xxx	xxx	xxx

Figure 4.35: Shows activated buyers

Active Buyers users

Active Users		Not Active Users		
Supplier Name	Buyer Phone	Supplier Email	Supplier City	Action
xxx	xxx	xxx	xxx	xxx

Figure 4.36: Shows Deactivated buyers

De Actived Buyers

Active Users		Not Active Users		
Supplier Name	Buyer Phone	Supplier Email	Supplier City	Action
xxx	xxx	xxx	xxx	xxx

4.8. Pseudo Code

The website http://www.unf.edu describes a pseudocode as, " an artificial and informal language that helps programmers develop algorithms."   It is a design tool that makes use of statements which are English like that describe the steps that are necessary in order for a problem to be solved. Gupta (2013) concurs by stating that pseudocode is key in that aids the developer in coming up with code that takes the form of the statements. They are the foundation of every program.

Logging in process

Enter username

Enter first email address

Enter second email address

Check and Verify first and second email address

       If first email1 and email 2 match

       If yes proceed

       Else re-enter

       Enter first password

       Enter second password

       Does first password and second password match

       If yes proceed

       Else re-enter

       Register applicant

EXIT

Tender process
Login

Create tender document

Upload tender documents

Put criterias to tender

Advertise online and other media tender

Add bidders

Add members to evaluation committee

        Does bidder meet criteria

        If yes proceed

        Else send to blacklist

Create notifications

Send notifications to all bidders

        Create contract documents

EXIT

Normal Quote Creation

Enter username
Enter School_id
Enter password
        Does password match with School_id
        If yes proceed
        Else re-enter

        Select products to purchase
        Select quantities
        Repeat until all products have been selected
        Calculate the total quote
Save
 Print
EXIT

Buying – Confirming a Quote

Enter username
Enter School_id
Enter password
        Does password match with School_id
        If yes proceed
        Else re-enter

        Select products to purchase
        Select quantities
        Repeat until all products have been selected
        Calculate the total
        Notify supplier

Send official order
Save
 Print
EXIT

4.8. Security Design

Security is making sure that a system is robust and free from intruders. It is being able to maintain integrity and have users be at their prescribed levels only. The system should be able to cater for inadequacies within it. Several security features have been incorporated in the software design stages so that unauthorized users do not access the system. The system ought to minimize any infringements upon it. Software controls are thus employed.

4.9.1. Physical Security

Usage of lock and key techniques will be employed to make sure the system is physically safe. Although primitive in this day and age, but they go a long way in warding off amateur intruders who are not techno savvy. In addition, closed circuit TV and infrared cameras will be employed. Burglar bars around rooms are already in place. In addition, air conditioners for maintaining the environment and also fire extinguishers in case a fire breaks out.

4.9.2. Network security

Nowadays, physical security has its limitations. Thus security has to be installed within the network which is software related. Mechanisms have to be put in place to only allow authorized users to have access to the system and to the network to a level prescribed by the administrator. Firewalls will be employed as stated before. User name and password that are unique will be employed. Updatable antivirus software will be employed to enable the system to work with little or minimum intrusion from malware.

4.9.3. Operational Security

Daily procedures and processes need users and network administrators to be vigilant so that they protect the system as they carry out routine procedures. Password policies should be enforced whereby a password should have a minimum number of characters with a mixture on alpha-numeric and special characters. Data backups and archiving of data should be carried out

periodically so that in the event of system failure, recovery is not very expensive and data regeneration cycles are shortened.

4.10. Conclusion

The design chapter provided a synopsis of the intended system; what users can expect the new system to be able to do. Through the use of DFD, ERD, Package diagrams and Level O context diagrams diagrammatic representations were able to be done. System architecture together with data models were highlighted so that one could fully understand the system. Intended user interfaces were designed so that they assist in understanding the system to be designed. Pseudo code for the system was also given in English-like statements. Input, output screens and security features of the system will be used. The coming phase will show the implementation of this phase, which will be run, tested and put to use.

CHAPTER 5

IMPLEMENTATION PHASE

5.1 INTRODUCTION

Several designs of the system were covered in detail in the previous chapter. It examined architectural, physical, database, program, interface and security issues that all need to be included in the system to be coded. The implementation phase is the last phase of the project where theory is made practical. This includes purchasing, installing software and hardware, programming, changeover and training Laudon and Laudon (2014). Newly programmed systems require debugging so that errors are eliminated to improve on software as supported by the website https://www.cs.colorado.edu . Changeover methods vary from system to system and in this project, parallel conversion will be considered using new formats and data structures. All programs are installed onto the intended hardware. Soon after loading, compatibility tests are performed to see if the program does indeed run on the computer's hardware. Parallel conversion will take about two months so that a comparison of the manual and information system is done.

5.2. Coding

Coding involved changing program logic pseudocode into computer language instructions. IEEE Computer Society (2014) states that during software construction, modules are created which make programming easier. This helps in fast development, maintenance and future changes, if required.

Coding was done using the three main attributes of program design as stated by the IEEE Computer Society (2014) namely; abstraction, cohesion and coupling.

Abstraction— There are unnecessary details that are removed during coding so that only the functionalities required in the code are found. IEEE Computer Society (2014) states that the designer thus focuses on relevant information whilst ignoring the rest of the information.

Cohesion— The website https://d.lib.msu.edu states that cohesion is about relationships that exist within a module. It states that a program should have well defined attributes. A program become reusable when it has high cohesion. The statements found within a procedure thus have to be related to the output. IEEE Computer Society(2014:52) says it is, "a measure of the strength of association of the elements within a module". This can apply in cases where attributes in a class have to be used by every method. Programs thus hence do not become too big. There is a reduction in obsoleteness and redundancy especially when a project is too big, much space is wasted.

Coupling— When programming, it is important that modules are linked together. Coupling looks at the relationships between modules as stated by the website https://d.lib.msu.edu . Coupling is the degree of interconnectedness of modules. A measure of coupling is carried out when a variable in one module changes and automatically results in a change in another module.

The lowest level of coupling in required, since interdependencies of variables can lead to modules lacking identities. Modules should have their independence whilst data within them has high dependence.

During the design of coding, functional user requirements which had been identified were manipulated and converted into input and output screens, internal files and external interfaces which clients would be using to access the website and log online. The system is client-based and involves users interacting with the graphical user interface (GUI), links, hyperlinks, drop-down menus, input boxes and apply points.

The system has several modules with different submodules. The code for the system is found in the appendix section of this dissertation. The code is used by technical people to make changes during perfective and adaptive maintenance. Php and MysQL were used used to code the system.

5.3. TESTING

During program development, tests are done at a small scale, at module level. When the system has been put together, thorough testing should be implemented. Testing as stated by Laudon and Laudon (2014) is a continuous process which gives assurance on whether objectives have been met or not. As testing takes place, bugs are removed in the process. Sharma et al (2016) states that testing is done to see if the results are correct and have the desired outcome. A test plan was designed to make use of the main testing activities namely, unit testing, integration tests, systems tests and acceptance testing. They all have different levels and test different attributes and thus they are important. The aim of testing is to run a series of test data so that the output matches the expected results.

Unit Testing
This is the lowest level of testing that is carried out on software as it tests modules as isolated entities according to Ghuman (2014). The IEEE Computer Society (2014:3-12) describes it as a test that verifies a, "unit's correctness under various data sets." Individual components are tested as independent objects in-house. Laudon and Laudon (2014) states that unit testing is primarily done to guarantee that programs are bug free by focusing on a unit of program or function. This will check whether objectives have been met and tasks have been accomplished. There are two categories of unit tests which are black box and white box testing.

Black Box Tests

Black box testing is used when there is limited knowledge of an internal system according to https://students.cs.byu.edu . It is primarily examining entered inputs and check on the outputs. The modules nor the underlying code do not need to be known. Interface, performance, functionality and initialization errors can be discovered. Lecturers and other students will carry out black box testing. The use of black box testing is good because any layperson can test the modules since they do not have to necessarily know the code Denis et al (2014). The people testing the units should be concerned with the graphical user interface (GUI). Therefore, not much time is wasted in the process of testing. It is simple even in large programs, one can carry it out. However, lack of knowledge of the internal system means important information will be left out. Test tests may be difficult to come up with.

5.3.1.2 White Box Tests

This is when the internal code is known and the tester tests with known parameters. Certain statements of code are tested so as to find errors which in black box would not be so obvious as described by https://students.cs.byu.eduThis testing is mainly performed by the developer of the code.

There are several advantages to white box testing. Hidden errors were discovered using these tests. Computer code optimization was possible as several errors were discovered and corrected. It has a focus on functionality and not for the code to be simply running and yet miss the point.

A few challenges may arise since it is an extensive process and hence a lot of time is required. Appropriate tests have to be applied to it so that the right data outcome can be realized. White box testing requires tight integration with the application being tested. This provides a complexity in that when testing, one may not be able to eliminate challenges being faced and attribute them to the program entirely or the tool itself.

5.3.2 Integration Testing

Sommerville (2016) states that modules are integrated into sub-systems and tested.. The main focus is on the interface. Is there a mismatch or not? It was continuously done during the software development process so as to locate errors that may occur during the linking of subsystems. Denis et al (2014) states that data flow testing is done by adding and testing one unit after another and checking the output. Functional checks were thus performed. IEEE Computer Society (2014) states that errors can be detected and corrected when they occur during integration. Bugs were detected and removed in-house. Supplier, buyer and administrator modules were tested to see if there is a link on objects. Integration was successfully accomplished by the system.

5.3.3. System Testing

This testing technique gives the system value. The linking of modules leads to an Information System. This technique examines the system in totality and usually done at managerial levels. IEEE Computer Society (2014) says it is performed to assess non-functional requirements for example speed, accuracy, robustness reliability and security as well. Requirements specification provided initially are tested to see if they have been met or not. Deviation from the norm were noted and corrected so that the results matched with the requirements specifications. Laudon and Laudon (2014) pinpoint that system testing checks for discrepancies and examine the functionality of discrete modules. During this process, verification and validation will be done. IEEE Computer Society (2014:10-6) says verification is carried out to improve software quality by ensuring that, "the product is built correctly, in the sense that the output products of an activity meet specifications imposed on them in previous activities." Whilst on the other hand, validation examines whether the product meets the target, is it the right product?

5.3.4. Acceptance Testing

This is when users test the system to see if it is the intended system. Laudon and Laudon (2014) state that the system is evaluated by users and reviewed by management. A go ahead to implement a system is given when parties are satisfied that the system meets the standards. The newly created system can therefore be installed and ready to be used. The customer can specify tests and data to be used. Testing can be performed by the client or on behalf of the client under scrutiny. This is used as a confidence booster for users. Other developers who did not develop the system can also come in and test the system so that eventually, it is accepted by the organisation Denis et al (2014). Functionality, effectiveness and efficiency of the system are checked within the customer's environment that is often characterised with heavy data capturing. There are two levels of acceptance testing, namely alpha and beta testing.

5.3.4.1. Alpha testing

This is a formalized testing technique that is supposed to be done when software development has taken place. Alpha testing is done by a team of programmers and they use data which they

perceive to be realistic. IEEE Computer Society (2014) explains that alpha testing is given to a group of selected users. The users are able to report problems they encounter. It is a trial run period. Alpha testing was done on the 5th and 6th of April 2018 by a team of three programmers who are in Sanyati District. They gave feedback on issues to do with the Know Your Customer (KYC) input form missing, a need for graphical representation of data, SMS alerts for messages when the order falls below the re-order level.

5.3.4.2. Beta testing

A system's functionality is best tested in the field, with actual data and real users. This stage marks the last stage of testing using representatives selected from the users as stated by IEEE Computer Society (2014). Conditions in the lab are ideal, so at times the situation on the ground may differ as real users make use of the system. Challenges that may emanate are related to hardware compatibility, clashes with currently available software. Users therefore examine responses the software gives, nature of the interface, output, input methods and volumes handling capacity Denis et al (2014). All discovered bugs that users will find, will be reported to developers to Users will report and document all problems and bugs to the developers for correction. The first round of beta testing is scheduled between 16 to18 May 2018. Bursars and accounts clerks and teachers from three different school will able to input the data. The software system will go for a second round of beta testing before it is released as a package before end of May 2018.

5.3.5. Testing strategies

The developer used several test strategies so that functionality of the system could be established. Run-time and syntax errors which are the simplest forms of errors to detect were identified as the system was being developed. http://space.wccnet.edu states that syntax errors emanate from a violation of rules and a compiler detects them. Runtime are errors that are detected when the program is in execution. Logic errors only appear when the program is running. These can be unexpected responses to a query and may be programs that are not working within set parameters. Verification and validation were also used as test strategies.

5.3.5.1. Validation

Evaluation of the system was done so that a check could be carried out on the built system. The objectives and system requirements were examine to see if the objectives were met by the system. An example is when an incorrect quantity which exceeds available quantity is input; the system rejects and advises the user.

5.3.5.2. Verification

Delivery of functionalities is key within any system. IEEE Computer Society (2014) states that checks on the correctness of data are carried out during verification. During data testing, documents were evaluated, code produced and reviews done. Verification was used to simply check if the developer was sticking to the plan. This avoids having a system that is running but diverging from user expectations.

Old system data and new system data was compared to check for congruence. White box verification was also carried out to find loopholes in the system.

5.3.5.3. Testing Screen shots
Figure 5.1. Supplier Panel to Sign in

Figure 5.2. Supplier Successfully logs in screen

Supplier Panel ☰   ✉ 0   🧑 tek tech solutions

ROLEX Welcome,
       tek tech solutions

GENERAL

🏠 Products   ∨
🖥 Tenders   ∨
🗂 Orders   ∨
📊 Report   ∨

Supplier Home Products

Product Categories	∧

Computers
2

Product In Stock	∧

Products With Less Stock

Product Name : Printers
Quantity :7
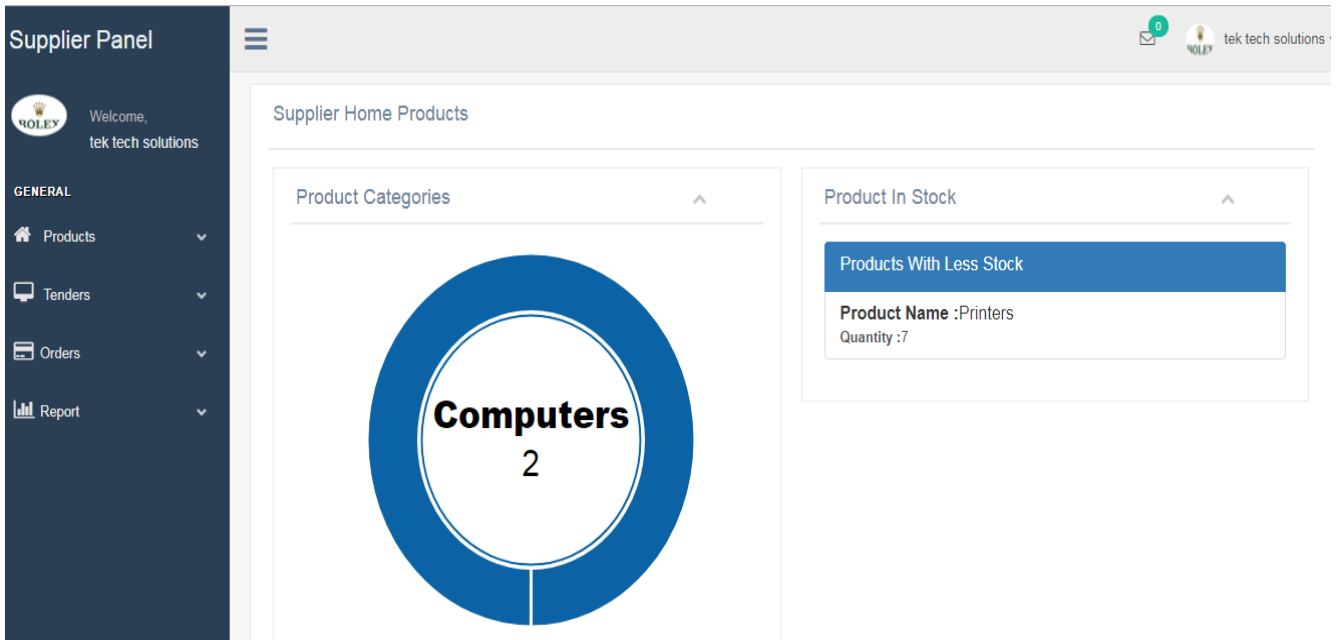
Figure 5.3. Shows supplier products

View Products

Copy	CSV	Print	Search: [ ]

Product image	Product Name	Product Category	Product Price	Product Quantity	Product Discount	Action
	Printers	Computers	300.00	7	30	✏ Edit
	Projectors	Computers	67.34	312	23	✏ Edit

Showing 1 to 2 of 2 entries   Previous 1 Next

Figure 5.4. Screen showing how to add a product

Add New Product ✕

Name *

Description *

Quantity *

Price Per Unit *

Discount *

Product Image *   Choose File   No file chosen

Select Category   Computers ▾

Add Product

Close

Figure 5.5. Products report sales

Month	Total Orders	Total Sales $	Total Quantity	rate	Amount
March	2	70.56	6	0%	0
April	1	2520.00	12	▲97.18%	2449.44

Sales For this Year

Figure 5.6. Bar graph showing monthly sales for product

Graph Monthly Sales

March
sales: 71
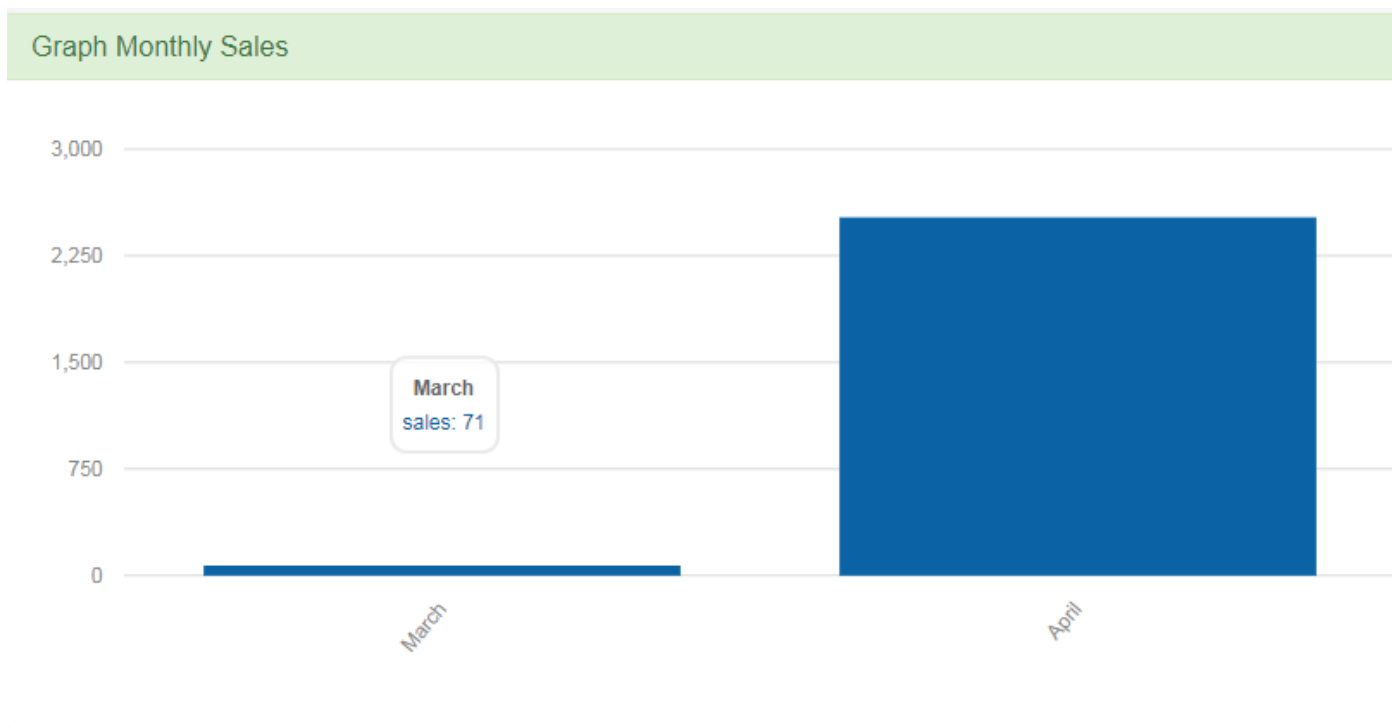
Figure 5.7. showing completed orders

Completed Orders

| Copy | CSV | Print | | Search: |

Buyer Details	Amount (USD)	Date Time	Plus Transport Included	View Products Orders
Rooterview	4179.26	2018-04-06 12:25:19	no	View...

Showing 1 to 1 of 1 entries

Previous 1 Next

Shop Supplier Products

Search for...   Go

Home

Acer , Laptops 20% Off	Tinned Beans 20% Off	Printers 30% Off	chairs
Category Name :*Computers*	Category Name :*Food Stuff*	Category Name :*Computers*	Category Name :*Furniture*
Was : $~~5.00~~	Was : $~~90.00~~	Was : $~~300.00~~	Was : $~~178.00~~
Now :$4	Now :$72	Now :$210	Now :$178
Stock 155	Stock 43	Stock 7	Stock 455
View More..	View More..	View More..	View More..

Figure 5.9 Showing quantity available exceeded.

Name : Acer , Laptops
Category : Computers
Description : black in color
Price per unit : 5.00
Available In Stock : 155
Discount : 20
Select Quantity: 800000

! Value must be less than or equal to 155.

Back to supplier shop
Back to home

Supplier
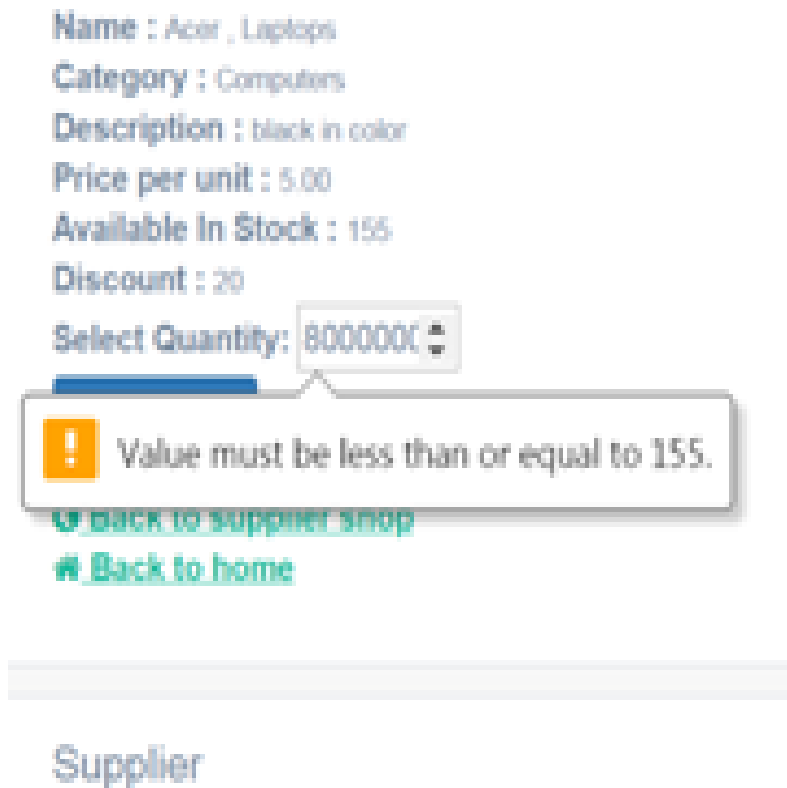
Figure 5.10. showing number of products added in my Cart

2

Alpha Chimedza
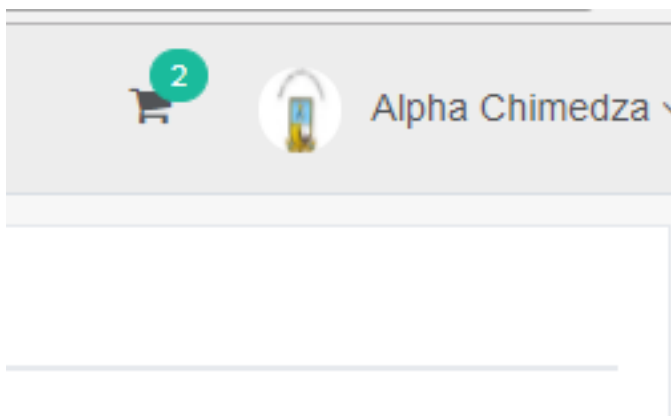
Figure 5.11. Products in my Cart

My Cart

Product Name	Product Qunatity	Product Price Per Unit	Product Discount Per Unit	Product Final Price	Remove From Cart
Tinned Beans	4	90.00	20	288	Remove
chairs	2	178.00	0	356	Remove

Quote One	Quote Two
Tax : $1.4168	Current Distance Price : $23.00 per km
Total Prices : $645.4168	Tax : $1.4168
NB:no transport included	Total Prices with distance (**Zvishavane - Masvingo** 🚗**95.72 km**): $2846.9768

Include Transport ☐ (check box if Yes and leave blank if no)

Figure 5.12. Method of payment

Select Payment Type:

(bank) ZB Bank ▼

(bank) ZB Bank
(bank) FBC
(mobile operators) Eco Cash
(mobile operators) Tele Cash

Online Procurement System

Figure 5.13. Tab showing successful ordering

order made successful

109
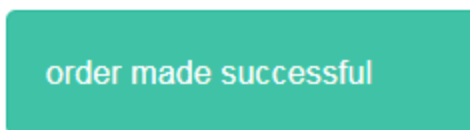
Figure 5.14 Cancelling an order

Orders

Supplier Name	Amount (USD)	Date Time	View Products Orders	Cancel Order
Ampke Pvt Ltd	358.29	2018-04-13 17:59:44	View...	Cancel Oder...
Ampke Pvt Ltd	645.42	2018-04-15 21:01:14	View...	Cancel Oder...

Cancelling order

Figure 5.15. Tab showing successful order cancellation

product cancelled successful

Figure 5.16. Drop down menu showing Profile, password change, settings, logs and logout.

Profile

Change Password

Setting

Logs

Log Out
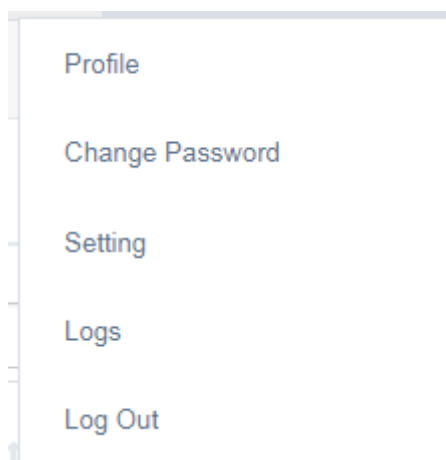
ADMINISTRATOR SECTION

Figure 5.17. Showing Active users and pending authorisations (notifications)

Buyers

Active Users   Not Active Users

School Name	School Address	City Name	Action
Jameson High School	28 Mashayamober Kadoma zimbabwe	Harare	Deactivate
Rooterview	556 West East Masvingo	Masvingo	Deactivate
Harare Poly Technic	289 Chinhoyi Json	Harare	Deactivate

Buyers

Suppliers

SYSTEM

Backup

Supplier Name	Supplier Phone	Supplier Email	Supplier City	Action
Ampke Pvt Ltd	263713313949	sup@sup.com	Zvishavane	De-Activate
tek tech solutions	293390	tek@tek.com	Chegutu	De-Activate
tiny ltd	287373783	dsjkdj@djd.coms	BeitBridge	De-Activate
chindunduma	06822337	til@gmail.com	BeitBridge	De-Activate
musero	24444234323	ss@js.com	Kadoma	De-Activate
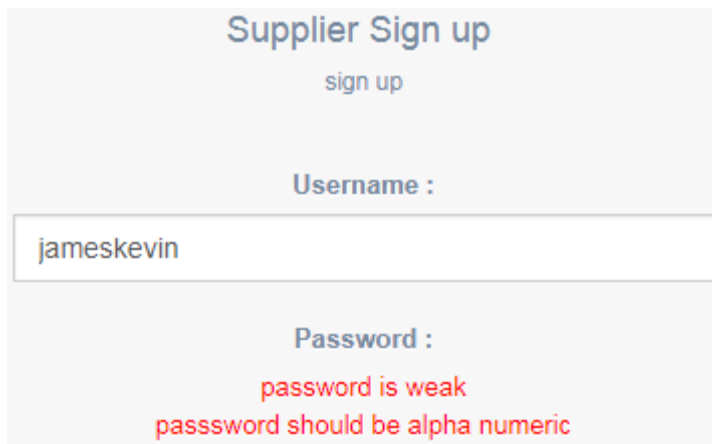
The previous figure shows the administrator screen showing a sample suppliers, who have been activated. These can be deactivated.
At the top right corner is action needed (notification), there are suppliers that require activation.

5.3.5.4. System Security Testing

Unauthorised access to a system is detrimental to both hardware and software. A system should be safe and secure and this ensures data credibility, reliability and integrity. Laudon and Laudon (2014:346) state that authentication which is "an ability to know a person is who he or she claims to be." Mechanisms were put in place to prevent manipulation of the system by different users. Differential views were set by which only administrators could view both buyers and suppliers. Failsafe methods were used during coding of software. Only authorised personnel with usernames and passwords can access the system. Verification and validation is carried out on authorisations. Security is aimed at minimising data theft, fraud, unintentional or intentional damage to equipment and property. A good password policy is required whereby every month, the users change their passwords. Entering in invalid passwords and usernames will not give one access to the system.

Figure 5.19.Signing up screen

Password to contain alphanumeric characters. Users are advised that password is weak using the red colour coding.

Figure 5.20 Entering in wrong username/ or password

Supplier Panel

Please sign in

Wrong Username And Password

Username :

admin

Password :

•••••

Login

Sign Up / Forgot Password / Home

Supplier Panel

©2018 All Rights Reserved. Online Procurement! Privacy and Terms

Intro   Supplier Sign In   Buyer Sign In   Admin

Session Timeout Out

5.3.5.5. Disaster and disruption control

When disasters happen, no one knows the extent of damage or loss of data. Therefore, an organization should always be prepared for them. A disaster recovery plan should be in place as stated by Denis et al (2014). Data files to be backed up need to be identified. Laudon and Laudon (2014) state that a business continuity plan should always be in place. For this project, Data will be backed up on two external hard disk drives (HDD) and on DVDs. Backup on external HDD will be done periodically, once a month. This will act as a fall back. Offsite storage facilities will be used so that if disaster strikes the computer room, the data is safe. Write once and read many (WORM) disks will be used for archiving data once every week. Offsite storage locations will be locked and not easily accessible to all users but be available to the administrator.

Figure 5.22. Backup screens
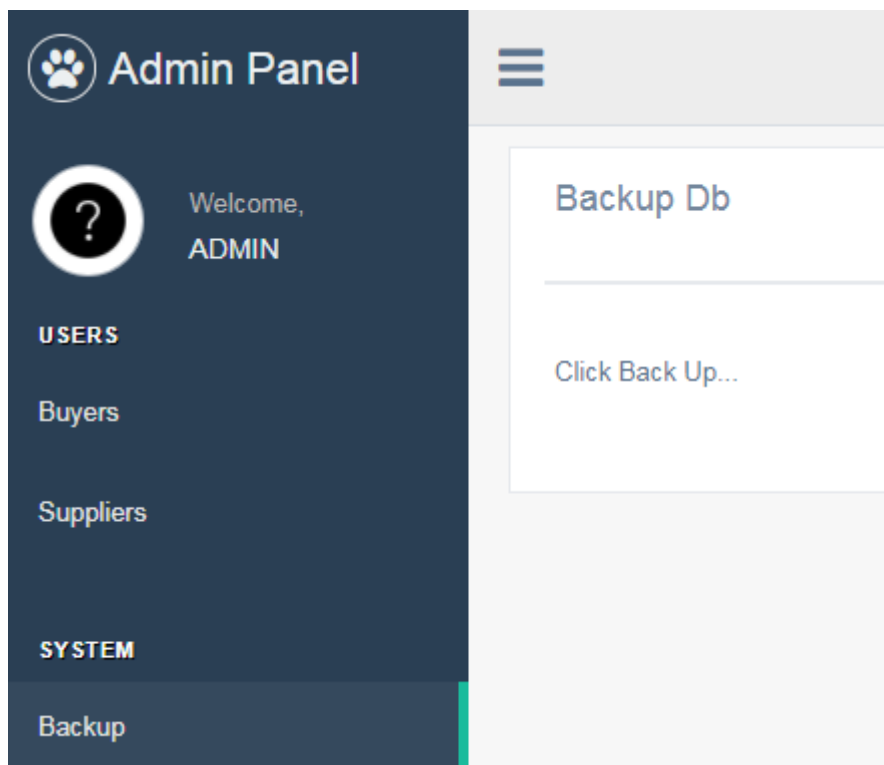
Figure 5.23. Successful backup screen

Backup Db

Database Backup Was Successful!

Get Database File...
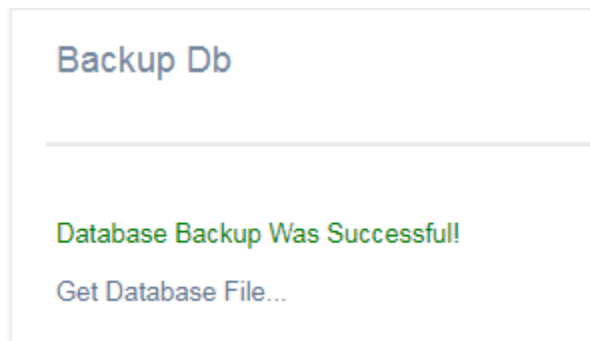
The system that has been created will be web based and hence it is prone to viruses. An anti-virus in the form of ESET NOD 32 will be installed and used. Files and external storage devices needing cleaning will be cleaned and disinfected. A regular update will be scheduled to take place on the internet.

An uninterruptible power supply (UPS) as stated in chapter 2 under hardware requirements will be there for power stabilization issues. Hardware and software damages that can emanate from power outages will be minimised. This will minimise damage and at the same time maintain data integrity. Users will be able to safely carry out saving, shut down processes and procedures procedurally.

5.4 Installation

System installation takes place when there is conversion from the old system to the new system. Users migrate, adapt to new system through a series of stages that include user training, familiarization with new system, file conversion and changeover methods. Necessary software is installed on specified hardware.

Steps to install the new system are detailed below

Install xxamp on machines

Run xxamp

Copy the folder "procurement" and paste it in the c://xxamp/htdocs folder.

Open a web browser

Type localhost/procurement

This opens the login index file by default

5.4.1 Training of Users

Whenever a new system is created, a training programme should be crafted to cater for changes that are being introduced. This has an effect of demystifying the system and increases acceptability by users. Denis et al (2014) states that employees need training so that they are prepared for the new roles they will undertake and procedures they will use. The plan for training will be targeting all stakeholders of the system, bursars. Heads of school will be trained because they have to be knowledgeable if they are going to supervise the bursars more effectively. Training focuses on key points such as

- ✓ How the software package is executed
- ✓ Process of entering data
- ✓ Processing of data required
- ✓ Output from the system, how it is managed
- ✓ Backup of data.

During user training, users are free to ask question freely and contribute positively towards system development and growth.

There is no need to employ new staff for the system as existing staff is computer literate. Personnel were given an open door for consultation in grey areas.

5.4.3. Data Migration

The process of file conversion entails changing from one form to another.   A new file based system is installed replacing the old manual system that was currently in use. The process took several days to finish since it is time consuming and delicate to convert from one format to another. Laudon and Laudon (2014) state that conversion involves file transfer, initiating new procedures. Data maybe lost in the process of conversion and data may differ. To minimise disturbances at the work place, conversion will done during weekends and after working hours.

5.4.4 System Changeover

This is when the old system is replaced by the newly created system. It is a technical process that takes the form of direct parallel, pilot, direct change over or phased says Denis et al (2014) Each conversion strategy has its own merits and demerits. He further states that choice of method is determined by variables such as cost, time and risk associated with the conversion method. These methods will be examined and the best method chosen for the system.

5.4.4.1 Parallel Running

This a gradual system changeover whereby, the old and new systems are run concurrently for some time before the new system takes over. Denis et al (2014) states that the approach has a back-up option and is less risky as data comparisons can be made. Parallel running assumes that data testing may not be thoroughly done and seeks to provide a concretised testimony of the functionalities of a system. Input is done on both systems, output compared so that the new system performs as expected. Gradual changeover gives users the ability to adapt and adopt the new system without putting much pressure. However, time and resources are consumed since identical data input is done for both systems Laudon and Laudon (2014). It becomes expensive and workers may end up working overtime if the system is rigorous.

5.4.4.2 Direct Changeover

A certain day is appointed when the new system takes over from the old system abruptly as stated by Laudon and Laudon (2014). The old system is stopped forthwith and data migration is instant. The old is thus rendered obsolete and all departments have to leave it and start carrying

out all their activities using the new system. In terms of cost it is cost-efficient since two sets of operations, hours or staff does not need to be paid. Immediate benefits can be realized if there are no challenges. However, Denis et al (2014) states that this is highly risky if the new system fails. There is also no fall back plan and hence there is need for careful planning by the system analyst and the team.

5.4.4.3 Pilot Implementation

During pilot implementation, both the new and old systems operate at the same time but the new is introduced to a limited part of the company (e.g. a school in a district or warehouse of a supermarket) and its performance is assessed Laudon and Laudon (2014). The pilot version is assessed and if found to be working smoothly, it is then adopted by the organization and installed in stages or simultaneously within Sanyati District. The new system in the pilot area is the only one affected if the new system fails. It is also feasible to train only one section of a company and therefore it becomes less costly in terms of time and resources as compared to parallel running as stated by Denis et al (2014). However, thorough testing and evaluation at the pilot area is required before the next stage is introduced.

5.4.4.4 Phased changeover

This is when initially, only a part of the new system is introduced. Laudon and Laudon (2014) say it is when a new system is introduced in stages by functions of as organisational units. Functional units look at the sections for example the bursars sections, then three months later the departments. Organisational units would entail for example the District office and then later the schools. Delays can be deliberate to assess performance and uncertainties. Only when it proves to work and management is satisfied that is when the next part is introduced and this process is repeated until the old system is finally replaced as stated by Denis et al (2014). If the latest part fails, it is only prudent to revert back to the old system to the point of failure, hence failure is not disastrous. This ensures the system works properly before expanding. However, more evaluation time and resources maybe needed before embarking on the next phase.

5.4.5 Recommended Changeover Strategy

Parallel Changeover was chosen although it is expensive in terms of time and money but has a back up facility. It was chosen mainly because there is a low risk of failure, there is a backup of the system. Comparison of results from both systems can take place and verification is done. Users do not get culture shocks as they move from one system to another overnight. They get time to adjust, adapt and adopt the system.

5.5 System Maintenance

This is a review that is done on the system by users and technical specialist to find out if objectives have been met and to what extent as stated by Laudon and Laudon (2014). IEEE Computer Society (2014:5-2) states that, "Modification requests are logged and tracked, the impact of proposed changes is determined, code and other software artifacts are modified, testing is conducted, and a new version of the software product is released." Therefore, this is a process of modifying software systems after their delivery to clients in order for correction of faults, improvement in performance or certain feature, adapt to changing environments. They state that a great deal of time can be spent in trying to maintain a system as failure can be seen for a long time. Reviews and maintenance will be briefly explained.

5.5.1. System Review

About four months down the line, users and supervisors would need to sit down, evaluate the system and come up with recommendations which are submitted for perusal and actioning by the system analysts and his or her team. It is proposed that these be done on a quarterly basis because if period s of review are stretched, the system, data and procedures might jeopardize operations and affect the whole organization greatly.

5.5.2. Reasons for Maintenance

When software is produced and users find it useful, it is prudent to extend its lifetime and prolong functionalities by modifying rather than discarding it when challenges are faced as stated by IEEE Computer Society(2014). Software changes may not cost as much as making a new system altogether in terms of time and resources. Modifying and correcting the existing package through patch files and system upgrades makes economic sense Laudon and Laudon (2014). Normally, software is much easier to change than hardware and can exist for longer than the

hardware that was initially installed. The software "laboratory" is always different from the actual environment. As users use the system, they have expectations which are seen when the system is in operation and maybe after some time

5.5.3. Types of maintenance

There are four types of maintenance namely perfective, corrective, preventive and adaptive. These will be discussed below. A system may undergo all four as there is no cast in stone remedy for maintenance.

5.5.3.1 Perfective Maintenance:

Modification of internal routines takes place making them more efficient and effective. IEEE Computer Society (2014) states that this may include documentation and other software attributes.   Users may supply requests to modify the system and interfaces. Initially, as systems are produced though error-free but may be slow and have long routines.

5.5.3.2. Corrective Maintenance

During usage of the system, bugs may be discovered and these need recoding. IEEE Computer Society (2014) states that corrective maintenance also includes emergency maintenance which is unscheduled and temporary maintenance aimed at keeping the software product. Developers might be unaware of the existence of some bugs while others are known to exist, but solutions won't be in sight or undergoing research. The software is released despite 'known bugs' so as to meet deadlines and targets and probably to get a payment. To maintain, a 'patch' is produced by developers to change the lines of code in the main program.

5.5.3.3. Adaptive Maintenance

A new system can be modified a stated by IEEE Computer Society (2014) after delivery so that it remains usable in a changing environment. New features are added when user requirements change. The latest version of the program contains modified features or may contain changes in interfaces. It is carried out mainly because of changes in law for example the new Public Procurement and Disposal of Public Assets Act [22:23] in Zimbabwe. Processes and procedures

at an organization may change necessitating adaptive maintenance for example ZIMRA tax changes. New technologies may exist that requires recoding of software to make it compatible.

5.5.3.4. Preventive Maintenance

Software modification maybe done after delivery of a software product when potential faults have been detected and corrected. IEEE Computer Society (2014) states that this is done before the faults become operational faults.

5.6. Recommendations for future development

There is no perfect system, this system is not spared. Therefore, it is necessary to prescribe ways in which the system may be developed further by this or other developers. Time permitting, the developer would have included several feature to improve on functionality and compatibility. The new system in available online, the trend nowadays is to have mobile applications so that people are able to access the system 24/7. Inclusions of text notifications whenever changes take place in terms of purchases and also for re-order values. There is need for increased security for the system through inclusion of hardware which results in better security such as biometric system. Tender handling still needs to be modified and further research given complex issues to do with tenders and the new regulatory framework that is currently available in the new dispensation in Zimbabwe.

5.7. Conclusion

This chapter saw the production of a system through coding. The coded system underwent several testing stages which included unit, system and integrated testing. The system is working as per requirements specification. Screen shots of a few test cases and security issues were included. Procedures of how the system can be implemented were given and a recommended strategy given as parallel running. Training needs and data migration procedures were highlighted. Methods of maintenance were given and these are all applicable to the new system. It was spelt out that maintenance is an on-going process and a system is in constant change. Users are very important in that they will need to use the system, review, evaluate and provide documentation for further development. Future development needs were also specified. These emanate from a lack of research time by the developer to fully implement a holistic system.

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APPENDICES

APPENDIX A: USER MANUAL

Appendix A: User Manual

Introduction

The user manual is created to simplify the navigation of the system by users, so it was prepared to provide guidance to the user in the absence of the helpdesk on how to operate the system.

About the system

The system was constructed using HTML, JavaScript and PHP as the programming language and MySQL being the system database from (Xampp Server) although importing to other database engines is possible. The system comprises of the following modules;

➢ Supplier module

➢ System Administration module.

➢ Buyer Module

Getting started

Online Procument system is accessed by entering the website: *http://localhost/procu/* on any web browser. When the URL is entered the following page is shown.

Main menu
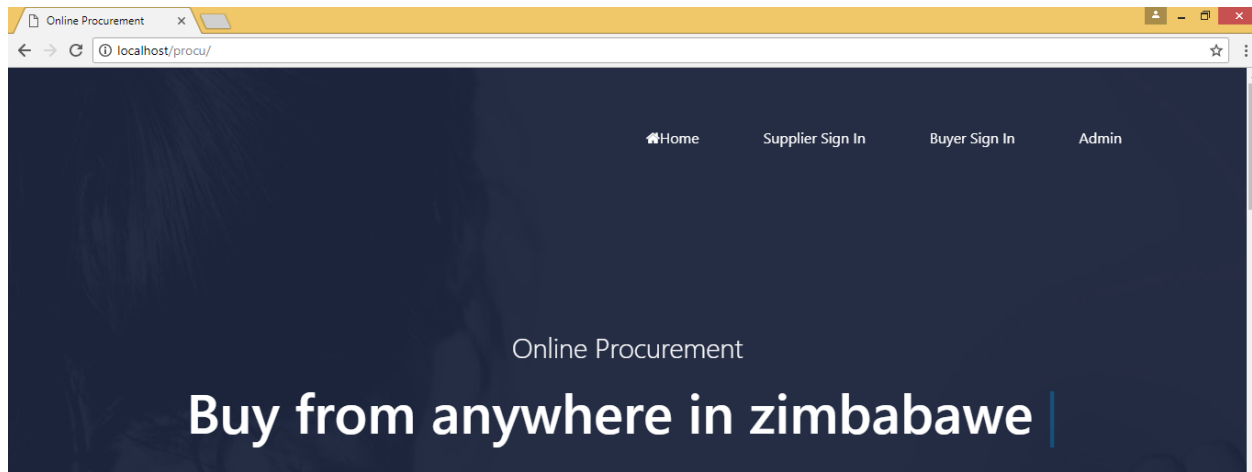
Buyer Panel

The buyer panel is a control panel where buyers can buy products from suppliers online.A sign up is required first to use the buyer panel, so as to login in.
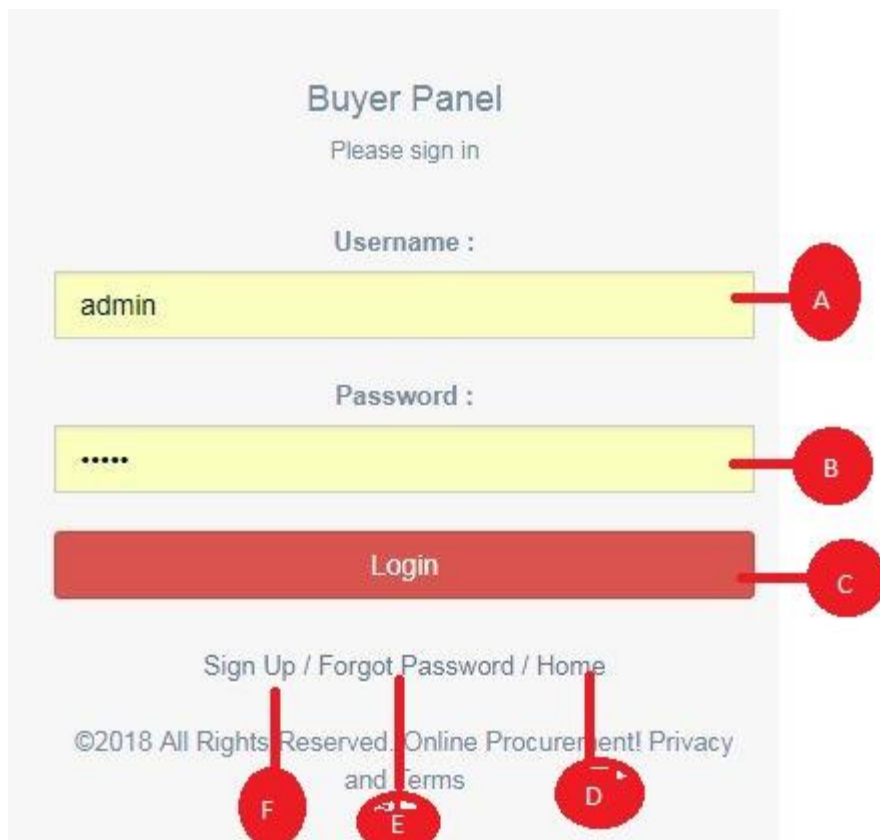
Fig Buyer login

A) username field

B) password field

C) button to proceed login

D) Link to home page

E) Link to forgot password

F) Link to sign up / buyer registration

Sign up / Registration Form

The signing process requires agreeing to the terms and conditions of Procurement system.

Account Display Name: — A

username: — B
admin

Password : — C
password is weak
•••••

email : — D

Organisation Name : — E

address : — F

City : — G
BeitBridge ▼

Account Profile Pic : — H
Choose File   No file chosen

By checking the box, I certify that have read the above disclaimers and — I
agree to the rules. ☐

Register — J

Sign In

The sign up form is for buyer registration. The first email used is the root admin for the organization , with privilege to add new users to the organization .
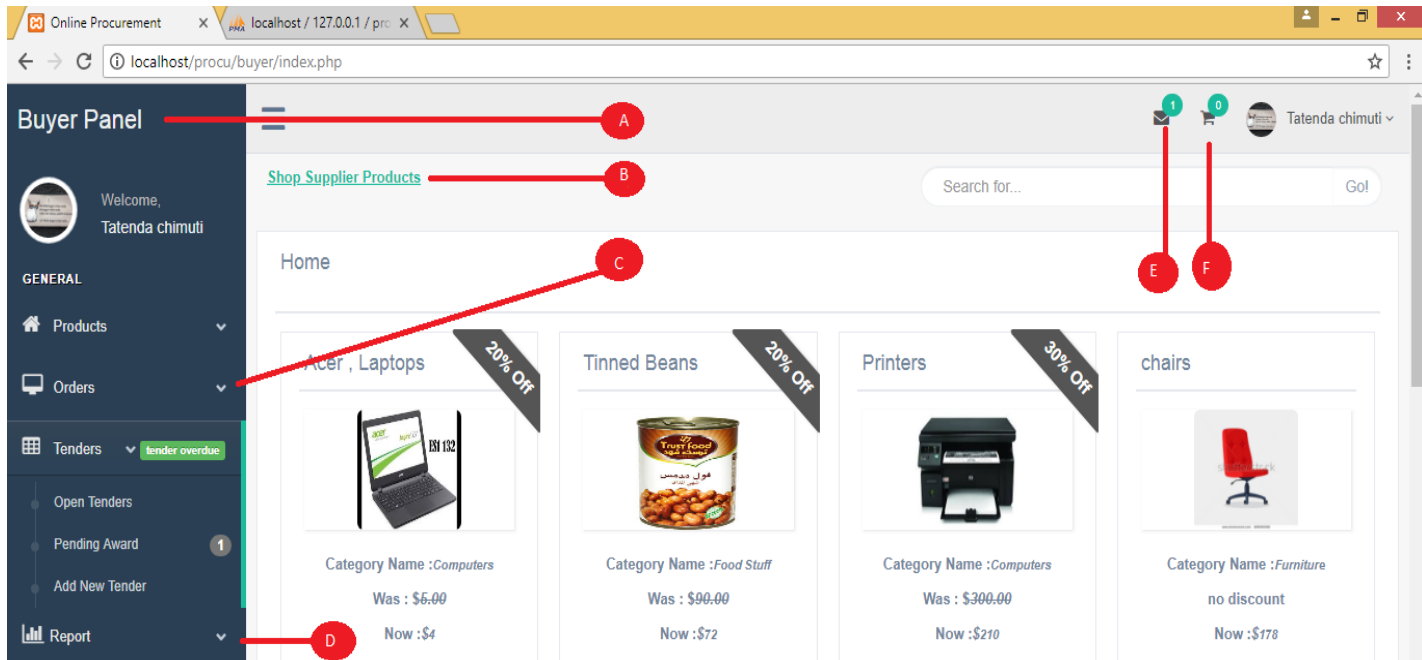
Fig Buyer Dashboard

A: Label for showing current Panel

B: Link to products based on supplier details

C: Link to track and view orders you have made

D: Report for the CompletedTransactions

E: Notifications

F: Shopping cart showing products added to cart by the buyer

The panel has two modules which are

1) Shopping Cart Panel

The buyer specifies the quantity he/she needs, after selecting the product he/she wants to add to cart as shown below

A) Product information and any special discounts

B) Supplier Information

C) Supplier Ratings By the User

To Add Products to cart specify quantity and then add to cart. After completing adding product to cart you can finalize the order as below.

My Cart
view Cart Details

Product Name	Product Qunatity	Product Price Per Unit	Product Discount Per Unit	Product Final Price	Remove From Cart
Tinned Beans	2	90.00	20	144	Remove
Salt	22	34.00	1	740.52	Remove

Quote One

Tax : $1.945944

Total Prices : $886.465944

NB:no transport included

Quote Two

Current Distance Price : $23.00 per km

Tax : $1.945944

Total Prices with distance (**Zvishavane - Masvingo** 🚗**95.72 km**): $3088.025944

Include Transport ☐ (check box if Yes and leave blank if no)

Select Payment Type:

(bank) ZB Bank ▾

Continue Make Order ...   🖨 Print

A) Final Confirmation of Order

B) Quote Without Supplier Delivery

C) Quote With Supplier Delivery

D) Remove Product From Cart

A confirmation is then shown after completing making order and waiting for supplier response

2) Tender Panel

A buyer can also add a tender and suppliers can applier for that particular tender.

- To create tender select tender link from buyer Dashboard
- Select Tender New Link from the Dropdown After Selecting Tender Link
- Fill the Form Below

A) Tender title

B) Closing Date of the Tender

C) Tender Description

D) Tender Amount

E) Button to add tender

Tender Bid Pending Payment Approval

For a Tender to have a chance to be selected, the supplier must submit a payment proof.

The buyer then approves the proof of payment as shown below.
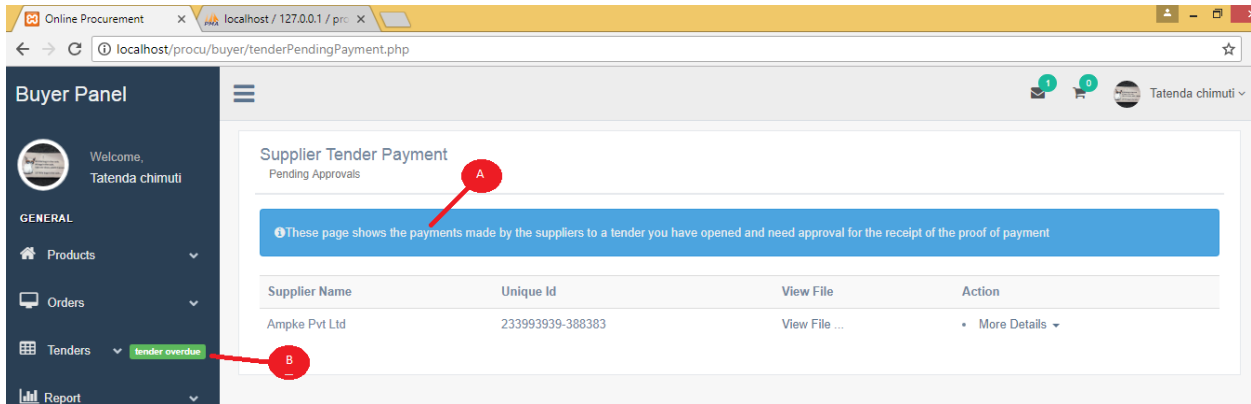
A) A card showing supplier list of pending proof of payments

B) Notification showing tenders due approval

Tender Bids

A list of suppliers is shown of bids the have made.

The buyer can view quote submitted by the supplier.

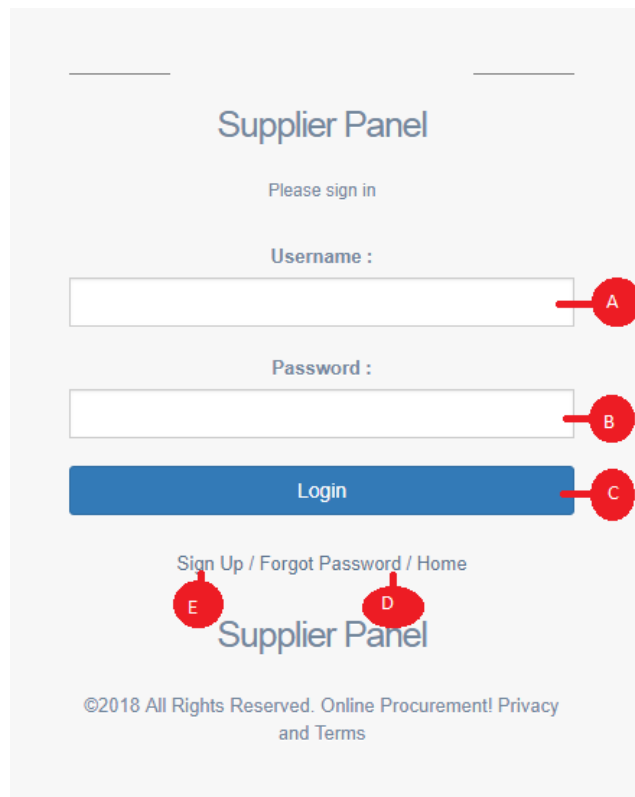A progress bar is shown for approved bids as three users must approve the tender before it has been awarded.
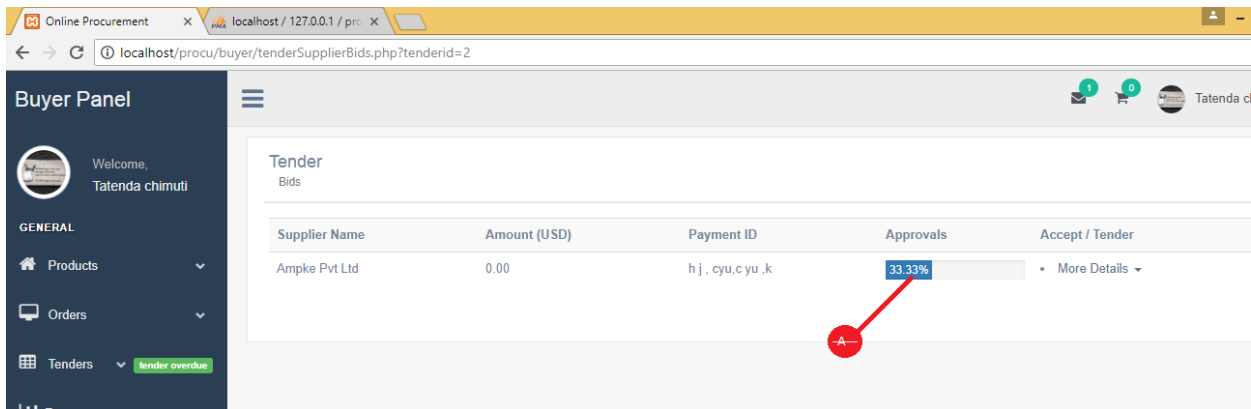
The supplier Panel

The supplier panel is for the suppliers who wish to sell their products to the buyers. The suppliers has the following functions

a. Add new products

b. Perform CRUD function on his products (Create , Read , Update , Delete)

c. Submit application for tender

d. Accept or deny order

e. Specify distance cost per km

For the supplier to perform this functions he/she first needs to sign in first. The sign in form and wait for admin approval.

Username and password are required to use the supplier panel.

A) Username field

B) Password field

C) Button to proceed login

D) Link to suppliers who won't remember their login credentials

E) Sign up form for suppliers

Supplier Dashboard

This is the landing page for the supplier after login in. The side bar has got all the links for different functions of the supplier. The image below shows the landing page of the supplier.
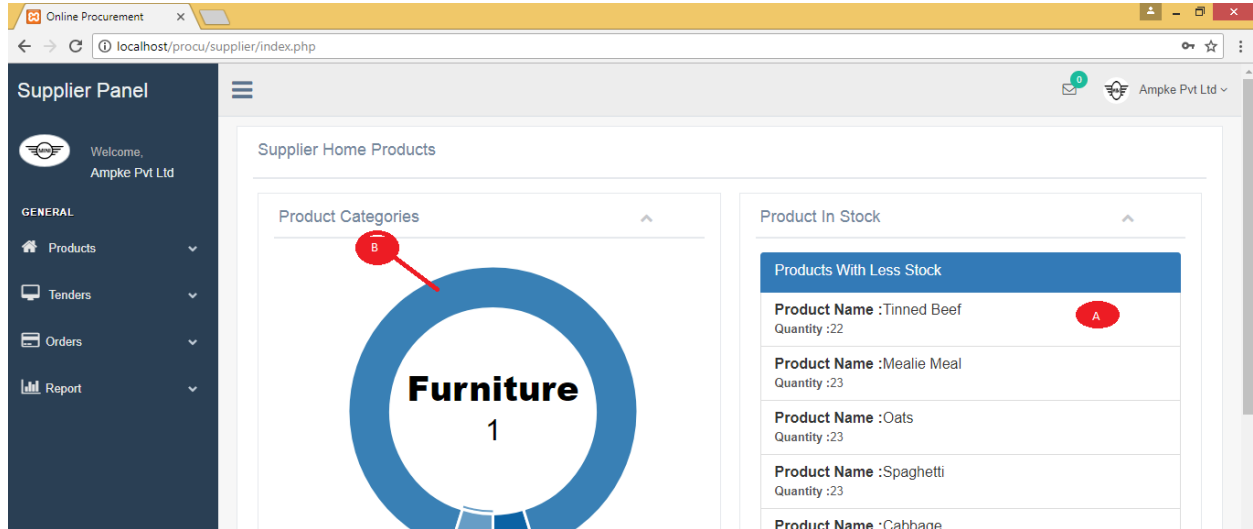
A) Products with minimum stock value
B) Product categories and their total number of products

Supplier's products
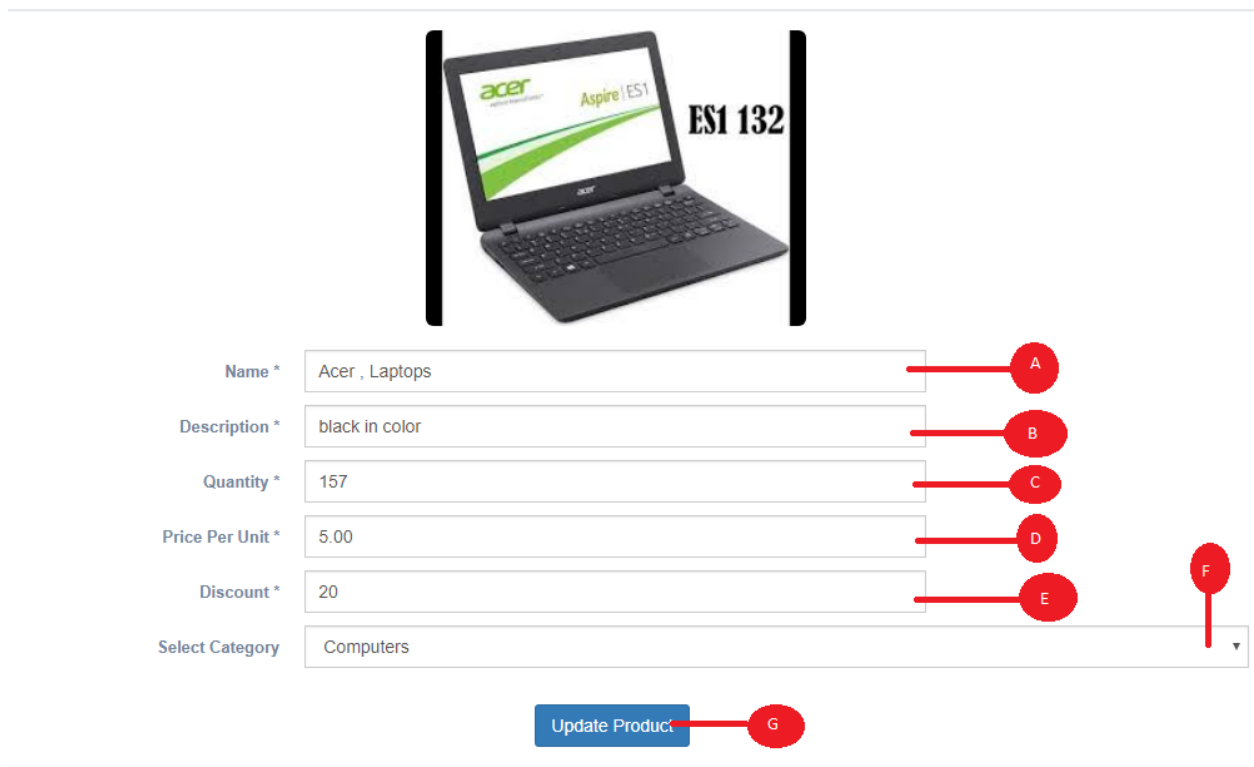
By navigating to the products the supplier can view all his/her organization products.
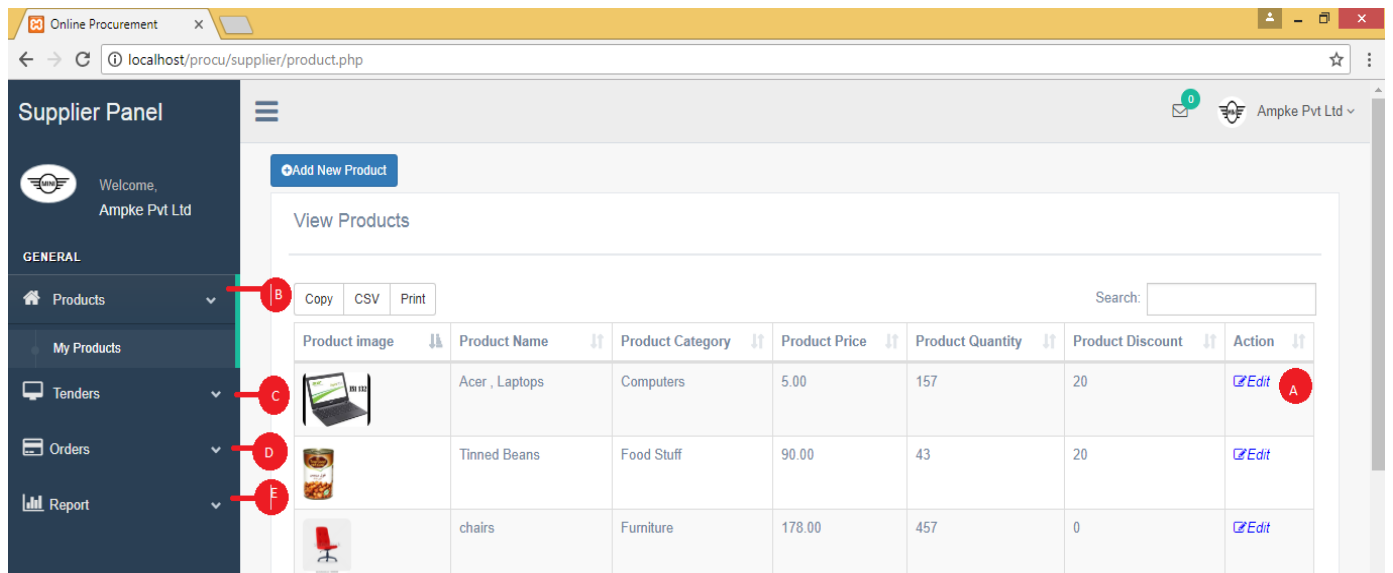
A) Edit the product

B) Link to all products

C) Link to tenders dashboard

D) Link to orders

E) Link to Report

Edit Product

The supplier can edit and update current stock level of the product. Thus through editing product details can be updated.

A) product name

B) product description

C) update product stock level

D) update product price per unit

E) update product percentage discount

F) update product category

G) button to execute command

Add new Product

If the supplier wishes to add new product a link is available on the products page.A modal will be show such as below with fields for adding new product details

A) Product name

B) Product description

C) Current Product Stock Level

D) Price Per Unit

E) Any Special Discount in percentage thus between 0 and 99%

F) Product image

G) Product category

H) Button to execute command

Product Notification

In case the product level reduces to 100 an sms/ email notification is sent to the supplier, such as shown below .
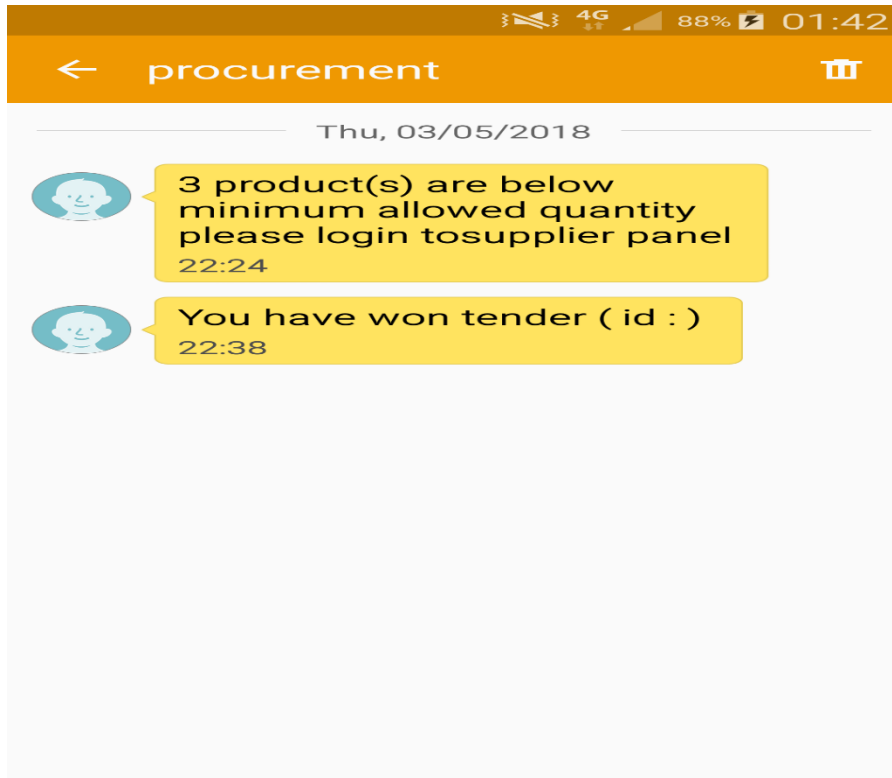
Product report

The system can also generate product reports based on the sales made during the period such as below
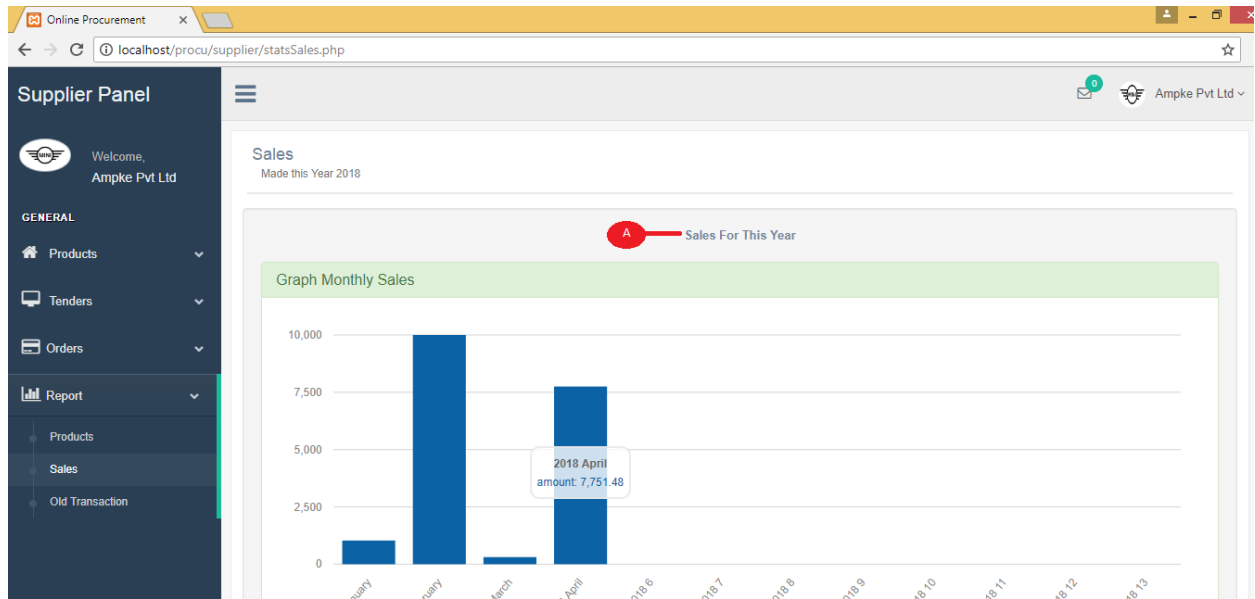
A) Showing sales made based on month

Tenders

Tenders are created by the buyers and the suppliers can apply. A payment has to be made by the supplier who wish to apply for the tender opened by the buyer.

Join Tender

To join tender a link is available on the side pane and the supplier has to provide details for the following form.
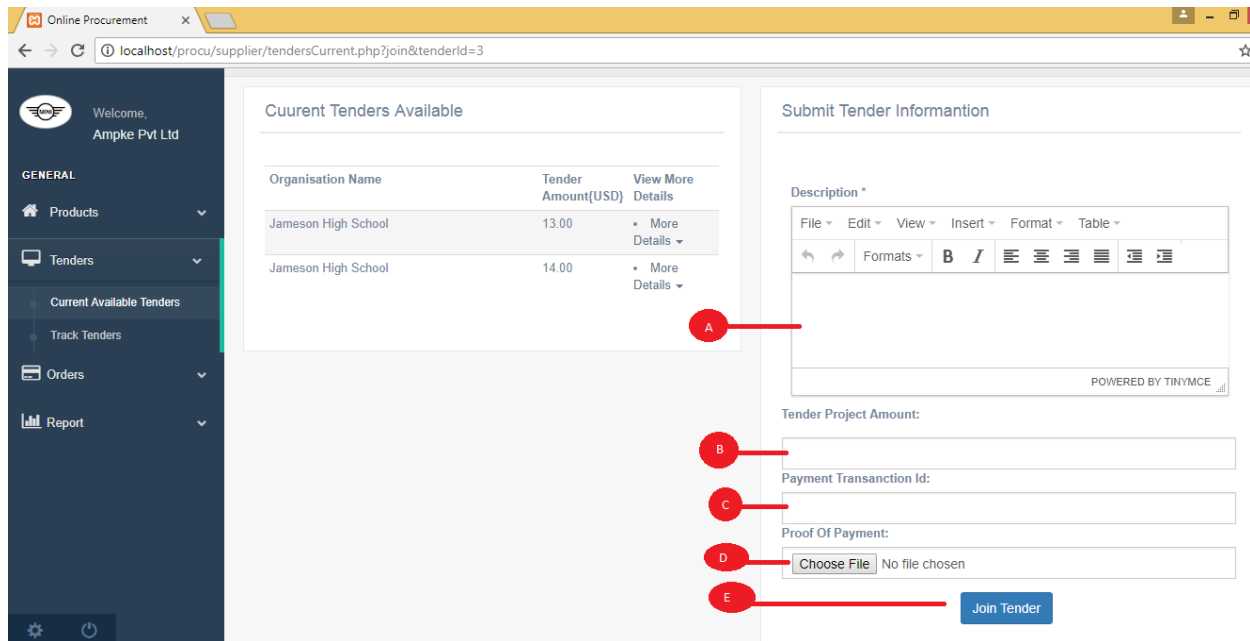
A) Supplier quotation

B) Quotation proposed amount

C) Payment transaction id

D) Payment Proof in image former

E) Button to execute command

Admin Panel

The admin is responsible for backing up the system as well as authenticating suppliers by activating them.
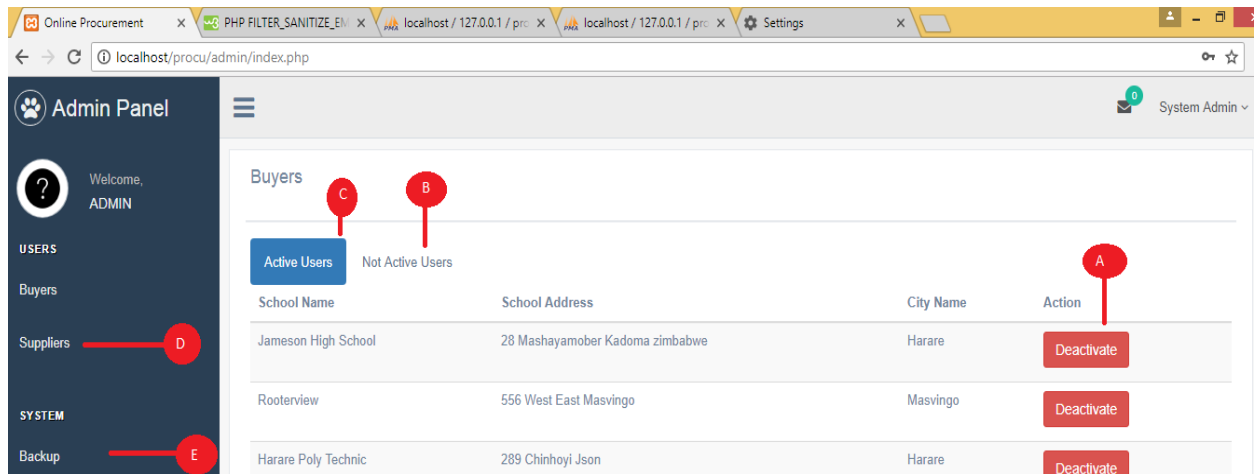
A) Deactivate buyer

B) View buyers deactivated

C) Tab to highlight currently active users

D) Link to view all suppliers

E) Link to backup

APPENDIX B

INTERVIEW SCHEDULE – FOR BURSAR/ ACCOUNTS CLERKS

My name is Kennedy Paridzira and I am a Bachelor of Science candidate at Midlands State University. My Project is "SANYATI EDUCATION ONLINE PUBLIC PROCUREMENT SYSTEM". I am conducting the research project as partial fulfilment of the requirements for the degree of BSc Honours Information Systems. I am interested in finding current Public Procurement system and ways in which these could be computerised and improved in the process. Your information will be held in the strictest of confidence and will only be used for the purposes of this research project.

Date:……………………… **Time:……………………..**

Formal Introductions (Title and Nature of Job) …………………………………………..……

1. How long have you been working as an accounts clerk/ bursar services at the school?

   ………………………………………………………………………………………………

   ………………………………………………………………………………………………

2. Briefly explain the procedure that you perform when procuring resources.

   ………………………………………………………………………………………………

   ………………………………………………………………………………………………

   ………………………………………………………………………………………………

   ………………………………………………………………………………………………

3. Does the system accommodate all buyers?

   ………………………………………………………………………………………………

   ………………………………………………………………………………………………

4. May you please specify the estimate time frames and activities taken between intial request and the final delivery.

   ………………………………………………………………………………………………

   ………………………………………………………………………………………………

   ………………………………………………………………………………………………

   ………………………………………………………………………………………………

5. May you describe the turnaround times for replies.

…………………………………………………………………………………………………

6. How do you handle big orders in terms of amounts or capital projects?

…………………………………………………………………………………………………

7. What further comments do you have for the system that your are currently using.

…………………………………………………………………………………………………

8. State the challenges associated with the current procurement system and state how you deal with them.

…………………………………………………………………………………………………

9. How effective is the manual procurement system?

…………………………………………………………………………………………………

10. Which features in particular would you be interested in within a computerized system for procurement.

…………………………………………………………………………………………………

11. Additional comments, recommendations about the new system.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

Signature:……………………………………………………..

Thank you for your cooperation

APPENDIX C

QUESTIONNAIRE – FOR PROCUREMENT COMMITTEE

My name is Kennedy Paridzira and I am a Bachelor of Science candidate at Midlands State University. My Project is "SANYATI EDUCATION ONLINE PUBLIC PROCUREMENT SYSTEM". I am conducting the research project as partial fulfilment of the requirements for the degree of BSc Honours Information Systems. I am interested in finding current Public Procurement system and ways in which these could be computerised and improved in the process. Your information will be held in the strictest of confidence and will only be used for the purposes of this research project.

Date:………………………   **Time:……………………………..**

May you please tick (√)

1. Tick your Position   Administration ☐

                         Head of Department ☐

                         Teacher in Charge ☐

                         Specialist teacher ☐

2. How many years have you been in the procurement committee system?

0 – 5 years ☐   6 – 10 years ☐   11-15 years ☐   16 – 20 years ☐ over 20 years ☐

3. How many times do you procure goods in a year?

0 – 3 times ☐   4 – 8 times ☐   8-10 times ☐   10 times +☐

4. Are you having problems with the existing system? Yes ☐   No.☐

If yes may you state them………………………………………………………………………..

………………………………………………………………………………………………….

5. How long does it take for an order to be delivered after initial inquiry?

0 – 5 days ☐   6 – 10 days ☐   11-15 days ☐   16 – 20 days☐ over 20 days ☐

6. What is the mode of communication between the supplier and buyers?

landline ☐   cellphone ☐   e-mail ☐   whatsapp☐   skype ☐   letters ☐

7. What duties do you perform and elaborate processes.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

8. How do you locate or find suppliers?

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

9. How many people are involved in procurement?

……………………………………………………………………

10. Could you estimate the costs that are involved during procurement

…………………………………………………………………………………………………

…………………………………………………………………………………………………

11. How reliable is the system?

…………………………………………………………………………………………………

12. Which reports are generated by the system?

…………………………………………………………………………………………………

…………………………………………………………………………………………………

13. How comfortable are people with the current system?

…………………………………………………………………………………………………

14. Describe the nature of backup that is currently used by the system?

……………………………………………………………………………………………………

15. What features do you want to be included in a computerized system for services.

……………………………………………………………………………………………………

Additional comments, recommendations about the new system.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Signature:………………………………………………..

Thank you for your cooperation

Appendix D

Questionnaires for Suppliers

My name is Kennedy Paridzira and I am a Bachelor of Science candidate at Midlands State University. My Project is "SANYATI EDUCATION ONLINE PUBLIC PROCUREMENT SYSTEM". I am conducting the research project as partial fulfilment of the requirements for the degree of BSc Honours Information Systems. I am interested in finding current Public Procurement system and ways in which these could be computerised and improved in the process. Your information will be held in the strictest of confidence and will only be used for the purposes of this research project.

SECTION A

May you please tick (√)

1. Tick the nature of your business. Food and Beverages ☐

Clothing and Textiles ☐

Furniture Supplies ☐

Computers and Consumables ☐

Stationery ☐

Sanitaryware ☐

2. How many years have you been supplying the educational system?

0 – 5 years ☐   6 – 10 years ☐   11-15 years ☐   16 – 20 years ☐ over 20 years ☐

3. Are you having problems with the existing system? Yes ☐   No. ☐

If yes may you state them………………………………………………………………..

………………………………………………………………………………………….

4. How long does it take for an order to be placed?

0 – 5 days ☐   6 – 10 days ☐   11-15 days ☐   16 – 20 days ☐ over 20 days ☐

Other specify …………………………………..

5. What is the mode of communication between the supplier and buyers?

landline ☐   cellphone ☐   e-mail ☐   whatsapp☐   skype ☐   letters ☐

SECTION B

6. Do you feel comfortable with the existing procurement system   YES ☐   NO ☐

If no give reasons for your answer ……………………………………………………………

……………………………………………………………………………………………………

7. Do you support the idea of developing a new enrolment system. YES ☐   NO ☐

If no give reasons for your answer. ………………………………………………………………

……………………………………………………………………………………………………

8. State the part that you play in the procurement process.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

9. Do you have any changes which you feel should be done about the current system.

YES ☐   NO ☐

If yes give reasons for your answer.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

9. Will a new computerized procurement system benefit suppliers. If so how?

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

10. What strategies do you use to reduce procurement costs and contract fulfillment delays?

………

………

………

11. What barriers have you encountered when implementing strategies to improve the manual procurement process?

12. What strategies have you adopted to respond to the changing technological global village.

………

………

………

13. What am I forgetting to ask that you have found helpful in improving procurement methods in Zimbabwean companies?

………

………

………

APPENDIX E

Observation Score sheet.

Date ……………………………….   Time:…………………………..

Section :…………………………………

Observation

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

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…………………………………………………………………………………………………

Conclusion

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

APPENDIX F

Code Snippet

System Config file

```php
<?php
# session name

define('SESS_NAME' , 'ss_id');

#igrade DATABASE CONNECTION

$__ip = 'localhost';//getHostByName(getHostName());

define('URL' , 'http://'.$__ip.'/procu/');

define('SERVER_URL_HOME' , 'localhost');

define('DB_HOST' , 'localhost');

define('DB_USER' , 'root');

define('DB_PASSWORD' , '');

define('DB_NAME' , 'procure');

#SMS Password

define('SMS_USER' , 'ReliableEA');

define('SMS_PASSWORD' , test123);

#email Password

define('EMAIL_ADDRESS' , 'kparidzira@gmail.com');

define('EMAIL_PASSWORD' , 'procurement');

?>
```

Database Connection

```php
<?php

$conn = mysqli_connect( DB_HOST , DB_USER , DB_PASSWORD , DB_NAME );
// Check connection
if (!$conn) {
    die("Connection failed: " . mysqli_connect_error());
}
require_once ('PHP-MySQLi-Database-Class-master/MysqliDb.php');
$db = new MysqliDb (DB_HOST, DB_USER, DB_PASSWORD , DB_NAME);
?>
```

Account.php

```php
<?php
Class Account
{
        public function login($username , $password , $table)
        {
                Session::name();
                global $conn;
                $parUsername = mysqli_real_escape_string($conn,Input::gp_clean($username));
                $parPassword = mysqli_real_escape_string($conn, $password);
                $sqlCheck = "SELECT * FROM $table WHERE `username`='$parUsername'
AND `password`='$parPassword' LIMIT 1";
                $resultCheck = mysqli_query($conn, $sqlCheck);
                if (mysqli_num_rows($resultCheck) > 0) {
                        $user = array();
                        while($row = mysqli_fetch_assoc($resultCheck)) {
                                $user = $row;
                                unset($user['password']);
                                $user['account_type'] = $table;
                        }
                        return $user;
                } else {

                        return false;
                }
        }
```

```php
public static function change_password_strength($newpassword = '' , $confirmpassword
= 'true1')
{
        global $conn;
        $state = true;
        $error = '';
        if($newpassword != $confirmpassword)
        {
                $state = false;
                $error .= 'New password Mismsatch<BR>';
        }

        if(strlen($newpassword) <= 6 )
        {
                $state = false;
                $error .= 'Password should be greater than 6 characters<BR>';
        }

        if(strlen($newpassword) >= 30 )
        {
                $state = false;
                $error .= 'Password should be less than 30 characters<BR>';
        }

        if(is_numeric($newpassword))
        {
                $state = false;
                $error .= 'Password should be not be numeric<BR>';
        }

        if($state == true)
        {
                return true;
        }
        else
        {
                return $error;
        }
}

public static function change_password($id , $password  , $column = 'id' , $table)
{
        global $conn;
        $teacher_id = mysqli_real_escape_string($conn,Input::gp_clean($id));
        $parPassword = mysqli_real_escape_string($conn, $password);
```

```php
            $sqlCheck = "UPDATE $table SET `password`='$parPassword' WHERE
`".$column."` = '$id' LIMIT 1";
            if (mysqli_query($conn, $sqlCheck))
            {
                    return true;

            }
            else
            {
                    return false;
            }
        }
}
?>
```