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DESIGN AND DEVELOPMENT OF A DISTRICT EDUCATION MANAGEMENT INFORMATION SYSTEM FOR NCHELENGE DISTRICT OF LUAPULA PROVINCE

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ABSTRACT *This study sought to design and develop a district education management information system for Nchelenge district of Luapula province. The study further investigated constraints for implementing a district education management information system and also looked at the challenges of using manual information system. In addition; the study investigated the level of utilisation of information and communications technology (ICTs) among teachers. A survey carried out targeted teachers and district Education board secretary (DEBS).*
Questionnaires, focus group discussion and oral interviews were used. The researcher adopted a case study design. Further the researcher sought to use agile method which represents a relatively new approach to software development. To solve this pressing issue, the Ministry of General Education in Zambia has initiated a pilot project to strengthen their Education Management Information System (EMIS) by implementing a digital report structure to complement their manual, paper-based system (Ommundsen, 2017). The findings of this study revealed that this is a system set forth to realize efficiency in data collection and submission by school administrators to the district office designed to overcome the many infrastructural challenges present in Nchelenge district by the use of internet. The study concludes that an EMIS that supports timely, decentralized decision-making needs to support multiple user objectives and needs to be flexible enough to fit
various work processes and tasks, while the technology needs to overcome infrastructural challenges and fit with staff skills. **Keywords:** *Information management system; Head Teacher; District Administrators; artificial intelligence Education and administration.*

1.0 Introduction

The Ministry of Education has over the years been seeking ways to improve the quality of teaching and learning in schools which would subsequently raise the standards of education in Zambia. The research done by Education Management Information System, EMIS, (2007) in basic schools in Zambia, confirmed that whereas Zambia was successful in improving access to education, the quality of education in basic schools, as measured by test and examination results, was still low. Computer technology provides technical support to the education management information systems by providing right people with right information at the right time to make best decisions, planning and monitoring for the organization, Bhatti (2019).

1.1.What is an EMIS?

The acronym EMIS stands for "Educational Management Information System". By definition an EMIS is an organized group of information and documentation services that collects, stores processes, analyzes and disseminates information for educational planning and management. It is a system for managing a large body of data and information that can be readily retrieved, processed, analyzed, and made available for use and dissemination, UNESCO (2015).

An Education Management Information System (EMIS) can be defined as a comprehensive system that brings together people, practices, and

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technology to provide quality education statistics in a timely, cost-effective, and sustainable manner, at every administrative level, and to support selected operational functions.

1.2.What is Education Management?

Education Management Information System (EMIS) is an institutional service unit which produces, and manages educational data and information. It is normally established within a national Ministry or department responsible for education in order to increase effectiveness and efficiency by saving time and facilitating development of alternative solutions for sophisticated problems (Vissher & Wild, 1997.

1.3. Motivation

Evidence-based decision making is the key output of any management information system. The EMIS in Nchelenge district has been paper-based since its introduction, rendering decision-making inefficient and the information produced outdated (Manya, 2012).

1.4. Knowledge Motivation

A large body of literature exists in relation to the strengthening of Health Management Information Systems (IS) in low resource contexts (Berntsen, 2015. The widespread development of HMIS in developing countries is largely a result of pressure from international donors providing funds and technical assistance Sahay (2012). The same investments have been lacking in the education sector, which is why there is a need to broaden the empirical basis on education management in low resource context within the field of Information System research. The research has been conducted as an exploratory case study providing a rich description on the context of how the digital Education Management Information System fits into the education management structure, which stakeholders are involved and what contextual challenges are present.

1.5.Significance of the study

The purpose of this project was to design and develop a district education management information system for Nchelenge district of Luapula province. In addition, the study sought to find out how best the government of Zambia and ministry of education will implement the designed system to address challenges faced by Nchelenge district education Board and come up with measures to overcome these challenges.

1.6.Scope of the system

This system will cover the aspect of operation of the delivery of the education system which is critical to running of the District education and schools efficiently. However, this system will not be used for monitoring of teacher performance in class.

1.7.Problem statement

The Ministry of General Education in Zambia has initiated a pilot project to strengthen their Education Management Information System (EMIS) by implementing a digital report structure to complement their manual, paper-based system, Simon (2017). DEBS and Schools have continued to use the traditional manual way of submitting and storing data and information to the District education Board secretary, a situation proving very expensive and time loosing, Degif (2008). Due to the inefficiency of the current manual system (Hedberg et. al. (1992), the need arises to design and develop a District Education Academic management information System (DEAMIS) in order to efficiently handle students and teachers for good results to be seen.

Aim

The aim of this thesis was to design and develop a district education management information system for Nchelenge District education of Luapula province in order to curb down on challenges and expenses by the district during the course of operation.

1.8.Objectives

1.8.1. General objectives

1. The main objective of the study is to design and develop a district education management information system for Nchelenge district of Luapula province.

1.8.2. . Specific objectives

1. To establish the constraints for implementing a district education management information system
2. To identify challenges of using manual information system in Nchelenge district education sector
3. To determine the level of utilisation of ICTs among teachers in Nchelenge district

1.9.Research question

1. What are the enabling and constraining conditions for implementing a digital EMIS in Zambia?
2. What are the challenges of using manual information system in Nchelenge district education sector?
3. What are the levels of ICT utilisation among teachers of Nchelenge district?

1.10. Organization of the document

This report contains five chapters including this chapter. Chapter two looks at literature review and defines concepts with regard to DEAMIS, aiming to give a general view to the reader of the document about tasks or activities which need automation in the district environment. Chapter three presents the methodologies of the project and the development of the DEAMIS, approach, and system design and data collection. In chapters four and five, we presented the results and discussion of findings, the analysis and design of the developed system respectively. Also prototype development, conclusion and recommendations are briefly explained.

1.11. Summary

Implementation failures are costly for any organization (McAfee, 2006; Russell & Hoag, 2004) and, as noted earlier, leadership is a key factor in the success or failure of change initiatives (Adamson, 2004; Bass, 2007; Tellis, 2006).

2.0. LITERATURE REVIEW

This chapter presents literature review that is relevant to the study. The literature review is presented according to the following themes; Introduction, related literature and summary of the designed and developed district education academic management and information system for Nchelenge district education board.

MIS is an integrated machine system for providing information to support the operations, management, and decision-making functions in an organization. Information consists of data being processed and made meaningful to the users while system consists of set of components used to operate together to make possible conversion of data into information for use by any decision maker within or outside an organization, Sajjad (2019).

Automated SMS plays a great role in simplifying the job of employees at the school and satisfying the need of customers and stakeholders of the school. Even though no documentation is found in Ethiopia to be reviewed, products have been observed at some schools to help understand the problem of managing schools and handling school data. This chapter reviews these products.

2.1. RELATED LITERATURE

2.1.2. School Management Information Systems

Telem (1999) defines school management information systems as “a management information system designed to match the structure, management task, instructional processes and special needs of the school”. As for a broad definition, contributions of the information systems to schools can be defined as making programs more

effective, making the teaching process and the changes in learning environment professional, enabling teachers to exchange their experiences in a more systematic way, working in teams, determining the needs of the students Gurr (2000) and Pegler, (1992), supporting the school managers and other staff in doing their duties, developing their performances, effectiveness and efficiencies, Telem & Buvitski (1995). In other words, school management information systems increase effectiveness and efficiency by saving time and facilitating development of alternative solutions for sophisticated problems, Vissher & Wild, (1997). Information systems support not only information process but also innovations (Haag, Cummings& Dawkings, 1998; Bellum, 2003

According to the research conduct by Christofeel (2006) in South Africa, the functional approach (also called the traditional approach) ISD is a planned and rational activity, carried out in a systematic, organized and methodical manner (Ahituv & Neumann, 1986; Bell & Wood-Harper, 2003; Benyon, 1990; Fitzgerald, 1998).

2.1.3 Functionalism

Hirshheim and Klein (1989) identify four major kinds of systems development approaches (functionalism, social relativism, radical structuralism and neo-humanism) and discusses how they lead to different outcomes. Henriksen (2003:21) underscores the positivistic notion of the functionalism paradigm of Hirschheim and Klein, when he refers to it as "organisational reality made up of objects, properties, and orderly goal- oriented patterns that are directly observable and predictable. The entire notion of functionalism presented by them stipulates that it is a technical process that makes system development more formal and rational, "placing less reliance on human intuition, judgment, and politics" (Hirschheim & Klein, 1989: 1203).

2.1.4. The application of the systems theory approach in information systems development

Systems thinking posits that an information system be viewed as a system, with data as the input and data analysis processes that transform them into information and knowledge as the output. The basic premise is that the general systems theory concepts underlie the information systems development (Ahituv & Neumann, 1986; Bell & Wood-Harper, 2003; Benyon, 1990; Checkland, 1999; Laudon & Laudon, 1995, 1998; O'Brien, 1991).

2.1.5. Stages of ICT Development in Schools

The stages are hierarchical with the emerging stage as a beginning point, and the transforming stage as a goal for the future of education, MOGE (2015).

2.1.6 Emerging

Schools at the beginning stages of ICT development demonstrate the emerging stage. Such schools begin to purchase, or have had donated, some computing equipment and software. In this initial phase, administrators and teachers are just starting to explore the possibilities and consequences of using ICT for school management and adding ICT to the curriculum.

2.1.7 Applying

Those schools in which a new understanding of the contribution of ICT to learning has developed are in the applying stage. In this secondary phase, administrators and teachers use ICT for tasks already carried out in school management and in the curriculum. For example, instructing may be supplemented with ICT such as electronic slide presentations and word-processed handouts. Pupils receive instruction and add notes to teacher prepared handouts. Schools at the applying stage adapt the curriculum in order to increase the use of ICT in various subject areas with specific tools and software.

2.1.8 Infusing

The infusing stage involves integrating or embedding ICT across the curriculum, and is seen in those schools that now employ a range of computer-

based technologies in laboratories, classrooms, and administrative offices. Teachers explore new ways in which ICT changes their personal productivity and professional practice. The curriculum begins to merge subject areas to reflect real-world applications. For example, content is provided from multiple sources, including community and global resources through the World Wide Web. Pupils' access to technology enables them to choose projects and ICT tools that stimulate learning and demonstrate their knowledge across subject areas. To advance to the next phase, schools choose an ICT curriculum that allows a project-based, ICT-enhanced stage. These schools begin to involve the community more in the learning environment and as resource providers, ZRDC (2017).

2.1.9 Transforming

The focus of the curriculum is now learner-centred and integrates subject areas in real-world applications. ICT is taught as a separate subject at the professional level and is incorporated into all vocational areas. For example, pupils may work with community leaders to solve local problems by accessing, analyzing, reporting, and presenting information with ICT tools. ICT is taught as a subject area at an applied level and is incorporated into all vocational areas. Schools at this stage become centres of learning for their communities.

2.2. ICT & Visualisation in the Construction Industry

Moore (2001a) argued that for most construction managers, the standard tool to enhance communication of operational concepts among project participants is visualisation.

According to Nielsen & Erdogan (2007), the need for visual communication is growing stronger than ever because communication based on texts have often led to information overload in handling and managing project data. Such information overload, in turn, has led to inefficiencies in the communication process. They believe that as operational processes in the construction industry become complex, there should be a communication system that allows for brief and instant understanding.

2.2.1 Visualised Communication in Scheduling and Planning

Nielsen & Erdogan studied that Visualisation technologies in construction can also be used in scheduling and planning, but not to a greater extend as in design communication. They stated that 4D applications alongside 2D and 3D applications and simulation can be used to demonstrate construction activities in real-life situations.

2.3. Conceptualisation of ICT Integration

Although the term 'ICT integration' has been broadly used and thought to bolster organisational effectiveness, recent studies by Gajendran & Brewer (2007) have revealed that the meaning of integration is not well understood in terms of ICT. Extensive literature review by Wainwright et al (2004) indicated that 'in a broad sense, the meaning of integration has become synonymous with utilitarian goal of greater efficiency, effectiveness and competitiveness in organisations'. Going by the authors' opinion, integration as the ability of computer systems to work with previously incompatible systems is limited to technical aspects.

2.3.1 ICT as an enabler for integration

According to Faniran *et al.* (2001), construction projects are complex collaborative processes that involve different bodies or organisations; including clients, designers, consultants, and contractors. The aim of having such integrated project teams is to give project participants instantaneous access to all project information through the use of information management systems.

2.3.2 Intergrating multidisciplinary teams

The role of ICT tools as an enabler of integration in construction projects is to give other project team players the opportunity to communicate and have a big picture of what they would be working on. Communication between multidisciplinary teams in

the construction industry has long received the attention of researchers (e.g. Katz, 1982; Lievens & Moenaert, 2000; Ganah et al, 2001; Giffin, 2002), and most recently in the work of Chiocchio (2007).

2.3.3 ICT as an enabler for collaboration and knowledge management

Clarke (1999) and Turner (2000) claimed that traditional project management often employed a simple and passive reporting mechanism instead of a dynamic team work. Clarke held that most project organisations consider project management methodology as a corporate reporting tool rather than a useful system that the various parts of the organisations can use to create value through collaboration and knowledge sharing.

Freeze and Uday (2007) inform us that the main emphasis of collaboration and knowledge management has been a system-oriented view that focuses on technology application; which range from rudimentary data-processing areas such as knowledge enabled supply chain management systems to expert networks framed to facilitate interdisciplinary communication.

2.4. Mobile Technologies

Mobile wireless or cellular phone is a portable, handheld communication appliance, or device that is connected to a network wirelessly in order to enable people make calls, send text messages and use applications. These devices are designed to meet the expectations of different people. In order to achieve this, different manufacturers make different devices that meet different customer profiles. The manufacturers of mobile devices include RIM, Samsung, Nokia, BenQ, Motorola, LG, Sony Ericsson to mention but a few. Mobile devices include standard phones, feature phones, smartphones, tablets, laptops and PDAs or handheld computers. The standard phones are low cost phone and usually run on proprietary or series 40 operating system (OS). Series 40 or S40 is proprietary to Nokia, although it is also used on some of the Virtue line of luxury phones. JAVA and BREW is the mostly used applications on these phones. The smart phones are priced slightly higher than the standard phones. The commonly used operating systems include the S60 from Nokia, Windows Mobile and Linux. These devices use any application that may be compatible.

2.5. Web Technologies

These are technologies that are used to exchange information on the computer networks such as the internet. The internet is a network of computers that cover the world and the World Wide Web (WWW) is a service that operates over the internet. All devices on the network need to communicate with each other on the same or other networks, and this is achieved through the web technologies.

a) Markup languages

Markup languages are designed for definition, presentation and processing of text. The code for both the style and layout within a file is defined by the language. Examples of the markup languages include HTTP, CSS, XML, CGI and HTML. All computers clients and servers on
the WWW use markup languages.

b) Programming languages and technologies

The programming languages and technologies are used to build applications for the web. Some of the commonly used languages are C#, Perl, java and Visual Basic Net.

c) Web servers and server technologies

The Web server and server technologies facilitate the handling of requests that are generated by different users on the network [64]. This is so because different users have to share the same resources and communicate with each another. The webserver is responsible for accepting requests for content that is defined in the Uniform Resource Location (URL). A URL is an address of the web page. It designates a unique address for a file that is accessible on the internet. The most popular Web server software include the Apache, which is an open source webserver and supports Windows, UNIX and Mac Operation Systems. Windows also

has a proprietary web server called Microsoft IIS, which runs on Microsoft Windows platforms only. The server executes a program to generate a web content as requested on the URL. Then the HTTP request details are passed over to the program by the server. The programs return the web content or an error code. The Apache server uses the Common Gate way Interface (CGI) while the Microsoft IIS uses the Active Server Pages (ASP).

d) The Browser and Server Communication via HTTP

The Hypertext Transfer Protocol (HTTP) is a standard protocol for transferring web content where the server listens on port 80 waiting for connections. From Europe in Netherlands, Limhurg, L. Van 1977, reported on the importance of educational information after World War 11. In Norway, Eide, K, 1977. reported a case of genuine participatory planning where information from the central authority was no longer prescriptive but informative to foster effective grass-root decision making. A study conducted by Dawam et al. (2009) examined the extent of ICT utilization in public and private higher learning institutions in Northern Malaysia. This study focused on identifying the extent of ICT resources provided by the university authorities, the type and extent of ICT usage in daily activities, the ICT proficiency level among faculty members, and the level of ICT integration in teaching activities. The finding indicated that the facilities provided in public higher learning institutes were not as plenty as in private institutes but the level of their usage was quite encouraging. The importance of ICT to society and to future prospects is clear within the educational literature, Passey, (2002). In Papua New Guinea, Hinchliffe, (1977), reported on educational problems and related information needs. Difficulties in teacher recruitment, highly aggregated and inconsistent statistical information from departments and lack of basic information on population distribution. The report concluded by providing taxonomy of educational problems around which information could be organized. Hammiche, (1977), studied the education system in Algeria, reporting on the structure, management and reforms. He described the type of data used for decision making and methods of collecting data. An educational reform had been started in 1969 with neither an idea about the size of the qualified manpower available nor where the forecasts would be put to determine long-term trends. In Ghana, Ekuban 1977, reported on the identification and analysis of national patterns of information policy and planning and the impact of educational information to decision-making. According to his report, information at the national level on educational policy was elicited on setting up a committee from a cross-section of the population.

Zambia is an Eastern African country with a lot of natural resources, striving for prosperity and social development. Its main industries consist of agriculture and mining, particularly copper, which makes Zambia's economy highly sensitive to changes in the global economy. The country is divided into 10 provinces which is further divided into 103 districts. In accordance with their decentralization policies, the districts have the overall responsibility for public service provision within domains like health, education and infrastructure development (National Planning Department, 2014). The country is landlocked, and borders to Malawi and Tanzania to the East, D.R. Congo to the north, Mozambique, Botswana, Namibia and Zimbabwe to the south, and Angola to the west.

The overall governing strategy for Zambia is outlined in the Revised Sixth National Development Plan (R-SNDP), which aims at achieving the objectives of the Vision 2030 of Zambia becoming a "prosperous middle-income country by 2030" (National Planning Department, 2014, p. ii).

In addition to their public government, Zambia has a traditional system of Chiefs, a system which is highly operational and well respected in local communities. The 288 Chiefs are represented in the

House of Chiefs, who advises the Government on traditional, customary and related matters. Issues concerning Chiefs and Chiefdoms are situated in the Ministry of Chief's Affairs ("House of Chiefs," 2016). Chiefdoms are passed down through male inheritance, and have massive influence on local communities, as well as business operations and social development. They can impose punishments and sanctions to their population, e.g. in the form of having them work in or with maintenance of the Chief's palace. The Chief resides in the Chief's Palace where he accepts audience with any government officials or NGOs who wish to intervene in communities within his Chiefdom. They are considered royalties, and during my visits to Chiefs it was common to kneel, refer to him as "your royal highness", and bring gifts like maize meal or cooking oil. Interventions in local communities will most likely fail if the Chief is not engaged.

The penetration levels of ICTs in Zambia's education institutions remain low, with those schools that are equipped mostly utilizing second-hand and refurbished computers. The integration of ICTs in learning and teaching practice has been limited, although the introduction of computer studies as a school study subject has begun to change this. The recent adoption of a national ICT policy, as well as the development of a draft ICT policy for education and an associated implementation framework, provides an enabling policy environment to promote far greater access and use of ICTs across all sectors of Zambia's education system, including a system for enhancing education management, administration, and teaching and learning. While the goals and targets set in these policy documents seem realistic, realizing them within the established time frames remains a challenge. The Zambian economy has historically been heavily dependent on copper mining. Since the early 1970s the terms of international trade shifted towards a significant decline in copper prices. This led to the closure of mines and had a far-reaching effect on the economy. Slow progress in diversifying the economy and high levels of borrowing and debt relief are contributing factors to the country's economic malaise, Shaffika (2007.

The emphasis to integrate ICT tools in the construction industry as a vehicle for operational efficiency and strategic management has been a topic of interest and debate for a number of researchers (Tushman, 1986; Nielsen & Erdogan, 2006; Kraus, 2006; Dyer, 2006; Wagner, 2000; Breidenstein, 2001; Giffin, 2002; Pinto & Pinto, 1990; Meredith & Mantel, 2003; Morris & Pinto, 2004; Gardiner, 2005; PMIBOK, 2000; Muller, 2002).

The common message passed by these researchers is that ICT application in the construction industry was relatively low compared to other industries like the aerospace and automotive industry, where the efficient use of ICT tools has been the fulcrum for improved project delivery. Therefore, it has widely been held that without effective use of these tools in the construction industry, traditional working methods among team members would continue to stall project delivery processes. On the other hand, the need for effective ICT tools to facilitate team interaction in construction projects cannot be overemphasized; given that the industry increasingly uses multidisciplinary skills than any other industry (Tushman, 1986; Nielsen & Erdogan, 2006).

2.6. Infrastructure

The Zambian infrastructure has a lot of challenges and a lot of work is still required to reach out to the rural population living without electricity, ICT, water and road connections. In many cases the lack of infrastructure, like roads or proper hygienic conditions, prevents children from reaching or staying at their school on a daily basis.

Zambia has a modest ICT infrastructure that is concentrated in urban centres. Zambia underwent a process of liberalisation of its telecommunications and broadcast sectors in the early 1990s. The current

regulatory framework is fragmented with three bodies regulating the sector. The Communications Authority regulates the telecommunications sector, the Ministry of Communications and Transport regulates the postal and courier services, and the Ministry of Information and Broadcasting regulates broadcasting. There will be attempts to harmonise the regulatory framework with closer collaboration between the different ministries in view of the country's new national ICT policy Shaffika (2007). A major boost to Zambia's ICT infrastructure is the impending establishment of the East African Submarine Cable System (EASSy), which is a submarine optical fibre system running along the east coast of Africa and which includes some of the landlocked countries like Zambia. This project is facilitated by the New Partnership for Africa's Development (NEPAD) Africa Commission in partnership with a host of telecom companies; in Zambia, Zamtel is the key partner.

2.6. ICT POLICIES

2.6.1 National Vision 2030

The National Vision 2030 is the Zambian government's long-term plan "to be a prosperous middle-income nation by the year 2030." The vision emanates from a series of discussions with a range of stakeholders from civil society, the private sector, and within government, and it articulates national and sectoral goals for the socio-economic development of Zambian economy and society.

2.6.2 Fifth National Development Plan

The Fifth National Development Plan (FNDP) represents the fifth of a series of successive five-year plans to promote the social and economic development of Zambia. The FNDP extends from 2006 to 2010 and has "broad based wealth and job creation through citizenry participation and technological advancement" as its theme and "economic infrastructure and human resources development" as its strategic focus. Unlike previous national plans, the FNDP makes specific references to ICT development. It proposes the installation of provincial and district fibre optical cables and the establishment of rural community multi-purpose telecentres.

The FNDP represents the engine for developing other forms of ICTs including capacity-building related to technologies and equipment as well as broadening access content such as news, information, and knowledge resources by the general public.

2.6.3 National ICT Policy

In March 2007, the Zambian government launched its national ICT policy. At the launch, President Mwanawasa reportedly emphasised the creation of an innovative, market responsive, highly competitive, co-ordinated, and well-regulated ICT industry Isaacs (20017).

2.6.4 The policy identifies three goals for ICT:

1. To enable a diversified and export-oriented economy
2. To improve livelihoods and protect the vulnerable through service delivery
3. To provide an efficient and effective public sector

2.6.5 The policy recognises the need to face the following challenges in education:

1. Low levels of ICT literacy
2. High cost of technology acquisition
3. "Brain drain" resulting in considerable loss of skilled personnel
4. Limited local ICT industry
5. Lack of standardisation and certification programmes in ICT
6. Inadequate institutional capacity

The policy states that computer studies were introduced as a subject in public schools in 1998 and that Zambia's private schools were producing ICT literate students. It also highlights challenges such as the financial and technological resource constraints, inadequate awareness on the benefits of integrating ICTs in the administration of the delivery chain of education sector, and the high opportunity costs and lack of co-ordination.

ICT Policy in Education With the support of the International Institute for Communication and Development (IICD), the Commonwealth of Learning (COL), and the United States Agency for International Development (USAID), the Zambian Ministry of Education had developed a draft ICT policy for education by October 2006 and an implementation strategy by January 2007. This represents an extension of Zambia's national education and national ICT policies. The vision is for ICTs to contribute towards reaching innovative and lifelong education and training in Zambia by 2030.

2.6.6 Roads

Zambia made most of their infrastructure investments during the early 2000's. Well maintained roads connect all major cities and international borders. Zambia was ranked 22 of 54 in the African Infrastructure Development Index for 2016, mostly due to their lack of rural coverage (Lufumpa, Mubila, & Lawson, 2016). Infrastructure development is at the core of social development strategies in Zambia. However, recent years has had a strong bias towards mining areas, continuing to neglect rural areas where people live. (The World Bank, 2011). Dirt roads are widespread, causing difficulties in accessibility and mobility, particularly during the rainy seasons. As distances are vast and population is widespread, a large number of primary schools is required to make education accessible without transporting children long distances on a daily basis. 81 % of all primary schools are located in rural areas (Directorate of Planning and Information, 2016).

2.6.7 Energy and ICT coverage

Zambia mostly relies on solar energy and hydroelectricity. The latter has caused a power shortage for years, as there has been little rain during rain seasons. Most of the energy production is however centered on mining and copper production, leaving only 22 % of the population with access to electricity. Only an estimated 21 % of Zambia's population use Internet. Mobile subscriptions are however relatively high, estimating approximately 77 subscriptions per 100 inhabitants.
("Zambia," 2017).

Computers are seen to have the potential to make a significant contribution to the teaching, learning, and administration in schools. The use of information technology in educational management has rapidly increased due to its efficiency and effectiveness. School managers who used to spend large amount of time in solving complex allocation problems (e.g., staff allocation, resource allocation, timetabling) and monitoring the school operations have now better options due to enhanced technology. Information technologies facilitate the decentralization of work tasks and their coordination in an interactive network of communication in real time (Castells, 1996).

They allow for greater flexibility and networking that emphasizes interdependence, interaction, and constant adaptation to an
ever-changing environment (Castells, 2001). Management information systems (MIS) are being used by schools to support a range of administrative activities including attendance monitoring, assessment records, reporting, financial management, and resource and staff allocation. MIS provide managers with the information required to manage organizations efficiently and effectively. These systems are distinct from other information systems in that they are designed to be used to analyze and facilitate strategic and operational activities in the organization (O'Brien, 1999).

Waston et al. (1987) describes management information system (MIS) as 'an organizational method of providing past, present and projected information related to internal operations and external intelligence. It supports the planning, control and operation functions of an organization by furnishing uniform information in the proper time frame to assist the decision makers. Telem (1999) defines MIS as 'a management information system designed to match the structure, management task, instructional processes, and

special needs of the school'. Based on the foregoing definitions, MIS refers to a system that uses the information required by the organization's management at every level in making operational, tactical, and strategic decisions. Its main objective is to design and implement procedures, processes, and routines that provide suitably detailed reports in an accurate, consistent, and timely manner.

2.7 Current EMIS in Zambia

The EMIS in Zambia consists of a large number of government bodies, who's tasks range from service provision, quality assurance, data collectors to policy makers. A variety of NGOs operate with a broad set of interventions within health, sanitation, school feeding, technical support for feedback, as well as advocacy towards policies and curriculum. Parent-Teacher Associations (PTAs) exist in most schools, and have a lot of influence on school management and the School Board. Chiefs have a lot of authority to see interventions carried through, and promote awareness around the importance of education in the community Simon (2017).

2.7.1 Information flow

Most routine data are collected on a daily basis by each teacher in their classrooms. The most frequently collected data is student attendance, kept in registers – one for each class with entries for each pupil. Separate registers keep track of examination and test scores for each pupil, which is assessed to set their final mark by the end of each term. Each school also keeps track of teacher attendance, registering if they are absent from work or not, regardless of reason. In most all cases, particularly in rural schools, these registers are physical books. Class registries and teacher attendance is aggregated on a monthly basis into school registries. Once a year, the school registries are aggregated again so the data can be entered into the Annual School Census Simon (2017).

2.8 Existing Systems

A good worldwide record of existing systems with similar functionality exists. Examples of these types of intervention include: programs aimed at improving school management and supervision, interventions providing incentives to teachers for improving student achievement (output-based incentives), programs providing incentives to students and programs tracking students by prior academic achievement (Banerjee and Duflo 2006, Rogers and Vegas, 2009).

2.8.1 Education Structure

Zambia's education structure starts with four years of pre-school education, which are optional. Primary schooling extends over seven years at an entrance age of seven years, followed by five years of secondary education at an entrance age of 14. Currently the Zambian government is placing emphasis on ensuring the provision of primary education. In 2005 Zambia had 6,962 basic schools with 2.8 million learners and 463 high schools with more than 136,000 learners. Almost two-thirds of the children end their education at the primary level. Only one-third of the primary school dropouts have the opportunity to go to secondary education. Of those who enroll for primary education, less than 20% enter secondary school, and only 2%of the 20 to 24 age group enter a university or some other form of higher education.8Higher education is provided by two universities under the aegis of the Ministry of Education and various specialized institutions (colleges and institutes) controlled by the Ministry of Science, Technology and Vocational Training. Primary and pre-primary school teachers are trained at primary school teacher-training colleges while secondary school teachers are trained in teacher colleges and at the University of Zambia, Isaacs
(2007).

2.9. Summary of the reviews of the studies

The study under review illustrated how information had been used by various Ministries and agencies for

decision-making. The focus was mainly on improving sources of information. Some indicated effort to unify information sources and alternative sources. The studies revealed problems such as collecting the same information, even with changing needs, tailoring it to technology irrespective of immediate; loss of data through aggregation; lack of contribution from institutions etc.

CHAPTER THREE: METHODOLOGY

3.0 INTRODUCTION

This chapter focuses on the description of the methods that were applied in carrying out the research. It introduces and describes the following, research methodology, Baseline study, system design and instruments for data collection and procedure for data collection.

Finally, we look at the results of the survey that enabled us to determine the development of the system. We also look at the results of the implementation of the system, that we have called the Nchelenge district education management information system using the information fusion developed in Chapter 3. A cloud-based system is developed using NetBeans IDE, HTML, Xamp, Dreamweaver programming language and MySQL database. The prototype is tested using a server that runs Windows operating system.

3.1. Baseline Design

A baseline study is an analysis of the current situation to identify the starting points for a programme or project. It looks at what information must be considered and analyzed to establish a baseline or starting point, the benchmark against which future progress can be assessed or comparisons made. It aims at quantifying the distribution of certain variables in a study population at one point in time. It involves the systematic collection and presentation of data to give a clear picture of a particular situation as it relates the following: What? Who? Where? When? Why? How? A baseline normally covers only a sample of the population, Adhikarya, Ronny. (1994).

3.1.1 Baseline Study

Zambia is situated in Central Southern Africa and shares borders with Zimbabwe, Botswana, Namibia, Angola, DRC, Tanzania, Malawi and Mozambique. It is divided into 10 provinces, as shown in Figure 10. and has a population of 15million people CSO (2010). Zambia covers an area of 752,612 Km^2 and is highly urbanized with a population density of 100 people per square kilometer in Nchelenge CSO (2010).

Figure 1 (CSO,2010) Map of Zambia

The baseline study was conducted in Nchelenge district. Nchelenge district in Luapula was chosen because it is rural and remote location and distance from the provincial town of Luapula. Not only that but also its impassability of the roads in the district especially during the rainy season.

3.1.2. Data collection procedure

The researcher used interviews, school records and other necessary documents that gave insight into the performance of Schools and the time it takes to submit reports to DEBS. Furthermore, the Head teachers for the respective schools in Nchelenge

District were approached for additional information (especially answering questions in the observation guide.

Furthermore, this researcher used Focus Group Discussions (FGDs) to collect detailed information as to the views and experiences of teachers who have worked in these Schools for a long time as the appendix FGD interview guide shows. FGDs are forms of interviews in which more than one person is involved (Bryman, 2008). Wellington (2000) recommends a small group of six to ten participants per session. A questionnaire was developed as an instrument of data collection. In the first part of the questionnaire, there were some items about the personal information of the school managers such as vocational experience and education level. In the second part, the items were about information technology facilities related to the information systems of the school and opinions of the school managers about technological facilities. The items about the number of the computers in the school and number of the computers connected to the Internet were open-ended and later, they were classified after examining their distributions. Participants were expected to choose among the options presented for the items about the places of the computers and the ones connected to the Internet and also the software used. Lastly, there were open-ended items related to the places to consult in case of a problem about the program and the ones related to reliability. In the third part of the survey, there were items related to the studies done with the school managing information systems and items about by whom these studies were done. These items were divided into two parts as the preparation of various documents, lists and statistics, and data entry. The fourth part consisted of the contributions of managing information systems to school management and problems encountered. These items were in the form of five point like scale. Options were ordered as; "Strongly disagree", "Disagree", "Undecided", "Agree" and "Strongly Agree". The answers were ordered from "Strongly Disagree" to "Strongly Agree" by grading them from 1 to 5. The fifth part included experiences of school managers in information systems and effects of managing information systems to the manager. In this part, school managers were asked questions about their experiences in information systems and the effects of managing information systems to their managerial efficiencies and occupational developments. Options were ordered as; "Strongly disagree", "Disagree", "Undecided", "Agree" and "Strongly Agree". The answers were ordered from "Strongly Disagree" to "Strongly Agree" by grading them from 1 to 5. In this part, to determine the validity of questionnaire was used the technique of content-related validity according to the opinions of the experts.

In this study both literature studies and interviews were done to gather information. In this research, a qualitative technique was conducted in order to collect information. Polkinghorne (2005) described that the most broadly used technique in the production of qualitative data is interviews with participants. In terms of sources of data, these data can be gathered either from primary or secondary sources. Generally, primary sources can be data which has been gathered from the people or organisation directly, and also unpublished data. On the other hand, secondary sources relate to any materials, such as books and articles, which have been published previously (Myers, 1997). This research used primary data which was collected through interviews with the respondents and the data obtained from interviews were also complemented with secondary data from internal documents and presentation documents of the Fenix System provided by the Fenix Program Manager and key people in the project. In addition, some parts of the user manual of the Fenix System are used to perceive the overview of the system.

3.1.3 Interviews

The general method to get qualitative data is interviews with participants or respondents and the

main reason to interview is to gain full and detailed information of the experience under study (Polkinghorne, 2005). Interviews are the most broadly used source as a method of collecting data for evidence (Blumberg et al., 2005). There is a definition of interviewing as: "interviewing is a technique of gathering data from humans by asking them questions and getting them to react verbally" (Potter, 1996). Another definition mentioned by Kumar (2005) is: "Any person-to-person interaction between two or more individuals with a specific purpose in mind". Also, Kvale (1996) described the aim of interviews thus: "[the] purpose is to obtain descriptions of the life-world of the interviewee with respect to interpreting the meaning of the described phenomena". Björklund and Paulsson (2003) categorised interviews as questioning which takes place through personnel direct contact, via telephone, e-mail or text messaging.

In order to collect information, the interviews are used to gain information. Interview guidlines with basic questions in the interviews was prepared (see Appendix 3). In this research, semi-structured interviews were used. Semi-structured interviews are another type of interview which is often used in case study research and usually start with rather specific questions but allow the interviewees to follow their own thoughts later on (Blumberg et al., 2005). Thus, when a semi-structured interview is conducted, the researcher can generate the questions that will be discussed with the respondents. In consequence, the respondents can answer the questions with freedom and further questions may be added during the interview. This research uses a qualitative view of science in order to find answers to individuals' perception of their reality, their beliefs and experiences. The reason why this research used the qualitative approach is that there is no need to receive numerical answers to quantify. The purpose of the interviews is to get the picture of the implementation process. These qualitative interviews need full and sufficient information. These interviews were based on the specific problems that are mentioned. By conducting face-to-face, phone, and e-mail interviews, a better understanding of problems and the current situation of the case are gained. The interview time was approximately an hour, the time varying from 40 minutes to 90 minutes. In addition, audio recording was conducted by a recorder device in order to support arranging the information further when I wrote in the research paper and, also, to avoid misunderstanding in the future. The disadvantages with selecting qualitative research is that the collected data might be prejudiced.

3.1.3. Research Approach

The researcher adopted a case study design. According to Polit and Hungler (1983) cited in Mwanza (2012), Case studies are detailed investigations of individuals, groups, institutions or other social units. A case study has one person, entity, a study of one thing; it is identified as one of the many. A case study may be of one person, class, district, country, continent or a family. A case study design was used because it allows the researcher to have an in-depth and detailed understanding of a single unit, such as one individual, one group, one organization, or one program. A case study provides a unique example of real people in real situations, enabling readers to understand ideas more clearly than simply by presenting them with abstract theories or principles. It further enables readers to understand how ideas and abstract principles can fit together.

There are many definitions of research design and some examples can be defined that "The research design constitutes the blueprint for the collection, measurement, and analysis of data" and "research design is the plan and structure of investigation so conceived as to obtain answers to research questions" (Blumberg, Cooper & Schindler, 2005). Phillips and Burbules (2000: p. 31) defined research as the process of making knowledge claims and then refining or abandoning some of them for claims that

are more strongly warranted. Another definition found explains that research is the process of answering unanswered questions or creating that which does not exist (Goddard & Melville, 2004: p .1).

After formulating the research questions, the next step of the research is to design the research strategy. However, before going any further, the question below should be considered. Is the purpose of the research to describe or to explain? Two of research approaches, which are deduction and induction, can be defined as following: "deduction is a research approach which involves the testing of a theoretical proposition by using a research strategy designed to perform this test. On the other hand, the induction is a research approach which involves the development of theory as a result of analysing data already collected" (Saunders & Lewis, 2012, p. 108 -109). According to Avgerou (2000), IS research is issue-oriented rather than theory driven which is in correspondence with an inductive approach. This thesis is more issue oriented and focuses on the single case study for achieving the purpose of the thesis rather than hypothesis testing based on existing theories. In this study, the researcher did not formulate any theory from the beginning, but instead had some questions in mind and then used the data collected to form the theory. In this case, mainly the inductive approach is applied.

3.1.4. Choice of Method

This chapter focuses on the method that will be applied in this research. Before discussing the research strategy and the data collection process, quantitative and qualitative research should be described. Myers (1997) mentioned that the choice of research methods manipulates the way in which the researcher collects data. Kumar (2005) claimed that choice of method of the research is decided by the type of information which is investigated. Also, the choice of method is based on three criteria including: the purpose of the study, how the variables are measured, and how the information is analysed (Kumar, 2005). Based on these criteria, differences between the quantitative and qualitative approach will be discussed in the following sections. Muijs (2004) defines that quantitative research explains phenomena by collecting numerical data that are analysed using mathematically based methods, particularly statistics. Another explanation by Antonius (2003) describes that quantitative methods are procedures and techniques used to analyse data numerically and quantitative data are measurable data. On the other hand, qualitative research deals with non-numerical data. Qualitative research methods were developed in the social sciences in order to study social and culture phenomena and some examples of qualitative methods are action research, case study research, and ethnography (Myers, 1997). In addition, Cooper and Schindler (2008) state that qualitative research includes an array of interpretative techniques which seek to describe, decode, translate and otherwise come to terms with the meaning, not the frequency of certain more or less naturally occurring phenomena in the social world.

They explain that qualitative research aims to achieve an in-depth understanding of a situation by using focus group, individual interviews, case studies, ethnography, grounded theory, action research and observation. This approach is more holistic and more suitable for research where the purpose is to gain more insight and understanding of an area (Silverman, 2006). One definition by Blumberg et al. (2005: p. 192) to differentiate between qualitative and quantitative is "qualitative refers to the meaning, the definition or analogy or model or metaphor characterizing something, while quantitative assumes the meaning and refers to a measure of it". Moreover, Table 3.1 below will show us how Padgett (1998) distinguishes both quantitative and qualitative methods. There is no general guideline to indicate which research is more suitable. Therefore, the researcher needs to take into account some questions, for example what is the

research problem? What kind of information do you want to get? (Blumberg et al., 2005).

It is important to emphasize that the qualitative method is conducted when translating and observing reality in order to develop a theory. In addition, this approach aims to explain what the researcher experienced and perceived (Newman & Benz, 1998). Denzin and Lincoln (2005, p. 3) concluded the qualitative research with "qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them". Therefore, qualitative researchers concentrate on understanding how people interpret their experiences, what meaning they attribute to their experiences, and how they construct their worlds (Merriam, 2009). In short, this research is more qualitative in its nature, since qualitative research methods are more likely designed to help the researcher understand people and the social and cultural contexts (Myers, 1997).

3.1.5. Case Study

In the research of information systems, case studies are becoming more widespread and the most common qualitative method used (Myers, 1997). Researchers use the case study approach in order to analyse a phenomenon in its natural environment, and collecting data through, for instance, direct observations, interviews, document analysis, and so forth. The case study can be defined as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used." (Yin, 1989: p. 23). A case study research highlights the coining of a phenomenon in its real-life context (Blumberg et al., 2005). Some of the advantages of using case studies are: an entity can be investigated in depth; more attention is given to details; the data is strong in reality due to being based on people's experiences; generalizations are allowed; and data can be achieved for further research work (Blumberg et al., 2005: p. 190; Blaxter, Hughes & Tight, 2006: p. 74).

Yin (2003) described the reasons why the researcher should consider using a case study approach. You should use case study approach when: (1) the researcher wants to answer "what", "how", and "why" research questions; (2) the researcher cannot manipulate the behaviour of those involved in the study; (3) the researcher would like to cover contextual conditions that are relevant to the phenomenon under their study; or (4) the boundaries are not clear between the phenomenon and context. Case study research is suitable for explanatory, descriptive and exploratory research. However, the researcher has to consider what type of case study will be conducted and appropriate for the research question (Baxter & Jack, 2008). The different types of case study described by Baxter and Jack (2008) consist of: explanatory, exploratory, descriptive, multiple-case studies, intrinsic, instrumental, collective. This research uses the descriptive type of case study which be used to describe an intervention or phenomenon and the real -life context in which it occurred (Yin, 2003). As a result, the case study research method is especially fit to information system (IS) research, since interest has shifted to organisational rather than technical issues (Benbasat, Goldstein & Mead, 1987).

The case which was selected for the purpose of this research concerns implementation of management information system (MIS) for aircraft maintenance which was implemented in the Swedish Armed Forces (SAF), the Czech Republic Air Force, the Hungary Air Force, and the Royal Thai Air Force (RTAF). However, this research mainly focuses on the Fenix System implemented in the RTAF which is named Finex E (export version). The Fenix System is intended to monitor the maintenance activities of the various kinds of aircrafts and safety equipment. The Fenix System was established by the Swedish Armed Forces (SAF). In order to achieve the goals, I have selected to use a single case study approach, collecting data by interviewing

people who were involved in the implementation process of Fenix (E) in the RTAF, Thailand. The reason why I have used this case study is because the implementation of the Fenix System is interesting itself, since Fenix (E) is the new information system in the RTAF and it changed RTAF's business processes. Additionally, this implementation of Fenix (E) system was successful and satisfied from the operational level to the top management level of the RTAF. To conclude, this thesis is more concerned with contextual understanding related to the MIS implementation and also effects and consequences of its implementation, along with the challenges and key success issues. Therefore, a mainly inductive approach together with a qualitative research method is taken into account to be the most appropriate to fulfil the purpose of this thesis. Furthermore, the case study approach of Fenix System implementation, as a management information system (MIS) for maintenance of aircraft, will be carried out. The result of the case study will accomplish the research questions as well.

3.1.6. Development of the application

This is the process of creating software applications. It includes user interface design, programming, alpha and beta testing and deployment.

3.1.7. Agile development for web based application

Agile methods represent a relatively new approach to software development becoming wide spread in the last decade. The ideas behind these methods originate from the principles of Lean manufacturing in 1940s and Agile manufacturing in 1990s, which emphasized the adaptability of enterprises to a dynamic environment (Salo:2006). The unique features of agile methods derive from the list of principles found in the "Agile manifesto": which postulates that individuals and interactions are more important that processes and tools, working software is more valuable than comprehensive documentation, customer collaboration is preferred over contract negotiation, and adaptability is valued higher than creating and following a plan (Agile Alliance: 2001). Boehm and Turner, (2003), identifies fundamental concepts to agile development which includes design principles, a large number of releases in a short time frame; extensive use of refactoring, pair programming, test-driven development, and seeing change as ad-vantage. Abrahamsson et al (2002) defines agile method as an incremental (multi release), cooperative (a strong cooperation between developer and client), straight forward (easy to understand and modify) and adaptive (allowing for frequent changes).

The use of agile methods in software development has received both supporting and op-posing arguments. The main arguments against agile methods is the asserted lack of scientific validation for associated activities and practices as well as the difficulty of integrating plan-based practices with agile ones. Indeed, some projects presents a mix of plan based and agile home ground characteristics, in which cases a balance must be achieved in the use of both types of methods (Boehm: 2002) there is also some amount of un-certainty in distinguishing agile method s from ad-hoc programming. However, as stated in Salo (2006), agile methods do provide an organized development approach.

When trying to compare web-based application characteristics to those of an agile method, difficulty comes partly from the fact that boundaries of agile methodologies are not clearly established. A comprehensive overview of research in the field is presented by Dyna and Dingsoyr (2009) partitions the introduction and adaptation, human and social factors, perception of agile method, and comprehensive studies. Findings indicate that the introduction of agile methods to software development yield benefits especially if agile pracstices do not completely replace traditional ones, but work in conjunction with them. However, Dyna and Disgsoyr (ibid) observes that studies in the field are mostly focused on extreme programming

which are limited in approach and often comprise quality.

3.1.8. Proposed System

The purpose of this system is to implement the computerization of the details of a District education academic management information system for such properties to be done electronically, thus removing the need of traditional manual system of travelling each time there is data to be submitted. Automating a District education academic management information system will be a system application which will be running across platforms of machines ranging from mobile to web-based technologies.

The system will also have a website for the purpose of Administration by the system Administrator who is system information system engineer and/or DEBS. The system administrator will use the website to upload queries for tasks against Head teachers, schools and Zones for each academic report session.

3.2. SYSTEM DESIGN

A system analysis was done in order to determine the requirements of the system. Functional and non-functional requirements were developed. In order to develop the requirements, the use case diagram and use case text were developed.

The system developed has four main participants being, the system administrator, the DEBs the headteacher and the teacher. The district education board owns and manages the system, through its system administrator while the headteacher and the teachers interact with the system without physical contact. Both the Headteacher and the teacher have to be registered on the system by the system administrator at DEBS. The Administrator manages the system.

3.2.1 System's Design and Analysis.

It involves: investigating the objectives of the information systems; defining the criteria for effectiveness; examining alternatives in terms of effectiveness and cost and analysing the feasibility of the existing information system. In an information system, one should see the system's concept applied. particularly so regarding: a definition of the objectives and boundaries to determine what educational information is involved in what sub-system; a definition of processing. operation and application; and system's development schedule (Weber, 1984). Once the system is in operation it is necessary to determine its performance. benefits and cost-effectiveness. A system's performance involves examining: its coverage, its recall or retrieval ability, its precision, its timeliness and user effort. A system's benefits involve examining: cost incurred in its use compared to using another system, loss of productivity if the system is not used, improvement in decision making, avoidance of duplication of past mistakes, predictive capacity. A system's cost effectiveness is determined by the resources invested in it compared to its benefits. Data processing involves: specification of data needs; selection of appropriate indicators; data collection; data analysis; and relating of results to policy issues.

3.2.2. Design Goals

Design goals describe the qualities of the system that developers should optimize. Such goals are normally derived from the non-functional requirements of the system.

Design goals are grouped into five categories. These are

1. Performance
2. Dependability
3. Maintenance
4. End User Criteria

3.2.3. Performance Criteria

The part of the system to be used for the record office should have a fast response time (real time) with maximum throughput. Furthermore, the system should not be taking up too much space in memory. The system has chosen fast response time over throughput and hence the system should try to be

more interactive. In the case of the data entry and submission, the system should be more reliable in order to satisfy the constraints than fast response time.

3.2.4. Dependability

The district and schools need the system to be highly dependable as it is expected to be used by non-IT professionals. The system should be robust and fault tolerant. Furthermore, as the system is handling sensitive data of the school, high emphasis should be given with regards to security, as there are subsystems to be accessed through web.

3.2.5. Maintenance

The system should be easily extensible to add new functionalities at a later stage. It should also be easily modifiable to make changes to the features and functionalities so as cope with modernity and the changing world.

3.2.6. End User Criteria

Usability: Usability is the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use. From the end users' perspective, the system should be designed in such a way that it is easy to learn and use, efficient and having few errors if any. Trade-off is inevitable in trying to achieve a particular design goal. One best case is the issue of security versus response time. Checking User-Id and Password before a member can enter to the SMS creates response time problem/overhead. The other case is the issue of response time versus quality. There is some amount of time taken by the system to generate the data. So, the user has to wait a little after telling the system to generate the data and getting the result to get a quality data analysis.

Architecture of the System

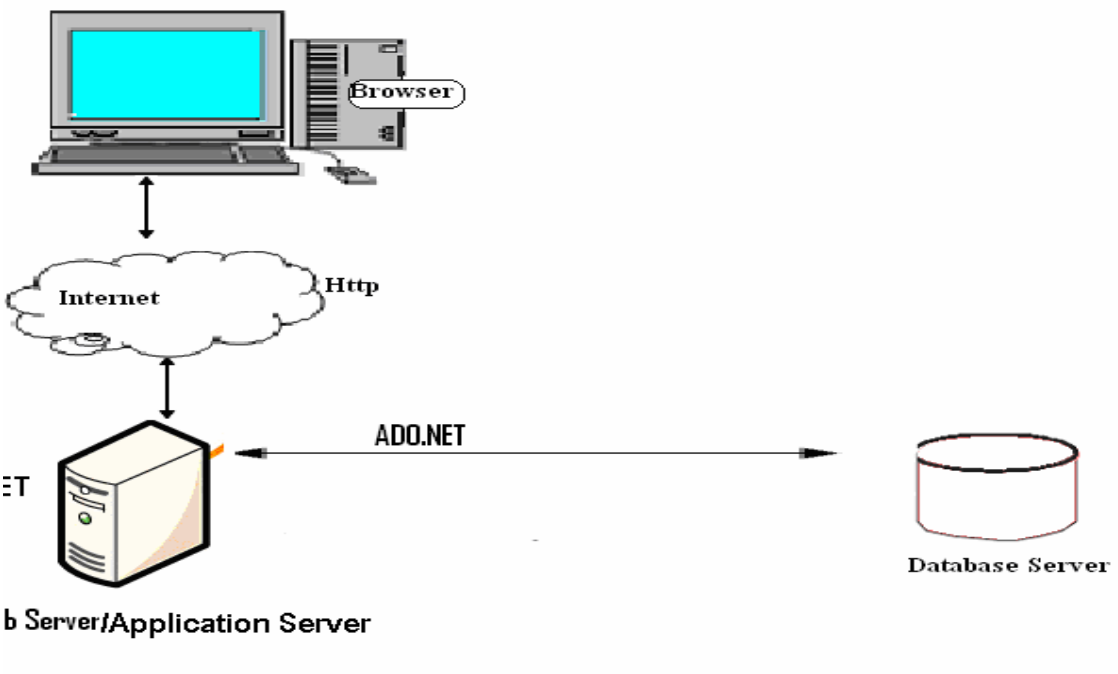


Figure 2 (Phiri,2016) Architecture of the System

The proposed system is expected to replace the existing manual system by an automated system in all aspects. The architecture used for the system is a 3 tier Client/Server Architecture where a client can use Internet

browsers to access the online report provided by the system within the local area network of the school or anywhere using the Internet.

3.2.7. Subsystem Decomposition

Subsystem decompositions will help reduce the complexity of the system. The subsystems can be considered as packages holding related classes/objects. The DEMS under consideration is decomposed into subsystems as shown in Figure 3.2. These subsystems are further decomposed into other subsystems. The major subsystems identified are "Login", "User Registration" "District details", "School Details", "Check Teachers", "Check Reports", "Check Accounts" and "Student Performance" subsystems.

Users are classified into roles and levels. The "Login" subsystem authenticates a user to grant access based on the role and level of the user. The "UserRegistration" subsystem registers a user offline. It allows recording the detail information of the user.

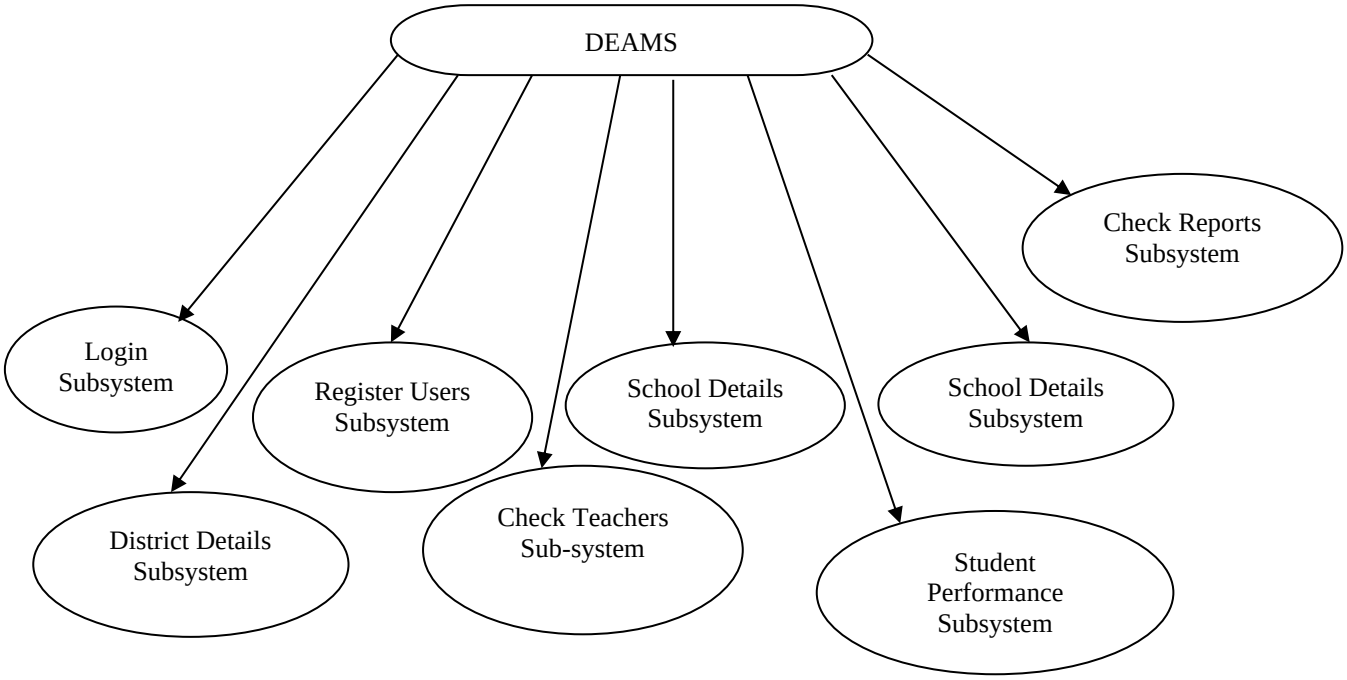


Figure 3 (Author) Layered Representation of the System

3.2.8. Modular design of the system function

a. Functional Requirements

The functional requirements of the system are:

1. Register DEBS
2. Register Head teachers
3. Register Teachers
4. record attendance of students,
5. generate various reports,
6. submit learners' academic performance report.
7. Login and Logout

b. Non Functional Requirements

Functional requirements describe what the system should do such as things that can be captured in use cases and things that can be analyzed by drawing sequence diagrams and state charts. Functional requirements will probably trace to individual chunks of a program. Functional requirements are the properties or function of the System Security requirements are important factors in this system as

classified data will be stored in the database. User validation will be done during login to ensure that the user is valid and that the user only has access to his or her permission data. General users will only have access through the user interface.

The system will have consistent interface formats and button sets for all forms in the application, will have a form-based interface for all data entry and viewing formats, and will generate reports that are formatted in a table and that should look like the existing manual report formats for user friendliness.

The system will be easily maintained by the developer or other authorized trained person and it shall respond as fast as possible in generating report.

3.2.9. Use Case Description

ADMINISTRATOR

1) **Add Administrator and Users:** The administrator must be able to add other Administrators and users

Name: Register Users

Actors: Admin

Description: To register someone as a user at the district or school

Precondition: A user has to be eligible (has to be from the pre-specified district education board secretary's office or school that recognizes him/her.

2) **Edit Administrator and Users:** The administrator must be able to edit administrators and Users information

3) **View Administrator and Users:** The administrator must be able to view administrators and Users

4) **Delete Administrator and Users:** The administrator must be able to delete administrators and Users

5) **Search Administrator and Users:** The administrator must be able to search for administrators and Users

6**) View Summarized Graphs:** The administrator must be able to view summarized statistical graphs of products financial contribution to the revenue and transactions per Traders across a period of time. This information will be used for business decision. The graphs must be printable and exportable.

7) **View System logs:** the administrator must keep records on the usage of the system. The administrator must be able to view and search.

a. USER

1) Manage headteachers (add, edit, delete, view and search)

2) Manage teachers (add, edit, delete, view and search)

b. Flow of Event:

(1) Users wants to be registered as members of the District (DEBS) and a school

(2) DEBS verifies that the user is eligible

(3) DEBS fills and submits the form to the system

(4) Students want to be registered as student of a school

(5) Students want to be registered as members of a school

(6) Registration form will be given to the student

(4) The student completes the registration form that contains student's full name, address, parent name, emergency person names and addresses and other detail information.

(5) The Deputy Head Teacher of the school checks whether the contents of the registration form are properly completed

(6) The teacher fills and submits the form to the system

(7) System register users and students

(8) Use case ends

c. Non-Functional Requirements

Non-Functional requirements can be defined as global constraints on the software system and they include development costs, operational costs, performance, reliability, maintainability, portability, robustness etc. hey usually cannot be implemented in a single module of a program

1. The System must be user friendly.
2. The system must be fast. Users must take less than 10 seconds for the system respond.
3. The System must be accurate. and if an error occurs, the system must revert back to the previous state.
4. The System must allow more than one User to submit information at the same time
5. The system must comply to the laws of Zambia.

d. Hardware and Software Requirements

A Laptop computer was used in the implementation of the system which were running on windows 10 with processor intel (R) cerelon (R) CPU N3060 @ 1.60GHZ, with a memory of 4.0 GB RAM and 64 bits of system. The system is able to work on both windows 7 and 8. The tools which were used include, HTML5, PHP, Xamp server and Dreamweaver. For the database, the MySQL database is used to store system templates and the other credentials captured during registration so that they are used for the authentication process.

3.3. System Class Diagram

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.

3.3.1. Use case Diagram

Use cases of the system are identified to be "Register Users", "Register DEBs" "Register Head Teacher", "Register Deputy headteacher", "Register Teachers", "Enter Teachers Details", "View Students", "View Report" and "Generate Results". The diagram depicted in Figure 2.1 shows the use case diagram of the system.

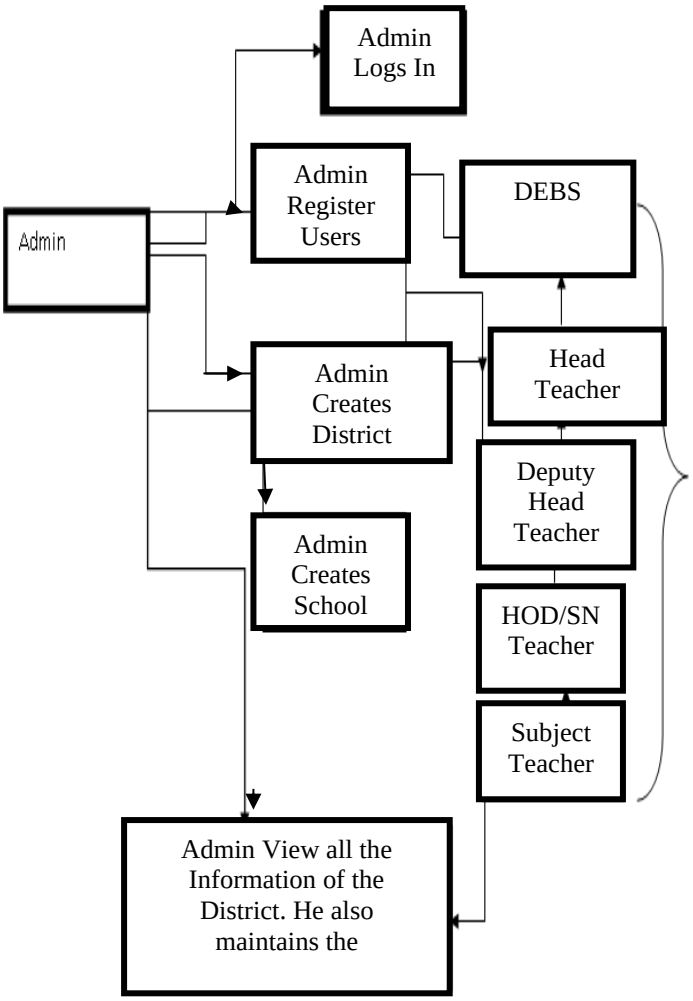


Figure 4 (Author) Use Case Diagram of the DEMIS

3.4. System Data Model Design

The other word for system data model design is database design. Database design is the organization of data according to a database model. The designer determines what data must be stored and how the data elements interrelate. With this information, they can begin to fit the data to the database model.

To produce a model of the system which is correct, complete and consistent we need to construct the analysis model which focuses on structuring and

formalizing the requirements of the system. Analysis model contains three models: functional, object and dynamic models. The functional model can be described by use case diagrams. Class diagrams describe the object model. Dynamic model can also be described in terms of sequence, state chart and activity diagrams. For the purpose of this project we have described the analysis model in terms of the functional model and dynamic models using use case and sequence diagrams.

3.4.1. User interface design

User interface design is a complicated process that requires detailed analysis of human performance and preference. Furthermore, developments in technology require an understanding of emotional and `trust' aspects of interaction that have yet to be studied in detail by cognitive scientists. As a form of applied cognitive science, interface design is a fruitful testing ground for a range of cognitive theories and methods It shows the step-by-step, with examples and screen dumps and will generally describe the system from installation, to getting started and using certain functions of the concerned application, Dillon (2002).

The user Interface is the means in which a person interacts or controls a software application or hardware device. This design involves the design of websites, computers, appliances, machines, mobile applications and so on with the focus on the user's experience and interaction. The goal of user interface design is to make the user's interaction as simple and efficient as possible. The website's application's user interface shall be as user friendly as possible. The aim is to produce a simple to use interface but packed with all the basic functionality, Kamoso (2018).

3.4.2. The interface has the following further characteristics:

1. A clear and easy-to-follow navigation system, that will allow the user to access various parts of the application, and further, allow him to know where he is at any particular time.

2. A neat appearance, that pleasing to the eyes

3. An attribute of attractiveness—visitor should be drawn to the site and fall in love with it at a glance. Because everything is in its place.

3.4.3. Scope of Design Specification

This chapter will guide the programmer in the implementation of the requirements de-scribed in the requirements specification section by describing the following;

1. Data Design
2. Physical Design
3. Logical Design
4. Interface Design
5. Security Design

3.4.4. Entities

The following entities were identified as the ones required for the system:

1. District education Board Secretary (DEBS)
2. Head Teacher
3. Deputy Head teacher
4. Head of Department (HOD)
5. Users
6. Task
7. Evaluation

3.5. Getting started

To run the District Education Academic Management Information System website, you need to start the browser of your choice then you type the path of the location where the application is located in the address bar of the browser which is: http://localhost/nchez/index.php

3.4.6 Start page

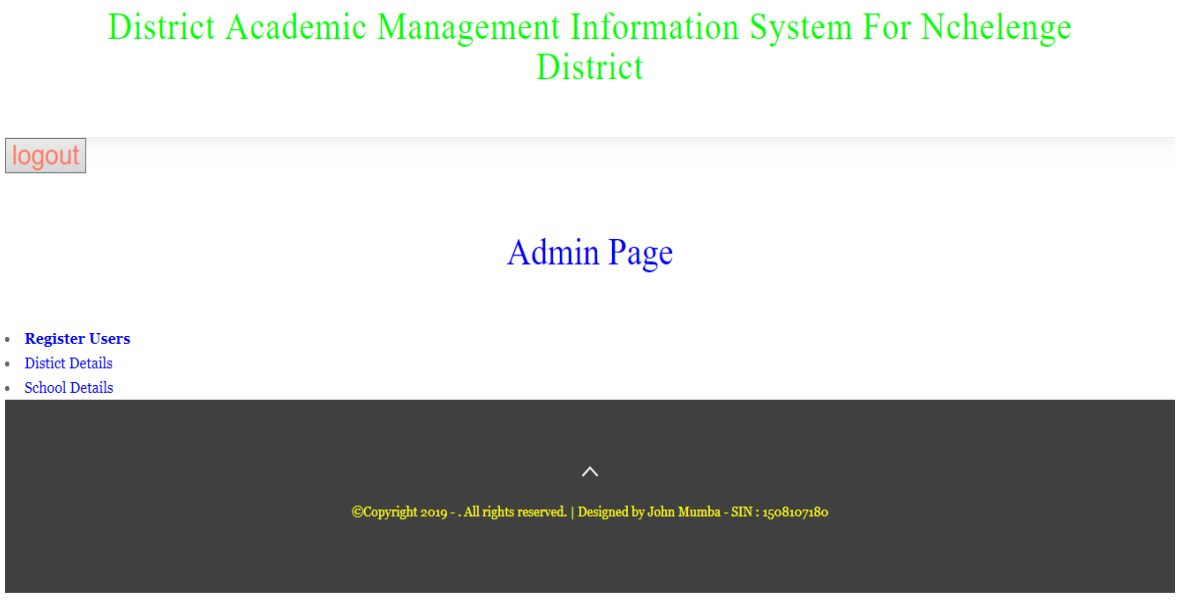
After successfully installing Xamp and run the browser, the users navigate to a start-up where they can login depending on the type of a user. See the screenshots below for more information.

Figure 5- System Start or Home Page

(Source: Author, 2019

Figure: 6 Admin Login

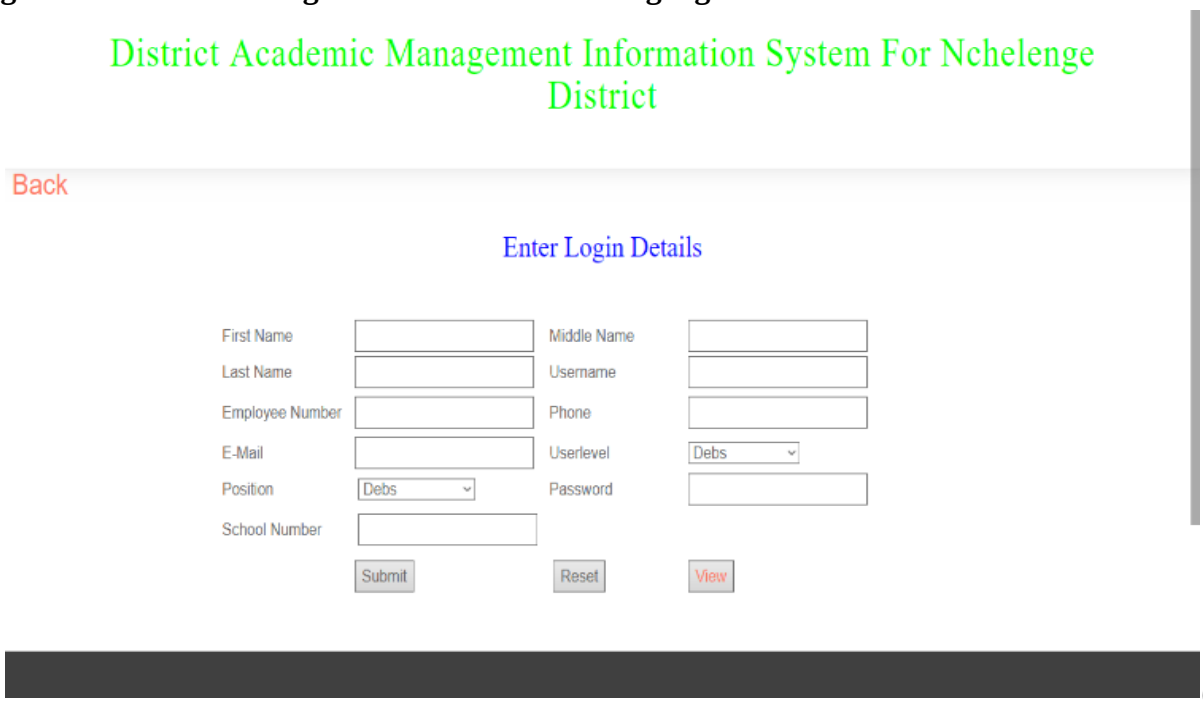
If you have credentials for an Admin, enter the username and password for the Admin then the following window will appear.



(Source: Author, 2019

Figure 7 bellow shows screenshot of the page where the Admin can create and enter the User details by entering the first name, Middle name, Last name, username, employee details and creating the password of the user.

Figure 7. Admin entering user details and creating login credentials



(Source: Author, 2019

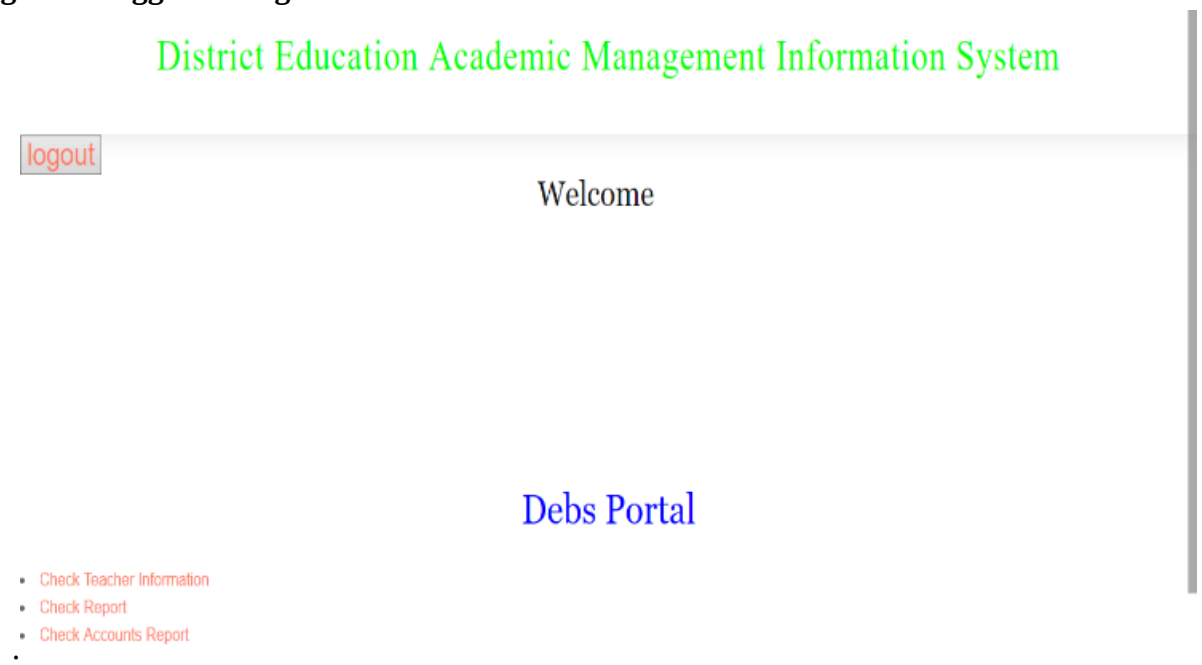
Figure 8 bellow shows screenshot of the page where the Admin can create and enter the district details by entering the name and creating the number of the district and the province to which the district belongs as shown below.

Figure 8, District details to be entered

(*Source: Author, 2019*

Figure 9 bellow shows a screenshot of the page where the Head-teacher is logged in and be able to check teacher's information, check reports and be able to check on accounts information as shown below.

Figure 9 Logged in Page

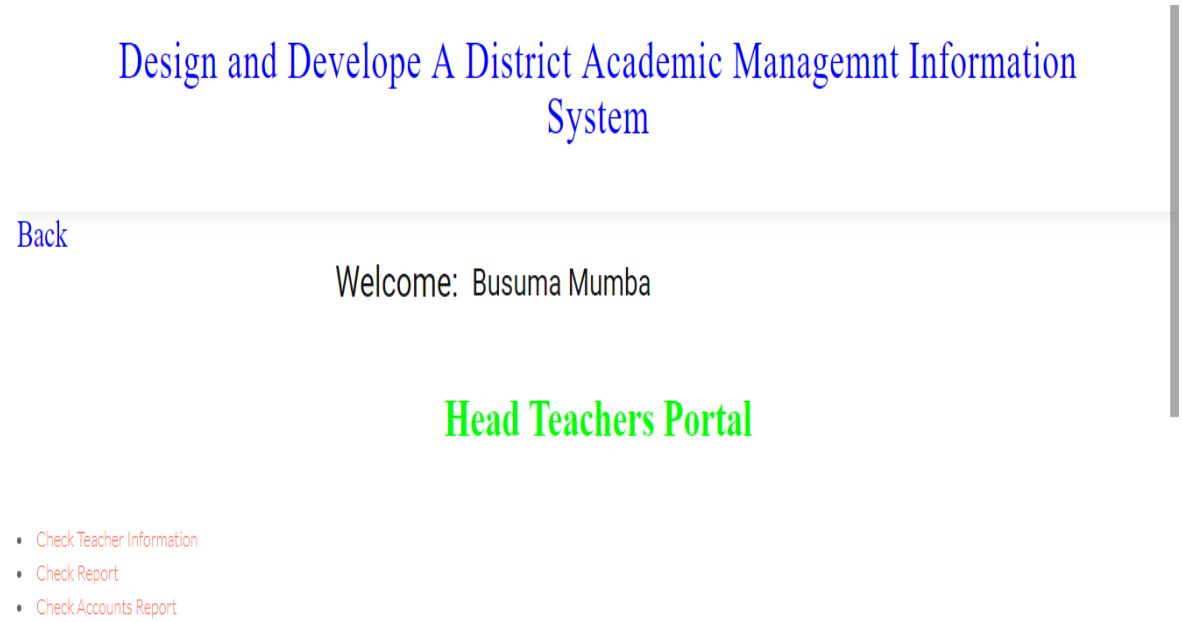


Source:

Author, 2019

Figure 10 bellow shows a screenshot of the page where the Head-teacher is logged in and be able to check teacher's information, check reports and be able to check on accounts information as shown below.

Figure 10: Head-teacher's page

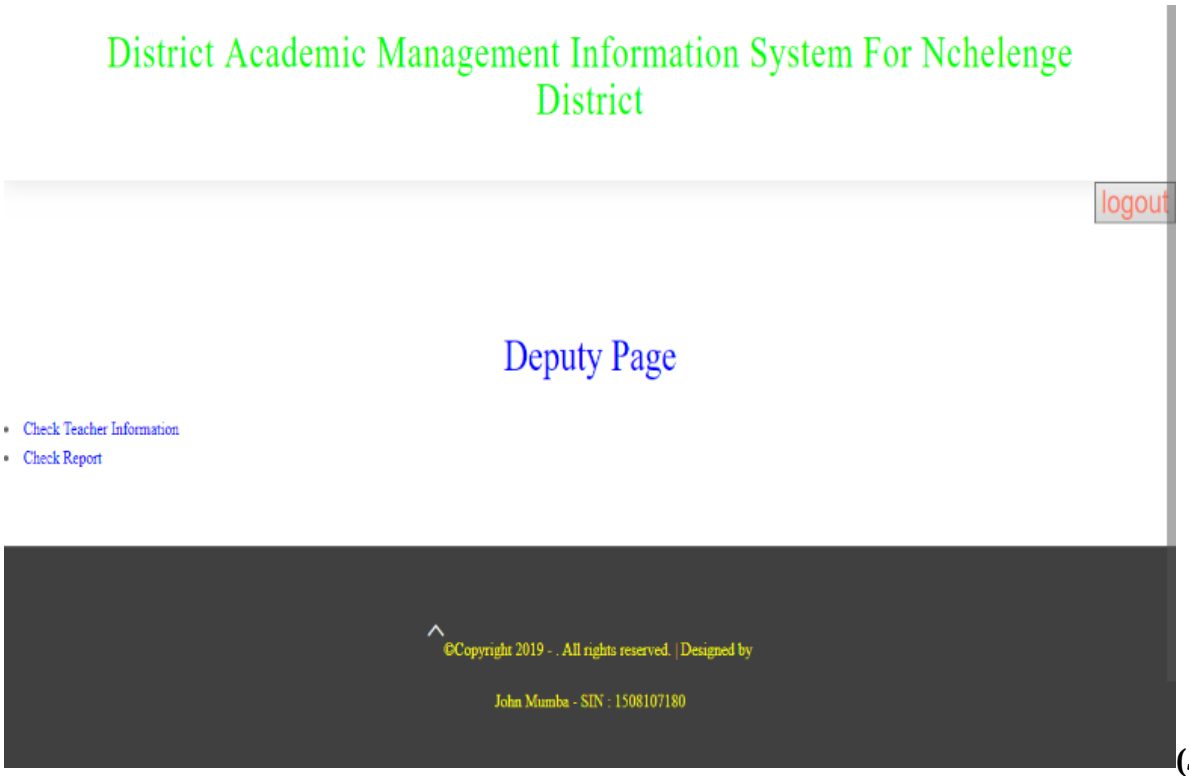


(*Source:*

Author, 2019

Figure11bellow shows a screenshot of the page where the Head-teacher is logged in and be able to check teacher's information, check reports as shown below.

Figure 11: Deputy Head-teacher's page



(***Source: Author, 2019***

3.5 Summary

In this chapter, the researcher looked at the baseline study, sample design and sampling, approach and the development of the system. The designing and development of the Nchelenge district education management information system, which is the proposed solution to reduce the cost of doing operation in Nchelenge district.

The chapter also looked at the methodology that was used for the software development process, function and nonfunctional requirements, process maps, implementation of languages and the configuration of equipment. The System was developed using the agile method. Finally, the development of the system was described in detail

.

CHAPTER FOUR: RESULTS

4.0 INTRODUCTION

This chapter presents the findings of the data gathered and the understandings gathered in the course of the effort to design and develop a district education management information system for Nchelenge district. The purpose of this study was to design and develop a district education management information system

According to Sarshar & Isikdag, information and communication technology tools have taken the fore as competitive tools in this market place. In fact, even acclaimed writers on strategy and business development like Porter (2001) maintained organisations that are matured in the use of ICT tools have better prospects for surviving and prospering in the phase of an information revolution.

Finally, we look at the results of the survey that enabled us to determine the development of The Nchelenge district education management information system. We also look at the results of the implementation of the system, that we have called the Nchelenge district education management information system using the information fusion developed in Chapter 3

4.1 Baseline Study Results

In this section, we look at the results of the survey which was conducted as part of this research, on which the justification for the design and development of the district education administration management information system was based. In the next section, we look at the results of the implementation of the system.

4.1.1 Survey Results and Discussion

In this section, the results of the survey that was done in this study are discussed. Themes were used to analyse the data, which was gathered from the survey.

4.2. System Implementation Results

In this section, the results of the district education administration management information system which is a cloud-based system, are covered. Initially, the interaction of the users with the System is explained. Then later, the interaction of the owner of the system (being the administrator) is also explained. The testing of the System was done.

4.2.1. Owner of the system

The owner of the System can be either a district education board or an IT specialist or the system developer. The owner assumes the role of the administrator of the Nchelenge district education administration management information system. The system has a login screen for the system administrator or user to access in order to gain entry into the system. The access levels have been included in order to define the roles of each user.

4.2.2. Design and development stages of the EMIS

There is a need for Government and the private sector to coordinate data collection activities to minimize duplication and overlap and to maximize the impact of the data collection results. A comprehensive EMIS will assist in this process. Managing education through informed decision-making requires the availability of accurate and timely information which links together resource inputs to education teaching and learning conditions and processes and appropriate indicators of the knowledge acquired by students.

There is need for a well-organized data presentation and data interpretation standards to provide managers with useful and relevant information. Ideally the design and establishment of an EMIS should be preceded by appropriate policy development legislation and relevant administrative decisions. Government commitment is of major importance in the first instance by the Ministry of Education. This ideal prerequisite situation is particularly necessary where the EMIS is to be established by unifying and expanding existing information structures and services. In s o m e countries, these services already undertake independent ongoing information activities for which they have sole responsibility. Hence a set of well-coordinated and clearly defined legislative and

administrative measures would be the first requirement in order to bring these services together under the s a m e EMIS. This is even necessary today as, in most countries, the formal education system includes a growing privately-funded sector, which often operates at both national and sub-national levels. It often handles information, s o m e of which is also relevant to the responsibilities of the central government, for example, for curriculum development or teacher training certification.

First stage: definition of the national development goals; statement of mission and objectives of the education system; and setting short and long-range targets. These are usually reflected in the national development plan of the country. From these goals, the national objectives of education are formulated to synchronize with the national vision for development in a given time frame. The mandates of the Constitution on education and other relevant educational legislation have to be carefully reviewed with reference to the development of the management information system.

Second stage: policy decision for purposes of implementation and monitoring. The resources needed to establish the EMIS are identified at this stage of the development. It is critical to determine the appropriate manpower to operate the system, the cost of services and activities, the overall structure, the timetable of activities and the overall strategies of implementation.

Third stage: identification of data needs and requirements. The necessary data needed to support the various measures in determining the attainment of the objectives of the system shall be carefully identified through consultations with the different sectors, and key officials school administrators and other potential data users. This will ensure that the data requirements and needs of the policy and decision-makers and other key users are taken care of while at the same time minimizing overloads of unnecessary data. The specific purpose and use of these data shall be m a d e clear at this stage of the process.

Fourth stage: establishment of databases. A database is an integrated collection of data and information, organized and stored in a manner that facilitate retrieval. Both manual and computer-based databases determine the nature of the files or the filing system. Proper labeling of these databases and the corresponding data elements is necessary for easy viewing and access to the hard/printed copies. The label is patterned after the cluster of similar data or related to the major component of the programme students teachers curriculum, finances, physical facilities and equipment, and others.

Fifth stage: design of monitoring/data gathering forms. These forms are designed to capture the required and needed data identified during the third stage of development. The designer of the questionnaire has the option to choose the appropriate modes and channels of collecting data from various sources. Forms are pilot-tested to ensure that the instructions, data definitions and data elements requested are understood by the data providers before these forms are administered on a wider or national scale.

Sixth stage: data and information collection. A Manual of Operation has to be prepared to spell out the essential information about data collection in terms of the objectives the schedule of activities, guidelines for conducting the survey/data gathering, the duties and responsibilities of the monitors/ surveyors and supervisors, the specific instructions on how to administer the questionnaire including definition of terms, and the collection or submission of completed questionnaire forms. It is also at this stage that training takes place for those w h o will be involved in data gathering activities both at the national and sub-national levels for purposes of uniformity and common terms of reference.

Seventh stage: data processing. A system of data verification and control procedures should be applied before processing takes place. These forms are verified as to the accuracy and consistency of the data entries. All data elements are coded according to the system designed by the programmer. A

training session may take place at this stage to train data encoders/data entry operators to interpret instructions, define data elements and apply software in uniform ways. The specifications of the reports to be generated from the processed data are also defined at this stage.

Eighth stage: data dissemination and report generation. The packaging of these data into statistical bulletins, compendia, reports, profiles and others will help facilitate the dissemination and use of the data by the users. At the national level, the Ministers, legislators, the members of Cabinets/ Parliaments and heads of international bodies need this information for policy making, legislation, programme development and other national concerns. The middle-level manages, including bureaucrats, need it for organization and control, project implementation, budget preparation, programming, monitoring and evaluation. At the operational level, coordinators, local organizations/ units and desk offices need information for their day-to-day operations, supervision, reporting, action planning, and advocacy and mobilization activities. The general public, such as the business sector the community, the professionals, the students, the media and academic or educational institutions are considered interest groups for data consumption and information users who participate in sustaining the development process.

Ninth stage: evaluation of the output. The ultimate end of an EMIS is to produce relevant and timely information of good quality. Towards this end, an evaluation mechanism should be designed to identify the strengths and shortcomings encountered in the development and operation of the EMIS. The results of the evaluation process are the basis for the strengthening of the system.

4.3. Summary

This Chapter presented the results of the baseline study and the development of the Nchelenge district education administration management information system. It covers the successful implementation of a cloud-based prototype that is able to successfully register a School and then perform successful login and submission sessions with remote users (school head teachers) using all the authentication. It concludes with the testing of the It concludes with the testing of the Nchelenge district education administration management information system

CHAPTER 5: DISCUSSION AND CONCLUSION

5.0. INTRODUCTIONS

From the discussion in Chapter 4, the following are some of the recommendation that were deduced from the data that was gathered. The chapter begins with the discussion, then conclude with recommendation based on the results of the research. It then looks at the possible future works pertaining to this research. The findings of this research Will be published in the International Journal of Innovative research in Science, Engineering and Technology (IJIRSET)

5.1. Discussion

This section discusses the implementation and results that were outlined in the previous chapter and how they relate to the objectives of this study. As a way to justify the development of the Nchelenge district education administration management information system that will mitigate the risks associated with travel, loss of cash, time spent to deliver submissions to DEBS and lives.

5.2.The baseline study

The first objective sought to establish the constraints for implementing a district education management information system pertaining to the Nchelenge school's participation. The study revealed that, Nchelenge district is located on the boarder of the Democratic Republic of Congo where the mobile telecommunication networks are mainly interfered with by Vodacom DRC. Main times there is loss of signal especially Zamtel which is the only Zambian network with 4.5 generation (4.5G) strength faster. Not only that, but also Zamtel is cheaper and very

easy to manage by most of the rural schools Nchelenge district.

5.3.Use of Technology

The second objective sought to identify challenges of using manual information system in Nchelenge district education sector. The study revealed that, submission of data and information to DEBS has always been a challenge especially during the rainy season where some roads become almost impassable in Nchelenge district. The research showed that designing and developing an education management information system is necessary in order to mitigate the challenges outlined above. This is especially applicable to schools located on the Island of lake Mweru, where, sometimes there is a strong storm making it difficult for even bigger boats to cross the lake from the Islands to the main land

5.4.Submission of data to DEBS

Firstly, the survey revealed that some of the respondents in Nchelenge district during a focus group discussion revealed that, they travel long distances for several day especially during the rainy season when most of the roads in the district become impassable. To some, they are cut off completely after the rain season is over. The situation is the same with those on the Islands of lake Mweru where there are usually strong and strange winds.

Further, the teachers indicated that it also become very difficult to access station as most teachers who can be asked to buy stationary for the school do not go for their salaries because of the poor road network in the district. Sometimes if stationary is accessed, it is also challenging to find a business centres where the printing of the report can be done.

5.5.Development of the system as a solution

5.5.1. ICT Utilisation

The third objective sought to determine the level of utilisation of ICTs among teachers in Nchelenge district. The study revealed that, the levels of ICT utilisation is not very good especially among school managers who are supposed to be the custodians of the system. Most head-teachers do not own even a personal laptop, if they do have one, then they always ask a teacher or even a learner who knows how to operate a computer to help them do some work on their personal computers. Some teachers have very basic mobile phones, if they own a smart phone, they can only make an active call; send a text that is SMS or WhatsApp. They cannot perform any other functions beyond that. On the whole the use of ICTs can limit the need to travel, hence reducing the exposure to road accidents and other risks.

The discussion above, motivated the development of a Nchelenge district education management information system that would be used by DEBS and schools to do business in cost effective way. The system was built using the agile software development method, using Xamp, HTML, Dreamweaver and MySQL as explained in Chapter 3 and 4.

5.5.2. Comparison with Other Similar Works

As has been covered in Chapter 2, significant work has been made in the area of innovative use of ICTs that cover various fields such as health, education, commerce and banking. This research acknowledges the work that have been done by the Zambian ICT Act and Frame Work Policy, National Information and Communication Technology Policy and Seventh national development plan 2017-2021, Ministry of National Development Planning. The Nchelenge district education management information system has built in features such data submission login and log out admin adding and deleting of users. The system is monitored by the administrator at DEBS.

5.5.3. Possible Application

The work in this study is an attempt to reduce the cost of managing the district schools of Nchelenge by reducing the need to travel in order to submit data and information to DEBS Nchelenge. This system may help government and the Ministry of education to effective in the running of district education affairs, as this application may be linked to the Ministry of education. This application can be used

by any institution or individual who is involved in the submission of schools and district information to DEBS.

5.6.Summary

This study proposed the development of a Nchelenge district education management information system that was going to be used by DEBS and schools within the district of Nchelenge, in order to reduce the risks and cost of doing business. This same system can be used by other players in Ministry of education for service delivery. In the urban areas, the Further the systems such as this one, are one of the solutions that can be used to address the problem of mobility and quick access to information in the district even during poor roads and weather conditions, for rural and urban educational districts. The need for traceability will become easy to implement as the requirement to adhere to standards will be given. It is fairly easy to implement traceability features with the use of mobile and web technologies, and ICTs as a whole.

5.7.Conclusion

Information and communications technologies can be used to address the plight of the Schools, and DEBS. A system such as this one can help improve the academic performance of the learners because there will be time saving on information delivery to DEBS. Not only that, but also cost saving thereby allowing schools and the district to save on money. Application of ICTs in this manner will stimulate good governance in the education sector.

In this project, the researcher designed and developed a District education academic management information system that facilitates the various activities taking place from schools to the district education board secretary.

The system designed and developed in the project, consists of windows and web applications. These are two different applications on the same database. The windows application takes most of the activities such as offline user registering, teacher details submission, student academic and performance submission and head teacher report submission. The web application facilitates Head teachers and DEBS to view reports and information submitted, to view status of students by students and teachers by teacher.

The solution of the designed and developed District education management information system is very simple. Data structures are used to implement the District education management information system designed. The scheduler selects a subject-teacher from the database, retrieves all the classes assigned to the teacher, retrieves personal and qualification of the teacher thereby curbing transportation and stationary costs. Finally, the result generated is stored in a database.

The prototype has been tested with data from Nchelenge district education and schools. It has been shown that the system effectively registers users alongside students, easily retrieves information about a student and generates the required reports such as transcript. In addition to generating a feasible teacher's qualification it also generates students' academic performance for each teacher and student. Furthermore, it has been shown that the web application of the system helps the DEBS to access information about teachers and students within a short space of time. DEBS and Head teachers can view the status of their learners using the Internet or Intranet of the district or school. Information technology in educational management is a relatively new field that not only needs in-depth studies on systems utilization in schools but also on their effects on the school processes and maybe outcomes (Bisaso & Visscher, 2005). Demir (2006) further supports this argument stating that although there are many studies on the role of information systems on class and teaching, few studies have been done on the use of them in educational management and their effects on the managers. Passey (2002) states that one of the key priority areas for future research is the investigation of MIS assistance in effective school management. There are issues in

this area both with the forms of technology being used, and with the lack of techniques available to enable users to make use of data currently available. Research could have a major role to play in supporting educational endeavour and practice in this area. The overall review of literature indicates a very positive impact of ICT use in the area of educational management. Principals and teachers' skills in working with ICT have developed significantly over the years and they are using ICT to support a range of administrative activities at both class and school level. School management information systems have greatly improved over the last two decades and most of them incorporate several important functions required by school administration; however, every school has its own specific needs. Further studies are needed to explore the areas of improvement in MIS as most of these systems are not developed according to the site-based needs. These systems are usually adopted from outside and may need further enhancement according to the site-based management. As Fulmer (1995) suggests that in order for an MIS to be utilized effectively, it should be designed through an inductive process that includes stakeholders from all levels of the organization in order that faculty will take ownership of the system and actually use it. Studies on MIS should also focus on finding ways of enhancing its use by school principals and administrators. Appropriate training and effective leadership could escalate the benefits of MIS in the area of school management.

In view of this project, the major recommendation is that automated district education management information system has a positive impact on improving efficiency and effectiveness of teacher's attendance and documentation of their activities in ensuring education quality service delivery. DEBS and Schools are therefore, encouraged to consider investing and applying this system in an attempt to enhance efficiency in their respective designation. In addition, the government as the major employer should consider implementing this facility if the equal work for equal pay and quality education is to be meaningfully appreciated.

Furthermore, if education is central to development there should be a good facility to make stakeholders participate in school improvement programs and decision making. Not only that, but also to facilitate easy information access to such bodies by further enhancing by incorporation additional reports required by the district education. Such a facilities will increase participants in decision making at educational activities and students' achievement

5.8.Future Works

The research implemented a number of functionalities in the system developed but the following was not covered:

1. Comprehensive integration of backend examination delivery, such as the link between
   the DEBS System ECZ.
2. Comprehensive integration for teachers and learners' assignments.
3. A web-based version of the System can be developed for use on mobile phones and other mobile computing devices on both offline and online.

These functionalities were not covered due to limited financial resources and time which was allocated to this study.

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?>

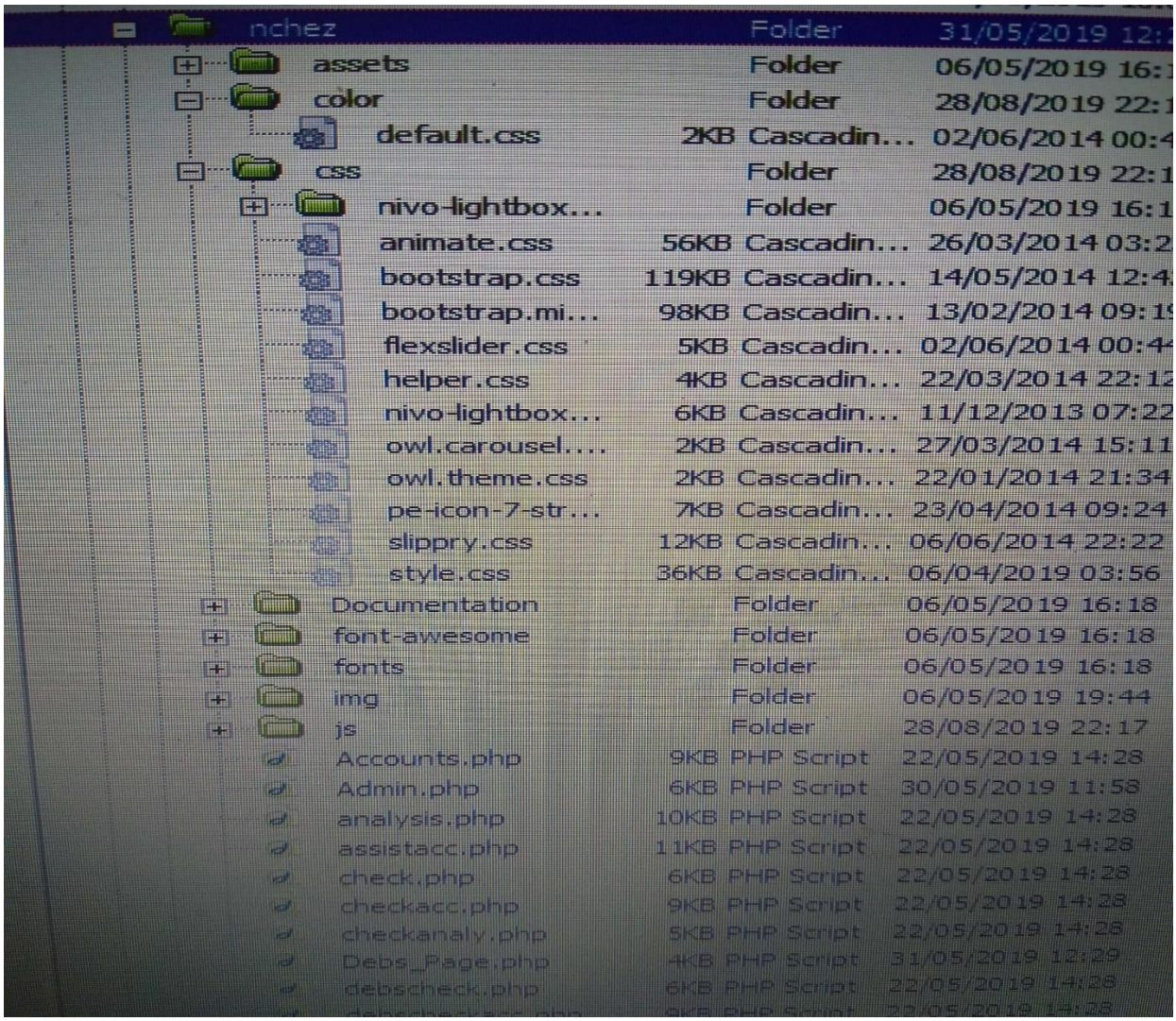
APPENDIX

A.2: Database Access Code sample

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<link rel="stylesheet" href="form.css" type="text/css" />
<title>Login</title>
</head>
<body>
<div id="Holder">
<div id="registered">
 <h1><strong><font color="#00FF00" face="Times New Roman, Times, serif">District Education Academic Managemnt Information System For Nchelenge District</font></strong></h1>
</div>
<div id="footer"></div>
</div>
</body>
</html>
<?php
```

A.2: SAMPLE CODE

The diagram below shows code structure of the software prototype. The diagram shows the hierarchy as was seen.



LIST OF PUBLICATIONS

1. **John Mumba**, "*an investigation of factors affecting the academic performance of orphaned children: a case of selected upper primary schools in Nchelenge district, Zambia*" The International Journal of Multi-Disciplinary Research, ISSN***: 3471-7102, 2018***

2. **John Mumba** *"Challenges and opportunities of e-learning for rural and remote secondary schools: a case of Masaiti district-copperbelt province, Zambia (conference* id: CFP/830/2018)" The International Journal of Multi-Disciplinary Research, ***ISSN: 3471-7102, 2019***