DEVELOPMENT OF A PROTOTYPE ELECTRONIC DOCUMENT AND RECORD MANAGEMENT SYSTEM (EDRMS) FOR SMALL AND MEDIUM BUILDING FIRMS

BY

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DEVELOPMENT OF A PROTOTYPE ELECTRONIC DOCUMENT AND RECORD MANAGEMENT SYSTEM (EDRMS) FOR SMALL AND MEDIUM BUILDING FIRMS

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NIGERIA

DECEMBER 2012

DECLARATION

I hereby declare that the work in this dissertation titled "DEVELOPMENT OF A PROTOTYPE ELECTRONIC DOCUMENT AND RECORD MANAGEMENT SYSTEM (EDRMS) FOR SMALL AND MEDIUM BUILDING FIRMS" was performed by me in the Department of Building, Ahmadu Bello University, under the supervisions of Dr. Y. M. Ibrahim, Prof. K. Bala, Prof. I. K. Zubairu and Prof. C. O. Egbu.

The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for award of another degree at any university.

Abubakar Darda'u ABDUL'AZEEZ **Date**

CERTIFICATION

This dissertation entitled "DEVELOPMENT OF A PROTOTYPE ELECTRONIC DOCUMENT AND RECORD MANAGEMENT SYSTEM (EDRMS) FOR SMALL AND MEDIUM BUILDING FIRMS" by Abubakar Darda'u ABDUL'AZEEZ meets the regulations governing the award of the degree of Doctor of Philosophy in Construction Management of the Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

Dr. Y. M. Ibrahim Chairman, Supervisory Committee`	Date
Prof. K. Bala Member, Supervisory Committee	Date
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Prof. A. A. Joshua Dean, Postgraduate School	Date

DEDICATION

Dedicated to my entire family.

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Alhamdulillah. I have completed this intellectually demanding and emotionally challenging task. Indeed, the road has been rough and turbulent in every way but at the end of it, I have the cause to once again, say all praise is due to ALLAH. I do acknowledge that His bounties on me are certainly immeasurable.

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ABSTRACT

The amount of documents and records produced within the information process during the course of a construction project is overwhelming. Consequently, proper management of these documents and records is of key importance regarding efficiency and quality management in the construction industry. This study is concerned with the status of records management practice among small and medium building firms in Nigeria. It examines the problems and challenges in the implementation of the record management practice by the building firms.

The major problems the small and medium building firms are facing in record management practice include, among others, is that records are not well organized to provide a competent business environment; capturing of records for sharing among wider team is expensive; time wasting in searching and retrieval of records; poor storage system; requiring large space to store voluminous records; information and technology (IT) facilities available to manage records are expensive and require high skill to operate. The aim of the study is therefore to develop a prototype electronic document and record management (EDRM) system for managing records in small and medium building firms with a view to enhancing project records management practices.

The research adopted a combination of methodologies using both quantitative and qualitative techniques that uses case study methodology, together with a literature review to identify challenges that hinder the efficient implementation of good record management practice. Structured questionnaires were administered to identify practice in records management through which the requirements for EDRMS was captured. In developing the

prototype EDRM system, the ‘system development life cycle (SDLC)’ approach was used and the ‘unified process’, was adopted.

The findings of the study show that storage space; filing system; searching; security of records; high cost of database record management’s applications and the technical skills required to operate them are the major problems and challenges the building firms faced in implementing efficient record management system. The study concluded that for the building firms to succeed in achieving proper records management, the established standards such as ISO 15489 and AS4390 could be adopted as a guide for effective records management practice. To address these challenges, an affordable, efficient and user-friendly computer prototype EDRM system was developed, tested, validated. A user guide was also provided for efficient use of the developed system,

Results of validation by industry practitioners showed that the developed EDRM system has at least a 75% rating in terms of its potential to improve productivity, enhance learning and research activities, improve management efficiency and provide an avenue for organizational learning. Similar ratings were obtained in terms of the developed EDMRS’s logical structure, clarity, relevance and comprehensiveness.

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LIST OF ACRONYMS AND ABBREVIATIONS

AA	Archives Administration
ACARM	Association of Commonwealth Archivists and Records Managers
ACCIS	Advisory Committee for the Co-ordination of Information Systems
AfDB	African Development Bank
API	Application Programmer Interface
ARMA	Association of Records Managers and Administrators
AS	Australian Standard
ASCII	American Standard Code for Information Interchange
CAD	Computer-Aided Design
CPU	Central Processing Unit
DBMS	Database Management System
EDMS	Electronic Document Management Systems
EDRMS	Electronic Document and Record Management System
ERM	Electronic Records Management
ERM & IT	Electronic Records Management and Information Technology
EU	European Union
GUI	Graphical User Interface
IBM	International Business Machines
ICA	International Council on Archives
ICT	Information And Communication Technology
InterPARES	International Research on Permanent Authentic Records in Electronic Systems
IRMT	International Records Management Trust

ISO	International Standards Organisation
IT	Information Technology
LAN	Local Area Network
MIS	Management of Information Science
MoReq	Model Requirements for the Management of Electronic Records
MVC	Model View Controller
NARA	National Archives and Record Administration (USA)
NARS	National Archives and Record Service (USA)
OECD	Organisation for Economic Co-operation and Development
PC	Personal Computer
RDBMS	Relational Database Management System
RIM	Records and Information Management
SDLC	System Development Life Cycle
SME	Small and Medium Enterprises
SPSS V. 20	Statistical Package for Social Sciences Version Twenty
USAID	United States Agency for International Development

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Although construction may intuitively be perceived as an industry concerned primarily with labour and material intensive processes, construction work is highly dependent on information and communication. The material process can only function in integration with an information process, which gives birth to design information describing *what* to build, and management information describing *how* to build it (Björk, 1999). The amount of documents and records produced within the information process during the course of a construction project is overwhelming. Consequently, proper management of these documents and records is of key importance regarding efficiency and quality management in construction industry.

Academic and collaborative research by government, institutions and private sectors, on record management both in the traditional and electronic form has been on-going process. The research being conducted mostly centred on theoretical issues and covered mainly public sectors. Such researches include, Kandur's (1992) and MacNeil (1998) that explored the evolution of methods of assessing the trustworthiness of records as evidenced from antiquity to the digital age and from the perspectives of law and history.

MacNeil's (1998) research was the first academic research that aimed at building a theoretical framework in the area of electronic record management (ERM). It sought to discover a technical solution for the creation and preservation of authentic and reliable records over time. Whereas Turner's (1999) research *focused on 'Theory and practice in the analysis of information policy in the digital age: a case study on the formulation of*

the European directive on the legal protection of database'. The research centred on the theoretical issues relating to database management within public sectors, while Walker (2002) study adds a new dimension to academic research. The research was aimed to introduce records managers to the world of Intelligent Agents (IAs), this research also remains theoretical.

Another academic research was the one conducted by Jahore (2006), it was on '*the development of a model for education and training in electronic records management*' and aimed at studying the education and training requirements for record keepers in ERM. It centred mostly on archivist and record managers working in government sectors, using Malaysian government as a case study. Borglund (2008) research on '*Design for recordkeeping: Areas of improvement',* was focused on the problems related to design of information systems in which records are born and managed. The benefits derived from the study, was by exploring standard ways to follow in designing recordkeeping systems for organizations.

A recent research work on record management was that of Isa (2009) and it was on '*Records management and accountability of governance'.* The research centred on the general record management, which involves the proper creation, capture, distribution and preservation of judicial evidence in the form of records. The work is among the few academic work that combined public and private sectors in the study of record management.

Collaborative research work on ERM were also carried out by the National Archives of Canada's IMOSA (Information Management and Office Systems Advancement) project in 1992, and FOREMOST (Formal Records Management for Office Systems

Technologies) to find out the needs of ERM of the Canadian government agencies of office information (McDonald, 1995). However, in the UK, the Joint Information Services Committee (JISC) of the Higher Education Funding Councils funded a number of research projects on digital archiving in collaboration with the National Preservation Office NPO. Five JISC/NPO projects, which were administered, by the British Library Research and Innovation Centre. The study was aimed at finding a solution for long-term preservation of digital materials. Bennet, 1997; Haynes et al., 1997; Hendley, 1998; Beagrie & Greenstein, 1998 and Ross & Gow, 1998, reported these research projects.

Other research areas explored on record management are the use of electronic document management (EDM) system and related technologies in construction projects. Research topics have covered various aspects such as the typical features required for EDM (e.g. Hartvig, 2001; Lakka *et al.*, 2001), practical benefits achieved (e.g. Lownertz, 1998; Björk, 2001; Ruikar *et al.*, 2005), financial gain achieved (e.g. Sulankivi *et al.*, 2002), usage patterns (e.g. Thorpe and Mead 2001; Andresen *et al*., 2003), industry-level adoption as well as project specific implementation challenges (e.g. O'Brien, 2000; Ruikar *et al*., 2005).

Despite the benefits outlined by some researchers on the use of EDRM system, several authors have discussed the inability of the construction industry to introduce modern technologies and production management processes (Wikforss, 1994; Kagioglou *et al.*, 1998).

As the construction, industry strives to import paradigms and methods of running and operating businesses, from other sectors of the economy, there is the risk of the industry

losing its specific competence, because organisation's management processes varies with respect to the services it offers. This applies in particular to information technology (IT), as software and application solutions developed for other industries or even administrative organizations, may not be easily applied to manage construction process. This tendency has been observed in the introduction of CAD, where integration is still limited to the design phase, and to producing documents rather than exchanging information to support decisions and improve the efficiency of the design team.

In developing countries, Thurston and Cain (1996) discovered a pattern of inadequate records management systems and argued that the situation is endemic. The authors observed that poor records systems have serious consequences for both government and citizens and affect governments' ability to manage resources effectively and to comply with international conventions.

The idea and research topic of this study, therefore, emerges from non-adoption and implementation of this vital system (EDRMS) of managing records by small and medium building construction firms. Though previous studies carried out in advance countries, on the EDRM adoption and usage focused on the types EDRMS facilities developed in those countries. The concepts adopted in this research is to explore ways towards providing an alternative prototype EDRM system that would be efficient, affordable, user-friendly and compatible with the current record management practice for building firms in developing nation, like Nigeria.

1.2 STATEMENT OF THE RESEARCH PROBLEM

Organisations often suffer in retrieving records that are not systematically stored. When the number of records accumulates, the problem would gradually emerge. The retrieval

process, in turn, takes longer time and thus affects the smoothness of the administration and decision making process. No organisations can remain competitive if retrieving records for decision making frequently encounters difficulties and worse if they are not retrievable at all.

The task of managing all the information needed to design and construct any major facility is a challenge, and many believe that more efficient information management is a primary mechanism for the construction industry to increase its productivity (Egan, 1998). In the construction IT, research literatures there are two streams, which propose different solutions to the problem of project information management. A solution which builds incrementally on the current documentation practice in the industry, is to enhance this practice through the wide-spread adoption of electronic document and record management (EDRM) systems, applied within companies and in particular across all the participants in projects.

Relatively little research has been done, within the period of 1990 - 2000 related to the technical and implementation aspects of EDRM systems in construction. According to Eastman (1999), more has been written concerning building product modelling technology and standards implementing it than in record management practices in the construction industry. In a survey made by Betts and Amor (2001) the relative frequencies of research themes were studied in the proceedings of the annual conferences of the CIB Working commission W78 (Information Technology in Construction) over the period 1992-2000, and the analysis covered altogether some 500 papers. The graphs presented by Betts and Amor show that there was about 2-3 times as many papers dealing with product modelling, as dealing with document management.

The situation in the construction industry shows that a mixture of different generation methods is used for managing documents (Björk, 2001). Hardly any documents are today produced by hand, but a lot are still transferred by printing them out and sending them to the other parties by mail or couriers, often-using copying companies as intermediaries. A slightly more sophisticated method is that documents are both produced digitally and transferred digitally as e-mail attachments. The process speed up the document transfer, but in terms of document management, this hardly offers any improvement over the current situation since finding a document in another person's personal computer may be even more difficult than on his shelves. Retrieving a document may often, as a last resort, require asking a person to deliver it.

Björk (2003) indicated that there was no any broad industry wide surveys that focused only on the use of EDM systems in construction. Due to the lack of a single dominant system provider (such as Autodesk for CAD system) it is difficult to find out the overall picture from figures provided by application system (ASP) providers, since each of them tend to have only small market shares. There have, however, been a number of general surveys of IT usage in the construction, which can give us some indications (Howard *et al.*, 1998, Rivard, 2000). What the surveys show very clearly is that Internet connectivity and the general use of email and the World Wide Web is already very high in the construction industry. This is clearly a prerequisite for the use of modern EDM systems. In addition, there are figures substantiating that already a large share of documents are transferred electronically.

A research carried out in Sweden and in a slightly modified form in Finland and Denmark included particular questions about the use of project webs (Samuelsson, 2002). The results show in a statistically reliable way that in Sweden almost 50% of

people in the industry worked in companies where project webs had been used in at least one project. Although this is not as indicative, a figure as say the proportion of projects run using EDM systems it at least shows the technology is becoming more common.

On the other hand, published figures from a research of the IT usage by Australian subcontractors indicate a much lower degree of usage (Ng *et al.*, 2001). Although 70% of the total sample had Internet connectivity and email, the most common usage was for general communication. Only 16% of respondents indicated email and Internet was used for the exchange of project information. In Nigeria currently this is the norm, where email is the main source of exchanging project information from consultants - client - contractor.

The more features a system contains the more complex it may be to learn, which can create a barrier to usage. Thus, the requirements of the end users in the construction industry may not coincide with the spectrum of technical features offered by system vendors. The general lesson coming from this type of research is that the simplicity to learn and use the system is a major factor to be considered. The capability to search documents should also as far as possible resemble current practice, thus relatively simple hierarchical folder structures are popular with end users, despite the more advanced features which can be offered by meta data based search mechanisms (Björk, 2003).

The full implementation of the automated EDRMS was mostly embraced by the public organizations, while few business organizations, such as the construction industry industries adopted the system, and most of which are large construction industries

(Swarts, 2004; Johnston et al., 2005; Bjork, 2006; Valerius, 2007). The problems encountered by the construction industries when implementing the EDRM system were; industry's unfamiliarity with documentation standards to provide basic framework; too much expenses in training personnel; the EDRM system was cumbersome, therefore, demand either a move towards national standards or user-friendly systems (Bjork, 2006).

In the developing countries, like Nigeria, most of the construction industry particularly small and medium building construction firms are yet to embrace the use of EDRM system. Even though there exist several of these facilities such as, IBM, Laserfiche, Oracle, Microsoft-Share Point, WatchDox, etc (Capterra, 2012). The systems adopted in the advance countries for record management could be too complex to work in the developing countries, mainly because of high technical skills required to operate them (O'Brien, 2000; Andresen *et al*., 2003; Björk, 2006). Other factors include overall cost of having and maintain the system is high; low speed Internet access and irregular supply of electricity in these countries could easily affect the system technical configuration.

In a nutshell, the major problems the small and medium building firms are facing in record management practice include, among others, is that records are not well organized to provide a competent business environment. Capturing of records for sharing among wider team is expensive; time wasting in searching and retrieval of the records; poor storage system – leading to loss of records; requiring large space to store voluminous records; IT facilities available are expensive and require high skill to operate; and in most cases records are not secured.

Despite the various research works carried out by different bodies including the academics, to address the above-mentioned problems, the small and medium building firms, were not really given much attention to provide them with an alternative, affordable, efficient and user-friendly automated EDRM system, that they can directly adopt to enhance the record management practice in carrying out their businesses activities.

1.3 JUSTIFICATION FOR THE STUDY

The use of EDM and related technologies in construction projects has been the subject of research interest in recent times. Previous research indicates that EDM technology has a huge potential as an enabler of quantitative and qualitative benefits in construction. While it appears difficult to empirically prove financial savings of significant magnitude, case studies reported that, EDM use in record management practice allows for improved speed, quality and cost efficiency in the information process (Sulankivi *et al.,* 2002), thus affecting the entire process of construction project positively.

The construction industry is changing constantly with the development of new business methods and technologies (Koota, 2003). Therefore, there is need for construction companies to adopt these applications and develop appropriate strategies to be more competitive and succeed in their businesses.

Keeping good records is essential to the organization; a well-maintained record will tremendously assist in supervision and monitoring the construction process; organize and prepare financial statements; easily search and retrieve information within the

shortest possible time. Unfortunately, this is not the trend in most of the building firms under study.

According to Achuenu (1999) computer applications in construction management hold the only prospect of a more organized and effective means of increasing the productivity of building construction projects. Several researchers (Schwegler *et al*., 2001) have generally discussed the benefits the construction industry is getting from information technology (IT) implementation. Some authors claim to have demonstrated measurable improvements in productivity due to increased IT usage (Thomas, 1999).

In the critique of Thomas's (1999) results, Koskela and Kazi (2001) on the other hand argued that the use of IT tools as such, has had very limited impacts, and that the positive effects are achieved more through the changes in working patterns which are induced by the introduction of IT (Koskela and Kazi, 2001).

On a more particular level, some authors have discussed the benefits, which can be achieved through the comprehensive use of EDRM systems throughout a design and construction project, stretching into the facility management (FM) phase, where an overall savings in the order of 5-10% of total construction costs were predicted (Löwnertz *et al.,* 1995), but according to Sulankivi *et al.,* (2002) proving the realisation of such benefits with empirical data is, however, extremely difficult.

According to Bäckblom and Björk (2003), the currently on-going survey in the B-webs project indicates quite clearly that individuals who have used projects webs in projects management, where the introductions has been unproblematic, would be very reluctant to go back to older ways of managing the documentation. This can be seen as indirect evidence that the benefits are greater than the cost or possible inconvenience.

Thus, it is justifiable, considering the stated problems and the benefits to be derived in using record management IT facilities that this research, tends to develop a prototype computer EDRM system, with a view that the system will improve management efficiency, improve productivity, provide an avenue for organizational learning, enhance learning and research activities and enhance resolution of conflict.

1.4 AIM AND OBJECTIVES

1.4.1 Aim

The aim of the research work is to develop a prototype electronic document and record management system for managing records in small and medium building firms with a view to enhancing project records management practices.

1.4.2 Objectives

In order to achieve the above aim the following specific objectives were pursued.

i. To identify the requirements for an EDRM system for small and medium building firms

ii. To identify the challenges associated with the traditional form of project records management and how they influence management practices in the small and medium building firms

iii. To develop the conceptual framework of the EDRM system,

iv. To develop a computer based prototype system of the conceptual framework

v. To test, validate the developed prototype system and provide a user guide.

1.4.3 Research Questions

The main interest of this research and the questions it set out to answer and revolve around is finding solutions to the problems of proper documentation and record keeping by small and medium building firms in Nigeria, this is with a view to improving and stabilizing the performance and achievement of expected roles in the economic development of Nigeria. It is against this background that this research is using the following specially constructed and directed questions to identify EDRM system requirements, identify challenges associated with TRM system and then develop a prototype EDMR system that would be used to enhance record management practices for building firms.

i. To what extent is the current practice in documentation and records keeping management system of project records challenging for small and medium building firms in Nigeria and why?

ii. To what extents will the automation of record management system be able to address the challenges of traditional record management, and how might this be effectively implemented in small and medium building firms in Nigerian Construction Industry?

1.5 RESEARCH METHODOLOGY

This study is a quantitative and qualitative research that uses case study methodology. The research works by Lincoln & Guba (1985), Yin (1989), Mellon (1990), Patton (1990), Layder (1993), Salkind (1997) and Silverman (1997) were explored. These works consider the rationale for qualitative research, its relationship to quantitative

methods, and techniques applicable to social research. The emergence of quantitative and qualitative data collection approach in response to content areas under study gives the writer an opportunity to integrate the various approaches to data collection and analysis through the triangulation method.

Structured questionnaires administered were used to identify practice in records management through which the requirements for EDRMS were identified for the small and medium building firms. The challenges associated with the record management practice towards providing an alternative to enhance the practice were also identified using the questionnaire.

In developing the prototype EDRMS, the 'System development life cycle' approach was used and the 'unified process' developed by Grady *el at*. (2005), was adopted. The programming of the system was developed using a 5-steps procedure adopted from Williams and Sawyer (2007).

The results obtained were used to develop a conceptual framework of the EDRMS first, and this guides to developing an affordable and user-friendly computer based prototype system that addressed the problems and challenges mentioned in the study. The developed system has been tested, validated and a user guide provided to serve as a guide to the operators and users of the system.

1.5.1 Research Programme

In accordance with the aim and objectives, the research programme was divided into four broad steps as shown in Figure 1.1. Step 1 was review of the literature, which guided to production of chapter 1. Step 2 discussed in detail the main work of the

research, while step 3 discussed the system development, testing and validation. Step 4 was designed to cover the summary, conclusions and recommendations from the study.

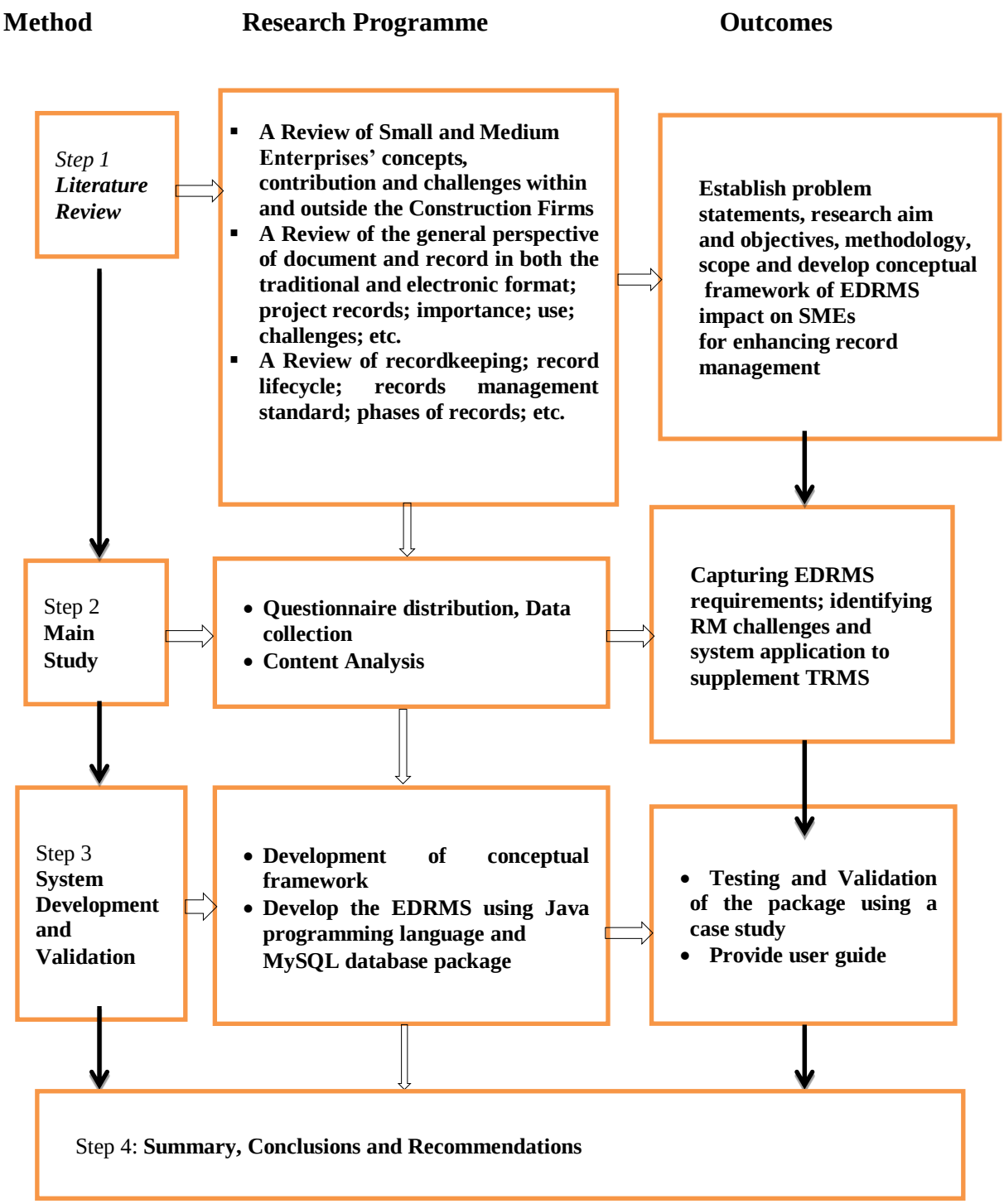


Figure 1.1: Research Programme

1.5.2 Structure of the Dissertation

The structure of the dissertation is shown in Figure 1.2 and is divided into 6 chapters. The first chapters covered introduction, problems and justification of the study, research aim, objectives and research questions, research methods, scope and limitation of the research. Chapter two covers the review of the related literature, while chapter three included review of research methods adopted for the research, data collection procedures and the methods adopted for the development of the prototype system.

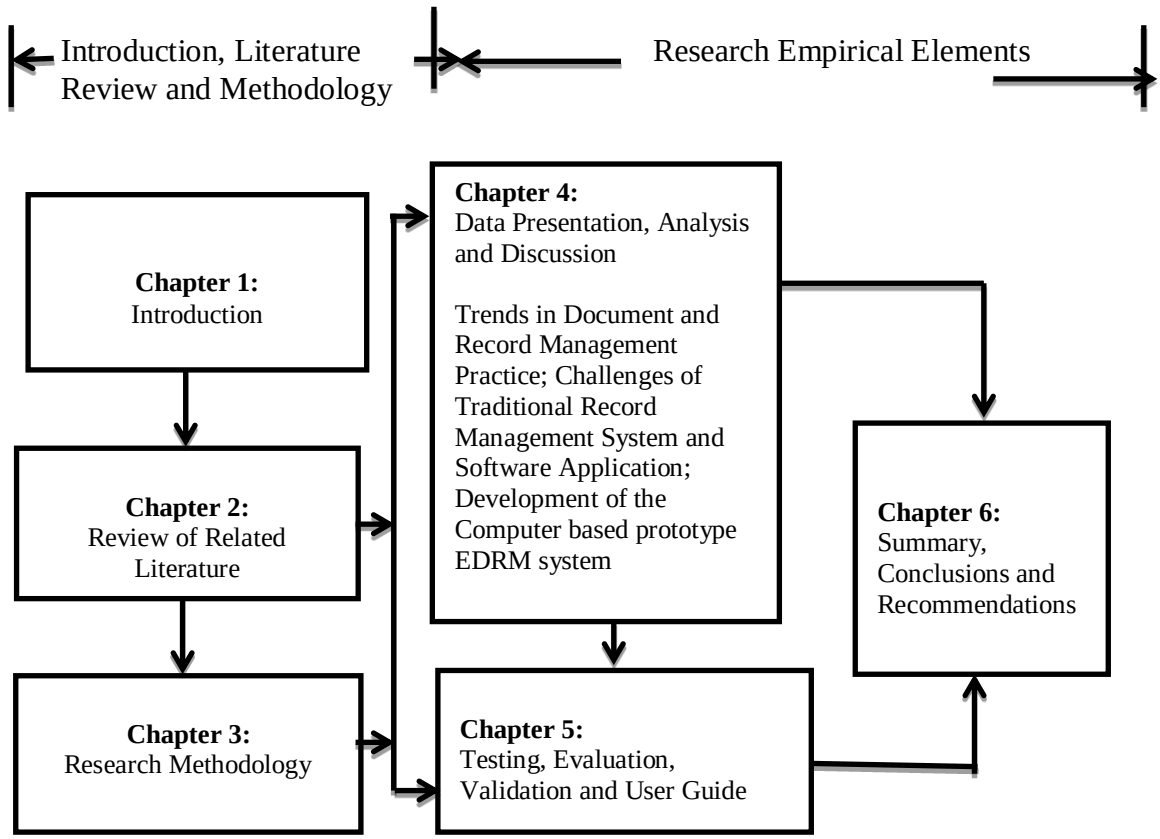


Figure 1.2: Structure of the Dissertation

Chapter 4 discussed on the data presentation, analysis and discussion on the results obtained from the research. The currents trend in record management system practiced

by the building firms, the result was used to identified the EDRM system requirements that was used in developing the conceptual framework of the system.

The challenges associated with the record management practice and the software applications used to supplement the traditional form of record management practice was presented in.

The conceptual framework development for the prototype EDMR system and the development of the computer-based prototype of the EDRM system were also discussed in this chapter.

Chapter 5 discussed the testing, evaluation and validation of the developed EDRM system. A user guide on how to use the developed EDRM system was also developed. Chapter 6 presents summary of the findings, conclusions and recommendations were made towards enhancing the developed system and for further research on areas not covered in this study.

1.6 SCOPE AND LIMITATION OF THE STUDY

1.6.1 Scope

The study concentrated mainly on Post Contract Project records (Contracts documents) and other relevant records required by law from inception to the completion stage of the projects. This includes minutes of meetings; compliance forms/daily records; inspection and testing report forms; etc. Only public building projects are considered. The study was not concerned with records on preliminary design stages of projects, method of contracting procurement and contract competence. Windows operating system was used for the system and the package was designed for contractors and clients.

1.6.2 Limitation

The developed package is to take care of contractors and clients record management needs, but other professionals, such as consultants, in the construction industry may find it useful. Windows operating system was used in the development of the system; thus, the application is only applicable for users with Windows operating systems. Other operating systems, such as, Mac, Ubuntu, Linux are not compatible with the developed prototype application. Data collection instrument used only captured data within the study area; therefore, the use of the system may not be applicable elsewhere if the system of contract execution and project record management differs with the one adopted in this study.

CHAPTER 2

LITERATURE REVIEW

Copious literature exists on Small and Medium Enterprises (SMEs) written by various authors and in different languages and for various purposes. This fact underscores the essence, importance and relevance of this sub-sector in the development of any given economy. The experiences of developed economies in relation to the roles played by SMEs buttresses the fact that the relevance of SMEs cannot be overemphasized especially among the less developed countries.

In this chapter therefore, the relevant literature is reviewed and appraised, the general concept of small and medium enterprises (SMEs) were looked into in the global perspective; contribution into the economy and challenges they are facing that are deterring their development. General literature on traditional and electronic documents and recordkeeping management system operated by organizations were also reviewed, with emphasis on project records utilized by SMEs building construction firms.

2.1 SMALL AND MEDIUM ENTERPRISE (SMEs): DEFINITION AND DESCRIPTION

Small and Medium Enterprises (SMEs) have been acknowledged worldwide as the catalysts for rapid economic growth and sustainability and a driving force behind job creation, income distribution and reduction of income disparities, export earnings, poverty reduction, and wealth creation. Definitions of SMEs vary significantly, usually in line with the scale of the economy concerned, its degree of development and the economic structures that are present. There is no single, uniformly acceptable, definition of a small firm (Storey, 1994). Firms differ in their levels of capitalisation,

sales and employment. Hence, definitions that employ measures of size (number of employees, turnover, profitability, net worth, etc.) when applied to one sector could lead to all firms being classified as small, while the same size definition when applied to a different sector could lead to a different result.

The first attempt to overcome this definition problem was by the Bolton Committee (1971) when they formulated an "economic" and a "statistical" definition. Under the economic definition, a firm is regarded as small if it meets the following three criteria:

(i) it has a relatively small share of their market place;

(ii) it is managed by owners or part owners in a personalised way, and not through the medium of a formalised management structure;

(iii) it is independent, in the sense of not forming part of a large enterprise.

The Committee also devised a "statistical" definition to be used in three main areas:

(a) quantifying the size of the small firm sector and its contribution to GDP, employment, exports etc.;

(b) comparing the extent to which the small firm sector's economic contribution has changed over time;

(c) applying the statistical definition in a cross country comparison of the small firms' economic contribution.

Thus, the Bolton Committee employed different definitions of the small firm to different sectors.

Table 2.1: The Bolton Committee Definitions of a Small Firm

Sector	Definition
Manufacturing	200 employees or less
Construction	25 employees or less
Mining & Quarrying	" " " "
Retailing	Turnover of 50,000 pounds or less
Miscellaneous	" " " " "
Services	" " " " "
Motor Trades	Turnover of 100,000 pounds or less
Wholesale Trades	" " " 200,000 pounds or less
Road Transport	Five Vehicles or less
Catering	All excluding multiples and Brewery – managed houses

Source: The Bolton Committee (1971)

A number of weaknesses can be identified with the Bolton Committee's "economic" and `statistical' definitions. First, the economic definition which states that a small business is managed by its owners or part owners in a personalised way, and not through the medium of a formal management structure, is incompatible with its statistical definition of small manufacturing firms which could have up to 200 employees. As firm size increases, owners no longer make principal decisions but devolve responsibility to a team of managers. For example, it is unlikely for a firm with hundred employees to be managed in a personalised way, suggesting that the `economic' and `statistical' definitions are incompatible.

Another shortcoming of the Bolton Committee's economic definition is that it considers small firms to be operating in a perfectly competitive market. However, the idea of perfect competition may not apply here; many small firms occupy `niches' and provide a highly specialised service or product in a geographically isolated area and do not perceive any clear competition (Wynarczyk *et al*., 1993; Storey, 1994).

Alternatively, Wynarczyk *et al* (1993) identified the characteristics of the small firm other than size. They argued that there are three ways of differentiating between small and large firms. The small firm has to deal with:

(a) uncertainty associated with being a price taker;

(b) limited customer and product base;

(c) uncertainty associated with greater diversity of objectives as compared with large firms.

As Storey (1994) stated, there are three key distinguishing features between large and small firms. Firstly, the greater external uncertainty of the environment in which the small firm operates and the greater internal consistency of its motivations and actions. Secondly, they have a different role in innovation; small firms are able to produce something marginally different, in terms of product or service; this differs from the standardised product or service provided by large firms. A third area of distinction between small and large firms is the greater likelihood of evolution and change in the smaller firm; small firms, which become large, undergo a number of stage changes.

Criticism of the Bolton Committee's "Statistical" definition observed that:

(i) no single definition or criteria was used for "smallness", (number of employees, turnover, ownership and assets were used instead).

(ii) three different upper limits of turnover were specified for the different sectors and two different upper limits were identified for number of employees. This makes the definition complex to allow for cross-country comparison.

(iii) comparing monetary units over time requires construction of index numbers to take account of price changes. Moreover, currency fluctuations make international comparison more difficult.

(iv) the definition considered the small firm sector to be homogeneous, however, firms may grow from small to medium and in some cases to large.

It was against this background that the European Commission (EC) coined the term 'Small and Medium Enterprises (SME)'. The SME sector is made up of three components:

(i) firms with 0 to 9 employees - micro enterprises

(ii) 10 to 99 employees - small enterprises

(iii) 100 to 499 employees - medium enterprises.

Thus, the SME sector is comprised of enterprises (except agriculture, hunting, forestry and fishing), which employ less than 500 workers. In effect, the EC definitions are based solely on employment rather than a multiplicity of criteria. Secondly, the use of 100 employees as the small firm's upper limit is more appropriate given the increase in productivity over the last two decades (Storey, 1994). Finally, the EC definition did not assume the SME group is homogenous, that is, the definition makes a distinction between micro, small, and medium-sized enterprises.

However, the EC definition is too all embracing for a number of countries. Researchers would have to use definitions for small firms, which are more appropriate to their particular `target' group (an operational definition). It must be emphasized that debates on definitions turn out to be sterile unless size is a factor, which influences

performance. For instance, the relationship between size and performance matters when assessing the impact of a credit programme on a targeted group, (also refer to Storey, 1994).

The current use of different definitions for SMEs, more so within the same economy, gives room for uncertainty in the identification of SMEs and inconsistency in the management of SMEs related data issues. Criteria for defining the scale of business vary from country to country, depending on country circumstances. Some countries define SMEs by total assets, others by employment, turnover, or paid-up capital while some vary it by sector and several others using more than one indicator.

According to Glancey and McQuaid (2000), categorized definition of SMEs into two approaches, that is, quantitative and qualitative. The quantitative is based upon criteria such as employment; turnover; asset size, and this often vary by industry and country, while the qualitative definition is based on ownership or control of the business. They further include qualitative approach in capturing the meanings, beliefs and behavior aspects including issues facing managers that distinguish small businesses from large firms.

There is no single UK Organization definition of an SMEs and its application of the term in its statistics service differentiates from the EU definition in that the EU's headcount includes part time and seasonal workers (i.e. agency staff as well as permanent employees) while the UK definition uses "employees" only, excluding those who are not permanent employees.

It further stated that over 2.3 million businesses in UK were ‘size class zero’ business, that is, they have no employees. This indicates that the workers for these companies are employed on temporarily bases.

The first step to qualify as an SMEs is to be considered as an enterprise. According to the new definition, an enterprise is ‘any entity engaged in an economic activity, irrespective of its legal form’. The wording is not new. It reflects the terminology used by the European Court of Justice in its decisions. By being formally included in the recommendation, the scope of the new SMEs definition is now clearly marked out. Thus, the self-employed, family firms, partnerships and associations regularly engaged in an economic activity may be considered as enterprises. It is the economic activity that is the determining factor, not the legal form.

Wignaraja and Ganesh (2003), summarised in Table 2.2 that due to its ease of collection, the most commonly used variable used in the definition of SMEs is the number of employees. The EU and a large number of OECD, transition and developing countries set the upper limit of number of employees in the SMEs between 200-250, with a few exceptions such as Japan (300 employees) and the USA (500 employees).

The variances in SME definitions have posed problems in developing targeted programmes or interventions for the sub-sector as well as in the development of policies that would impact on the SMEs. There have been attempts at adopting a single definition within countries and by economic group of countries as part of endeavours at mitigating the challenges posed by varying SME definitions. The EU, for instance, has adopted a single definition of SMEs based on the number of employees and turnover/balance sheet (Table 2.3), which is applied across community programs and

proposals, and which member countries are expected to adopt. The use of existing definitions is however permitted till December 2007.

Table 2.2: Definition of SME by Number of Employees

Economy	Year	Definition of an SME (a)
Developing Economies		
Taipei	Early 1990s	<100 employees
China	Early 1990s	<100 employees
Korea	1995	<300 employees
Vietna	Early 1990s	<200 employees
India	1991/1992	<Rs 30 M investment in plant & machinery
Si g pore	Early 1990s	<100 employees
Ma ay ia	Early 1990s	<75 employees
Indonesia	Early 1990s	<100 employees
Thailand	Early 1990s	<100 employees
Mauritius	1997	<50 employees
Tanzania	2002	<50 employees
Malawi	2003	<50 employees
OECD		
Denmark	Early 1990s	<500 employees
France	1994	<500 employees
Sweden	Early 1990s	<200 employees
Finland	1991	<500 employees
Japan	1991	<300 employees
USA	1994	<500 employees

Note: (a) Definition adopted by each study, which may be different to the official national definition of an SME.
Studies: Korea (Kim and Nugent, 1999), India (Badrinath and Others, 1997), Mauritius (Wignaraja and O'Neil, 1999), Tanzania and Malawi (estimates based on Wignaraja's fieldwork), the remaining countries (OECD, 1997).

Table 2.3: Enterprise Categorisation in the EU

Category of Enterprise	No of Employees	Turnover/ Balance Sheet
Micro	Less than 10	< € 2 million
Small	10 – 49	< € 10 million
Medium	50 – 250	< € 50 million

Source: Wignaraja, Ganesh (2003)

Another definition adopted by Onugu (2005) in the study carried out on problems and prospects of SMEs in Nigeria is, SMEs definition as:

i. **Micro Enterprise:** A firm, whose total cost including working capital but excluding cost of land is not more than ten million Naira (N10,000,000) and/or with a labour size of not more than thirty (30) full-time workers and/or a turnover of less than two million Naira (N2,000,000) only.

ii. **Small Enterprise:** An enterprise whose total cost including working capital but excluding cost of land is between ten million Naira (N10,000,000) and one hundred million Naira (N100,000,000) and/or a workforce between eleven (11) and seventy (70) full-time staff and/or with a turnover of not more than ten million Naira (N10,000,000) in a year.

iii. **Medium Enterprise:** A company with total cost including working capital but excluding cost of land of more than one hundred million Naira (N100, 000,000) but less than three hundred million Naira (N300, 000,000) and/or a staff strength of between seventy-one (71) and two hundred (200) full-time workers and/or with an annual turnover of not more than twenty million Naira (N20, 000,000) only.

iv. **Large Enterprise:** Any enterprise whose total cost including working capital but excluding cost of land is above three hundred million Naira (N300,000,000) and/or a labour force of over two hundred (200) workers and/or an annual turnover of more than twenty million Naira (N20, 000,000) only.

SMEs in the Nigerian perspective, according to a report strategy document produced based on the works of the SME Team of the Financial System Strategy 2020 (FSS2020), which is a platform on which major stakeholders in the country's financial

system, they envisaged that by 2020, Nigeria's financial system will be the safest and fastest growing among emerging markets, and her economy among the top 20 economies in the world, put the structure of SME in Nigeria into four groups of stakeholders as shown in Figure 2.1.

i. the Operators
ii. the Drivers
iii. the Enablers
iv. the Regulators

Figure 2.1

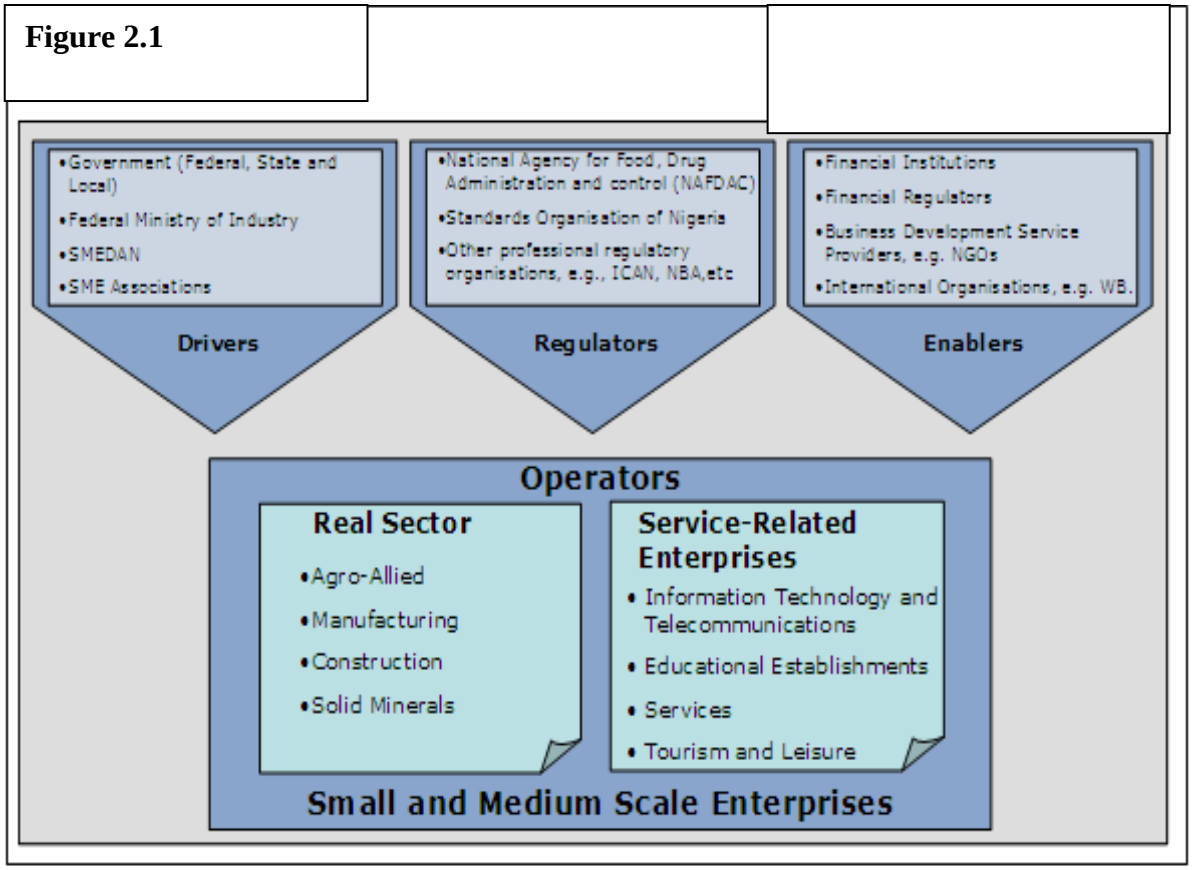


Figure 2.1: SMEs Structure in Nigeria

The Operators of the SME sector is largely grouped into three distinct classes: Micro, Small and Medium enterprises. Definitions of how businesses are classified into any of these three classes are as varied as the institutions that relate with the sub-sector (Table

2.4). Mainly, three criteria are used either in isolation or in conjunction, as discussed in the earlier definitions:

i. number of employees;

ii. annual turnover; and

iii. asset base

Table 2.4: SMEs Definition in Nigeria

Source	*No of Employers*			*Assets (₦ million)* [1]			**Turnover (₦ million)**		
	Micro	**Small**	**Med**	**Micro**	**Small**	**Med**	**Micro**	**Small**	**Med**
NASME	<10	<50	<100	<1	<50	<150	<10	<100	<500
NASSI		3-35		<1	<40			<40	
Min of Industry	<10	<100	<300		<50	<200			
CBN [2]					<1.500				
NERFUND NACRDB					<10				

Source: Chemonics International report for PRISMS for USAID, 2004
[1] Excludes real estate
[2] CBN's revised definition (2006) for the purpose of SMEEIS

The use of these different definitions makes statistics on SMEs in Nigeria rather unreliable. In 2004, the Nigerian government and USAID ran an initiative to assess the use of the microfinance industry as a foundation for driving rural economic growth utilising the PRISMS (Promoting Improved Sustainable Micro, Small and Medium Enterprise Services) methodology. From this initiative, it was estimated that there are about 1.7 million SMEs in the country (based on the definition that SMEs are firms with 5 to 50 employees) and when added to micro enterprises represent 8.4 million (or 87% of businesses in Nigeria).

The Small and Medium Sized Development Agency of Nigeria (SMEDAN) defines SMEs based on the following criteria: a micro enterprise as a business with less than ten people with annual turnover of less than five million Naira, a small enterprise as a business with 10-49 people with annual turnover of five to 49 million naira, while a medium enterprise as a business with 50–199 people with an annual turnover of 50–499 million naira. According to SMEDAN, SMEs cover the entire range of economic activity within all sectors (SMEDAN, 2005).

The recent definition of SMEs by EU (European Commission's Directorate General for Enterprise and Industry, 2009), is that 'small' is defined as less than 50 employees and 'medium' enterprise as less than 250 and with a turnover of less than €40m. The definition adopted for this study is by Federal Ministry of Industry Nigeria that 'micro' is defined as less than 10 'small' as less than 100 and 'medium' enterprise as less than 299 employees (Udechukwu, 2004).

2.2 CONTRIBUTION OF SMEs IN CONSTRUCTION INDUSTRIES

The dynamic role of small and medium enterprises (SMEs) in developing countries as engines through which the growth objectives of developing countries can be achieved has long been recognised. It is estimated that SMEs employ 22% of the adult population in developing countries (Fisseha, 1991; Fisseha & McPherson, 1991; Daniels and Fisseha, 1992; Daniels & Ngwira, 1993).

The notion of SMEs and entrepreneurship development was introduced into the growth and development landscape as early as the late 1940's with the introduction of targeted policies (grants, subsidized credits, special tax treatment, etc.) and the establishment of small business or SMEs support agencies by organizations (*e.g.*

publicly funded SME agencies were set up in 1948 in Japan, 1953 in USA, 1954 in India, 1966 in Tanzania, 1976 in Turkey), OECD, 2004.

Globally, there is an increasing focus on small businesses as a key driver of economies and engine of growth and development. In the European Union (EU), the Heads of Government identified the SME sector as one of the pillars for making the EU "the most competitive and dynamic knowledge-based economy by 2010".

In the US, where small businesses are estimated to represent about 99.7% of all employers (OECD, 2009), SMEs have been variously recognised as the "backbone of the American economy and the path to success for many Americans".

According to the Organisation for Economic Cooperation and Development (OECD), it is now recognised worldwide that the contribution of SMEs and entrepreneurship to employment, innovation and overall economic dynamism is essential to growth performance both in OECD and non-OECD economies. The Organisation for Economic Cooperation and Development (OECD) *Bologna Process,* which is a mechanism to foster entrepreneurship and competitiveness of SMEs of members of the economic group, monitors the *Bologna Charter for SME Policies* adopted by member countries in Italy in 2000.

Similarly, there is the Asia Pacific Economic Cooperation (*APEC) Integrated Action Plan for SME Development*, *Daegu Initiative on SME Innovative Action Plan* in 2005, and an annual Ministerial Meeting on SMEs of member countries of APEC all towards using SMEs as catalysts of economic growth and key drivers of innovation in today's knowledge-driven economy.

Figure 2.2 shows the contribution of small businesses to the economies of some advanced and emerging countries including Nigeria in the areas of employment generation; export earnings, and contribution to GDP. The figure clearly shows the high rate of contribution SMEs are making in the area of providing employment to the people.

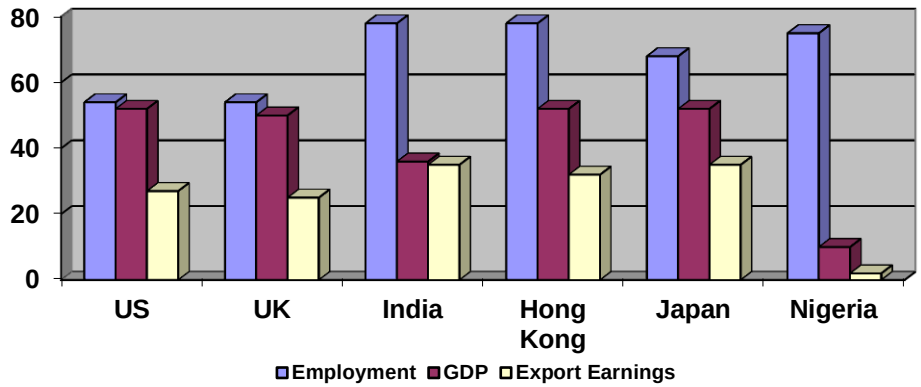


Figure 2.2: Contributions to the Economy by SMEs
Source: SMEDAN, 2006

Small businesses dominate the world business landscape and account for an average of 98% of all enterprises in most economies. Based on the global importance and prevalence of SMEs, there is an increasing focus on the sector by different countries, regional governments, international organisations and other stakeholders. SMEs are recognised for enhancing competition and entrepreneurship and giving external benefits on economy-wide efficiency, innovation, and overall productivity growth. It has thus become more imperative for developing countries like Nigeria to strategically focus on small businesses to accelerate economic growth.

Despite a long history of development efforts, SMEs, including the informal sector, were perceived rather as a synthetic construction mainly of "social and political" importance, especially throughout the 1980's and up to late 1990's. Although domestic

SMEs and the informal sector constituted most of what could be and what are still deemed as “the” private business activity in most developing countries, private sector development strategies advocated for and implemented in these countries were skewed towards the needs of large-scale business, including foreign invested ones. This type of policy advice was partly motivated by the rather disappointing results achieved through extensive SME support systems operated in developed countries since the 1970’s.

Due to their flexible nature, SMEs are able to withstand adverse economic conditions. They are more labour intensive than larger firms and therefore, have lower capital costs associated with job creation (Anheier and Seibel, 1987; Liedholm and Mead, 1987; Schmitz, 1995). SMEs perform useful roles in ensuring income stability, growth and employment. Since SMEs are labour intensive, they are more likely to succeed in smaller urban centres and rural areas, where they can contribute to the more even distribution of economic activity in a region and can help to slow the flow of migration to large cities. Because of their regional dispersion and their labour intensity, the argument goes, small-scale production units can promote a more equitable distribution of income than large firms. They also improve the efficiency of domestic markets and make productive use of scarce resources, thus, facilitating long-term economic growth.

Studies have indicated that the sustenance of interest in SMEs in the developed economies is due to technological as well as social reasons more so as those economies are currently driven by knowledge, skill and technology as opposed to material and energy- intensiveness. This is also as a result of a paradigm shift to new processes of manufacturing that are based on flexible systems and processes of production driven by sophisticated software on robust hardware platforms. The social reasons include the

need for generation of more employment and poverty reduction through self-employment ventures and decentralised work centres. Though it is difficult to obtain exact and comparable figures on SMEs for developing countries, it is obvious that the role of SMEs is equally important in the economies of developing and developed countries alike.

2.3 CHALLENGES EXPERIENCED BY SMEs

Although SMEs in developing countries and countries with economies in transition are regarded as the engine of economic growth, they face enormous challenges in attracting investors and accessing modern technology. Other barriers which SMEs in developing economies face include the lack of effective investment and technology promotion policies, inappropriate legal and regulatory frameworks, inadequate capabilities of investment promotion and technology support institutions and the lack of access to potential investors and sources of new technology, limited technical and managerial skills, difficulty in obtaining financing and insufficient knowledge about laws and regulations (Ihua, 2009). Others are inability to achieve economies of scale through integration or linkages, problems of size and relative isolation such as the difficulties in entering into national and global value chains driven by large multinational corporations.

Generally Small and micro enterprises have been found to have more problems and challenges than larger ones. Delone (1998), Southern and Tilley (2000) argued that small enterprises have higher failure rates. Lyytinen (1991), Rayport and Jaworki (2002), found that small enterprises have problems managing their records effectively. Others found that small enterprises usually have little control over their environment

and have small market shares. (Storey and Cressy, 1995), Khattab (2009) pointed out that small enterprises suffer from inadequate marketing and promotion techniques. Therefore, they are unable to access new markets and acquire new customers. Furthermore, many studies suggested that small and micro enterprises still avoid adopting advanced software applications (Khan and Khan, 1992, Chen, 1993). Generally the Information Communication Technology (ICT) diffusion in small and microenterprises is low.

Most SMEs die within their first five years of existence. Another smaller percentage goes into extinction between the sixth and tenth year thus only about five to ten per cent of young companies survive, thrive and grow to maturity (Onugu, 2005). Many factors have been identified as to the possible causes or contributing factors to the premature death. Key among this include insufficient capital, lack of focus, inadequate market research, over-concentration on one or two markets for finished products, lack of succession plan, inexperience, lack of proper book keeping, lack of proper records or lack of any records at all, inability to separate business and family or personal finances, lack of business strategy, inability to distinguish between revenue and profit.

Though many attribute the relatively poor performance of SMEs in Nigeria when compared with the significant roles which SMEs have played in developed economies such as the United Kingdom, Germany and the United States and even developing countries of the world like India to the challenges outlined above, some others hinge the reasons on the fair share of neglect on the sector by the organization (Olorunshola, 2003).

The key issues affecting small and medium enterprises in Nigeria can be grouped into four classes:

i. Unfriendly Business Environment
ii. Poor Funding
iii. Low Managerial Skills
iv. Lack of Access to Modern Technology

2.3.1 Unfriendly Business Environment

This deals with both issues/concerns on infrastructure and properly coordinated policy and regulatory framework, which are major contributors to making the business environment unfriendly to SMEs.

The deplorable state of infrastructure is arguably the biggest problem facing SMEs in Nigeria as opposed to finance as widely perceived. Epileptic power supply, poor road network, lack of clean water, and costly telecommunication facilities amongst others affect all businesses in the country. But has the harshest impacts on small businesses, which are more vulnerable than large enterprises.

The country's legal framework, which encompasses business registration, recognition, enforcement of property rights, dispute resolution, competition and monopoly, etc., is inadequate and unsupportive of SMEs. The 2006 World Bank *Doing Business* report estimates that it takes about 43 working days to register a business in Nigeria relative to 35 days in South Africa and China, 30 days in Malaysia and 15 days in the United Kingdom; meanwhile resolving a dispute via legal mechanisms can take several months.

The policy, legal and operational shortcomings in the country partly explain the poor rating of the Nigeria in *Doing Business* (2005 edition) ranking by the World Bank. The Table 2.6 highlights the result of some countries and it indicates Nigeria is really behind as ranked 118 in terms of ease in starting business and 108 in ease in doing business.

Table 2.5: Country Doing Business - World Ranking (2005)

Country	Ease of Starting a Business (Rank)	Ease of Doing Business (Rank)
Singapore	3	1
United States	3	3
China/Hong Kong	5	5
United Kingdom	9	6
Australia	2	8
Korea	116	23
Nigeria	**118**	**108**

Source: World Bank Report, 2005

2.3.2 Poor Funding

Access to adequate and affordable long-term funds is also a major concern to SMEs globally. SMEs in Nigeria are not exempted. Majority of Nigerian entrepreneurs are dependent on their personal earnings, friends, family, and loan associations/cooperatives (informal sources) as their main sources of financing as revealed in the report by Promoting Improved Sustainable Financial Services (PRISMS) in 2005.

However, funds from these sources are unreliable and inadequate to meet the financial needs of SMEs, thus necessitating funds from formal financial institutions. However, financial institutions have not effectively met the financial needs of small businesses in the country as shown in the graph below, which shows the quantum of funds obtained from various sources (Figure 2.3).

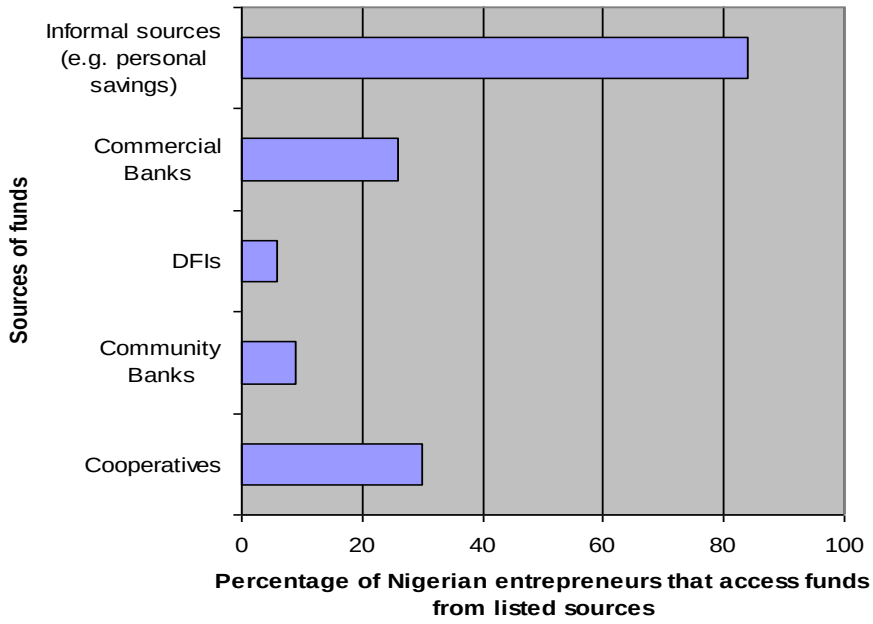


Figure 2.3: Sources of Funds for Nigeria Entrepreneurs (2005)
Source: USAID/Nigeria PRISMS Project, 2005

Some of the challenges faced by SMEs in accessing finance from formal sources include:

i. Inability to provide adequate collateral to meet requirements;
ii. Inability to understand the complex loan application/approval process;
iii. High interest rates;
iv. Short-term duration of loans;
v. Lack of knowledge and proper understanding of the various funding schemes and how to access them;
vi. Lack of managerial skills; and
vii. Poor record keeping

Nigerian SMEs have operated in an economy characterised by rising inflation and high interest rates. With interest rates averaging 21%, it is difficult for small businesses to break-even as a huge part of their earnings is used to service loans.

2.3.3 Low Managerial Skills

The SME industry suffers from a dearth of highly skilled business managers/ entrepreneurs who have the skills required to run a business according to modern business practices and needs. Majority of owners of SMEs do not have adequate knowledge of business practices such as record keeping, business plan development, accounting, etc. Most do not even realise the need or benefits of such practices to even seek the providers of such services.

2.3.4 Lack of Access to Modern Technology

Nigerian SMEs run businesses using traditional labour intensive operations relative to modern technologies. In the agriculture sector, where SMEs are very active and are dominant, mechanised farming is very limited as majority of farmers depend on the use of rudimentary tools like hoes and cutlasses. SMEs in the manufacturing sector also use technologies and production methods that are old and sometimes obsolete. The costs associated with acquiring technology are often beyond the reach of many Nigerian entrepreneurs. The country's level of technological utilisation has not been helped by the total dependence on importation of needed technologies and the lack of a well-developed lease-financing sub-sector.

2.4 PERSPECTIVE ON DOCUMENT AND RECORD

2.4.1 Document

Several different types of documents are produced in the information process of a construction project: architectural and structural drawings, technical specifications, financial calculations, contracts, bills of materials, schedules, meeting minutes, etc. In terms of content, construction documents of today still bear resemblance to those of the mid 20th century. The means for producing and exchanging these documents have, however, undergone major changes.

Photocopying simplified the distribution of documents in the 1970's, and the facsimile allowed to bridge geographical gaps and shorten delivery delays in the 1980's. Since the definite breakthrough of personal computing in the late 1980's and early 1990's, most of documents are produced with the help of computers, and can thus also be distributed electronically. Prior to the Internet era, electronic distribution could be committed over expensive, dedicated private networks or simply by exchanging diskettes.

Towards the late 1990's, increasingly widespread access to the e-mail enabled a significant step towards faster and cheaper collaboration in the digital domain. However, given the amount of documents produced in a construction project, e-mail is far from an ideal solution for managing and exchanging information. In the following sections, the concept of document, record in the traditional and electrical form as well as electronic document and record management would be discussed.

'Document' and 'record' are terms that are frequently used interchangeably. An understanding of these terms is essential to facilitate the capture of records that are

judicial evidence of organisations. Foucault brought a new dimension to the notion of documents. He argued that in the past, the document was always treated as the language of a voice since reduced to silence, its fragile, but possibly decipherable, trace. Hynes (1996), quoting Foucault, states:

> *Document is not the fortunate tool of a history that is primarily and fundamentally memory... In our time, history is that which transforms documents into monuments. In that area where, in the past, history deciphered the traces left by men, it now deploys a mass of elements that have to be grouped, made relevant, placed in relation to one another to form totalities; it might be said, to play on words a little, that in our time history aspires to the condition of archaeology, to the intrinsic description of the monument. (Foucault, The Archaeology of Knowledge, 1972, cited in Hynes (1996)).*

Ability to allocate documents accurately within totalities helps historians to understand the documents and the contexts that contributed to their existence. These surroundings embrace the law, society, culture and civilization, which influence human actions and reactions. In other words the understanding of documents or records leads to the understanding of systems, culture and civilization of the society that produced them. This concept is certainly useful in identifying accountability of any entity within the totalities.

Jenkinson (1949) describes documents as anything written or annexed to writing, by whatever means that writing is made or reproduced. Modern inventions are extending this definition inevitably to substitute for writing technologies such as sound recording. A more comprehensive elaboration by Buckland (1998) states bibliographers and documentalists in the documentation movement concerned with information storage and retrieval problems in the early twentieth century addressed the meaning of ‘document’. One solution was to use ‘document ‘as a generic term to denote any physical information resource rather than to limit it to text bearing in specific physical media

such as paper, papyrus, vellum, or microform. Buckland claims that Otlet, Briet and other documentalists affirmed that:

> *i. Documentation (information storage and retrieval) should be concerned with any potentially informative objects;*
> *ii. Not all potentially informative objects were documents in traditional sense of texts on paper; and*
> *iii. Other informative objects, such as people, products, events, and museum objects generally should not be excluded.*

Levy (2001) provides a much simpler elaboration by stating that documents are quite simply, talking things. They are bits of the material world - clay, stone, animal skin, plant fibre, sand that we have imbued with the ability to 'speak'. Shepherd and Yeo (2003) also state their views, the term 'document' can be used in many ways and even some managers have used 'document' and 'record' synonymously. On the other hand, Barry (1994) claims that documents in preparation or at some early draft stage are not normally regarded as records, until such time as they are communicated into the business or corporate (institutional) domain for comment or action. He further states that a large majority of documents are also records. This statement means that there will be no document once a process has been completed. Instead, only records will be available.

This definition seems unhelpful because people still use the term 'document' to refer to records.

Utilitarian definitions are perhaps more helpful for managing records. Robek *et al.* (1995) define a 'document' as the smallest unit of filing. The International Records Management Trust (IRMT, 1999) defines a 'document' as a unit of recorded information, while for the International Standard Organisation (ISO) (2001) it is recorded information or object, which can be treated as a unit. The similarity of these

definitions that embrace documents and records supports smooth administrative and business operations. Roberts (1994) provides two definitions of 'document'. First, a 'document' as recorded information, regardless of medium or form, a meaning that can be applied to both paper and electronic documents. The second definition is a 'document' as a physical record item or unit, perhaps in terms of a specific physical format. There is similarity between the definitions by Robek *et al.* (1995) and Roberts (1994), in that all the authors agreed a 'document' is a unit of filing. This definition covers the usage of the term 'document', when referring to a component in filing.

Above all, the notion of document from a legal perspective is essential. In the UK, the Civil Evidence Act 1995 section 13, states:

> *… 'document' means anything in which information of any description is recorded and 'copy', in relation to a document, means anything onto which information recorded in the document has been copied, by whatever means and whether directly or indirectly.*

Apart from paper and its predecessors (parchment, vellum, stone, marble, clay and metal); film, photographs, video tape, audio tape, computer disks, fax, are all capable of being documents within the meaning of the Civil Evidence Act (Uglow, 1997). Records managers with the assistance from other professionals are expected to identify records of judicial evidence, in any format, to be kept for any subsequent possible legal requirements.

2.4.2 Record

One of the many problems facing any serious study of Records and Information Management (RIM) work is that of terminology. Words and concepts such as data, information, knowledge, documents and records are sometimes used interchangeably

with each other, and often may mean different things to different people. Different people of various backgrounds may interpret the same word differently. This is particularly true of records. Even amongst the RIM group, there is not as yet a unified or generally accepted definition for the word.

When discussing records management, either as management tool or as a profession, there seems to be a fundamental problem of how to define the core element of the subject in the field - the records. Definitions of records seem to be continually debated in the literature. Some definitions are based specifically on the function of the records, whilst others treat records as physical objects for posterity. It is not the author's intention to list all the various definitions of records, but a few are required to show that there is a range of different perspectives in defining the term.

Cox (1995a) has discussed problems in defining records at length. He observes that many definitions of records are complex and problematic. He suggests that "most archival and records management literature suggest authors and readers know a record when they see one, yet the essence of 'a record' may be contrary." There is still a fundamental problem with how both sets of practitioners (archivists and records managers) define records, though both are engaged in managing the same type of resource (the records) as their main activity. As such, Cox suggests that the definition of records should be continually debated.

The difficulty in defining records is not only restricted to practitioners; it extends to other writers in the field. Some writers on records management are often bogged down with the problem of establishing or agreeing a comprehensive definition of records. Langemo (1995) regards records as the 'memory of organisation', the 'raw material for

decision making', and the 'basis for legal defensibility'. Langemo's opinion represents one of many views about what records are. The variety of definitions that one encounters in the textbooks makes it essential in this section to achieve an understanding of what records are before we can be in a position to develop the idea of records management. While all records convey information, not all sources of information are necessarily records. Records arise from actual happenings; they are a 'snapshot' of an action or event. They offer a picture of something that happened. To serve their purpose in providing reliable evidence, records in both paper and electronic form must be accurate, complete, and comprehensive.

It can be argued that any definition of records is pragmatic. The definition has changed with the passage of time and as the profession gets involved with more complex issues. This is particularly true when one considers the subject from the perspectives of those involved with paper as the main records medium and those working in an electronic environment. Traditionally, differences in definition are based around the record's function and the record's preservation for posterity. Each of these definitions reflects an existing school of thought underlying records management practice. One-school views records from a functional or management standpoint while the other views it from the standpoint of archives (Cook, 1993).

The definition of records from the functional standpoint is clearly pictured by Gagnon (1987). He says records are:

> *all recorded information regardless of media or characteristic, made or received and maintained by an organisation or institution in pursuance of its legal obligations or in the transaction of its business.*

This functional based definition has been adopted by the School of Library and Information Science, University of Pittsburgh in its *Recordkeeping Function Requirements Project* (Cox, 1995b). This project started in 1993 and completed in 1996, developed and tested a set of recordkeeping functional requirements and their applicability in electronic recordkeeping systems.

The Association of Records Managers and Administrators (ARMA International) as cited by Robek *et al.* (1995), rejects Gagnon's definition. This professional society defines records as "recorded information regardless of medium or characteristic". In considering the definitions by Gagnon and ARMA International, Cox comments "those definitions are actually describing records as physical, tangible objects. One provides a specific function while the other is rather vague. The latter is trying to include anything similar to what a record might be" (Cox, 1995c).

It appears that the definition of what a record is began to vary and expand as the profession has developed and shifted its emphasis from the traditional function filing and storage to retrieval and dissemination; and to the handling of records in electronic systems. The function of the record has also changed, from that of documenting organisational activities, to that of providing information for decision-making and providing evidence and compliance. This function is likely to become more complex as advances in technology urge the profession to handle more complicated materials and issues.

A variation in definition is found where records are viewed in the broader context of information. According to Penn *et al.* (1994) whose definition focuses on the informational content of the record. Their definition includes "any information captured

in reproducible form that is required for conducting business". This is at variance with Smith who makes the point that-.

> *records contain data, ... therefore are the substance of information. Information is contextual, that is one cannot have information without data, but one can have data without information. A record must be viewed within the context of an organisation to be meaningful and have value. In isolation, a record of specific transaction, discussion, or agreement is often meaningless. Because records are form or medium oriented, whereas information is contextual, blurring the distinction between the two can create problems. While records are static and finite, information is changing and on-going (Smith, 1986).*

Apart from the definition by Gagnon and ARMA International, Gill (1993) puts a sense of archives into his definition. He defines records as:

> *any media ...documenting communication in an enduring format that preserves the communication and can be recalled. They are facts to support decisions, ... and facts upon which to base future decisions; facts to communicate to employees, to customers, to potential- customers, to the government, and to stockholders; facts to document the history of a company (1993).*

Gill's, definition specifies a business environment. However, Emmerson's (1989) definition is more comprehensive. It states:

> *records are all those documents, in whatever medium, received or created by an organisation in the course of its business, and retained by that organisation as evidence of its activities or because of the information contained. Records, it must be stressed, are, first and foremost, products of the activities of which they form a part. They arise naturally from the functions, activities, processes and transactions, substantive and facilitative, of the creating organisation. Indeed, records have no existence other than as a product of business activity, without which they have no context or meaning (1989).*

Whatever definitions have been given to records, it seems that the definition of the term is likely to be continually debated especially where electronic records come into existence.

Realising this, Cox (1995a) calls for the need to develop a firmer definition of records. This is crucial and essential in order to provide better understanding of what records management is all about. What is needed, he argues, is a degree of tolerance in order to arrive at an acceptable definition of records, which emphasises the commonalities of the missions between the various segments of the information management professions.

Before the advent of electronic systems, Cook had seen the relationship between information and records in much simpler terms. He distinguishes information as something current, up to date and eventually disappearing (1993). But, he argues, some kinds of information have much more static, permanent or long-lasting qualities. Cook (1993) sees records as information media, which are created in the course of business organisation. They are kept because organisations need to use them. Cook's definition however, emphasises the role of paper-based documents, though he admits that the medium can be anything such as recorded sound, machine-readable disks, microform or parchment.

Cook's definition is expanded upon by Penn *et al*. (1994) who state that business records are any information that is: recorded on any physical medium; generated or received by a business enterprise as evidence of its organisation, functions, policies, procedures, operations, and internal or external transactions; and valuable because of the information they contain. They stress that there are three key factors - the physical form, evidence and value - that differentiate records from other types of information particularly in terms of data processing.

As a new phenomenon, the concept must be made clear so that business can assess the advantages and benefits to be gained. In this review of literature, various definitions of

terminology have been considered in order to arrive at a definition that can be easily understood, particularly within business organisations. In this respect, the author's consideration of the concepts is not intended to enhance the philosophical debate relating to records or information and its relation to wisdom. In a pragmatic management way, it is used broadly to refer to recorded information created as the result of the activity.

2.4.3 Electronic/Digital Document

The phenomenon of ICT has resulted in the production of various types of digital documents as well as conventional paper documents. Buckland (1998) argues that attempts to define digital documents are likely to remain elusive, if more than an *ad hoc* pragmatic definition is wanted. A more comprehensive notion of document developed by Foucault is certainly useful for understanding their total complexity. A document is not only a single entity as it is seen, but its interpretation extends far beyond. Its relationships with other entities to form totalities are essential for a greater understanding of their content. In the electronic environment, which cannot be seen by naked eyes, digital documents present a far more challenging and complicated situation. Due to the very nature of digital documents that are intangible and the instability of binary code, digital objects are prone to changes, both physically and electronically. Defining an object based on form, format and medium appear to be less satisfactory than a functional approach, following the path of reasoning underlying the largely forgotten discussions of Otlet's objects and Briet's antelope. Otlet (as cited in Buckland, (1998) stressed the need for the definition of document and documentation to include natural objects, artifacts, objects bearing traces of human activities, object such as models designed to represent ideas, and works of arts, as well as text. Briet (as cited in

Buckland, (1998), a French documentalist, claimed that the catalogued antelope is a primary document and other documents are secondary and derived. Buckland comments that objects are ordinarily documents but become so if they are preserved for informational purposes. To this end, a digital object would only be meaningful when supported by adequate contextual information.

This claim is based on the understanding that in digital form, what appears on screen is not everything. The result must be supported with processes (algorithm or function) hence producing a digital document. Therefore, each and every algorithm or function has to be approved by a responsible entity to produce results that represent the intended business operations. Irresponsible parties can manipulate electronic data to generate the same result, which does not represent the actual operation. This situation can only be traced if a reliable audit trail exists. Audit trails are usually reviewed at regular time intervals or in response to accountability triggers. Because the document is a part of a record series, its authenticity underpins the authenticity of all the records in the series. In a more complicated situation, such as in database environments, preserving authenticity of digital documents often requires records managers or archivists to draw statistically sound samples from the datasets to determine which of the actual files are to be preserved in the long term, while at the same time preserving the dataset to provide the overall context. As a consequence, the archivist's task will be complicated rather than simplified by the existence of large datasets of personal records (Moss, 1997).

The terms ‘digital’ and ‘electronic’ document are also used interchangeably. Most document management software uses the term Electronic Document Management System instead of Digital Document Management System. Even though both terms

refer to the same conditions binary digits of 0s and 1s, the term ‘electronic’ is more widely used. The term ‘digital’ is frequently used to refer to digitisation, where documents are converted into digital form, with obviously the same electronic form. This might be the result of a conversion process, which is known as digitisation, converting analogue into digital form. ‘Digitally born’ refers to objects electronically created rather than converted into digital format. In other words, there is no absolute term. Either ‘digital’ or ‘electronic’ terms can be used to refer to the same situation or object. Even though both terms refer to the same processes, the term ‘electronic’ is more widely used.

2.4.4 Electronic Records

In the computer era, the problems in defining records are becoming even more critical. Skupsky (1995) admits that, with the widespread use of information management technology, it has become more difficult to determine exactly what a ‘record’ is. He questions the fact that traditional definitions of records that have emerged from paper-based concepts have merely been applied to these new technologies. This can handicap the records manager today. Clubb (1991) concludes that it was relatively easy to provide a definition of a record a generation ago. However, with advances in technology, the definition of the term needs to be reviewed.

Duff (1995) claims that records in an electronic environment are transitory, unstructured and insubstantial, as their form and content can change with changes in the software that control them. The principles applied to paper-based records are no longer applicable to those in electronic form. In the paper environment, records are tangible, their creation and the function they serve can be easily recognised (*Management of*

electronic records; issues and guidelines, 1990). But this is not the case with electronic records: records managers are not in a position to see records as they are created and transmitted, the records exist under software and hardware control.

It could be argued that with the rapid changes in technology, and the challenges and substantial risks faced by the records manager in this latest environment, records management should incorporate another stream of thought. The archival and information management approaches, although they have resulted in the presently accepted principles and practices in records management, are inadequate to cater for the changes brought about by information technology which impacts upon today's records. A blend of existing principles which comprise theories of archives and information management, integrated with the principles and practices of information technology will lead to a vast improvement in the quality and success of records management.

As IT is incorporated into the new approach, O'Shea (1996) realises that there are two areas that require immediate attention. Firstly, the definition of records needs to be updated, and secondly, there are needs to be a re-evaluation of the techniques required to capture and preserve records as evidence of organisational transactions. Most importantly, the record that is the main interest of both records management and archive professionals needs to be precisely defined in these contexts as other information professionals commonly use the term.

Traditionally, and practically, records have been viewed as physical objects such as paper files, tapes, disks etc. Such a description presents a major problem with electronic records since in the electronic systems; records are neither purely documents nor objects. They are dependent on the medium on which they were originally or currently

held. Individual records and their component parts are not necessarily physically located in a logical sequence (O'Shea, 1996). Based on such characteristics, the concept of the life cycle, which forms the primary conceptual framework of paper-based records management, is no longer appropriate for electronic records although, clearly, the concept is still central to the management of these records.

The Society of Australian Archivists supports the above argument. In the Australian Archives Act 1983 records are defined as physical objects:

> *a document (including any written or printed material) or object (including a sound recording, coded storage device, magnetic tape or disc, microform, photograph, film, map or graphic work) that is, or has been, kept by reason of any information or matter that it contains or can be obtained from it or by reason of its connection with any event, person, circumstance or thing.*

In contrasting this definition with the definition of records in an electronic environment, the author refers to this as the 'records as objects' environment. This definition does not adequately define electronic records. This is because electronic records are neither pure documents nor objects, they are independent of the medium, and are not located in a logical sequence or in the same physical space. Furthermore, the definition does not provide any evidentiary test (O'Shea, 1996).

Realising the problems of applying the Australian statutory definition to the electronic environment, the Society proposed to update the definition. The new definition is:

> *a record is that which is created and kept as evidence of agency or individual functions, activities and transactions. To be considered evidence, a record must possess content, structure and context and be part of a recordkeeping system. (http://www/aa.gov.au/AA_WWW/A A_Issues/managing ER. html# What).*

Stressing that for any document to qualify as a record, it must have evidentiary value has further expanded the definition. Records must be seen as evidence of business

transactions. The concept of evidence is central to this new definition. O'Shea (1996) stresses that "for a document to be useful as an evidential record, it must possess content, structure and context and be part of a recordkeeping system. A document in an information system which is, "used ... for consultation"' only, has limited value as evidence".

Defining records in an electronic environment poses several conceptual problems. On the one hand, Cox suggests that the functional approach is an excellent conceptual framework in which a practical means of managing records can be developed; whilst Duff holds that the transactional nature of the record is the core concept in defining records (1994). On the other hand, Bearman emphasises the aspect of evidence. He firmly asserts the importance of the characteristic as central to the electronic records management issue (Bearman, 1995).

Bearman has called for a review of the approaches and concepts used in managing records as a result of the increasing proportion of records now in electronic formats. He observes that in the 'records as objects environment', the discipline depends on the study of original texts, images and multimedia sources. The emphasis has always been centred on the ability to view sources, which have been created in the past, the certainty of authenticity and ascertaining provenance. However, the electronic environment broaches questions of how to create and preserve electronic records with provable authenticity. Authentication is important to ensure records serve their evidential function. Records will only be evidence if the content, structure and context information (metadata) required to satisfy the functional requirement is captured, maintained and

made usable (Bearman, 1995). Since electronic records can be easily amended, leaving no trace of the original version, special precautions therefore need to be developed.

The issue raised by Bearman has prompted O'Shea to suggest that there is a need for a re-evaluation of the techniques required to capture and preserve records as evidence or organisational transactions (http://www.intergate.bc.ca/netpac/provenance/vol.l.and2/features/erecsla.htm).

Bearman's views are supported by Duranti, Eastwood and MacNeil (http://www.slais.ubc.ca.users/duranti/teml.htm). They agree that in the 'records as objects environment', a record needs several components such as medium, content, form, persons and actions. Records consist both of the information and the carrier. Since most records are created on paper, so records have traditionally received treatment as physical materials. In other words, it is the medium that has been the concern in the past and records are not affected by their state of transmission (http://www.slais.u bc.ca/users/duranti/tem3.htm).

Cook agrees that the situation discussed above is no longer practical as electronic methods come to dominate administration. He says that in this situation, records are both objects and components in dynamic systems (1993). A record itself is not a physical substance, but an abstract commodity, which takes real form only when captured and put on to a carrier. As such, the basic idea of the record has been transformed significantly and the standard means of describing records are inadequate for electronic records. Records in the electronic environment are different in physical form, technological dependence, use and custodianship (Cox, 1995a).

This 'records as electronic objects' environment now seems to offer the best way forward for an acceptable and universal definition. That there is now a degree of agreement can be seen in the definition in the Australian Standard, the European view and the definition adopted by the International Council on Archives (ICA) Committee on Electronic Records.

Records are defined by the Australian Standard as "recorded information, in any form, including data in computer systems, created or received and maintained by an organisation or person in the transaction of business or the conduct of affairs and kept as evidence of such activity". The European view on records as expressed in the INSAR document is that: "a specific piece of recorded information generated, collected or received in the initiation, conduct or completion of an activity and that comprises sufficient content, context and structure to provide proof or evidence of that activity" (INSAR, 1997). This definition agrees with the international definition from the ICA Committee on electronic records.

Regardless of the environment in which records are created and managed, as Hare and McLeod (1997) correctly point out, there are three aspects common to all records. These are the message or the information they carry, the medium or the physical carrier of the information, and the context or the purpose for which they were created.

Duranti (2001a, 2001b) simply defines electronic records as records that are ‘born digital’ (The requirements of authenticity and reliability, which are stated in ISO 15489, are also requirements for electronic records. Electronic records have changed the way in which one can interpret a record. The electronic record is not necessarily a physical entity, which in electronic form can be, for example, a Word document (e.g.

Thomassen, 2001; Reed, 2005); it is possible that electronic records may be more of a logical entity. An electronic record can consist of several components that are managed in different databases, or information systems (Dollar, 1992). This duality makes it possible for the electronic record to both appear as 1) an entity; and 2) aggregated or composed by data from different sources. Records that are transformed from analogue form into electronic form are also treated as electronic records.

Electronic records are created within a transactional or business context and kept as evidence of that business activity (i.e. they have an evidential purpose). In contrast, electronic documents are typically created and managed using various data and document management tools such as Electronic Document Management (EDM) software. When an electronic document is part of a business transaction, then it becomes part of an electronic record.

Based on the discussion above, it can be concluded that there is as yet no single definition acceptable by all. However, attempts are being made to develop a definition as comprehensive as possible suitable to cater for all approaches. This is evident from the most recent definitions referred to above (the Australian Standard, INSAR and ICA) that all support the concept of the separation of the message from the carrier (the system), and the need to concentrate on the logical structure or entity as the means of providing authenticity and evidence.

For the purpose of developing a framework in this research, this study prefers the definition of records as offered by the Australian Standard. The Standard defines records as "recorded information, in any form, including data in computer systems,

created or received and maintained by an organisation or person in the transaction of business or the conduct of affairs and kept as evidence of such activity".

2.4.5 Building Construction Project Records

According to (Wildman, 1990), the extent of record keeping required for a particular construction job will depend on the type of contract. However, some record keeping will be required in any case because it is:

i. *Required by law*
ii. *Required by the terms of the contract*
iii. *Needed to control the on-going work*
iv. *Needed as data for estimating future work*
v. *Needed for preserving the contractor's rights under the contract*

The first item listed above is ascertained by referring to the authorities having jurisdiction over the place of the work. The second is determined by a thorough reading of the contract documents, both in terms of the administrative requirements contained in the general and special conditions, and the technical requirements contained in the specifications. The third, fourth and fifth items are for the contractor to decide, and depend largely on his disposition.

Perhaps the best case that can be made is that, if the contractor wishes to remain profitable he must maintain control of his on-going work, and control of on-going work requires on-going records. Some records may need to be kept daily, others weekly, and still others monthly. Different frequencies are appropriate for different records, but the key is that all such records must be on going. Studies have however shown very often

most of these records are poorly kept by supervisors (Scott *et al.*, 1997; Sommerville *et al.*, 2004).

From the literature, various activities that required be documenting and keeping as records were identified commencing from initial construction stage to handover stage of the completed building projects (Nigerian (2006) and Canadian (2007) National Building Codes; ISO 9000 and International Building Code (2009)). A good set of records (Table 2.7), that might be kept on a fair sized construction project could well include the following files. These files could be assembled into blocks of like subject matter, and this approach could greatly facilitate ease of filing and subsequent retrieval.

2.4.6 The Importance Records and Records Management to an Organization

Changes have occurred in the perception of information, from where information was regarded as a burden, to information as a resource as at present. This has made information increasingly an organisation's most prized asset, and a dominant commodity, giving many businesses untold competitive advantage (Wadding, 1995). Business activity now depends on information, the fourth type of resource (Chartaby, 1991) that plays a vital role in ensuring that organisations remain competitive in their respective industries. Information has undergone a shift of paradigm where it is no longer perceived as a burden. It is now acknowledged as a vital component of management resources that helps decision-making, avoids failures, and helps meet organisational goals. As a result, information now exerts some pressure on organisations to devote more effort to their information handling mechanisms.

The importance of information has persuaded many organisations, especially in the UK and the USA, to invest in their information management budgets to ensure their

survival, and meet the legal requirements of their country. Skupsky and Montana (1994) stress that organisations must comply with laws that affect them based on the jurisdictions in which business activities are carried out, their office location and manpower, types of products manufactured, the environmental impact by business and other aspects related to regulation currently enforced by any individual country. Business organisations must have adequate knowledge of the relevant key laws and regulations. This means that business organisations are required to possess some legal responsibilities that must be manifested in their records management programme. One of the ways is through the records retention schedule, which determines which records, must be kept and for how long. An adequate knowledge in this aspect will help organisation to retain records according to law, which will then prevent organisation from potential legal risks. Records will be in a ready state for access in case any legal problems arise.

Many large-scale organisations employ personnel to handle their information and to develop sophisticated techniques in order to exploit their capability for information processing. A third of all large-scale organisations in the USA employ 'Chief Information Officers' with the main objective to manage the information resources of the organisation (Modern Office Technology, 1992). Drucker (1988) makes the point that information is central to corporate operations, and information managers are essential to the enterprise.

Table 2.6: Set of Construction Project Record

S/No.	*Project Record*	*S/No.*	*Project Record*
1	Original Contract Tender Documents	20	Actual Cost Reports, weekly or monthly, including Exception Reports.
2	Issued for Construction set, and all subsequent revisions	21	Forecast-to-Complete Estimate up-dates
3	Instructions to contractor	22	Productivity Reports/Analyses
4	Contemplated Change Notices issued by the owner, Change Estimates, and Change Orders received	23	Inter-office correspondence, including memos and faxes (all filed by topic).
5	Sub-contractor quotes, contracts, purchase orders and correspondence	24	Contract correspondence
6	Shop drawings, originals, all revisions and re-submissions	25	Minutes of Contractual Meetings
7	Shop drawing transmittals, and transmittals log	26	Minutes of Site Coordination Meetings
8	Daily time records	27	Requests for information
9	Daily equipment use	28	Notice of claims for delays and/or extra cost by contractor
10	Daily production logs, e.g. concrete pours etc.	29	Government Inspection Reports
11	Material Delivery and Use Records, including expediting	30	Accident Reports
12	Accounting records: pay-roll, accounts payable and receivable, etc.	31	Daily diary or journal entries
13	Progress Payment Billings under the contract	32	Notes of telephone conversations
14	Daily Force Account Records, pricing and billings	33	Progress Reports, weekly, monthly or quarterly
15	Contract Milestone Schedule or Master Schedule	34	Progress photographs
16	Short Term Schedules and up-dates	35	Any other reports, such as special consultant reports
17	Task schedules and analyses	36	A Filing Record of all the Record Files that are being maintained
18	Original tender estimate	37	Consultant Inspection Reports
19	Construction control budget		

The paradigm shift in information has resulted in the creation of titles such as 'Information Resource Manager' or 'Information and Records Manager'. These imply a way of looking at information and a set of skills and tools to bring to bear on information (Candy, 1993). The argument by Candy implies that the terms ‘records' and

'information' are synonymous and can be used interchangeably. The information that is recorded in some form are records, they contain information about, and evidence of, organisational functions, policies, decisions, procedures, operations and other activities (Ricks *et al.* 1992). Thus the term 'records' and 'information' in many textbooks are being used interchangeably based on the argument that records are the recorded form of information.

However, records need special management, which is different from other types of information such as archives and library materials (Penn *et al.* 1994). A systematic approach to records must be applied from the moment records are created. This is to ensure that only records of identifiable importance are created. Records that have enduring value must be identified from the very beginning so that further action can be taken. Not to mention records in electronic environment; records in paper-based environment pass through several stages from active to non-active through semi active phases. These phases of records require systematic management to enable organisations to recognise what records to retain what are to be disposed-of. There is a distinct need for managing records compared to other types of information.

Pech and Mathew (1993) indicate that there are nine major factors that usually contribute to business failures, especially those operating on a small scale. These include:

i. *lack of financial planning;*
ii. *unavailability of business records;*
iii. *lack of understanding or not using business records;*
iv. *poor financial management;*

v. *poor debt management;*

vi. *poorly managed inventory;*

vii. *weakness in determining costing/pricing;*

viii. *poor market research and*

ix. *overborrowing*

Bennet and Berkey (1990) discovered that small-scale businesses are commonly found not to use standardised filing equipment. Their filing equipment is not protected from disaster such as fire, theft and other forms of vandalism. Furthermore, records storage equipment do not meet the organisation's needs; records classification is not used; active and non-active records are not stored separately; and vital records are kept in active files without proper safety measures. The cost of keeping records is not known and they are not aware of the necessity of retaining records as required by government and by law. Records are not used in planning the operation and the future growth of the business.

Many organisations are ultimately faced with the problem of information overflow. Therefore a system must provide for the entire life cycle of information from the creation stage, through usage and maintenance to ultimate disposal, either as final destruction or kept for research. It is the role of records management to assist in the effective and efficient management of organisational records. Honkanen (1992) says organisations need a complete record of the past and present and a way of keeping important information. At the same time they need to decrease the volume of space required to keep that much information in paper form. Records management can assist in the effective and efficient management of organisational records (Candy, 1993). The main issues in increasing productivity are the need for information systems, cost justification, efficiency, access, location, compliance, security and service (Honkanen,

1992). Records management is important to the cause of an organisation's operation in the West because it provides a means of information retrieval. It provides a major success story at a time when organisations are struggling for their survival. Additionally, it offers control to today's organisations in the world of electronic communications, databases and terminals (Zawiyah and Chell, 1998).

Records management provides the procedures and service with the best combination of management resources, capital, technical resources, goodwill of users and creative thrust that are necessary to develop such a new service. Ricks *et al.* (1992) point out that organisations need records management for several reasons that include managing and preparing corporate memory; helping management with better decision-making; providing litigation support; controlling the volume of paperwork and cost reduction; promoting organisational efficiency; meeting legislative and regulatory requirements and keeping documents for historical reference. Robek et al. (1995) assert that records management brings additional advantages. They give ten business reasons that support the need for records management. These include controlling the creation and growth of records, reducing operating costs, improving efficiency and productivity, assimilating new records management technologies, ensuring regulatory compliance, minimizing litigation risks, safeguarding vital information, supporting better management decision-making, fostering professionalism in running the business, and preserving the corporate memory.

Poor records management could create business problems, particularly in matters relating to liability, litigation and finance. Conversely, with good records management practices, organisations could make well-informed decisions and increase profits (Mbamali, 1996; Kartam, 1999; Kululanga *et al.*, 2001).

The records management function should impact across the whole organisation and not be confined to one central department. Due to its far-reaching nature integrating the records management function into an organisation's business systems, processes and culture often requires a significant amount of resources.

The benefits synonymous with records management are well understood and often repeated. These commonly include:

a. Intangible benefits

i. *effective compliance with the data protection principles;*

ii. *effective compliance with freedom of information and other information-related legislation;*

iii. *demonstrating the authenticity of records to increase the evidential weight for legal admissibility;*

iv. *improved decision-making and policy formation supported by reliable information;*

v. *increased accountability by providing reliable records of actions and decisions;*

vi. *improved innovation and creativity through enhanced corporate knowledge management; and*

vii. *efficient collaborative working*

b. Tangible benefits

i. *increased efficiency in retrieval of records;*

ii. *increased efficiency in receipt and fulfilment of customer orders;*

iii. *reduced storage costs associated with keeping only required records;*

iv. *reduced storage costs moving from paper-based to electronic storage;*

v. *reduced storage costs associated with offsite storage;*

vi. *reduced consumable costs associated with less paper-based records;*

vii. *increased productivity associated with automation of information related tasks and use of document templates; and*

viii. *reduced staff costs due to efficient performance of information related tasks*

2.4.7 Use and user of records

In this section some theoretical perspectives of use and users in archival science are presented. The perspectives are then put in relation to traditional information systems research perspectives of users and use.

In archival science limited research efforts have been put into studies about access, use, and users of records (Sundqvist, 2007). Sundqvist argues that studies on use and users are important in order to be able to conceptualize those concepts in the electronic records era. Without knowledge and conceptualization of use and users of records, design of electronic recordkeeping systems could be difficult (Sundqvist, 2007). A distinct difference is found in the literature between use and users of records. Different perspectives on use will be presented first.

In archival science a theoretical distinction between a record's primary and secondary value (Schellenberg, 1956/1998) has been basis for different views of use. The primary value of a record is its value to the organization in which the record is created, and its use is also found in this context. The secondary value for records is its evidential value and informational value suitable for future research, i.e. when records are no longer of operational value for the organization; they are valuable to researchers (Schellenberg, 1956/1998). Schellenberg represents a perspective on records and archives, where the record is primarily kept for evidential purposes, and preserved long-term for research purposes. Another contribution that makes distinctions between different use categories

is presented by Shepherd & Yeo (2003). Shepherd & Yeo present three different purposes of using records: 1) Business purposes; 2) Accountability purposes and 3) Cultural purposes. According to Sundqvist (2007), this may be an attempt to bridge between the two values of records presented by Schellenberg (1956/1998). In the ISO 15489 (International Standards Organization, 2001) a set of different organizational benefits of records is presented, e.g.:

i. *Conduct business in an orderly, efficient and accountable manner*
ii. *Support and document policy formation and managerial decision making*
iii. *Provide consistency, continuity and productivity in management and administration*
iv. *Facilitate the effective performance of activities throughout an organization*
v. *Meet legislative and regulatory requirements including archival, audit and oversight activities*

Pugh (1992) has yet another contribution to the definition of records use. She presents two categorizations of records use: *direct use;* and *indirect use of records*. Direct use is when someone is actually using a record by e.g. reading a record. The indirect use is when someone is affected by someone else's direct use of records.

According to Sundqvist (2007) there are extensive research efforts on user studies in archival science. However, the research is limited to user behaviour in archival institutions. Research about records users in organizations seems to have been given lower priority.

There are some small differences between the way use and users have been applied in information systems research compared to the archival perspective presented above. The IS research tradition usually interprets users as those individuals that are physically

going to use or interact with the information system. It is also possible to find this perspective in IS educational literature (e.g. Pressman and Ince, 2000). A study of the use of information technology constitutes one part of the field of research called the *new informatics* (Dahlbom, 1996), and social informatics (Kling, 2000). Another user perspective is the involvement of users in systems development (see e.g. Saarinen and Sääksjärvi, 1990; Bjerknes *et al.* 1994 and Bratteteig, 1995). In information systems quality research the quality of an information system can be measured by user satisfaction when using an information system (Bailey and Pearson, 1983; Ives, Olson, and Baroudi, 1983; Doll and Torkzadeh, 1988; DeLone and McLean, 1992, 2003;) Satisfied users have been used as the easiest way to assess whether or not an information system has fulfilled its stated and implied needs (Dahlbom and Mathiassen, 1993).

In archival science interest in the use of information technology has been of secondary value. In archival science the user uses records, i.e. a subset of information. If the record is electronic the user must use information technology to access the record, but only because the use of information technology is necessary in order to use the records. In comparison, IS research focuses on users that use information technology, and not mainly on users that use information. The border between use of information technology and use of information does not have a sharp edge. Although the concept of the user is very widely used in various information systems research contexts, there is some criticism of the concept. The term' user' is imprecise: Is everyone interacting with an information system a user or are they something else? According to Lamb and Kling (2003) the term 'user' can be someone using an information technology artefact (information system) on a daily basis. Modern information technology opens up the

prospect of a different type of user, a user that is not a primary user of information technology. This kind of user is better described as a social actor (Lamb and Kling, 2003; Lamb, 2006).

In this dissertation a user of records is an individual that uses records as subset of information. Access to records could be given by use of different information technology artefacts such as e.g. information systems.

2.4.8 Electronic Documents and Recordkeeping Challenges

Changes in technology and multimedia have brought new types of records into existence. They are more difficult to identify and therefore challenge the record keepers' ability to capture them in a static or permanent form that will enable them to provide evidence of business or administrative transactions.

In traditional paper-based document systems, the media and format used for a record has been the same for the entire history of the record from creation, transmission, use, and reference, through to storage. There is no difference between preserving the form and preserving the content because of the permanent relationship between the physical format of the paper and the information it contains.

For electronic documents, the media and format of information can be changed during the lifecycle of the document, and the actual encoded format during authoring or creation, transmission and storage is almost certainly different in order to support the processing required at each stage (Hoffman, 1999). Therefore, the form of a record only exists when it is generated during authoring or creation, printing or viewing and may be slightly different for different creating and display devices.

This confluence of form and content also forces the development of information locator system and carefully organized filing systems for paper based records. They are needed because the content of records may not themselves include references to descriptions of business processes and because the content of records is not directly searchable. However, electronic or digital records permit direct access to their content through indexing and search techniques. As a result, the approach to finding aids and search and retrieval can be completely different

Electronic transactions are in principle no difference in nature from their paper counterparts; they need to be recorded, captured in a fixed form, maintained and made accessible as records. Electronic records should provide the same degree of evidence of business activity and support the same level of accountability for the immediate and future needs of organisations, individuals and societies. However, they are far more venerable than paper records and must be carefully managed to ensure their accuracy and authenticity as proof of accountability as the term preservation as applied to electronic records no longer refers to the protection of the medium of the records, but to that of their meaning and trustworthiness as records (Duranti, 1999).

Even when records survive, and can be read, further challenges remain: can the particular record that is wanted be found? Can it be read and understood? Can the user be sure of its authenticity? “Divorced from the control associated with paper-based filing systems an electronic record may convey little meaning to those who need to use it, as there is often no visible evidence of the context in which it was first created” (McDonald, 2003). “If a record is required in legal proceedings, it may also be necessary to prove that it is genuine and complete, and that it has remained secure from deliberate or accidental amendment. If electronic records have not been managed

effectively, such proof will probably be impossible to provide" (Crockett and Yeo, 2001). Thus designing and building systems that ensure the survivality, accessibility, availability and integrity of electronic records is a challenge that every record keeper and organizations needs to meet. However, the record keepers have not necessarily been made aware of their responsibilities (McLeod *et al.* 2004).

2.5 RECORDKEEPING AND RECORDKEEPING SYSTEM

2.5.1 Recordkeeping and Record Keepers

Based on the ISO 15489 (2001), and discussion by Evans (1990), Bearman (1994), Erlandsson (1997), McKemmish *et al.* (1999), Brogan (2000), Hurley (2000), and Kilkki (2004) the writer is able to conclude that the term 'recordkeeping' should be understood as referring to the creation and maintenance of complete, accurate and reliable evidence of business transactions in the form of recorded information. The above writers suggest that the record keepers must fully appreciate their job and responsibilities in recordkeeping functions and activities aimed at protecting the integrity and authenticity of records as evidence of accountability in the electronic environment.

Based on the view of Emmerson (1989), Blethyn and Parker (1990), Cox (1992), Duff (1995), Barata and Cain (1999), it is obvious that 'record keepers' is not an undifferentiated term. It includes various categories of personnel involved in the management of records, archives and information. In this dissertation, therefore, the entire management of records goes under the term recordkeeping, which is a term associated with the Australian archival tradition.

ISO 15489 (2001) clearly states that the electronic recordkeeping activities involve four groups of key players. They are record creators (senior managers/administrators and the various administrative staff) throughout the organization; record users (managers/admin istrators and the various administrative staff); record management professionals (records managers/officers and other records staff/archivist/archives officers and archives staff); and technical staff dealing with design and maintenance of information technology managers or management information systems managers their subordinate staff including system analyst, programmers and data base administrators).

2.5.2 Recordkeeping System

A "recordkeeping system" is a manual or automated system that collects, organizes, and categorizes records, facilitating their preservation, retrieval, use, and disposition. A recordkeeping system has four components:

i. ***Records*** *- information resources, in any format, that are:*
   a. *created in the course of business,*
   b. *received for action, or*
   c. *needed to document Agency activities*
ii. ***People*** *- the Records Liaison Officer and records contacts, who oversee a records management program; and Agency staff, who create, receive, and use records in conducting EPA business.*
iii. ***Processes*** *- procedures on how to manage records throughout their lifecycle.*
iv. ***Tools*** *- equipment and software used to capture, organize, store, track, and retrieve the records*

Several types of systems that control and manage records exist in recordkeeping. In advance countries, many organizations records are managed by electronic records management systems (ERMS). The definition of an ERMS is: “An automated system

used to manage the creation, use, maintenance and disposal of electronically created records for the purposes of providing evidence of business activities./…" (National Archives of Australia, 2004). A closely related system type is the electronic document management system (EDMS), which is defined as: "An automated system used to support the creation, use and maintenance of electronically created documents for the purposes of improving an organisation's workflow./…" (National Archives of Australia, 2004). An EDMS differs from ERMS in many ways. In an EDMS documents are managed, they can exist in many versions, be deleted and changed by their users, and the structure of the storage is optional. In an ERMS records are managed, only one final version can exist, deletion is very regulated, and the structure of storage is very strictly regulated (National Archives of Australia, 2006b).

In many situations records are born and managed outside an ERMS. Such systems can be described as business information systems, i.e. systems that support the business of an organization (National Archives of Australia, 2006b). Such systems do not necessary fulfil recordkeeping requirements (European Commission, 2002; National Archives of Australia, 2006a, 2006b).

2.6 THE RECORD LIFE CYCLE

One of the core concepts in records management is that of the record's life cycle. It is invariably used in records management textbooks and widely accepted by professionals in the field. Pedley (1992) regards this concept as so important that it serves as the basis for a total records management programme. It is so crucial that he equates the term with theory.

As an important concept 'the life cycle' provides the greatest potential for effective management of recorded information, particularly where records are held in paper form. As for electronic records, there is an on-going debate that such a concept is no longer applicable to the management of records in what is becoming an increasingly common environment. As such, it is imperative that this study examines the concept of the life cycle in the light of its established acceptance for paper records management and the criticism of its ability to accommodate records in electronic form.

This section attempts to review this issue extensively, by drawing attention to various interpretations of the life cycle of records in relation to the development of the field. These interpretations seem to indicate that the life cycle concept is not entirely applicable to technology generated records.

2.6.1 Development and Stages of Record's Life Cycle

In the American context, Erlandsson (1997) explains that the life cycle of records begins when records are first organised, maintained, and actively used by the creators. It continues as records are stored for an additional period of infrequent or dormant use in off-site records centres, and ends when their operational use ends entirely, or when they are 'selected' as archival valuable and transferred to an archive, or declared non-archival and destroyed.

Another model, Figure 2.4, of the records life cycle is from North America, by Read-Smith *et al.* (2002)**.** The model consists of five phases; they are creation, distribution, use, maintenance and disposition. According to the model, the first stage is the creation stage, which includes records that are internally produced or received from external parties. The second stage is distribution, where records are then distributed to the

persons responsible for their use. The third stage is use, where records are commonly used for decision-making, documentation or reference, in answering inquiries, or in satisfying legal requirements. When a decision is made to keep a record for use at a later date, it must be stored, retrieved and protected – three key steps in the maintenance stage, which is the fourth stage. Records must be stored (filed), which involves preparing and placing records into their proper storage. Whenever a request is made for a record, it must be retrieved from storage for use. When the retrieved record is no longer needed for active use, it may be re-stored and protected, using appropriate equipment and environmental and human controls to ensure record security.

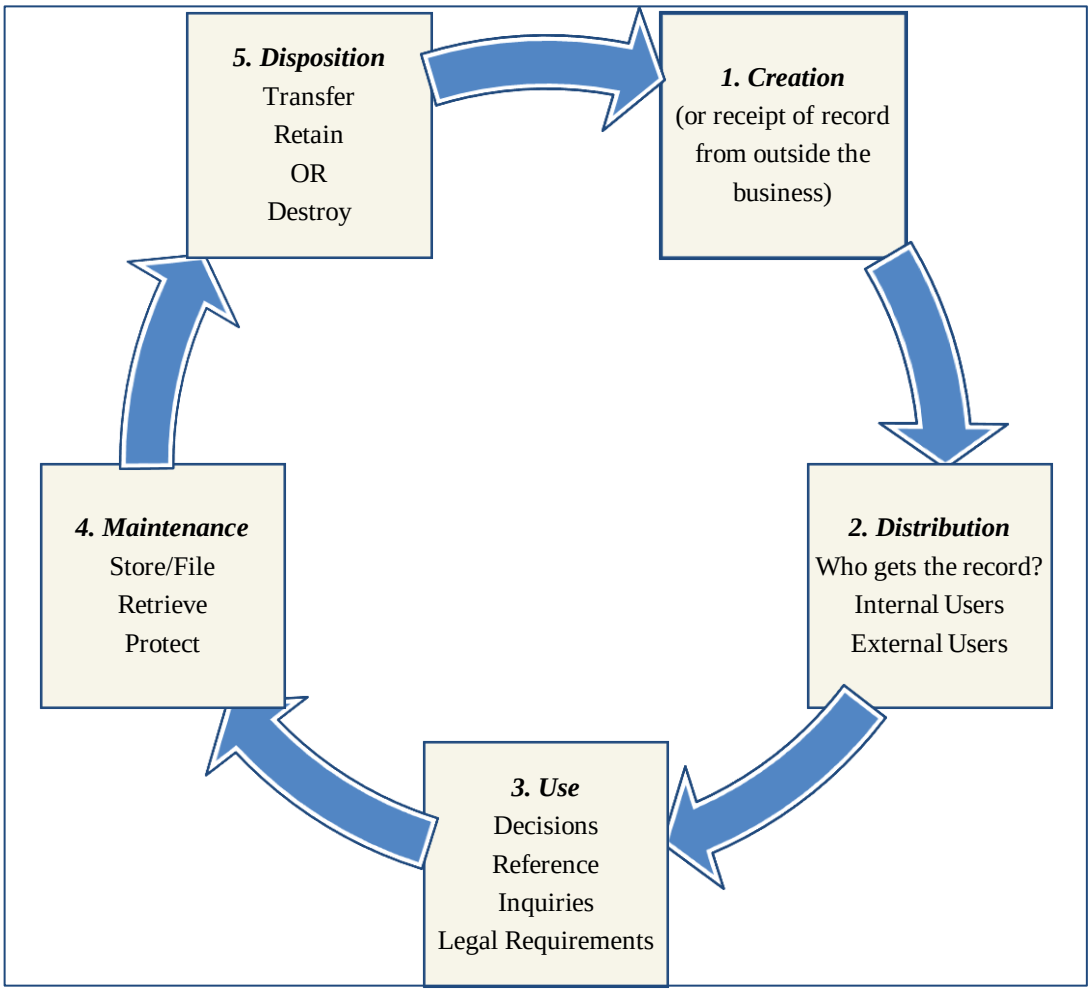


Figure 2.4: The Record Life Cycle (Read-Smith *et al.* 2002)

According to Newton (1989), the life cycle of records reflects the opinion that all records, irrespective of form and purpose, pass through certain well-defined phases. Each phase requires special techniques for effective control. On the other hand, Ginn emphasizes that the record's life cycle means a movement of a record "in logical steps from the creation, through its use, storage, and retention in active files, to its transfer to inactive files, storage, and final disposal" (1993). McLeod (1996) argues that in such a context the life of a record has a defined beginning and end. As such she intuitively describes this as a lifetime rather than a life cycle, but distinguishes between the lifetime and the life cycle on the grounds that both the message and the medium of records may have either a finite lifetime or an infinite life cycle.

The development of the life cycle concept can be traced to the USA in the 1930s (Penn *et al.*,1994; Hare and McLeod, 1997). At this time, the concept consisted of three phases that included the creation phase, a maintenance and use phase, and disposal. The concept was founded and invented by the National Archives of the USA in response to the ever-increasing volume of records produced by organisations. The concept stated that records have a clearly defined life from birth to death, and the life cycle concept was regarded as very relevant in providing a framework for identifying the specific elements, or functions of records management (Hare and McLeod, 1997).

Penn *et al.* (1992) *regard the life cycle concept as a theory, which provides a framework for the operation of a records management programme.* The principle behind this concept is that recorded information has a 'life' similar to a biological organism. It is born, lives and dies. However, they stress that like most theories, the concept will only have value if it is put into practice.

The function of the life cycle as the framework for records management is also highlighted by Hare and McLeod (1997) who use the term to identify the specific elements or functions of a records management programme, which are appropriate to an organisation.

According to Barry (1994), there are defined limits to the life cycle concept, which begins at creation and ends at disposal. This characteristic would not be applicable to records in the electronic environment. Barry argues, "documents in a distributed electronic environment are dynamic and recursive in nature and may exist in more than one stage of the life cycle simultaneously. They may not follow a serial path from creation to disposal but may be re-appraised at disposal time and reappear in an earlier stage". Barry is not alone in suggesting that, in relation to electronic records what is needed is an extension of the life cycle concept.

O'Shea and Roberts, both Australian archivists, argue that there is a contrast between the concept of the 'whole-life-cycle' or 'records continuum' and the 'traditional lifecycle' concept. In the traditional setting, records are seen as outputs rather than transaction (Erlandsson, 1997).

According to the Australian Standard (1996) the records continuum is "the whole extent of a record's existence. It refers to a consistent and coherent regime of management processes from the time of the creation of records (and before creation in the design of recordkeeping systems), through to the preservation and use of records as archives."

Electronic recordkeeping and systems have caused a paradigm shift (Cox, 1997a). The introduction of electronic recordkeeping systems has dictated a change in a core concept, and the need to replace 'the life cycle' with the 'continuum'.

Brooks (1996) discusses the life cycle concept in relation to the appraisal process. He argues that the selection of records for disposal or preservation must be accompanied by a thorough understanding of their value. This is determined by appraisal. Brooks ascertains that before a record is created, the professional background and level of knowledge of the creators plays a significant role. At this stage, if the created records are of no value, they should be disposed of as soon as they have fulfilled the function of their creation. Only records with enduring value are permitted to undergo the complete life cycle process. Interestingly, Brooks' conceptualisation of the life cycle explicitly refers to records as tangible objects.

Recent discussions on the concept of the life cycle do not focus merely on the inadequacy of the concept to cater for electronic records. Another interesting perspective of the concept is the number of stages in the life cycle that are addressed.

Stephens (1996) observes that in the UK, the records or information life cycle is usually considered to be composed of at least three stages. However, in the USA, the usual interpretation is that there are five stages in the information life cycle: creation, distribution and use, storage and maintenance, retention and disposal, and archival preservation.

Regardless of the number of stages involved and the descriptions given to explain the life cycle of records, it is obvious that paper records pass through various stages in their

lives. Every record, particularly in paper format, has to be created, used, maintained and stored, and finally either be destroyed or retained in an archive. Often, the division and the meaning of the life stages depend on the individual organisation. In some organisations the disposal stage would mean ultimate destruction whereas in another it means sending those records to the archive for research and posterity.

The focus of the records life cycle model is on routine processes. Little consideration is given to what records need to be created in the first place and how those records are best captured and managed, given their form, significance and context. While the context, structure and content of paper-based records are self-contained; this is not generally the case for electronic records or other forms of technology-dependent records. Consequently, recordkeeping practice must also consider how the context and structure as well as the information content of a record are to be captured as evidence of the business activity from which it was generated.

Perhaps the most significant shortcoming of the application of the life cycle model to the dynamic electronic business environment is the way it handles the appraisal and disposal of records.

Appraising and determining the disposal status of records at the end of the records' existence may not be possible or, where records do exist, the integrity and reliability of those records may not meet evidential or informational requirements for current and future stakeholders. This is because:

i. a large volume of electronic records are stored outside traditional records systems, for example, on PCs, desktops, data bases

ii. electronic mail server records may be easily manipulated, altered or deleted without a trace.

2.6.2 The Life Cycle versus the Records Continuum

The life cycle concept has long been established and fits well with paper-based records management. Heywood (1992), points out that the traditional paper-based record's life cycle controls the management of recorded information. In this setting, 'the container of information' i.e. the medium, is prominent. With the introduction of information technology, this focus seems to be unsuitable, opening the concept of the life cycle to further debate and review.

Records in the electronic environment are no longer tangible objects. They are both hardware and software dependent and both can quickly become obsolete. The Australian Society of Archivists asserts that it is the content of the records and no longer the medium that becomes the concern of records management in this later environment. As records are technology dependent, the content is prone to transformation and conversion. It is in this regard that the concept of the continuum has been promoted in the records management world. If the life cycle works well for paper-based records, the idea of a continuum seems to be the best concept for the management of electronic records.

The increasing complexity of the interpretation of the life cycle presumably reflects this transition. In the paper environment, records have their 'birth' and definite 'death'. But electronic records are subject to hardware and software control. The content of the information is only readable by the use of electronic devices, and the medium that holds the information is likely to change as the system matures. Any incompatibility over time

either in the software structure or the hardware system will result in records that are no longer readable. The nature of electronic records is such that they are prone to loss, and easily tampered with unless security measures are in place. It is this characteristic of electronic records that urged Goodman (1994) to devise his ten stages of the record's life cycle. His argument was that the traditional life cycle has a limited number of components and that electronic records needs many more components to explain their life stages.

The limited suitability of the life cycle concept in relation to electronic records has been argued by the ACCIS (1990). This committee suggests that the concept of the life cycle must be incorporated into a broader concept of information management. The suggestion is based on the notion that electronic records would not undergo the same life cycle as the paper records. Figures 2.5 and 2.6 explain the differences of life cycles of paper records and electronic records respectively.

Paper records will either be surrendered to archives after the sum of XI, X2 and X3 years, or destroyed after (XI), (XI+X2), or (XI+X2+X3) years. The specific number of years depends on the appraisal of internal and external requirements as set out in the retention schedule of each individual organisation. As paper records have tangible physical entity, their life cycle can be definitely defined from creation to destruction. This is illustrated in Figure 2.7.

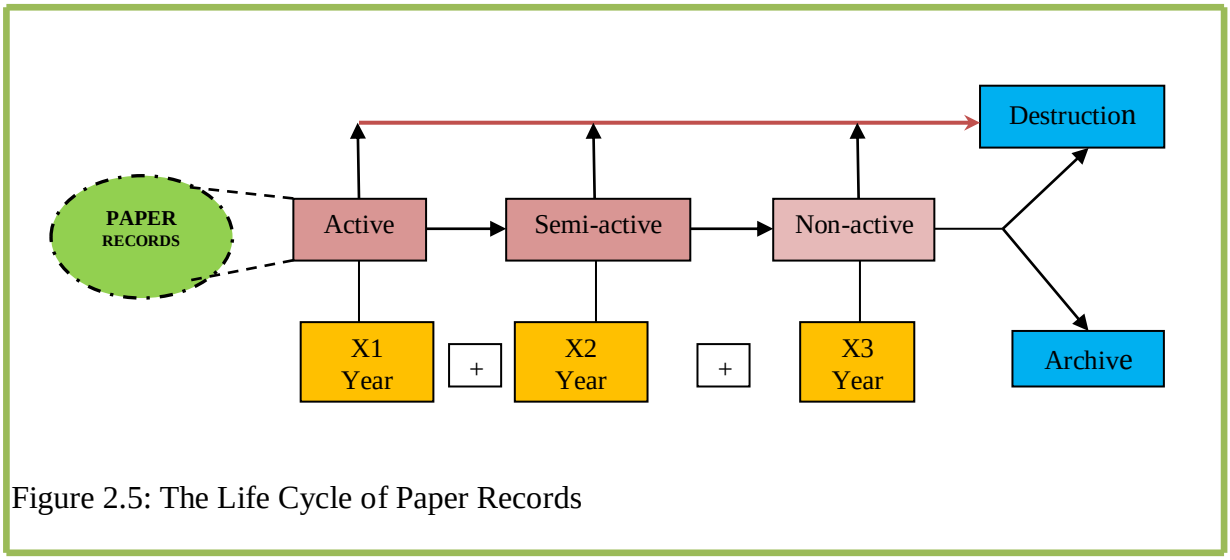


Figure 2.5: The Life Cycle of Paper Records

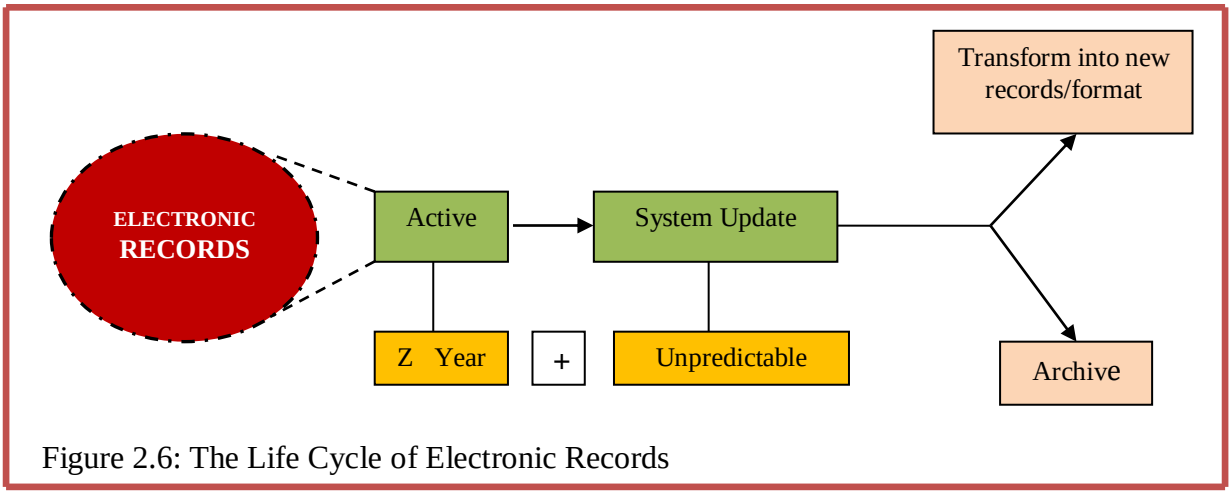


Figure 2.6: The Life Cycle of Electronic Records

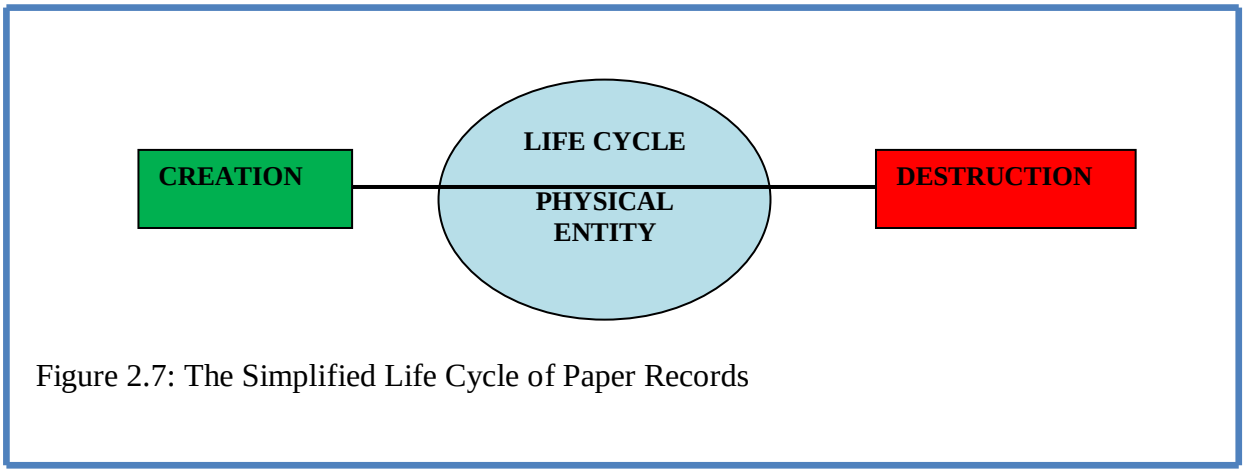


Figure 2.7: The Simplified Life Cycle of Paper Records

Governed by technology (hardware and software) the route taken by electronic records would not be the same. Systems can be upgraded at an unpredictable rate. Technology changes very quickly and new products and services are introduced displacing older ones. Both hardware and software can become obsolete in a few years (Z year). With changes in the system, many records will be migrated and transposed into new forms, whilst others will be 'archived' in native formats. At this stage there arises the question as to whether records generated by a previous technology before upgrading are compatible with the new technology. Figure 2.8 illustrates the route taken by electronic records.

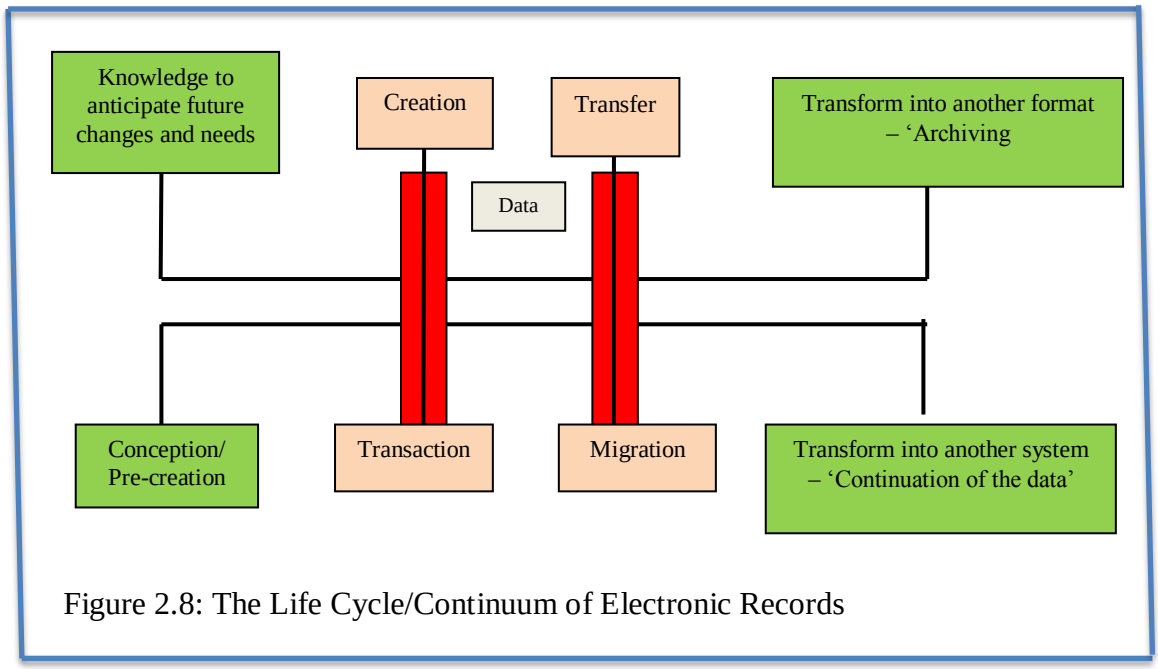


Figure 2.8: The Life Cycle/Continuum of Electronic Records

It has been accepted that not all information qualifies as a record. To qualify as a record, information in a document must be able to provide evidence of a transaction. In the paper environment, documents provide both the data and the carrier that provide evidential material, and documents that relate to the same transaction are kept together. But this approach does not function in an electronic environment because records seem

transitory, unstructured, and insubstantial. Their content alters depending on the technology that controls it (Duff, 1995).

2.7 RECORDS MANAGEMENT STANDARD

ISO 15489 was published in 2001 and the first ever-international standard on records management. For the first time records practitioners have a recognized standard to provide a benchmark for professional best practice on records management including that of electronic records. Perhaps the most important message in the standard is that records are an important resource and assets for an organization and therefore they need to be consciously and systematically managed. The Standard outlines the elements that are required for good records management – appropriate policy, assigned responsibility, understanding of the environment and records management principles, design and implementation of records system, use of processes to support records systems, monitoring and training. At the core of the standard is a process for design and implementation of the record system (Dan, 2002). The total approach of ISO 15489 is to support record keepers in making decisions about how records are created, captured, controlled and kept at any stage, including design of the records systems.

Records management activities are carried out in various organisations such as in academic institutions; in government at national, state, regional and local levels; in public and private corporations, and institutions of all types and sizes. Therefore the discussion in this section will be applicable in a range of environments.

The characteristics of records as elaborated earlier, indicate the approaches used to manage them. The art of managing these records is known as records management.

Again, in much the same way as with records, this art of management often reflects the influence of several distinct schools of thought.

The author would like to emphasise that the term 'records management', in much the same way as 'records, has been criticised as eluding definition. Therefore, in this section he will attempt to discuss some definitions of records management from different standpoints, so as to arrive at a suitable definition for the records management discipline and for professionals.

Robek *et al.* (1987) define records management as "the application of systematic and scientific control to all of the recorded information that an organisation needs to do business". Ricks *et al.* (1992) state that records management is "a function that provides for the systematic control of records from creation, or receipt, through their processing, distribution, organisation, storage and retrieval to their ultimate disposal". Smith, on the other hand, tries to define records management by emphasising the functions that should be taken up by the programme. These functions are based on the record's life cycle that covers the generation, active use, inactive use and disposal (1986).

Penn *et al.* (1994) describe records management as "the management of any information captured in reproducible form that is required for conducting business". This definition stresses the management aspect. An understanding of management principles helps provide a better understanding of the records management function. Thus records management must be placed in its proper context. The programme must exist as a function of managing recorded information and not for other reasons such as cost savings. Savings are merely a bonus that may be obtained from managing the information effectively (Penn *et al.* 1994).

Previously, definitions of records management had emphasised ways to avoid losing important pieces of paper while disposing of those of negligible value. However, the rapid expansion of IT in different contexts throughout the world has led to some confusion as to its present interpretation. In this context Wallace *et al.* (1992) have offered the following functional definitions:

> *records management is the systematic control placed over the lifecycle of recorded information from creation to ultimate disposal or permanent storage of a record.*

The above definition is expanded by Emmerson (1989), who states that records management" Is an administrative system by which an organisation seeks to control the creation, distribution, filing, retrieval, storage and disposal of those records which are created or received by that organisation in the course of its business".

Records management as defined by the Australian Standard is "the discipline and organisational function of managing records to meet operational business needs, accountability requirements and community expectations" (Australian Standard, 1996). This definition is derived from the observation that records management plays many roles within an organisation and in the organisation's relationship with the world. With such an understanding, records management is concerned with the following:

i. *managing the records continuum, from the design of a recordkeeping system to the end of the record's existence;*

ii. *providing a service to meet the needs, and protect the interests, of the organisation and its clients;*

iii. *capturing complete, accurate, reliable and usable documentation of organisational activity to meet legal, evidential and accountability requirements;*

iv. *managing records as an asset and information resource, rather than as a liability; and promoting efficiency and economy, both in the management of records and in organisational activity as a whole, through sound recordkeeping practices (Australian Standard, 1996).*

The definition by the Australian Standard is fairly comprehensive but the author observes that there is as yet no single definition comprehensive enough to incorporate both the function and purposes of records management covering both the traditional approach where records are treated as physical objects and the electronic management aspect, where records are treated as digital objects. This phenomenon confirms Cox's assertion that records management is still evolving (Cox, 1994). According to Schwartz and Hemon (1993) the definitions referred to above seem to be based on the systematic approach to planning and focus on the functions of business operations.

In practical terms, records management programmes are adopted by organisations on the basis of individual interest. Some organisations adopt the practice for administrative reasons, whilst in others; it could be for economic or legal reasons. Whitehead (1985) asserts that opinions on the purpose of records management can vary according to the priorities of the managing body. However, the prime objective of records management to many industries and commercial organisation are:

i. *to ensure that all records are efficiently stored, managed and retained for as long as, and no longer than, they are needed;*

ii. *to ensure that archives, that is, records worth preserving permanently because of the administrative, technical, commercial, legal, scientific, historical or other importance, are identified at the earlier possible moment and stored under proper conditions.*

In principle, what has been discussed above is actually the result of implementing records management. The concept and meaning of records management has been, and still is, a hotly debated theme among information professionals. A variety of definitions

is offered. Some definitions are straightforward while others are more complex involving many issues, especially where electronic records are concerned. Regardless of the scope of the definitions, records management is universally concerned with the consistent and cost effective management of records throughout their life cycle (Hare and McLeod, 1997).

From the information management perspective, Jones (1994) provides a general, all-encompassing definition:

> *a practice which allows the parent organisation to gain the greatest efficiency and effectiveness from its information resources in an economical way, by the development of strategic processes and procedures to handle that information.*

The literature on records management includes various perspectives and dimensions. It not only touches upon the varied definitions accorded to several key concepts, such as records, records management and the record's life cycle, but also elaborates on several ways of applying records management practice. Robek *et al.* (1987) suggest that changes in the application of records management control systems have resulted in organisations reaping its benefit. A number of works indicate that records management practice has resulted in improvements in terms of storage space, filing activities and the retrieval of documents or information. Schwartz and Hemon (1993) associate records management with information science, arguing that inclusion of the management of information and resources more accurately reflects the present state of records management.

Parer and Parrott (1994) argue that the management of records, especially of electronic records, has adopted concepts and procedures from library science, information

management and computer science. Many organisations, he points out, do not manage their records according to accepted principles or professional practices. This is particularly true of the management of records in the personal computer (PC) environment.

Records management is the task of ensuring that recorded information, paper and electronic, is managed economically and efficiently. Records management controls the creation, maintenance, use, and disposal of records so that the right records are provided to the right person at the right time. When a records management system works well, the information contained in records can be readily retrieved. The disposal of unneeded records and the retention of valuable information can be managed effectively, and space, facilities, and resources can be used efficiently and economically.

Based on the discussion of the problems in defining records management as above, the author concludes that there is as yet no single definition accepted by all. However, recent attempts seem likely to lead to the development of a definition as comprehensive as possible and suitable to cater for all approaches. As has been argued, it is extremely difficult to establish a definition for the term, which is acceptable in all conditions, and for all RIM professionals.

Again, this author prefers the definition of records management by the Australian Standard, which defines records management as the discipline, and organizational function of managing records to meet operational business needs, accountability requirements and community expectations" (Australian Standard, 1996).

2.7.1 Traditional Record Management System

The traditional records management systems refer more often than not to the records management systems prior to the use of electronic systems and those of developing countries that has not discovered the potentiality of information communication technology (ICT).

However, with the current technological advancement, some of the strategic benefits of information technology, which makes the electronic method of record management desirable, stand out as obvious challenges organisations running the traditional method of management face (Frank, 2001; Kampffmeyer, *2008*). For example some of the challenges include;

i. Lack of Quick accessibility of records: because of the volume of records generated and required in the construction industry the manual search approach makes it extremely difficult to access especially when in high volumes
ii. Difficulty of Simultaneous documents sharing: coupled with the high volumes of records sometimes handled in the construction industry and the tedious archiving and retrieval system, simultaneous document sharing is difficult and sometimes impossible between collaborating organisations separated over distant geographical locations
iii. Lack of ease and accuracy of updating records is an inherent challenge in the traditional system of record management because of the high volumes of files and paper material to be handled coupled with the manual approach to updating. In accuracy of updating this records in inevitable because of the strenuous demand of the system

iv. Incorrect filing system

v. Cumbersome space requirement for archiving of records especially when relevant records are in high volumes and of various types makes the system inefficient

vi. The error of duplicity of record is common in this system because there are search engines to verify the previous existence of the record

vii. There is the possibility of mismatching identical records because the system lacks unique identification that can automatically be issued as with the electronic system

viii. Strategic benefits of information technology is leanly if at all explored e.g. due to the space requirement for the traditional method, cumbersome records which could be easily stored in and retrieved from micro devices over distant geographical locations is not possible

ix. Traditional record management methods are largely centralized and can be lost in the incidence of fire out break because the space requirement makes it too expensive for organisations to have an equally bulky back up this sometimes may mean building a ware house for files

x. Lack of resources, space constraints, ad hoc approaches to Records and Archives Management

xi. High staff turnover required to handle cumbersome records

2.7.2 Electronic Document and Record Management

The aim of electronic document and record management systems (EDRM) is to support information processes by providing users with simple, logical and quick ways of storing, finding and retrieving documents.

Today, application of computers in workplaces is almost inevitable, even in a small organisation, for at least word processing tasks. Medium and large-scale organisations normally implement their own networking systems. In these situations, besides paper records, various types of electronic records are produced everyday in the conduct of daily business. In public organisations, the implementation of e-government in many countries has contributed to the production of a mass of electronic records. Ross (2006) calls attention to trust in the accountability of e-government and its success depends upon transparent, secure and workable digital curation mechanisms within public sector environment. Ross (2006) describes digital curation encapsulating the many activities involved in caring for digital entities such as selection, documentation, management, storage, conversion, security, preservation, and provision of access. Curation focuses not just on preserving digital entities but also on keeping them functional. Supporting their continuous annotation and maintaining their fitness for purpose is essential. The need for a sound management of electronic records is imperative.

As electronic records by their very nature are intangible, a comprehensive and holistic approach to item creation and management is essential to ensure electronic evidence is accurate, authentic and sustainable like their paper counterparts. Principles and approaches used in managing conventional records can be used for managing electronic records, though it may require adaptation to suit different electronic environments. To remain competitive, organisations cannot afford to lose their records, and electronic records are particularly at risk due to their unstable (volatile) binary nature. Managing electronic records, just like their paper equivalent, requires support and cooperation from senior management and other professionals. Procedures and guidelines alone are

not enough to achieve organisational goals, if responsible officials do not consistently follow them.

Electronic records present a complex and never ending task for records management professionals due to their intangible nature and the fast changing technology that supports the creation and future use. The emergence of various types of electronic documents demands efficient management to retain their accuracy and authenticity as evidence of transactions and the accountability of officials or organisations. Metadata is the in-thing or core to ensure the authenticity and durability of electronic records. The ability to capture and retain adequate metadata is certainly crucial for the preservation of electronic records over time.

2.7.3 Development and Design

Traditional phases of software development cycle usually run along the lines of analysis, design, coding and maintenance. These activities usually flow in one direction. A typical example of this is the water-flow process model, which defines phases as; requirements analysis, system and software design, implementation and unit testing, integration and system test and operation and maintenance. Figure 2.9 shows pictorial representation of the phases involved in the water-flow process model (Williams and Sawyer, 2007).

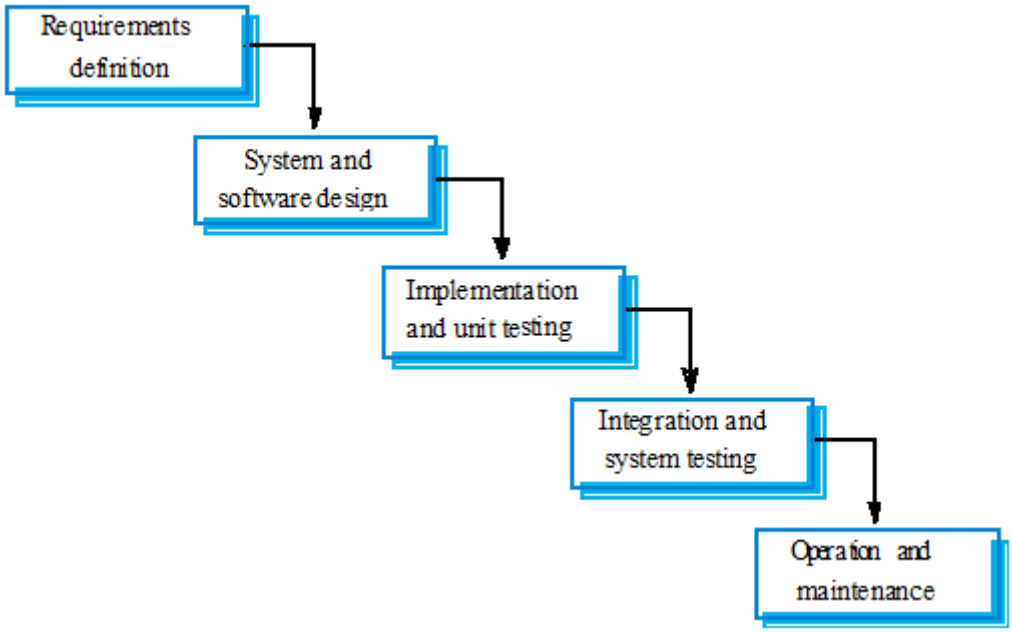


Figure 2.9: Traditional System Development Life Cycle

The main drawback of the water-flow process model is the difficulty in accommodating change once the project is on the way. During the course of developing the software, the customer decided to have some features added to the software; this was difficult if not impossible, this meant that the software was obsolete as it was being coded. An assumption with this model is that each phase is completed usually with minimal to zero errors. This was not the case in real life; phases were completed with errors, these errors then get carried over to other phases. These made this model very prone to errors and what make the model less and less used over the time.

The unified process is what is being used nowadays. The same people who developed the universally recognized and accepted UML (Universal Modelling Language) developed it; these are Grady Booch, Ivan Jacobson and James Rumbaugh (Grady *et al.*, 2005).

The unified process is divided into four phases:

Inception

i. Elaboration

ii. Construction

iii. Transition

The **inception phase** is where the overall scope of the project and its feasibility are determined; it ends with management giving their approval for the project. In the elaboration phase, the basic architecture of the system is designed. It is here that the needs of the user are determined. The construction phase deals with actual making of the software, usually involving program coding. The transition phase is where the system is handed over to the user for testing and deployment.

All of the four phases could be broken into iterations as shown in Figure 2.10. The construction phase in particular will contain a number of these iterations. Iteration is a subset of the overall system and corresponds to a single task the user wants to perform. This is synonymous with use case. Each of the iteration contains its own sequence of analysis, design, implementation and testing.

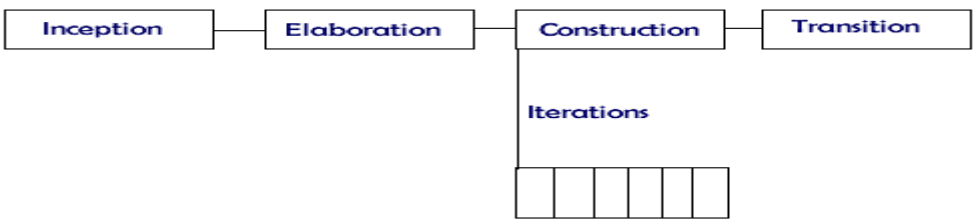


Figure 2.10: Iteration of Phases

Unlike the waterfall model, the unified model is flexible, therefore, makes it easy to return to earlier phases if re-planning is required. For example, discoveries made by users in the transition phase will cause revisions in the construction phase, and perhaps the elaboration phase as well; this model can accommodate this modification without starting all over again.

2.7.4 Use Case

A ‘use case’ is a specific task, usually initiated by an actor (Figure 2.11a). An actor is usually one who:

i. Provides information to the system
ii. Needs information from the system
iii. Assists other actors

A ‘use case’ describes a single task the user wants to perform. In general, everything you want the system to do should be specified by a use case (Figure 2.11b). The ‘task’ is represented by an oval-shape, while the ‘actor’ (represented by a stick figure) and a line indicating the line of action.

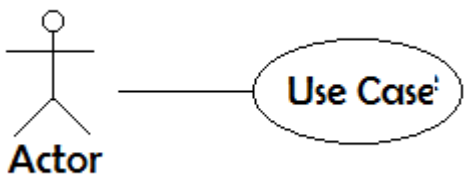


Figure 2.11a: A snapshot of the Use Case Model

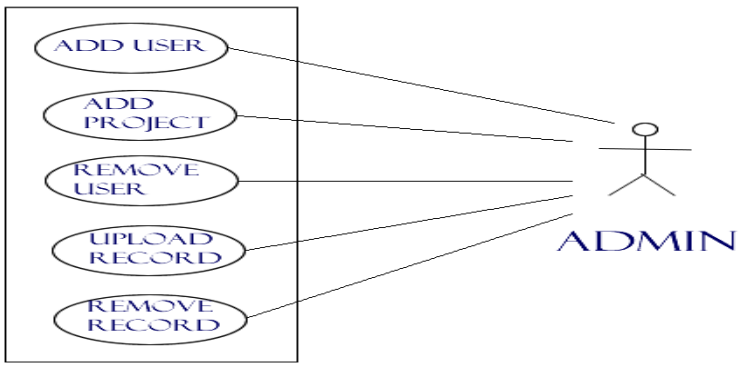


Figure 2.11b: A snapshot of the Use Case with Multiple Task

a) Scenarios

A ‘use case’ is the goal; a scenario is a particular outcome from trying to achieve the goal. For example, the actor might want to create a project, it may be successfully created or it may not due to the database being in error. These two outcomes are called scenarios; whether the goal was achieved or not.

2.7.5 Use Case Description

Since a ‘use case’ diagram does not give room for detailed description, this description, then, have to be provided elsewhere. This is the job of the ‘use case’ description. In small projects, a paragraph or two will suffice. But in larger projects, the description may be a formal endeavour in its own.

From the above ‘use case’, the ‘use case’ description may be given below:

i) Add User

NOTE: Admin login required to add a user.

Launch the program and login using the administrators' credentials. Select the Manage Accounts Item from the File Menu. A new window will open with a form on the right that makes the provision for username and password. Fill in the data and click the button labelled 'Add'.

ii) Add Project

NOTE: Admin login required for project management.

Launch the program and login using the administrators' credentials. The window that opens after successful login has a form on the write with fields for name and location with commencement date. Fill these in and select the button labelled 'Add project'.

iii) Remove User

NOTE: Admin login required for project management.

Launch the program and login using the administrators' credentials. Select the Manage Accounts Item form the file Menu. A new window will open with a form on the right with fields labelled username and password; also a list of users will appear on the left. Select a user from the left and select the button labelled 'Delete'.

2.7.6 System Works Representation

A brief a representation of how the system works in general is discussed under this section;

i) Classes

After the use case description has been completed, the next is to extract classes from the description to model the use cases. A simple procedure used for extracting classes is by

taking the nouns from the use case description. Most of the extracted nouns are eligible to be use cases but not all. Generally, only nouns that hold complex data and closely resemble real world objects are ideal for class names; nouns not selected to be class names will most likely be eligible to be attributes to some classes. In fact, most attributes can be discovered using this method.

ii) Member Functions

Nouns serve as the class names; verbs serve as messages from object to object (an object is an instance of a class). These messages are synonymous with member functions; but in object-oriented analysis, these are known as methods.

iii) Entity Relationship Diagram

An entity relationship diagram (ERD) is a data model utilizing several notations to depict data in terms of the entities and relationships described by that data. An entity is a class of persons, places, objects, concepts and events. It represents all instances of a group of similar things.

It is something about which the business needs to capture and store data about. In DRDs, an entity is represented as a rectangle with rounded corners; usually with the name of the entity on the top and its attributes below. An attribute is a characteristic property of an entity. A compound attribute is one that contains other attributes as shown in the following example:

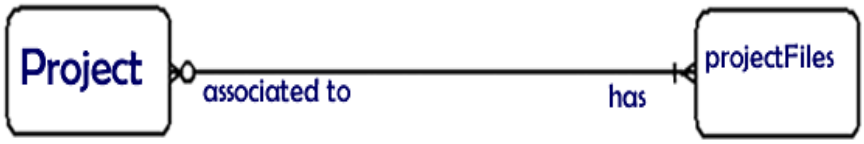
iv) Related Terms Used In ERDs

Data type: is a characteristic of an attribute that defines the values that attribute can take on. Examples include; NUMBER, TEXT, DATE, YES/NO, IMAGE.

Domain: is a characteristic of an attribute that defines the range of values an attribute can legitimately take on.

Default value: the value that will be stored when not specified by the user.

Relationship: A business association that exists between one or more entities, it is also used to reflect 'business rules' as shown in the following diagram:



2.7.7 Database

A database is an organized collection of data, today typically in digital form. The data are typically organized to model relevant aspects of reality, in a way that supports processes requiring this information. The term *database system* implies that the data is managed to some level of quality (measured in terms of accuracy, availability, usability, and resilience) and this in turn often implies the use of a general-purpose database management system (DBMS). A general-purpose DBMS is typically a complex software system that meets many usage requirements, and the databases that it maintains are often large and complex.

Well known DBMSs include Oracle, IBM DB2, Microsoft SQL Server, Microsoft Access, PostgreSQL, MySQL, and SQLite.

The database concept has evolved since the 1960s to ease increasing difficulties in designing, building, and maintaining complex information systems (typically with many concurrent end-users, and with a large amount of diverse data). It has evolved together

with database management systems, which enable the effective handling of databases. Though the terms database and DBMS define different entities, they are inseparable: a database's properties are determined by its supporting DBMS and vice-versa. The Oxford English dictionary cites 1962 technical report as the first to use the term "data-base." With the progress in technology in the areas of processors, computer memory, computer storage and computer networks, the sizes, capabilities, and performance of databases and their respective DBMSs have grown in orders of magnitudes. For decades it has been unlikely that a complex information system can be built effectively without a proper database supported by a DBMS. The utilization of databases is now spread to such a wide degree that virtually every technology and product relies on databases and DBMSs for its development and commercialization, or even may have such embedded in it. Also, organizations and companies, from small to large, heavily depend on databases for their operations.

a) **Components of a Database**

Some terminologies used in database include:

i. Data: These are binary computer representation of stored logical entities; they could be in the form of text, numbers, date, time etc.
ii. Tables, columns and rows: The rows correspond to entities and column corresponds to attributes and their intersection called cell (usually corresponding to a single attribute of an entity), these collectively form tables, where all data is stored in a database.
iii. Key: An attribute that is used to uniquely identify each entity instance of a table (primary key). They are also used to identify links and relationships between entities (tables); this is achieved using a foreign key.
iv. Query: The main purpose of a database is to store data, but stored data without being able to manipulate and display them in a variety of way is unproductive.

Queries are what make manipulating and displaying data in various forms possible.

v. Schema: An organization of related tables into a logical unit. These are usually synonymous with databases. A collection of columns and rows form tables, a collection of tables form schema. A schema might also contain just a single table

b) Database Models

A database model is a theoretical foundation of a database and fundamentally determines in which manner data may be stored, organized and manipulated in a database system. It thereby defines the infrastructure offered by a particular database system. Common models include:

i. Hierarchical Model
ii. Network Model
iii. Relational Model
iv. Objectional Model

i Hierarchical Model: Here, data is organized into a tree-like structure, implying a single upward link in each record to describe the nesting, and a sort field to keep the records in a particular order in each same-level list. Each parent node can have many children but each child can only have one parent, thus the type of relationship here is one-to-many.

ii Network Model: This model uses records and sets to store data. Records can be taken to mean entities in this scenario and sets are the relationship between said entities. The main difference between this model and hierarchical model is that the hierarchical can only handle one-to-many relationship; but this model can handle many-to-many relationships.

iii Relational Model: This is a mathematical model define in terms of predicate calculus and set theory. It was designed to work independent of any application. It is here that terms such as relation, attribute and domain are defined. Relation is simply a table, attribute can be taken to mean a column and domain is the legal values that column can take. It is also here that the discussion of keys exists as well.

iv Objectional Model: This actually comprises of two models; the object model and the object relational model. In all these models, the type of data used here are objects that the user is familiar with in the real world. This is done so that the database and application share the same types so as to prevent an overhead known as impudence mismatch (converting data types in the database).

The reasons for a using database are trivial; they are simply to provide the capability of being able to store huge amount of data efficiently, allowing for easy retrieval. It also provides manipulation of the stored data. It also provides a centralized control of the data. The database used in this research is the MySQL relational database management system (RDMS).

2.7.8 Java

Java, object-oriented programming language introduced in 1995 by Sun Microsystems, Inc. Java facilitates the distribution of both data and small applications programs, called applets, over the Internet. Java applications do not interact directly with a computer's central processing unit (CPU) or operating system and are therefore platform independent, meaning that they can run on any type of personal computer, workstation, or mainframe computer. This cross-platform capability, referred to as "write once, run everywhere," has caught the attention of many software developers and users. With

Java, software developers can write applications that will run on otherwise incompatible operating systems such as Windows, the Macintosh operating system, OS/2, or UNIX.

Java was chosen in developing this prototype EDRM system, not only for its platform independence but also for its quick and easy ability to pick up, develop an application and deploy without much fuss. This is particularly when the de facto development environment; Netbeans integrated development environment (IDE) is used. It is what is known as WYSIWYG (What you see is what you get). This is because the developer can easily select an element to add to his application, be it a button, a text field or an image; he can easily select one, drag it over to the location he wishes to add it and place it there. It also makes code alteration quite easy and straightforward. This dramatically reduces the development time.

2.7.9 Record Keeping Metadata

The elements of metadata were used long before the term 'metadata' itself was created, perhaps, since human being started recording information and contextual details. Today, ubiquitous application of ICT has resulted in the creation of enormous number of digital objects. Managing most electronic information objects can only succeed with the availability of adequate metadata that function to aid the identification, description and location of networked electronic resources. Without metadata, electronic documents in particular, lose their original context and become less useful, as the metadata functions like a map and a compass to make it easier for everyone searching for information to find it (Hansen, 2003). Record keeping metadata, on the other hand, is not the same as resource discovery metadata that enables Web-based information to be retrieved (Cumming, 2001). There are several definitions of record keeping metadata advocated

by various groups, based largely on their specific local needs. These include the Records/Documents/Information Management (RDMIS) Working Group on Work Processes and Practices (WPPWG) for the government of Canada (Government of Canada, 2001) which defines record keeping metadata as the type of information required to describe the identity, authenticity, content, context, structure and management requirements for records created in the context of a business activity.

Another working group on record keeping metadata that consists of archivists, metadata experts and computer scientists defines record keeping metadata as structured or semi structured information that enables the creation, management, and use of records through time and within and across domains (Working Meeting on Recordkeeping Metadata, 2000). However, the group admit that record-keeping metadata may or may not follow a structured schema for organising metadata. The group also agrees that it was unlikely a single fixed metadata schema could be developed or would be accepted to serve all record keeping environments. Establishing a fixed record keeping metadata schema across an organisation would only generate more problems rather than facilitating the management of organisational records.

In most situations a semi-structured schema is more suitable as different departments may require different metadata fields adequately to represent their business operations. It is, therefore, more appropriate to have a core set of metadata elements that meets the minimum requirements for describing and sharing information, while at the same time facilitating interoperability between departments. In addition, departments with specialised needs should be allowed to add new elements and/or sub-elements to the

basic metadata in order to satisfy their particular business requirements (Government of Canada, 2001; Hänger, 2003).

Record keeping metadata has two important functions, to support the transfer of records across domains and over time (Working Meeting on Recordkeeping Metadata, 2000). As records provide evidence of business transactions, and must be accurate over time, the comprehensiveness of record keeping metadata captured should not only identify the who, what, where and why of business, but also identify the management processes required to maintain records. Record keeping metadata contextualises and facilitates the management of records (Cumming, 2001), as well as facilitating risk management by ensuring the accuracy of information (Duff *et al.* 2003). Cumming (2005) further advocates that effective metadata implementation also facilitates the ability to increase access and use of organisational information securely as a valuable commodity in today's business environment.

The benefits of effective record keeping metadata can only be achieved with the existence of policies or standards that would attract, if not oblige, organisations to adopt good record keeping practices (Duff, 2003; Shepherd and Yeo, 2003; Cumming, 2005; Hofman, 2005; McDonald, 2005). For the records management community, there was light at the end of the tunnel when the ISO 15489:2001 was introduced as a part of requirements for the ISO standard. In addition, a more recent technical specification ISO 23081-1:2006 was published in January 2006, which superceded ISO 23081:2004, would enhance the management of record keeping metadata. It is a high level standard which explains what records management metadata is, why it is necessary, what roles

and responsibilities can be identified in its implementation, what types of metadata exist and how to manage them (Hofman, 2005).

Among others, the ISO Technical Specification states that the purpose and benefits of metadata are to support business and records management processes by:

i. *Protecting records as evidence and ensuring their accessibility, and usability through time*
ii. *Facilitating the ability to understand records*
iii. *Supporting and ensuring the evidential value of records*
iv. *Helping to ensure the authenticity, reliability, and integration of records*
v. *Supporting and managing access, privacy and rights*
vi. *Supporting efficient retrieval*
vii. *Supporting interoperability strategies by enabling authoritative capture of records created in diverse technical and business environments and their sustainability for as long as required*
viii. *Providing logical links between records and the context of their creation, and maintaining them in a structured, reliable and meaningful way*
ix. *Supporting the identification of the technical environment in which digital records were created and the management of the technological environment in which they are maintained in order that authentic records can be reproduced as long as they are needed, and*
x. *Supporting efficient and successful migration of records from one environment or computer platform to another or any other preservation strategy (cited in Duff, 2003).*

Many of these benefits have been advocated by various electronic records management initiatives including InterPARES, the Pittsburgh Project, the Preservation of the Integrity of Electronic Records which is also known as the University of British Columbia Project, the US Department of Defence's DOD5015.2-STD, the New South Wales Recordkeeping Metadata Standard, the UK's Functional Requirements for

Electronic Records Management System and the European Model Requirements for the Management of Electronic Records or MoReq. Although these projects and other smaller scale projects were developed in effort to satisfy their local business requirements, their findings have contributed to the establishment of the international standard for records management such as ISO 15489-1:2001 – Records Management; ISO 23081-1:2006 – Information and documentation – Records management processes – Metadata for records, and ISO 14721:2002 – The Open Archival Information System (OAIS) Reference Model (An, 2003).

The purpose of the ISO document is to provide guidance in understanding, implementing and using record keeping metadata and establishing metadata management frameworks, not to specify a mandatory set of record keeping metadata (metadata schema) (McKemmish et al., 2005). Nevertheless, it is undoubtedly due to its status as an internationally respected organisation, ISO made a tremendous impact on both public and private organisations in improving their record keeping systems that eventually will increase not only their business profitability, but also accountability and transparency by ensuring the availability of authentic records.

The reason for better acceptance of standards such as ISO 15489 is, perhaps, according to Murdock (2006), because such standard presents a credible, independent and natural view of record keeping by identifying a set of principles based on a common vocabulary, which is an effective reference point for records managers and archivists when dealing with sceptical management. To this end, metadata should document content, context, and structure at the time of capture, and also should document records

management and business processes throughout the life cycle of records, including changes to the structure or context (Duff, 2004).

Record keeping metadata is the lifeblood of a record; therefore, they must be captured adequately though the task is complicated and challenging. The effective management of electronic records is not just a technology issue but also requires an infrastructure of extend laws, regulations and policies, standards and practices, systems and technologies, and qualified people, all supported by an effective management framework and leadership capable of continually aligning the infrastructure in support of the business of the organisation (McDonald, 2003). Metadata is a tool and only one component of accountable record keeping and business infrastructures. Therefore, managing records must be business driven by and needs to be managed in a controlled and coherent fashion (Cumming, 2005).

Since metadata is the life of a record, Moss and Tough (2003), from their first-hand experience, rightly pointed out that one of the major challenges is to design systems that derive metadata from the directory structure or file plan and attach them automatically to documents at the point of creation, thereby minimising human intervention and opportunities for human error. Indeed, in an electronic environment this should apply throughout the records life cycle, as contextual information of records can easily be changed, deliberately or accidentally, either whenever records have been accessed, transferred or modified.

Electronic records can only be regarded as authoritative and potentially as authentic if they are accompanied by metadata that identifies them and testifies to their appropriate management (Cumming, 2005). In essence, it is contextual information that is more

essential than the content and structure of a record, as it facilitates audit that eventually determines accountability. The design of a record keeping system must reflect the organisation's business structure, and this can be demonstrated by the directory or file plan structure. Implementing and organising record keeping metadata requires extra resources in term of time and effort (Currall *et al*., 2002). It is important, therefore, to keep in mind that automating a non-effective directory or file plan structure will not improve the situation, but waste money and resources.

An effective directory or file plan structure must precisely represent every business function and its context so as to facilitate the capture of adequate metadata. Undoubtedly, a better option is if the directory or file plans structure has proved its effectiveness in the analogue order it only requires to be replicated in an electronic environment. This is to say, a comprehensive study is required to avoid over-engineering of existing systems, which simply increases cost whilst delivering a diminishing return for investment.

2.7.10 Academic and Collaborative Research Related to ERM

Kandur's PhD research entitled *The Management of Electronic Records* (1992) was an initial mark of transition to research on electronic records. Kandur's work remains theoretical in nature because he relied heavily on literature review in his methods of data collection and analysis. This work is more exploratory than definitive because of the lack of in-depth investigation into the subject, and absence of hard data to support his argument.

MacNeil (1998) explored the evolution of methods of assessing the trustworthiness of records as evidence from antiquity to the digital age, from the perspectives of law and

history and based on a contemporary adaptation of diplomatics. MacNeil's work was the first academic research aimed at building a theoretical framework in the area of ERM. It sought to discover a technical solution for the creation and preservation of authentic and reliable records over time. Even though it proved to be a remarkable departure from the previous academic work in terms of its aims and findings, it remains theoretical

Turner's (1999) PhD study *was on 'Theory and practice in the analysis of information policy in the digital age: a case study on the formulation of the European directive on the legal protection of database'*. This study centred on the theoretical issues relating to database management within public sectors. Walker's (2002) study adds a new dimension to academic research when she aimed to introduce records managers to the world of Intelligent Agents (IAs). This study also remains theoretical.

Jahore (2006) work was on *the development of a model for education and training in electronic records management*, and it was aimed at studying the education and training requirements for record keepers in ERM. It centred mostly on archivist and record managers working in government sectors, using Malaysian government as a case study. The achievement on this study was the development of a generic model for vocational and professional education and training in ERM to the situation in Malaysia. As other academic research discussed earlier, this study's constraint is being more or less theoretical and centred mainly on public sectors.

Borglund (2008) worked on '*Design for recordkeeping: Areas of improvement'* and it was focused on the problems related to design of information systems in which records are born and managed. In order to have an effective information system, the study major findings towards achieving this, includes among others; there must be conceptualization

of use of records and users of records; private organizations appraise records principally upon business values, and public organizations base their appraisal criteria upon accountability and legislative values. The two views on records should be brought into one view and form a risk management-like appraisal and proactivity is a way of thinking and should be applied on several levels in the recordkeeping environment: to the electronic record, to the information system where the electronic record is born and managed, to the organization, and to the user.

Another recent academic study on record management is that of Isa (2009), which was on *'Records management and accountability of governance'.* The study centred on the general record management, which involves the proper creation, capture, distribution and preservation of judicial evidence in the form of records. He argued that the accountability of a government can arguably only be achieved when it demonstrates considerable transparency, which in turn can only happen when trust is supported by authentic and reliable records. The records management community claims that records have to be preserved for accountability, but they rarely explore what 'accountability' is and what role records play in the accountability processes. In addition, the contribution of records management to good governance and accountability are often not recognized by other professions and management.

Isa (2009) uses case studies on the research, and is among the few academic work that combined public and private sectors in the study of record management. The case studies include Standard Life Plc, Edinburgh; European Investment Bank, Luxembourg and NHS Greater Glasgow and Clyde Health Board, Glasgow. From the finding of his study, the researcher concluded that there is lack of awareness and commitment among

senior management of the importance of good record keeping and that records management is not embedded in most businesses processes.

Collaborative research study on ERM were also carried out by the National Archives of Canada's IMOSA (Information Management and Office Systems Advancement) project in 1992, and FOREMOST (Formal Records Management for Office Systems Technologies) to find out the needs of ERM of the Canadian government agencies of office information (McDonald, 1995).

In the UK, the Joint Information Services Committee (JISC) of the Higher Education Funding Councils funded a number of research projects on digital archiving in collaboration with the National Preservation Office NPO. Five JISC/NPO projects, which were administered, by the British Library Research and Innovation Centre aimed at finding a solution for long term preservation of digital materials. These research projects were reported by Bennet (1997), Haynes *et al.,* (1997), Hendley, (1998), Beagrie and Greenstein, (1998) and Ross & Gow (1998).

This research study, therefore, studied the limitation of the previous studies with respect to small and medium building construction firms in the developing country like Nigeria where issues related to record management and use of IT facilities to enhance it are not given adequate attention due to problems and challenges discussed in chapter one.

2.8 BENEFITS OF EDRMS

Streamlining business processes and increasing efficiency are fundamental concerns for any organization, regardless of size or sector. In today's increasingly-strict regulatory environment, compliantly managing documents and records of all types, whether paper,

electronic, audio, video or email, takes significant time and money that could better be spent achieving mission-critical objectives. By implementing document and records management software, business owners can realize many benefits that noticeably improve organizational efficiency. EDRMS can help your organization succeed by:

i. *Saving money*
ii. *Saving time*
iii. *Increasing efficiency*
iv. *Increasing productivity*
v. *Increasing inter-departmental and inter-organizational communication and collaboration*
vi. *Generating revenue*
vii. *Enabling automation*

While these systems have many benefits, they are complex undertakings that require a significant investment of both capital and staff. Because of the significant investment required, it is crucial that organizations thoughtfully evaluate their current and future needs before deciding on a solution.

A study report by Laserfiche (2007) showed a typical worker would take 12 minutes to process a single document. Nine of these 12 minutes are spent searching for, retrieving and refiling the document—meaning that only three minutes are spent actually using the information they've found. PriceWaterhouseCoopers study reports that the average worker spends 40% of their time managing non-essential documents, while the IDC estimates that employees spend 20% of their day looking for information in hardcopy documents and that, 50% of the time, they cannot find what they need. Laserfiche estimates a 20% timesaving based on filing and retrieval efficiencies, eliminating

misfiling and workflow efficiencies. Increased efficiency, as well as greater staff productivity, can save up to 6,000 hours annually, or 2.4 full-time staff positions.

2.9 SUMMARY

The review of the literature indicates that records management has a stronger foundation in the public sector than in its private counterpart. The history of its development is that the discipline was first introduced systematically and officially in government agencies, even though the practice had always taken place in business and trade. However, as the impact of efficient records management is significant in the survival of organisations, these systems were adopted by businesses, which then introduced a new approach, new concepts and a new focus resulting in the shift of its paradigm. The field's subsequent development has been designed to meet practical requirements rather than for academic advancement.

The literature supports the view that the management of information in general, and specifically of records, is critical to the success of the company besides their quality and value. Good records management will result in economies in various areas such as in storage, maintenance, organisation and retrieval, efficiency and effectiveness of the parent organisation, and the identification and preservation of records of enduring value. Failure to give records management a high profile will result in hidden costs such as unplanned and distributed storage in high-cost accommodation and inefficient arrangement of information, leading to increased costs in retrieval and the underutilisation of information resources.

Previous work on information in general shows that information is crucial to the survival of an organisation. It has been observed that internally generated information -

the records - are increasingly recognised as important sources of information valuable to the organisation. Furthermore, it is cheaper and easier to get information from internal sources than to depend upon external information.

On the other hand, works specifically about business records management are still rare. The majority of research projects carried out were as investigations into the accumulated records of organisations, with the aim of introducing records management programmes. Few studies investigating the theoretical dimension of records management have been seriously encountered. Schellenberg contributes seminal works in this area. Much of what has been discussed by Schellenberg in his book in 1956 still remains central to many discussions pertaining to records at present. In fact what concerned Duranti and Bearman at present regarding functional analysis has been long the concern of Schellenberg.

Theory in records management is also generally associated with Newton (1996) who observed that today, despite the concern that records management has been too diverged the main conceptual issue regarding records is central and being repeated. Though projects relating to electronic records dominate the scenario, defining records has been part of the focus.

The situation mentioned is the reverse in the current trend of records management research, which is influenced by the advent of technology. Technology has impacted upon the procedures and principles of managing records. Technology has put the traditional concept of the record as a 'tangible object' at risk because electronic records have become virtual.

The limited nature of related research found suggests that the only obvious focus in existing records management works is its pragmatism; few writers, apart from Bearman, Cox, Duranti and O'Shea have addressed the theoretical dimension for the advancement of the discipline. Most studies are based on preliminary surveys investigating the status of records in individual organisations. Their methodologies are simple, involving basic surveys. The technique or instrument employed for collecting data is usually the questionnaire. In a number of studies, the questionnaire is followed up by interview and in some cases by visit, but these are in a minority. The simplicity in methodology reveals that records management research is still very basic, fulfilling the daily practical requirement. There is hardly any study employing a combination of methods and studies involving the formulation of theory are rare.

While many businesses have formal written policies pertaining to information and information technology that cover security and protection, these policies rarely address records management issues. Records management is a newer field that remains to be fully recognised and acknowledged and is often misunderstood. The vast dimension and proliferation of definitions of records as discussed above indicates that the term is used broadly to include the spectrum from data to information to knowledge as it applies to the business setting. As discussion proceeds there seems to be a blurring of the line between records management and other fields in information studies particularly in archive and library science. There are significant linkages between archives and records and strong relationships between records management and information science. This blurring of distinctions is further aggravated by the unpredictable development of information science where technology has urged all information segments to adopt each other's methods and skills. As a result, records managers are also being confronted by a

shifting technological landscape, which urges them to shift their focus in managing records. Records management had already expanded from merely focusing on the document in paper form to microfilming and now the focus has shifted to automation. The differences in the definition of records and records management reveals that the field is still evolving, this in turn has its impact on the formulation of a body of knowledge to support its methods and practices. The on-going debate suggests that records management can be better portrayed in the broader context of information science, as it is a subset within information management.

The literature in both archives and records management suggests that the concept of the records (as a physical tangible object) in the paper-based environment has often been taken for granted. But the technology-dominated environment has brought about changes. Some experts such as Cox observe that technology has put the concept of records at risk of getting lost.

At the same time, there is a growing concern for implementing technology-based records management programmes. Many writings in the USA reveal that many organisations in the country had been successfully implementing electronic records management. It is apparent that those organisations seem to equate electronic document management systems (EDMS) with electronic records management systems (ERMS). It has been argued that EDMS is closely related to ERMS in the sense that both are concerned with electronic records. But one major difference is that EDMS concentrates on keeping records in technology generated medium such as microfilm, magnetic media and optical disc while ERMS goes beyond that issue. It is not the medium but the message that become the focus of ERMS.

Professionals from Australia suggest that the implementation of electronic records management needs a new perspective that is different from that of paper records. Principles applied to paper records are not applicable to records in this latest environment. Their counterparts in the USA are however, not convinced by the suggestion that electronic records management is more complicated and claim that it has been implemented by some organisations successfully.

At present the only agreement on matters relating to electronic records is that they deal both with the information content and the information carrier or the medium. This shift in paradigm calls into question the suitability of the life cycle concept for electronic records. Furthermore, it is an unavoidable fact that electronic records will have to transform, convert and migrate in parallel with the development of technology. This situation presents a great challenge not only to records managers but to archivists as well. These factors reveal that the definition of the subject of electronic records management is far from complete.

It can be concluded that debates about records have not come out to any single agreed definition. The situation is now becoming more complex as technology impacts on the environment when, at the same time, a definition of paper-based records has not settled. Many other concepts have been affected and need revision. Discussion and projects, predominantly in the developed countries, are focusing on electronic records when at the same time there are many organisations in other parts of the world that are ignorant of the concepts even at the most basic level.

While debates on the concept of records and records management continues, another key concept in records management, the life cycle concept, has been regarded as no

longer suitable to cater for records in an electronic environment and the concept may soon be replaced by the continuum concept if current argument prevail. However, in the USA, there is a view that the life cycle concept can be applied to electronic records based on the notion that the art of managing records, regardless of their medium, is based on the same principles. The argument is that the life cycle forms the backbone of records management systems and has proved its success in most organisations, including those opting for office automation. However, the differences in the interpretation of the record's life cycle indicate that the 'life cycle" is inadequate in explaining the route taken by electronic records.

It can also be concluded that most of the literature reviewed from 1990 to 2001, was on trying to have an agreed definition of records both on the traditional form and electronic form. It also concentrate on establishing information and retrieval problems of records and recordkeeping function requirements; it also looks at the needs to be a re-evaluation of the techniques required to capture and preserve records as evidence of organisational transactions in the era of IT (Cook, 1993; Roberts, 1994; Cox, 1995a,b; Robek *et al*., 1995; Skupsky, 1995; Hynes, 1996; Barry, 1996; O'Shea, 1996; Moss, 1997; Buckland, 1998; Duranti, 2001a, 200b; ISO 15489). Within this period, collaborative research study on ERM were also carried out by the National Archives of Canada's IMOSA (Information Management and Office Systems Advancement) project in 1992, and FOREMOST (Formal Records Management for Office Systems Technologies) to find out the needs of ERM of the Canadian government agencies of office information (McDonald, 1995). In the UK, the Joint Information Services Committee (JISC) of the Higher Education Funding Councils funded a number of research projects on digital archiving in collaboration with the National Preservation Office NPO. Five JISC/NPO

projects, which were administered, by the British Library Research and Innovation Centre aimed at finding a solution for long term preservation of digital materials. These research projects were reported by Bennet 1997, Haynes *et al.,* 1997, Hendley, 1998, Beagrie and Greenstein, 1998 and Ross & Gow, 1998.

A lot was achieved within this period which includes identifying the problems of accumulated records in organizations and therefore come-up with a suggestion to introduce proper record management in the organizations so as to address these problems. It also identified that good record management in organization will result in economies in various areas such as in storage, maintenance, efficiency and effectiveness of the parent organization, and the indication and preservation of records for enduring value. The constraints/weakness of these studies within this period were; most of the studies were theoretical and were linked to archive, library science and few government agencies, and there were no written policies rarely addressing record management issues. This was the case till in 1996 when the Australian Government introduces the first standard document guides on record management practices (AS 4390, 1996).

The summary of the reviewed literature from 2001 to 2012 shows a shift of paradigm on record and record management practices. Part of the study from the previous decade was carried to this period. The study were centred both on TRMS and EDRMS, it was within this period the first international standard on record management practice was established (ISO 15493). The studies include, particularly definitions of the ERM, guide on the creation, uses, maintenance of records and guides on record management practices. The studies included also concentrated on public organization on RM and ERM, its implementation, challenges and the way forward. Part of constrain/weakness of these studies are, it is theoretical, and centred mostly on public organizations, such as

government ministries, public health services and security agencies such as police and military. Only few of these studies addresses business record management (Gregory, 2005; Dransfield, 2006; Loussouarn, 2006; McKinnon, 2006; JISC-InfoNet, 2008; Mooradian, 2009).

The full implementation of the automated EDRMS was mostly embraced by the public organizations, while few business organizations, such as the construction industry industries adopted the system, and most of which are large construction industries (Swarts, 2004; Johnston *et al*., 2005; Bjork, 2006; Valerius, 2007). The problems encountered by the construction industries when implementing the EDRM system were; no significant drop in paper usage, for a variety of reasons; difficult to measure costs and benefits; industry's unfamiliarity with documentation standards to provide basic framework; too much expenses in training personnel; the EDRM system was cumbersome, therefore, demand either a move towards national standards or user-friendly systems (Bjork, 2006).

Despite these various studies carried out by different bodies, including the academics, small and medium building firms were not really given much attention so as to provide them with an alternative, affordable, efficient and user-friendly automated EDRM system that they could adopt so as to enhance their record management practice.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter is devoted to fieldwork, data handling and analytical tools used in the research. The description on the Size of the Organisations; Description of Data; Study Instrument adopted and Nature of Data; Adopted Sampling Techniques and Study Approach; Sample Size; Data Collection and Handling; Tools for Data Analysis and IT packages to be used in developing the prototype electronic document and record management system (EDRMS).

Thus, the chapter explains the methodology chosen for the research, highlights several general theories, and describes the course of the process. It also presents the description of methodology employed in the EDRMS research and explains in detail the methodology and method applied for this study. In order to achieve the aim of this chapter firstly, is to justify the research methodology employed and how it works differently from other research on record management practice and secondly, to examine the data collection and analysis techniques undertaken in the research and thirdly describes the strength and limitations associated with the methodology used for this research.

The term 'research' can be explained as the search for knowledge or the systematic way of establishing facts. What is learnt about reality is not necessarily true but the aim is to improve the current view of the world and the mechanisms controlling it. To increase the relevance of the findings researchers have to determine the approach used for the knowledge to be gained defining what is knowledge (*ontology*), how it can be obtained *(epistemology*), and the processes required for studying it (*methodology*).

Patton (2002) regards methodology as the paradigm and the philosophical frameworks underpinning research. Wildermuth (1993), Ingham (1984), Hirschheirn (1985), Grover and Fowler (1993), Layder (1993) and Merriam (1998) agree that the methodology employed within a project emerges from the nature of the research questions. However, methodology, although a general and conceptual term, also includes the question of method, which refers to the actual process of data collection.

3.1 DEVELOPMENT OF RESEARCH METHODOLOGY

In order to achieve the aim and objectives of the research, this study was divided into four phases. The two main research questions stated in chapter one, were modified and emerged from these four phases helped the writer in making his decision on the methodology that was used in this research. The project records asked in the questions cover both that are in traditional and electronic form, and were detailed in the questionnaire. The research questions appeared in every phase of the study is tabulated in Table 3.2. The types of questions in each phase are stated as follows:

Phase 1:

i. Do SMEs manage project records?
ii. What types of projects records are managed?
iii. What, if any, standard do they use in managing these records?

Phase 2:

i. Who manage these records?
ii. What are the roles and responsibilities of the record keepers?
iii. Do they have sufficient knowledge to manage the records?

Phase 3:

i. What challenges are there in managing these records?

Phase 4:

i. What software is used to supplement the management of paper records?
ii. What types of medium use for storing these e-records?
iii. How can automated computer system address these challenges and enhance records management?

The form of the research questions, helped to determine quantitative, qualitative or case study research as the strategy of the existing project or combination of both (Yin's 1994), as shown in Table 3.1.

In conducting qualitative research, Yin (1994) suggests that the type of questions asked would determine the kind of research strategy that must be adopted. According to him, a case study approach is appropriate for investigating "how" questions. In seeking an answer, the researcher does not try to influence or to control behavioural events. The subject studied is a contemporary and real-life phenomenon. Yin (1984) presented three conditions for the design of case studies: a) the type of research question posed, b) the extent of control an investigator has over actual behavioural events, and c) the degree of focus on contemporary events. In the Levy (1988) study and this study, there are several "what" questions. This type of research question justifies an exploratory study. The existence of several "how" questions in the questionnaires make the study explanatory as well, which is not uncommon (Yin, 1994).

The research questions framed as "who", "what", "where", "how", and "why" determine the relevant strategy to be used. The nature of the questions, therefore, leads to an explanatory-exploratory case study. The study, being exploratory, need not, and do not

have a proposition (Yin, 1994). The unit of analysis in a case study could be "an individual, a community, an organization, a nation-state, an empire, or a civilization" (Sjoberg *et al.*1991). In this research, small and medium building firms serving Ahmadu Bello University (A. B. U.), Zaria was used as the unit of analysis for the research.

Table 3.1: Relevant Situations for Different Research Strategies

Strategy (Data gathering methods)	Form of research question	Requires control over behavioural events	Focuses on contemporary events	Strategy of the existing study
Experiment	how, why	Yes	Yes	No
Survey	who, what, where, how many, how much	No	Yes	Yes
Archival analysis	who, what, where, how many, how much	No	Yes/No	No
History	how, why	No	Yes	No
Case study	how, why	No	Yes	Yes

Source: Yin (1994)

3.1.1 Application of Recommended Procedures

Yin (1984) presented three conditions for the design of case studies: a) the type of research question posed, b) the extent of control an investigator has over actual behavioural events, and c) the degree of focus on contemporary events. In the Levy (1988) study and this study, there are several "what" questions. This type of research question justifies an exploratory study. The existence of several "how" questions in the questionnaires make the study explanatory as well, which is not uncommon (Yin, 1994). Examples of these questions are shown in Table 3.2.

The research questions framed as "who", "what", "where", "how", and "why" determine the relevant strategy to be used. The nature of the questions, therefore, leads to an explanatory-exploratory case study. The study, being exploratory, need not, and do not have a proposition (Yin, 1994).

Table 3.2: Data Collection Techniques in Relation

Project	Research question	Types of data needed	Purpose/aim/ objective	Data collection techniques
Phase 1 Looking for SMEs record management activities	"what" management standard do they follow in keeping records? "what" records do they keep? "how" do they keep these records?	Qualitative	To provide broad answers to questions	Survey questionnaire across the selected small and medium building construction firms
Phase 2 Analysis of record management by stakeholders	"who" manage these records? "what" are their roles and responsibilities?	Qualitative	To give in-depth understanding to questions	Survey questionnaire across the selected small and medium building construction firms
Phase 3 Investigating the challenges associated with record management	"what" problems they have in the management of these records?	Quantitative	To provide broad answers to questions	Survey questionnaire across the selected small and medium building construction firms
Phase 4 The development of prototype computer system (EDRMS) for enhancing record management in small and medium building construction firms	Is the framework suitable for building construction firms? If yes what features would it have to make it easy and efficient	Qualitative	To give in-depth understanding to questions	Survey questionnaire across the selected small and medium building construction firms

The unit of analysis in a case study could be "an individual, a community, an organization, a nation-state, an empire, or a civilization" (Sjoberg *et al.,* 1991). In this

study, the small and medium building construction firms working at Ahmadu Bello University, Zaria is used as the unit of analysis for the research.

The emergence of quantitative and qualitative data in response to the nature of the research questions and content areas under study shown in Table 3.2 gives the writer an opportunity to integrate the various approaches to data collection and analysis through the triangulation method.

In this research, quantitative and qualitative data were collected from the survey questionnaire (Methodological triangulation). DePoy and Gitlin (1993), Cohan and Manion (1994), Denzin (1997), Mason (1998) and Robson (1998) also call this methodological triangulation, whereby different methods were used to collect different types of data. "The aim was to pick triangulation sources that have different biases and strengths, so that they complemented each other" (Miles and Huberman, 1984). In this case the need for triangulation arose from the research questions and thus fulfilling the ethical need to confirm the validity of the processes.

Methodological triangulation was considered appropriate for the research as it permitted constructive blend of a primary qualitative oriented approach with a few, albeit important quantitative elements with a view to providing a more holistic understanding but also to verifying and, thus enhancing the credibility of the research outcomes.

Finally, another reason as to why triangulation methodology was adopted for this research is related to the arguments that relying exclusively on one research strategy, could potentially bias the researcher's perception, limit and perhaps distort the understanding of the phenomenon under study. "This becomes even more dangerous when the research object is not only so complex and multi-faceted, but also minimally

explored previously" (Cohen and Manion, 1994) as in the case of automating record management solely for small and medium building firms in Nigeria.

3.2 SAMPLE SIZE

A useful, general and non-technical definition describes sampling as "a small separated part of something illustrating the qualities of the mass" and the taking of a sample is said to enable one to 'get a representative experience' or to 'test the qualities' of the subject of the research (Hull, 1981). This process of sampling, or the selection of part of a population from which the characteristics of the whole are inferred, has long been accepted as a legitimate and expeditious method of research.

Sampling, rather than making a complete enumeration of the population of entire small and building construction firms in Nigeria, was adopted for this study as the procedure offers several advantages. Among the reasons why a population may be sampled rather than a full census taken are:

i. A full census may be impractical because of the cost and effort involved. Sampling should make the survey much less expensive than a complete enumeration if properly designed.
ii. Sampling is faster than a full count. If small samples are employed, an estimate of the characteristics of the total can be secured in a much shorter time than would be possible otherwise. This timesaving advantage is especially important in studies in this modern dynamic society where conditions change so rapidly. Measurement can be out of date before the survey is completed unless methods are devised for measuring social situations.

iii. Samples may be more accurate than full censuses. Large numbers in a sample are no guarantee of correct results (Parten, 1965). It is better to repeat the same survey several times in the same area and thus secure enough cases to 'impress' those who do not have much faith in small samples. The consistency of returns for different periods is usually impressive. When small samples are used, it is possible to give more attention to each return received and to make certain that the schedule data are as accurate as possible. Large samples do not necessarily justify either the effort involved in designing and controlling them or the returns received. Often the largest errors in a survey are not the sampling errors. Rather, they are the non-sampling errors that are due to such things as biased sampling, mispunching data, questions not being understood, records being lost, etc. A relatively small but well-organised sample will often give better results than a full survey or a large sample that cannot be properly administered because of the lack of adequate resources (Parten, 1965).

Samples of small and medium building construction firms having construction activities with Ahmadu Bello University, Zaria, were surveyed. Data obtained from Estate Department of the university indicated there are 148 firms carrying out various types of contracting activities, and from this, 113 firms are solely engaged in the building construction activities. The study intends to cover all the 113 firms. Table 3.3 shows number of contractors based on project classification, 24 contractors were engaged in carrying out capital projects, 26 contractors on ETF projects, while 63 contractors were in engaged in internally generated revenue projects. Table 3.4 gives a comprehensive summary of the building structures belonging to the institution located at Zaria (Main campus, Kongo campus), while some are located at Barau Dikko, New A. B. U.

Teaching Hospital, Mando and Kabba College. These lists do not include the current additional structures currently under construction by the University, ETF and Central Bank of Nigeria.

Table 3.3: Projects Type and Number of Contractors

Project from 2010 to 2012	No. of Contractors	Remarks
Capital projects	24	Expansion of Sickbay and renovation of Sulaiman Hall
Educational Trust Fund (EFT) projects	26	Dept. of Geomatics Engineering, Rehabilitation of lecture theatres, Faculty of Environmental design (Computer Aided Design Studio), Faculty of Social Sciences, ABUTH Medical Library at Shika, etc.
Internally Generated Revenue projects	63	Renovation and expansion of some selected faculty and departmental building structures, residential houses and administrative buildings
Total	113	

Source: Estate Department, A. B. U. Zaria, 2012

Table 3.4: Summary of A. B. U. Zaria Building Structures

S/No.	Building Structure type	No. of building structures	Location
1	Lecture theatres and Auditorium	39	Main campus, Agric & Kongo campus
2	Laboratories	219	Main campus, Agric & college of Agric. Mando
3	Workshops/Studious/Gymnasium	61	Main campus & Agric
4	Libraries		
	i. Main library	2	Main campus & Kongo campus
	ii. Faculty libraries	13	Main campus & Kongo campus
	iii. Departmental libraries	57	Main campus & Kongo campus
5	Students' hostels & Refectories		Main campus, Teaching hospital, Kabba college of Agric, Mando college & Barau Dikko
	i. Hostels	42	
	ii. Refectories	9	
6	Other existing facilities for teaching & learning (Staff school, Demonstration, Museum, etc	106	Main campus, Teaching hospital, Kabba college of Agric, Mando college & Barau Dikko
7	Lecture rooms		Main campus, Teaching hospital, Kabba college of Agric, Mando college & Barau Dikko
	i. No. of Departments	92	
	ii. No. of lecture rooms	171	
8	Residential Buildings	-	Records not available

Source: Estate Department, A. B. U. Zaria, 2012

3.3 QUESTIONNAIRES DESIGN

Questionnaire has been reported to be the most popular data collection technique in library and information research methods (Goodall, 1997). The use of questionnaires in research is based on one basic, underlying assumption, that is, the respondent will give truthful answers (Berdie and Anderson, 1974). This means the respondent will be both willing and able to give truthful answers. Consideration of this assumption is vital throughout any study using questionnaires.

In common with other techniques, questionnaires have both strong and weak points (Moore, 1987) and (Powell, 1997). Some of the reasons for choosing to use questionnaire for this study include the following:

i. *when economy and the elimination of the interviewer's bias are involved, this technique has its advantages*

ii. *when responses are gathered in a standardized way, so questionnaires are more objective, certainly more so than interviews*

iii. *it is relatively quick to collect information using a questionnaire*

iv. *the results of the questionnaires can usually be quickly and easily quantified by either a researcher or through the use of a software package*

v. *can be analysed more 'scientifically' and objectively than other forms of research*

vi. *When data has been quantified, it can be used to compare and contrast other research and may be used to measure change*

The instrument for the research requested the respondent to provide some biographical details. The questionnaire was divided into four sections. The first section examined the characteristics of respondents in terms of name and size of firm. The second section

captured the requirements of EDRM System for these firms through examining the current trends in document and record management standard practice by the building firms. The third identified the challenges the firms faced in traditional record management practice and the electronic system they used to supplement it, while the fourth section collected views from the respondents on how and the impact an affordable and user friendly EDMR system will have in record management practice in their organisations.

The questionnaire was designed to be attractive (in terms of layout), user friendly (in vocabulary and style), and not longer than two sheets of A4 paper, i.e. four sides to encourage respondents to complete it. Appendix I contain an explanatory letter and the questionnaire used in the study.

3.4 METHODS ADOPTED FOR DATA COLLECTION

There are two types of data collected in this study. First was quantitative data and secondly data qualitative in nature. This study needs quantitative data in order to investigate the areas outlined in objectives 2 and 3, while the qualitative data is essential to provide solutions to the problems discovered by the first method. Although two questions seeking qualitative data is included in the questionnaires it provides additional space for respondents to express their views and comments. The information gathered from this data is useful to explore some fundamental problems likely to be used in providing a comprehensive electronic package that would address the challenges and other issues explore from the quantitative data obtained.

A total of 113 questionnaires were sent for data collection out of which 82 were returned, giving a response rate of 72.57 per cent. Returns were analysed using

Statistical Package for the Social Sciences (SPSS). SPSS was used for the analysis, because it is a comprehensive statistical package, that enables the user to perform many different types of data analysis, in a simple manner, from simple frequency distributions to many other statistical routines commonly used in the social science (Nie *et al.*, 1975). Although it is a powerful software package for data management and analysis, it can also be used for simple basic statistical analysis as required by this study, which does not seek or require cross-tabula analysis. Thus, SPSS is used by the study merely for quantitative analysis of basic statistics only, though one would argue that the simplicity of the statistical analysis in this study could be undertaken using other much simpler statistical packages had they been available.

3.5 DESIGNING AND DEVELOPMENT OF THE PROTOTYPE EDRMS

The entire System Design was made using the MVC (Model View Controller) Design pattern. In MVC the Presentation layer, GUI (Graphic User Interface) was separated from the business logic and the databases, thereby enabling the system to seamlessly integrate with one another both on a local system and on remote (Separate) systems. The Software was designed using Java Programming Language, and the Database runs the My-SQL Relational Database Management System (RDBMS). The life cycle of the projects and the coding of the program follow the standard software development life cycle as discussed in item 3.6.1. This part was used to achieve objective (v).

3.5.1 System Development Life Cycle (SDLC)

In developing the EDRM System, unified process developed by Grady *et al*., 2005, was adopted in this study. The unified process is divided into four phases, Inception, Elaboration, Construction and Transition as shown in Figure 3.1. The *inception phase* is

where the overall scope of the project and its feasibility are determined; it ends with management giving their approval for the project. In the *elaboration phase*, the basic architecture of the system is designed. It is here that the needs of the user are determined. The *construction phase* deals with actual making of the software, usually involving coding the programme. The *transition phase* is where the system is handed over to the user for testing and deployment.

3.5.2 Programming: A Five-Step Procedure

The program was developed using a 5-steps procedure adopted from Williams and Sawyer (2007). Figure 3.2 Summarizes the five steps adopted for the programming process and they are as follows. First, *clarify/define the problem*.

Secondly, *Design a solution* by using modelling tools to chart the program, Thirdly, *Code the program* by use a programming language's syntax, or rules, to write the program. Fourthly, *Test the program* by getting rid of any logic errors, or "bugs," in the program ("debug" it), and lastly to *Document and maintain the program* by including written instructions for users, explanation of the program, and operating instructions.

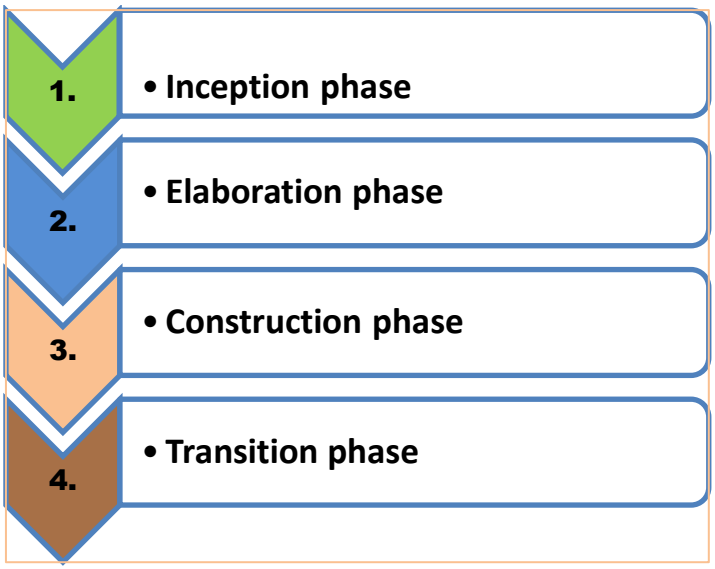


Figure 3.1: The System Development Life Cycle



Figure 3.2: Model for Program Development

The entire System Design was made using the MVC (Model View Controller) Design pattern. In MVC the Presentation layer (GUI) was separated from the business logic and

the databases, thereby enabling the system to seamlessly integrate with one another both on a local system and on remote (Separate) systems.

The Software was designed using Java Programming Language, and the Database runs the My-SQL Relational Database Management System (RDBMS).

3.6 VALIDATION OF THE EDRM SYSTEM

Validation is defined as an assessment of whether a framework or model is in congruence with reality (Brink, 2003). A variety of ways exists for model validation. However, as noted by Sargent (2005), there is no formalised guide or procedure for selecting the approach to adopt. Martis (2006) developed a simplistic view of a model validation process (Figure 3.3). The 'problem entity' represents the system (real or proposed) being modelled.

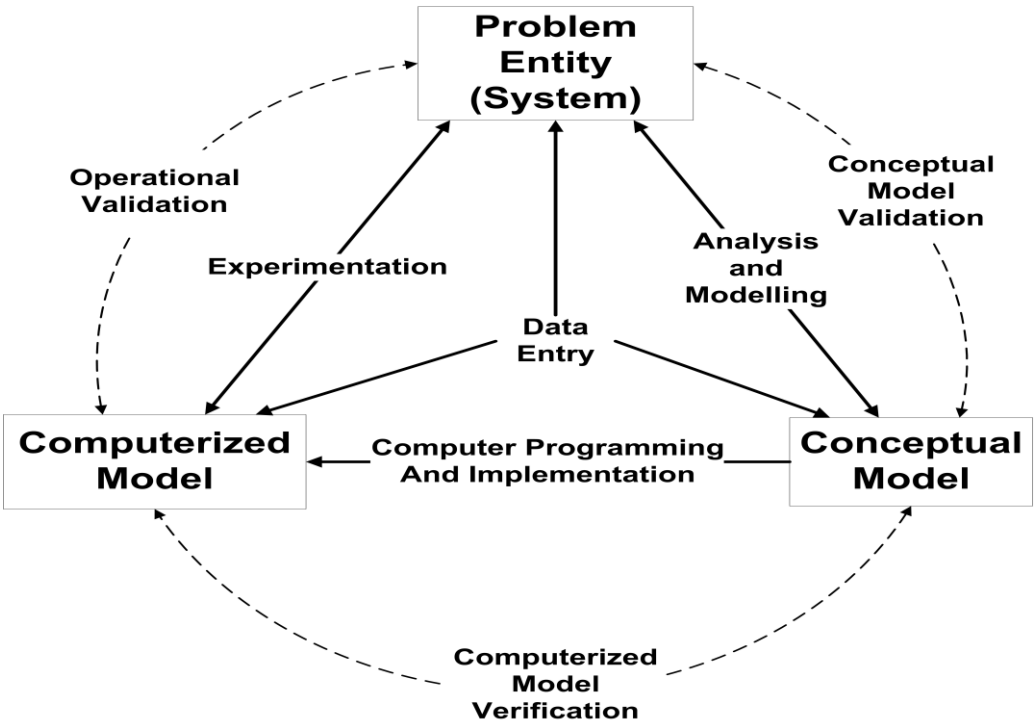


Figure 3.3: Model Validation Process
Source: Martis, 2006

The ’Conceptual Model’ Represents the Mathematical/Graphical/Verbal Representation of the problem entity, while the ’Computerised Model’ represents a computer implementation of the conceptual model. A first step in the model validation process relates to the conceptual model. This entails assessing the degree to which the model representation of the problem entity is sufficiently reasonable. The second step relates to the computerised view of the model. This relates to verification of the degree of correctness of the computerised model as a representation of the conceptual model.

Other steps include ’operational validation’ which is employed to determine whether or not the model’s output behaviour has sufficient accuracy for its intended purpose (Sargent, 2003). As a last step, the validity of the data used to develop the model, and that used for validation, needs to be assessed to ascertain its adequacy. Varieties of techniques for model validation do exist. Sargent (2005) gave a comprehensive and helpful review of these techniques. However, as noted earlier, there is no formalised guide for selecting the techniques to adopt. Each modelling task presents unique set of challenges and one has to figure out the best approach to test the model. Martis (2006) stated that the researcher alone cannot carry out validation. Rather, this should be done in communication with the user as this enhances the process of establishing the validity of the model. For this reason, the validation exercise in this work is carried out in conjunction with contractors who are the perceived users of the model. The focus of the validation exercise is on the conceptual and computerized models. The operational and data validation are intertwined in the computerised model validation.

3.6.1 Conceptual Model Validation

Chew and Sullivan (2000) noted that conceptual model validation is concerned with determining and ensuring that that the model adequately captures or meets its intended objectives. The essential output of this validation includes model weaknesses, points of strengths, and the extent to which the model meets its requirements (Ibrahim, 2008). Also, Sargent (2005) noted that the objective here is to determine the appropriateness of the structure, logic and causal relationships that exist in the model. In addition to these, effectiveness, pragmatism, and clarity tests have been proposed (Martis, 2006). A combination of two approaches aimed at capturing both subjective and objective measures of validity were adopted in this work. The 'scoring model' approach was used to obtain a quantitative measure of the model validity while 'face validity' approach was used to obtain a qualitative measure. These, according to Sargent (2005) are the primary validation techniques used in model concept validation. The definitions of, and results of the two approaches are presented in the following paragraphs.

The model was evaluated in three parts. Thirteen participants were involved in the exercise. The first part involved four academics; the second part involved six contractors and the last seating three of the client's representative were involved. Both the conceptual and computerised models were demonstrated and discussions followed regarding its potential use in record management practices. Both quantitative and qualitative data were also collected. The quantitative data was collected based on the scoring model approach. According to Martis (2006), the scoring model approach employs weights or scores to determine scores for each test category. These are then combined to obtain an overall validity score for the model. To obtain these scores, graphical representations of the different views of the model were presented. This was

followed by a demonstration of the actual computer implementation of these views. Participants were then presented with an evaluation questionnaire (Appendix V), and asked to score the model in terms of a number of criteria. In addition to this, notes were taken on the discussions that followed. Details of results of validation, and the issues discussed are presented in chapter 5.

3.6.2 Testing and Debugging

Testing the computerised model serves to ensure that the conceptual model, including its associated design is correctly converted into code (Chew and Sullivan, 2000). The questions that this exercise seeks to address relate to whether or not the conceptual models are implemented as documented. Also, the exercise helps in debugging and ensuring that the implementation of the model yields the desired results.

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DISCUSSION

The aim of this research work was to develop a prototype EDMR system for managing electronic records in building firms with a view to enhancing projects records management practice. This aim of the study was translated into six objectives as stated in chapter one. The presentation, analysis and discussion of the results is the concern of this chapter, and is intended to cover objective one, two three and four of the research, while objective five would be discussed in Chapter 5.

There are 22 questions consisting of 100 variables, grouped into three sections based on the objectives of the study. These questions were included to elicit information on the project records management being practised by the small and medium building firms. The subsequent analysis of the questionnaire returns produced a great deal of quantitative data and some general information that contribute to the understanding of the state of project records management. The data collected was analysed within the framework of the research study and geared towards providing a framework to address the challenges identified during the course of the study. This analysis concentrated on the variables, which lead to effective records management. An attempt was then made to determine to what extent the construction firms had developed a records management programme. Descriptive statistical analysis using SPSS was applied to summarise and organise the data and to present it in a series of tables and charts, in order to investigate the relationship between the variables. The resulting tables and charts do not in themselves provide conclusive indicators, but they can be used to see if any clear association is apparent. In some cases, follow up research will be required to amplify

these results. The number and percentage of firms responding to each choice within the questionnaire were presented. Analysis and comments on the responses follow each table and chart representing the data collected.

4.1 DATA REQUIREMENT FOR EDRM SYSTEM

In order to ascertain the requirement for the proposed EDRM System, the study examined the current trends in documents and record management standard being practiced by the surveyed firms, and the standard requirements set-up by ISO 15489 was adopted as a guide.

Table 4.1 shows that 42 firms have 0 – 9 employees (Micro), 32 firms have 10 – 99 employees (Small), while 8 firms have employees ranging from 100 – 299 (Medium). Thus, all the firms surveyed for the study fall under SMEs category.

Table 4.1: Size of the Building Firms

No. of Employees	Firm Type*	Frequency	Per cent	Cumulative Per cent
0 – 9 employees	Micro	42	51.2	51.2
10 – 99 employees	Small	32	39	90.2
100 – 299	Medium	8	9.8	100
Total		82	100	

Source: Field Survey, 2012
* Categorization by Federal Ministry of Industry Nigeria (Udechukwu, 2004)

The result shows only 22 (26.8%) respondents are adopting a particular standard in managing records, while the remaining 60 (73.2%) respondents admitted they do not use any standard in managing their records. Figure 4.1 shows only 2 (2.4%) firms adopt ISO 15489 standard in managing their project records, while none of the firms are using standard established by Australian Government, AS 4390. Respondents using their own standard in managing records account to 20 (24.4%), while 60 (73.2%) admitted for not

using any standard in managing records in their firms. The lack of proper standard methods in managing records could affect the smooth running of these firms.

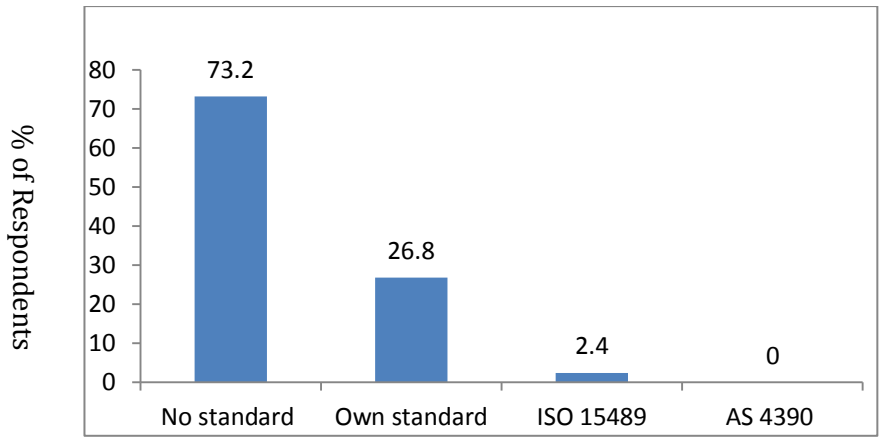


Figure 4.1: Record Management Standard Use by the Firms
Source: Field Survey 2012

With respect to maintaining records, the result shows that all respondents (100%) reported that they maintained a collection of project records relating to the organisation's building construction activities. This was determined to be an indication that all the surveyed firms attached a degree of the importance to maintaining project records to enable them to carry out their business activities. Table 4.2 shows the respondents appear to keep their records for minimal reasons, i.e. to enable them to perform their business activities without any concern to keep records for other reason such as for legal compliance, research, etc. Although most of these firms may not understand the art of managing records according to professionally accepted records management principles, they basically understand the importance of keeping those records.

According to records management principles, companies ought to keep their minutes and supporting papers because these records contain most information about their operations and are of high evidential value.

Table 4.2: Percentage of Project Records by Type Retained by the Building Firms

S/No.	Project Records	No. of Firms	Percentage of All Firms
1	Architectural Drawings and Specification	82	100
2	Structural Drawings and Specification	79	96.3
3	Mechanical Drawings and Specifications	70	85.4
4	Electrical Drawings and Specifications	72	87.8
5	Priced Bill of Quantities	82	100
6	Construction Projects Plan	51	62.2
7	Project Quality Management Plan	18	22.0
8	Project Health and Safety Plan	17	20.7
9	Condition of Contract	54	65.9
10	All-risk Insurance for Building Works, Personnel and Equipment	19	23.2
11	Approval of Building Plans from Government Agencies	47	57.3
12	Documents on Business Agreement (Legal records)	40	48.8
13	Setting out Compliance Form	31	37.8
14	Inspection and Testing Report Forms	27	32.9
15	Foundation/Basement Compliance Form	19	23.2
16	Superstructure Compliance Form	17	20.7
17	Services Compliance Forms	17	20.7
18	Progress Reports, Weekly, Monthly Reports	55	67.1
19	Minutes and Supporting Papers	56	68.3
20	Progress Photographs	60	73.2
21	Finishes Compliance Form	19	23.2
22	Circular Form	33	40.2
23	Correspondence Reports	29	35.4
24	Accounting and Financial Records	61	74.4

Source: Field Survey 2012

The study found that 68.3% respondents retain such records of enduring value, 57.3% retained approval of building plans, 37.8% setting out compliance details, 32.9% inspection and testing report records, while only 20.7% each of superstructure and services compliance records were retained by the firms.

These data clearly indicate that the small and building construction firms surveyed in this study do not have an appreciation of the concept to associate with the value of project records. This implies that appraisal process is not practised and retention schedule not applied to their records. Thus, the 'core' elements of a records management programme have not been incorporated in their record management practice. Although these firms do keep some project records, but they do not manage their records according to a widely accepted records management practice. Records are kept without realising that they need to be managed according to a certain standard for some reasons beyond their immediate concern such as for legal compliance and to provide reference for research. The result also, reveals that firms are likely to keep records to fulfil short-term functions; the project records are kept merely for carrying out business transactions. Though this is the very main reason why records are retained by businesses in general, but small and medium building firms seem not to foresee the further needs of keeping records. Thus, keeping records for legal compliance appears not to be a primary concern.

This result also implies that the firms are unaware of the social responsibility of making their project records available and accessible to users and researchers. They are not aware of a requirement to disclose information contained in their records to the public

after a certain period of time. Furthermore, respondents do not appear to understand the fact that project records can play a significant role in the development of the country.

With respect to the personnel looking after the management of the records, the results in Figure 4.2 shows other than professionals such as archivist, keeper of document and librarian there are several other titles of persons employed by the firms to handle their records. These include, Contract Manager (6 respondents); Project Manager (14); Administrative Manager (4); Project Engineer (7); Company Secretary (9); and Clerk (2 respondents). In some of these firms, more than one personnel indicating that project records are kept in various departments handle records. Several personnel handle these records and many are the managers of respective departments. This altogether makes 51.2% of firms employing officer of various titles (other than archivist, keeper of document and librarian) to manage their project records.

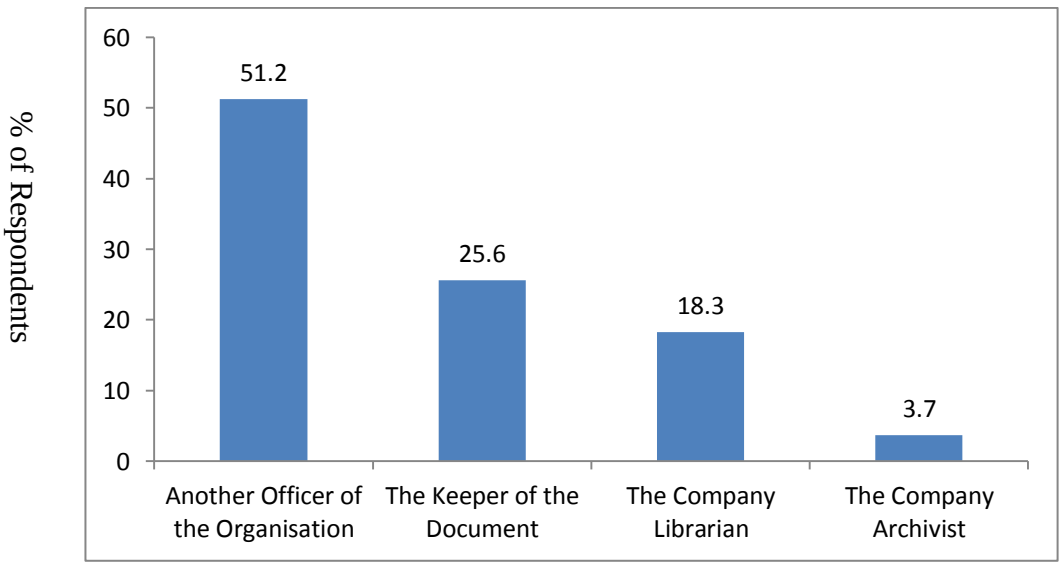


Figure 4.2: Designated Title of Person Responsible for Firm's Project Records
Source: Field Survey 2012

In developed records management programme, para-professionals are normally responsible for the routine work of listing, boxing, shelving, and retrieving records. As relatively untrained personnel can do this work, staff with a library background can perform these jobs. But the records professional is the person who creates and extends the systems. Only professionally trained records managers will be able to justify (and hence convince their superiors of) the need for developing a records management system within an organisation.

Figure 4.3 shows that the staff assigned to manage the firm's records are unlikely to have received appropriate professional training in records management. The inconsistency in the data in Figure 4.2 and Figure 4.3 also indicates that in some firms, more than one person is given the responsibility to take charge of the records.

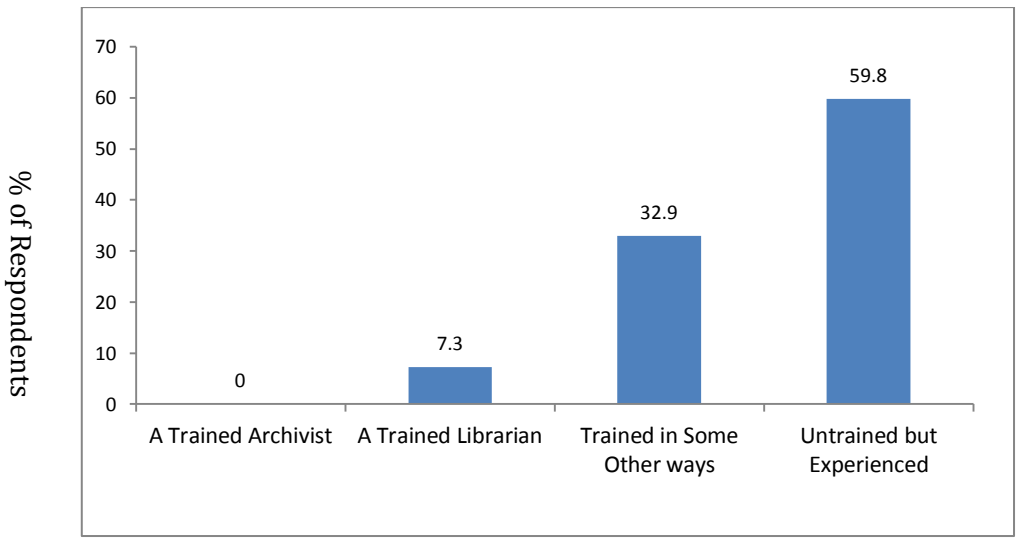


Figure 4.3: Trained Personnel Responsible for Firm's Project Records
Source: Field Survey 2012

This data also implies that there is no strong correlation between post designated and qualification of personnel employed to handle the firm's records. Again, it infers that firms are not clear about what constitute records management The general perception

they have is that any personnel can handle records. This is confirmed when 59.8 per cent of the firms answered that personnel handling their records are without appropriate qualification.

Figure 4.4 further confirmed that personnel handling the firm's records are without appropriate qualification, where it shows responses on Librarian 7.3% against 18.35, while none of the Archivist has any formal qualification to handle the firms' records.

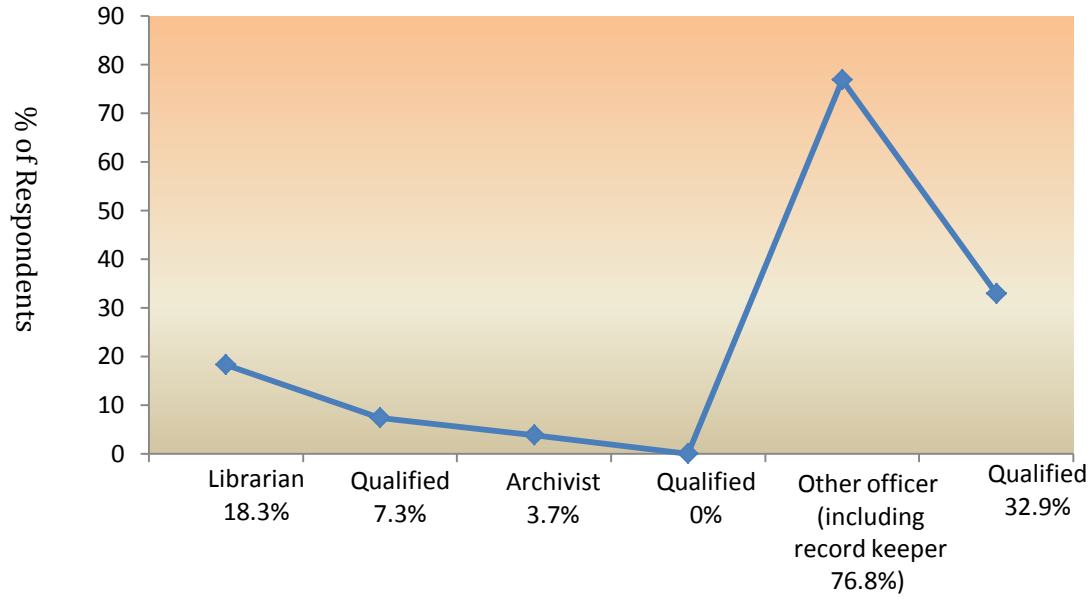


Figure 4.4: Designed Post Versus Qualification
Source: Field Survey 2012

On the issue of storage of the records, Figure 4.5 shows more than half of the respondents (57.3%) reported that the firms records are not stored in a central location, they were scattered. Only 6.1% have records in a single central store, this indicate that most firms surveyed are ignorant of one of the major benefits of a records management system, namely removing records from relatively expensive to relatively cheap accommodation. The expected correlation between the persons responsible for records and their locations was not evident from the responses to these findings. Secondly it

shows that respondents are unable to rationalise the importance of setting up a central location (i.e. a records centre) to accommodate their inactive records on the grounds of costs of records centre storage against office storage.

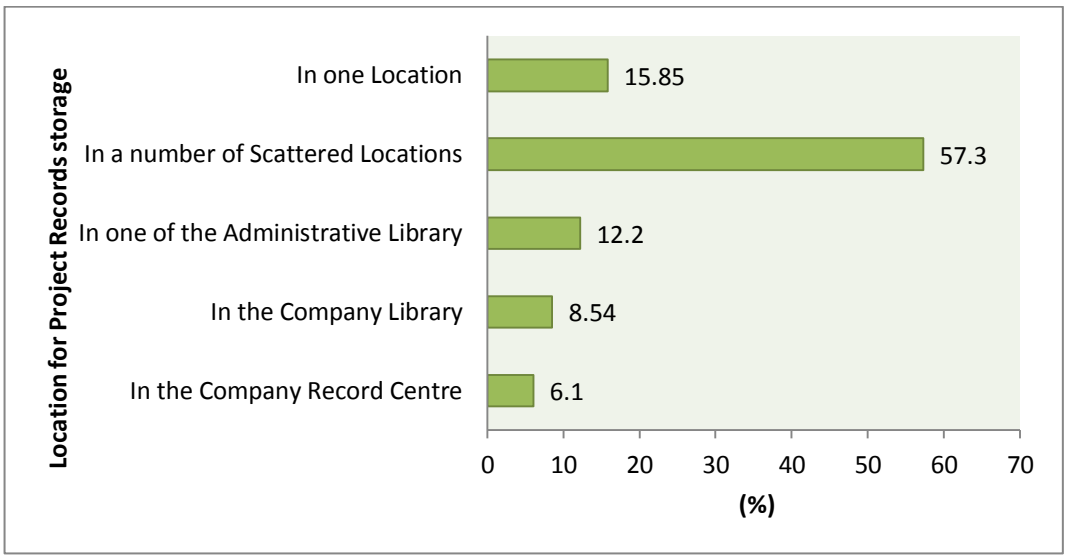


Figure 4.5: Locations where Project Records are Kept
Source: Field Survey 2012

On the other hand, to be effective, a records management programme must be acknowledged by the management of the firm by setting up a committee that will be in charge of the organizations' records. Unfortunately most of the firms' respondents confirmed for not having committees looking after these records. Figure 4.6 represents the committee's set-up to govern the whole business of the firm's records management; it showed that, in only 28 firms, a committee looked after the records management programme: the records committee (3), the library committee (6), and some other company committee (19). It is noticeable that where control was considered necessary, it seems often to have gravitated to the library committee, often because the library is, or is regarded as, the most suitable repository for records. The remaining firms reported that no separate body exercised general oversight. In some of the firms, the

management of records has been wholly delegated to the appointed personnel without any committee to refer to or ask for advice. This could be the result of being unable to appreciate the significance of records management programmes to the survival of their business.



Figure 4.6: Committee Responsible for Records
Source: Field Survey 2012

Part of good record management practice is, an organisation to set up a policy that could be used as guide in managing their records (ISO 15489). Figure 4.7 shows there are generally an absence of written policy and guides about the management of records by these building firms. The responses of the firms with respect to presence or absence of a records management programme policy, that can be formulated in the form of advice or a manual in the firms, is that, only one quarter of the firms (25.6%) has written policy and guidance about the management of their records. Firms without any written guide are up to 53%, but often asked other personnel to issue such guide. These included the Administrative Manager (4), Personnel from various departments (2), Audit Department (2), Contract Manager (5), Company Secretary (1), Project Manager (5), and Project Engineer (2), while 21.4% of the respondents did not specify the persons responsible for

issuing the guide even though they may have written policy and guidelines about the management of records.

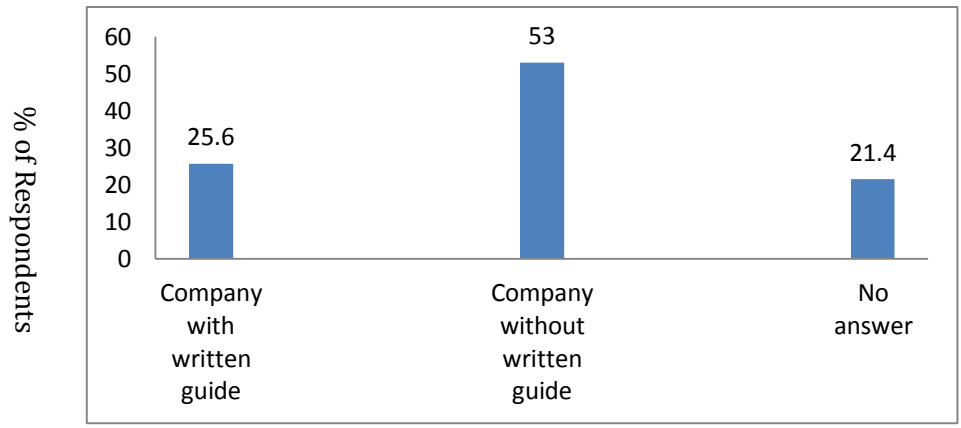


Figure 4.7: Responses Regarding the Presence of a Record Management Programme Policy and Guidelines
Source: Field Survey 2012

Respondents were also asked about the form in which the written policy and guidance was published and only 7 respondents (8.5%) reported that their guide was issued in written format such as a handbook, brochure of leaflet; 46 (56.1%) reported that the guide was not written, while there was no answer from the remaining 29 (35.4%) respondents.

This result is important because, for a records management programme to succeed, a clear written procedure manual that includes the policy of the company and the strategy for the programme must be available. Such a guide ensures consistencies in activity and procedures. A standard approach also helps ease the overall management of records. A guide will avoid the situation where different departments take different actions and approaches to solving problems relating to records management. Inconsistencies in approach will often impair instead of support the management of the organisation.

Respondents were also asked about the scope of written guidance, based on what a typical handbook might contain as reflected in good practice adopted in various centres. Table 4.3 reports on the responses made by the 24 firms that responded positively.

According to ISO 15489 (2001) generally, a booklet of guidance should contain the following.

i. after a brief preface from the General Manager explaining under whose authority the handbook is issued and recommending the practices contained within it, the handbook should describe the services which the records management staff can supply to offices in the company,
ii. it should give general guidance about the categories of records to be destroyed almost as soon as they are received and about those categories which the company wishes to preserve, and
iii. accompanying the handbook there should be a list of the classes of records known to exist in the company at the date of publication, with recommendations for their permanent retention, preservation or destruction.

Ten firms (12.2%) in the sample included information about the storage of non-current records in office accommodation in their written policy and guidance. Fifteen firms (18.3%) had information about the removal of non-current records from filing cabinets, the listing of non-current records, and the periods of time for which noncurrent records of various classes should be kept. As had already been pointed out, less than a quarter of the firms as a whole had written policies and procedures for records management activities. This is another indication of the conclusion that small and medium building

construction firms surveyed do not generally understand and apply records management principles in running their businesses.

On the other hand, the absence of written policy and guidance does not imply that simple records management practices are never carried out. Office staff is often familiar with at least some of them. But it does not appear that many firms regard the proliferation of records as sufficient justification for publishing general guidance.

The result also shows 36 respondent (44%) indicated that the written guide was issued by officers in charge of the firm's record management (the archivist, the keeper of documents, the librarian or some other officer); 32 (39%) the guide does not come from any of the mentioned officers, while there was no response from remaining (17%) of the respondents.

Table 4.3: Particulars Included in the Guide

S/No.	Type of Guidance	No. of Firms	Percentage of All Firms
1	The removal of non-current records from filing cabinets	15	18.3
2	The packing of non-current records in transfer cases or other boxes	13	15.9
3	The listing of non-current records	9	11
4	The storage of non-current records		
	i. in office accommodation	10	12.2
	ii. in the institution archives	3	3.7
5	The 'weeding' of non-current records	8	9.8
6	The periods of time for which non-current records of various classes should be kept	5	6.1
7	The shredding, destruction or disposal of non-current records	5	6.1

Source: Field Survey 2012

Table 4.4 shows records management practice carried out by the surveyed firms. Only 38 (46.3%) of the respondents practice the removal of non-current records from filing cabinets and 24.4% look at the periods of time for which non-current records of various classes should be kept in the central store, while only 28% practice the shredding, destruction or disposal of non-current records.

Table 4.4: Records Management Practice Carried Out by the Firms

S/No.	Type of Records Management Practices	No. of Firms	Percentage of All Firms
1	The removal of non-current records from filing cabinets	38	46.3
2	The packing of non-current records in transfer cases or other boxes	33	40.2
3	The listing of non-current records	28	34.1
4	The storage of non-current records in office accommodation in the institution archives	**28** -	**34.1** -
5	The 'weeding' of non-current records	31	37.8
6	The periods of time for which non-current records of various classes should be kept	20	24.4
7	The shredding, destruction or disposal of non-current records	23	28.0

Source: Field Survey 2012

4.1.1 Challenges in Traditional Record Management System

The result shows that all the respondents (100%) reported facing some challenges in using traditional (paper) form of record management. This was determined to be an indication that most of the small and medium building firms have some degree of the

problems pertaining to maintaining project records, and if these problems are not addressed properly, it would not enable the firms to carry out their business activities properly.

The results in Figure 4.8 shows that, the most frequent challenges facing the building construction firms are the large storage space required to manage the paper records. This shows that the space needed to store huge amount of volume of records in the traditional record management system (TRMS) is a serious challenge, because as the volume of records increase, so also does the physical space required storing them. Space savings is therefore, the most immediately realized benefit of a records management program. By implementing retention schedules and systematically destroying records that have met their retention requirements, an organization can significantly reduce the space occupied by records. Time consuming for searching and filing records scored 52% each from the respondents' point of view. This indicate the use of traditional form of records management amounts to delay of information flow, as an information needed would have to be searched for manually, and this result in loss of valuable time, which consequently results in economic loss.

In record management security is one of the vital considerations in the progress of a firm or an organisation by preventing unauthorised access to confidential information. Almost 50% of the respondents have security challenges in managing their records. This is an indication that there is a risk of unauthorised personnel gaining access to the organisation' records.

Records loss due to natural disaster, like, fire outbreak scored 44%. The fact that traditional record management methods are largely centralized, makes it vulnerable to

be lost in the incidence of fire out break because the space requirement makes it too expensive for organisations to have an equally bulky back up, this sometimes may mean building a warehouse for files.

The results furthermore show that traditional record management is slow and expensive (32%). This as a result of the huge amount spent in personnel to manage the voluminous amount of paper records and high cost spend in buying papers, photocopying, binding and filing. Time consuming and difficulty in locating the records is 30%, while limited user access, where multiple users at different workstation cannot access the same data simultaneously ranked 29%. The least challenge reported by the respondents, is where records are misfiled, this scored only 4%.

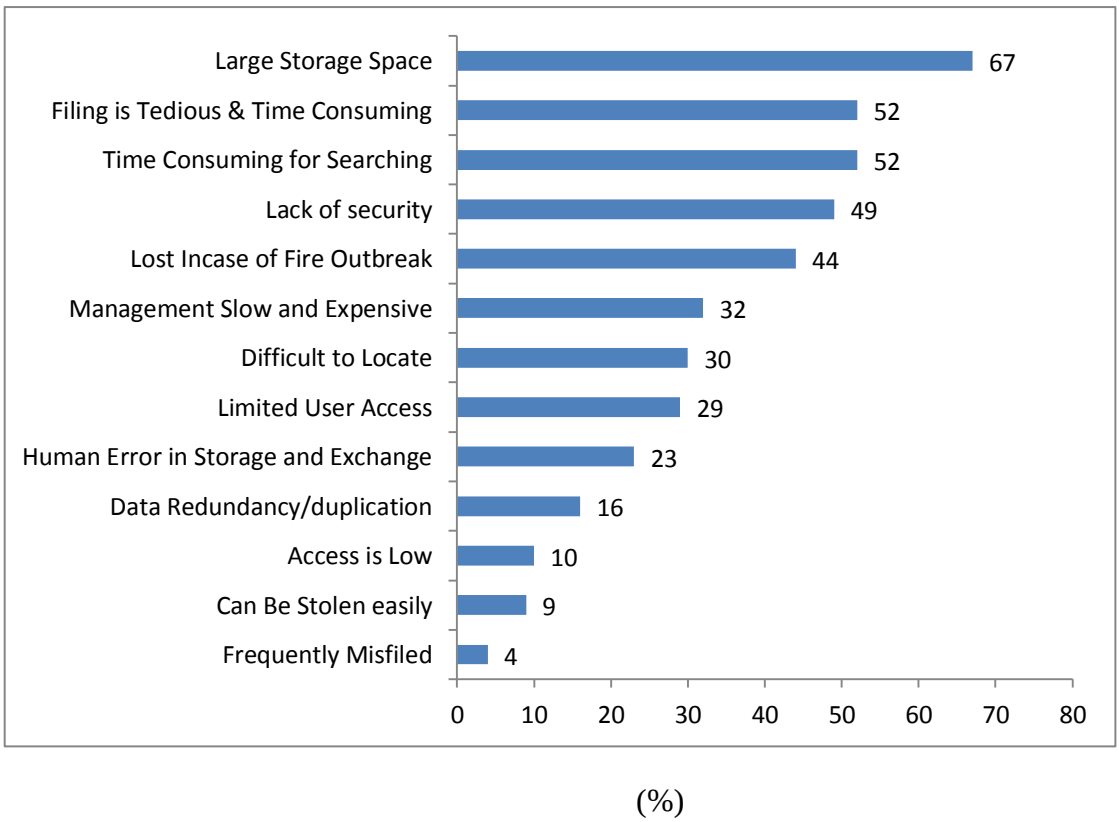


Figure 4.8: Summary of Challenges in Traditional Record Management System

4.1.2 Software Supplement for Traditional Record Management

The result shows all the respondents use some of the available IT software to enhance their records management practice. Figure 4.9 reveals the extent of software applications of some business processes. All respondents use computer for general administration works. Microsoft word is a word processing document whose function borders around formatting, editing, planning and finally printing of the processed document into hard copies. It is basically meant for processing documents and records. This software is also used in storing the produced records, but will limitation of storing only documents or records created in that format.

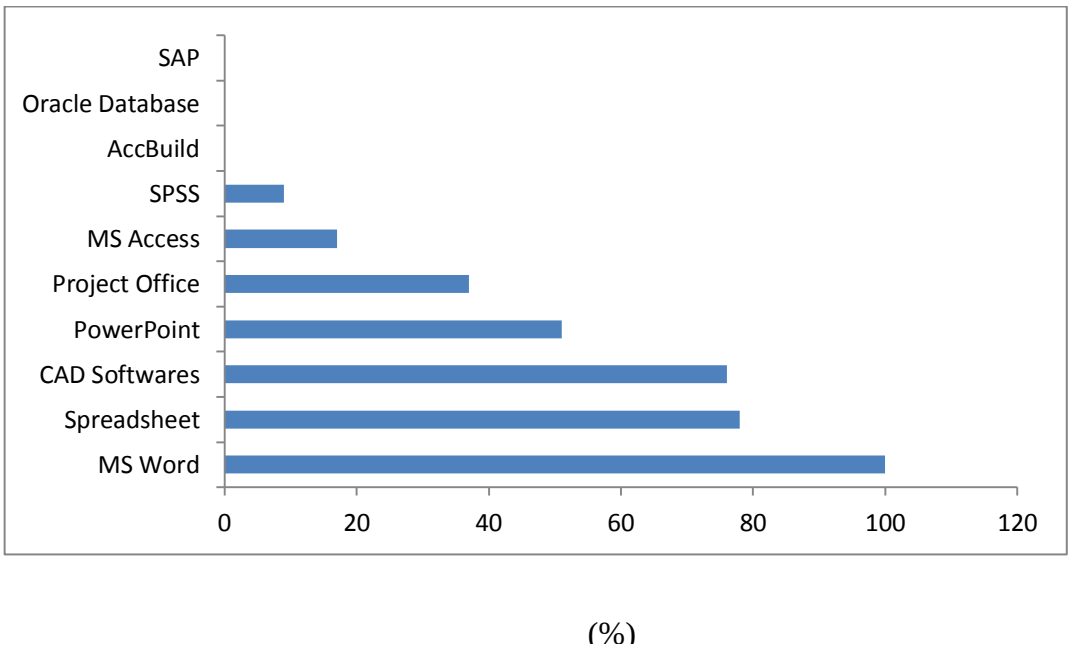


Figure 4.9: Software Usage to Supplement Management of Records

Operations such as, drawings, tender preparation, bill of quantities, costing, and invoicing are highly computerized. Many functions such as project management, scheduling, material control, technical calculation and engineering analysis, are moderately computerized, while usage of statistical tool is rated very low. These software are generally designed to enhance creation of documents and records in their

formats with limited facilities in-built to store, search and provide security of such records. They are not designed to serve as a document and record management package with the ability to support other records created from different software and allow multi sharing of records created in different formats. The database management applications, which is the prime tool in record management process is not in use at all by the surveyed firms.

Since database record management software are not in use by the firms, other storage facilities to supplement the facial record management are employed. Figure 4.10 shows all the respondents (100%) use hard disk to supplement storage and sharing of the records. This is an indication the values attached by the respondents' in keeping the available e-records in the organisation. Other storage medium, such as compact and optical disk are moderately used. The study also reveals that their still some construction firms that uses floppy disk as a medium for storing and sharing of the records.

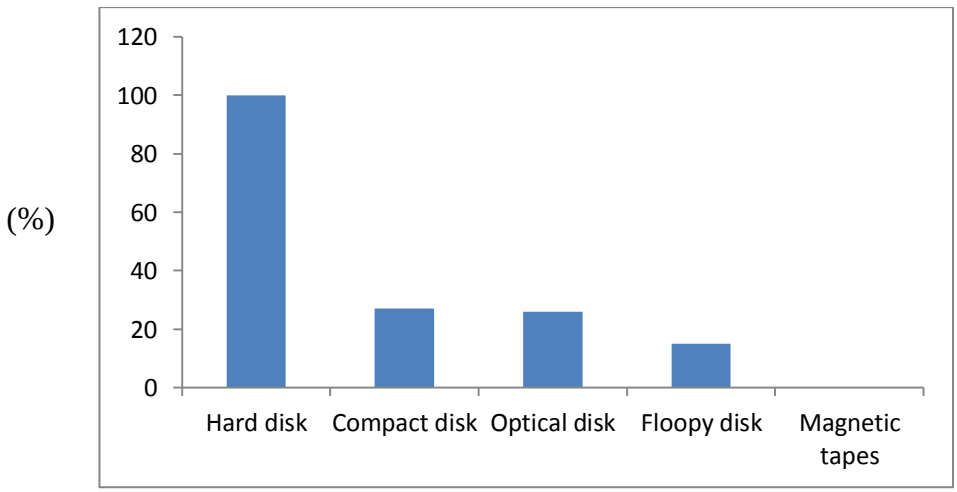


Figure 4.10: External Source for Storing e-Records

The results discussed in this chapter addressed the various problems and challenges the small and medium building construction firms faced in record management practice and

the available IT facilities within their reach, used in supplementing the record management practice. The results shows also that the firms have the basic IT skills required in using a simplified database record management facilities that is affordable in managing their records, which if provided will greatly reduce the much use of the traditional record management system by the firms.

The results also shows that part of the EDRM system requirement established for the small and medium building firms from this research should include among others, the types of records to be stored in the database and logical arrangement of records (Filing System). Other essential requirements should include easy searching and retrieving of the records; security of records; system compatibility and ease of sharing of records among staffs (Networking System). Detail technical requirements for the EDMR system were discussed under item 4.3.2.

4.2 SCHEMETIC PRESENTATION OF EDRMS CONCEPTUAL FRAMEWORK

The various problems and challenges associated with the traditional form of paper record management being experienced by small and medium building firms and the available IT facilities used in supplementing these challenges discussed above, and the requirements for EDRMS established in this research were used to develop the conceptual framework of the EDRM system.

Developing a computer system requires designing of the program as discussed in chapter 3. To therefore, develop the EDRM system prototype, there is need to first design a concept that will be used as a guide when developing the prototype EDRM system.

A conceptual framework in form of schematic diagram, shown in Figure 4.11, was developed, and it was designed by considering the requirements of EDRM system and the various problems and challenges associated with record management practices mentioned in the previous chapters.

In developing the conceptual framework, security was considered first. Two ways to get access to the database was designed, the first way is through the administrator, who will be in charge of the entire record management of the firms' records. The administrator requires basic IT skills to operate and manage effectively the developed prototype EDRM system. The functions of the administrator as a trained record manager, would be, among other functions is to create and provide username and password for authorised firms' staff. He/she can also remove any username in the event a staff leaves the firm or is disengaged from the services of the firm.

Other responsibilities designed in the conceptual framework for the administrator include creating a project file detail. This include the name of the project; commence date of the project work; brief description on the project. The framework was designed to automatically create an ID for that project based on the initial information inserted in the database on the project. The next responsibility for the administrator is uploading documents and records into the database. This include any document or record that has been certified by the management to be put in the database, and it can be from any IT source, such as directly from the CPU, external sources (hard disks, compact disks, flash memory, etc.); emails or directly from the net.

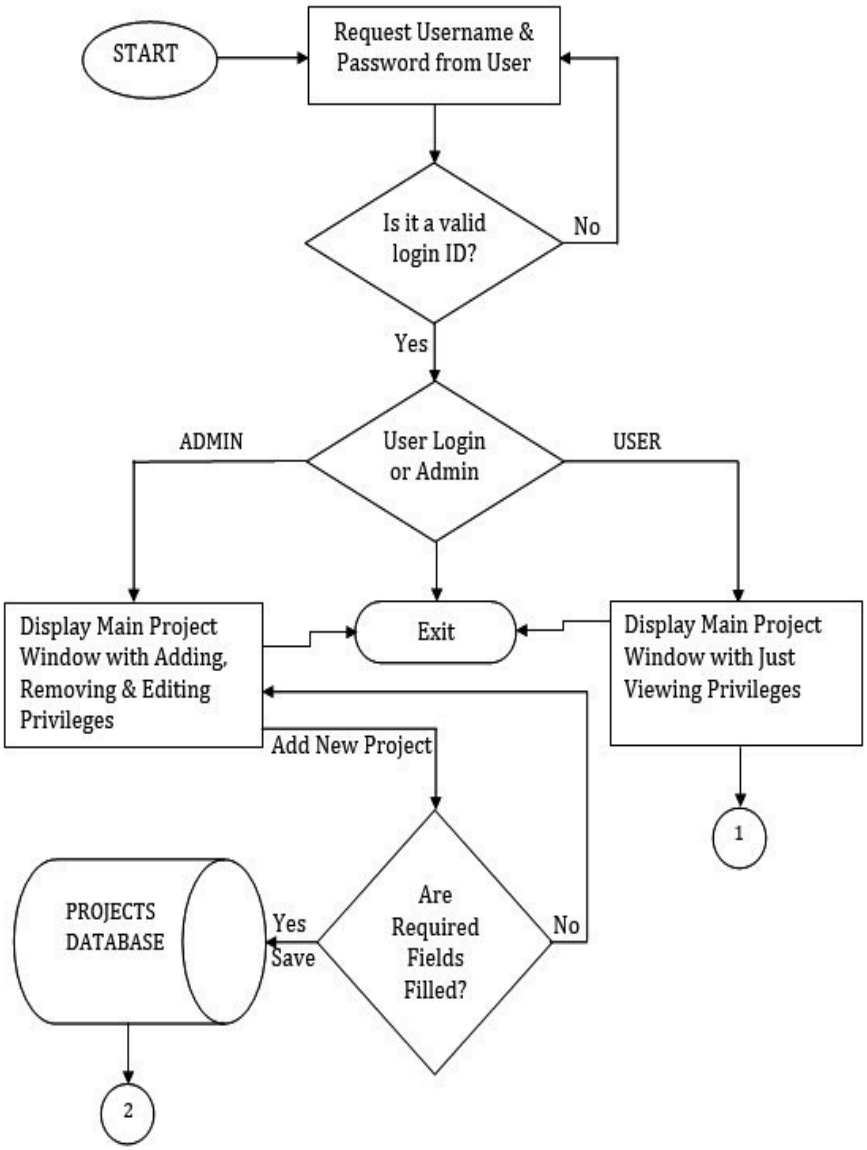


Figure 4.11: Conceptual Framework of the EDRM System

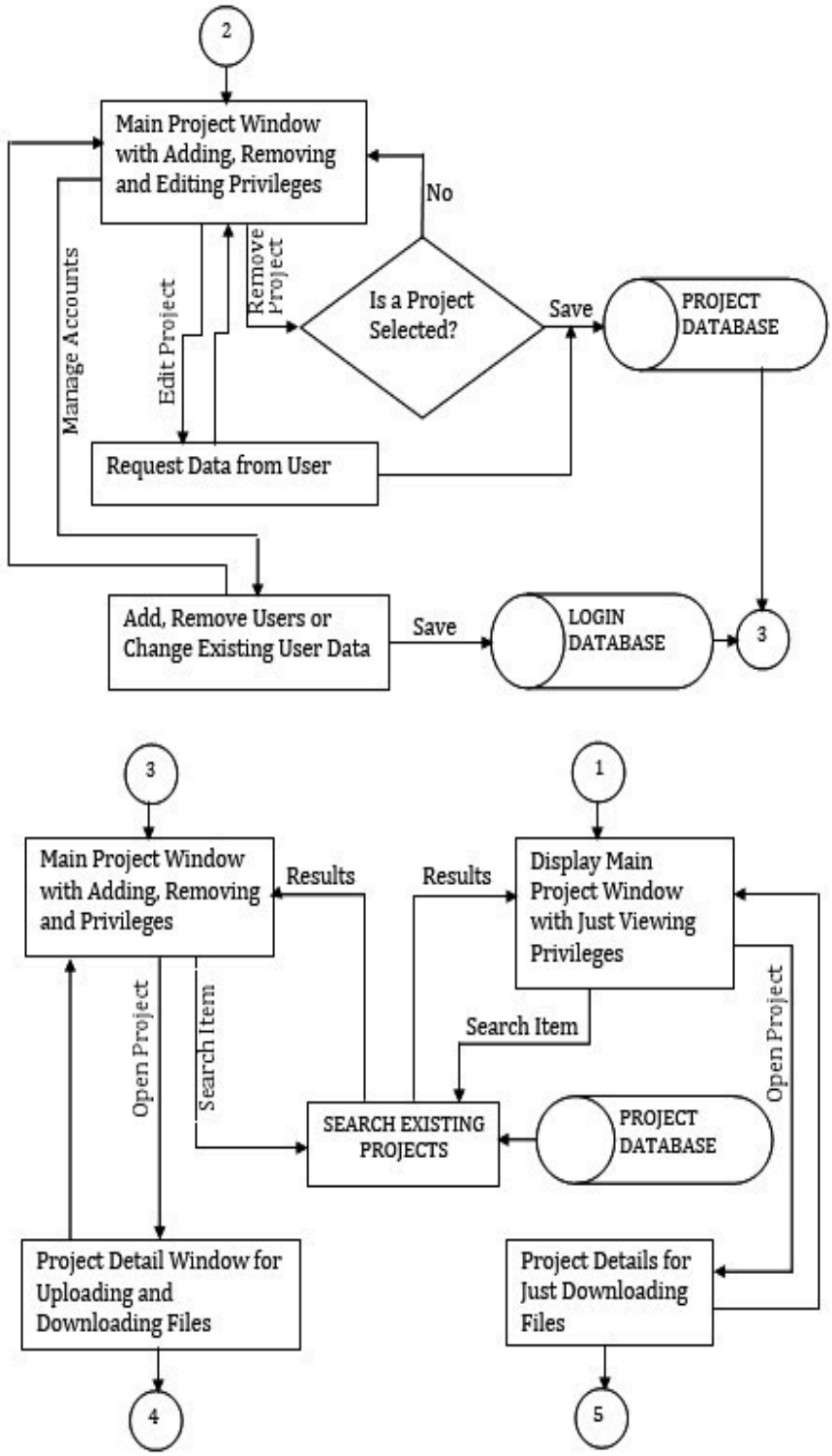


Figure 4.11: Conceptual Framework of the EDRM System (Cont.)

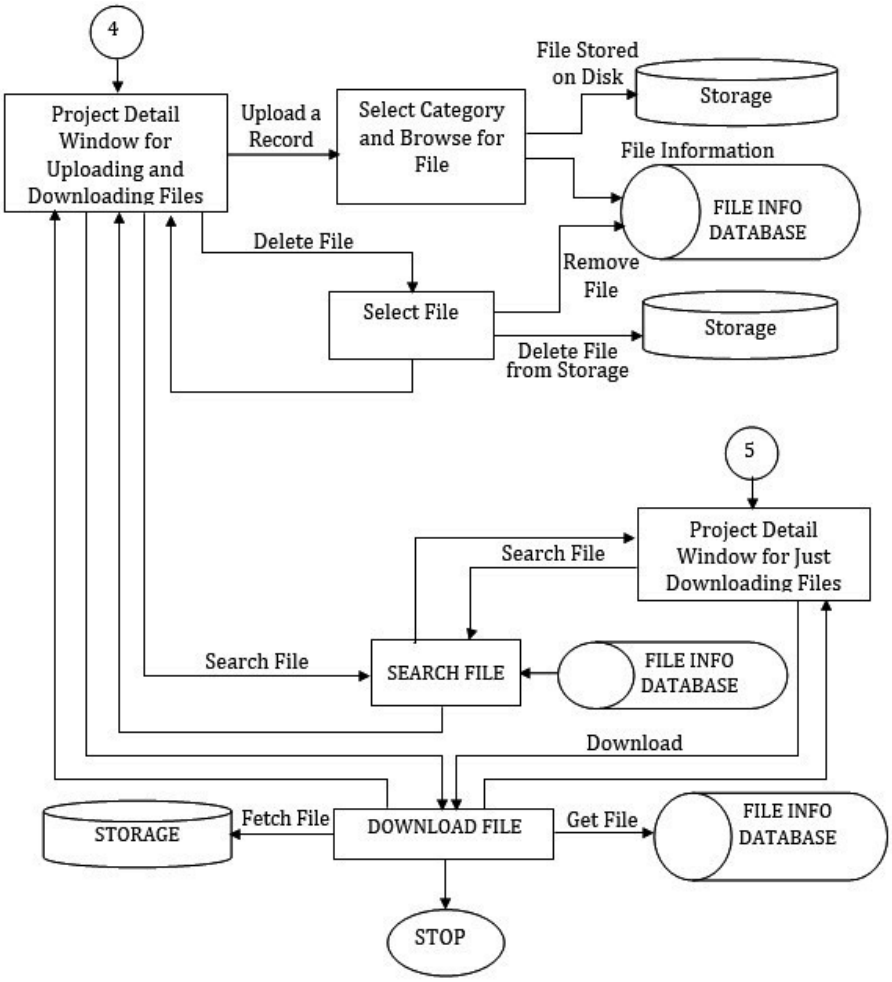


Figure 4.11: Conceptual Framework of the EDRM System (Cont.)

The other facilities designed in this framework for the administrator include searching, filtering, retrieving and downloading of any information on projects, documents or records in the database. The administrator, with the authority from the management can also edit and delete completely a project or a document or a record from the database.

The second way of getting access to the database is through the user. A user is the person that has been given an authority by the management to have access to the database. He/she would be assigned with a username and password. This conceptual framework is therefore designed to allow the user getting access to the database by

login in with his/she correct username and password. The user has limitation on the use of the database. He/she has the permission to view, search, filter, retrieve and download any document or record from the database. However, because of the security designed in the framework, the user cannot upload, edit and delete anything from the database.

4.3 COMPUTER PROTOTYPE EDRM SYSTEM

Objective 4 was achieved through developing the prototype EDMRS using the concept developed in the EDRM conceptual framework. The requirements for EDRMS for the small and medium building firms and the various challenges they face in using the TRMS were fully integrated in the developed computer prototype EDRM system.

The system has been developed to be a user friendly; thereby a user with basic IT skills can operate the system. The functionality of the system among others is to, create; save; share; update; search and retrieve records and with maximum security of these records built into the system.

The theoretical background and underlying principles supporting the development of the package was discussed in chapter 3. This is followed by an outline of the design and the main functions of the package. The potential of the package to enhance organizational ability to properly manage project documents and records were also discussed. The testing, evaluation and validation of the package was discussed in chapter 5.

The conceptual framework developed, previously shown in Figure 4.11, was used as the basis for developing this prototype computer (EDMR) system. The login sequence used in the framework, which start from developing in-built security for the system – through

adding username and password – to uploading; searching; filtering; download; deleting of project or document or record, etc. was followed to the end of the design.

The database has been configured to be storing data in a tabular form. This makes it easier to design and assigns the contents required to be in the database, it also allow for developers of computer system to plan and arrange all the contents that would be required for the system to operate before programming commences. The code used in creating the database and the contents is:

```
create database engr;
use engr;
create table contract_docs(path text,
    doc_type int,
    projectID int,
    name text);
create table execution(path text,
    parentID int,
    docID int,
    projectID int,
    name text);
create table general(path text,
    doc_type int,
    projectID int,
    name text);
create table login(name text,
    pass text);
create table projects(file_no int primary key not null auto_increment,
    ID text,
    location text,
    commenced date,
    completed date,
    description text);
create table suggest(user varchar(20), project(20), complain text);
insert into login values("admin", "admin");
```

The major contents for this prototype EDRM system included in the database are:

i. Login into the database system- security for the stored records; which was designed to include the administrator (trained personnel in charge of the system) and other users of the records as shown in Figure 5.5a;

Login

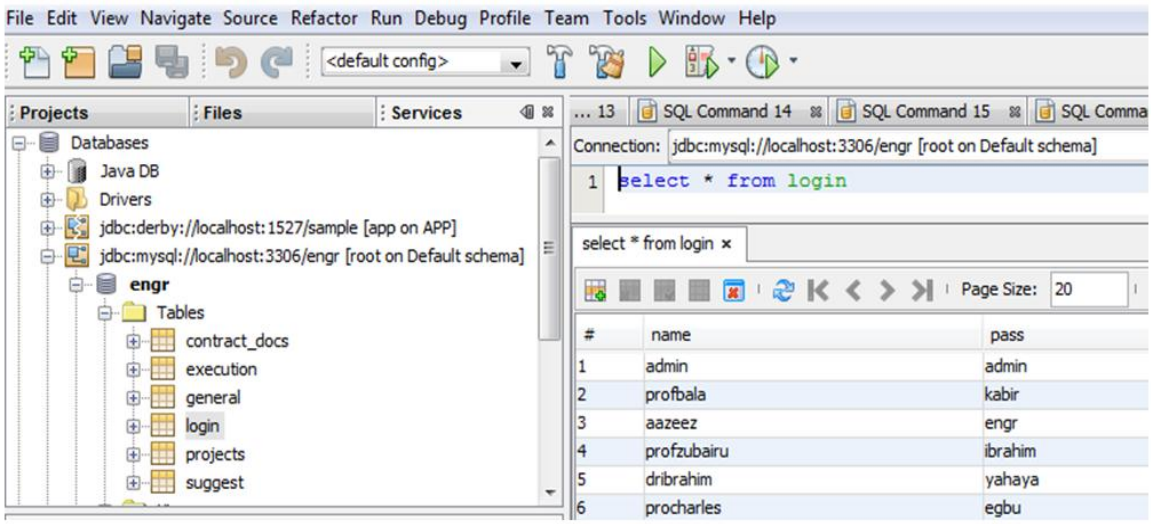


Figure 4.12a: Database arrangement for Login Details

ii. Project – This contained all the details for each project stored in the database. This include project ID; location where the project is sighted; brief description of the project; date the project work commences and the date the project is completed as shown in Figure 4.12b.

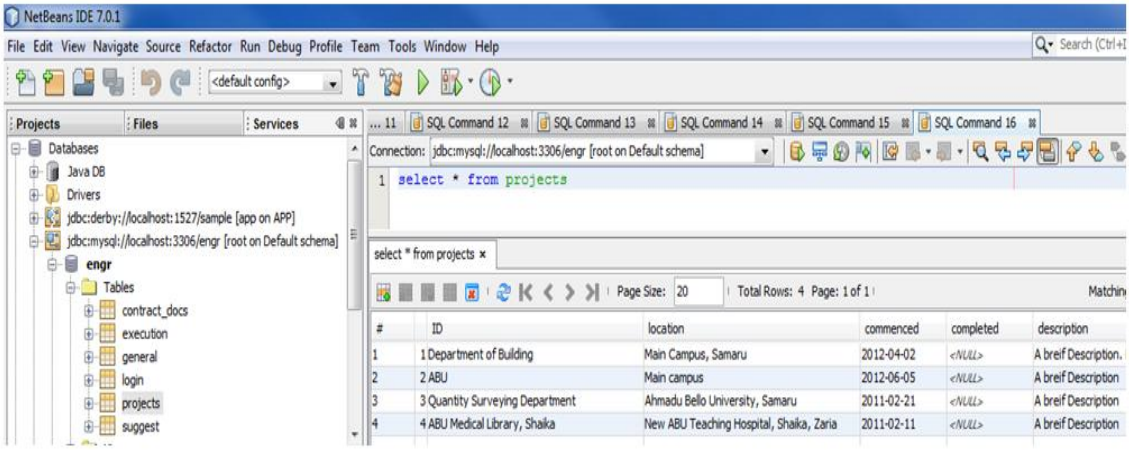


Figure 4.12b: Database arrangement for Project Details

iii. Contract document – it contents the category at which the record is stored and the name of the record stored as shown in Figure 4.12c. The categories were divided into three (3) parts. Part A contains Contract Documents; these include records on Architecture, Structures, Services, Bill of Quantities, etc. Eleven different records are place in this section of the database. Part B contains all records used from inception to completion of a project; these include minutes of meeting, compliance forms/daily record, accounting records, etc. About forty-six different types of records are slotted in this part of the database. Part C was assigned for any documents or records not covered in the other two parts in the database. Details contained in Part A and B are shown in Appendix II.

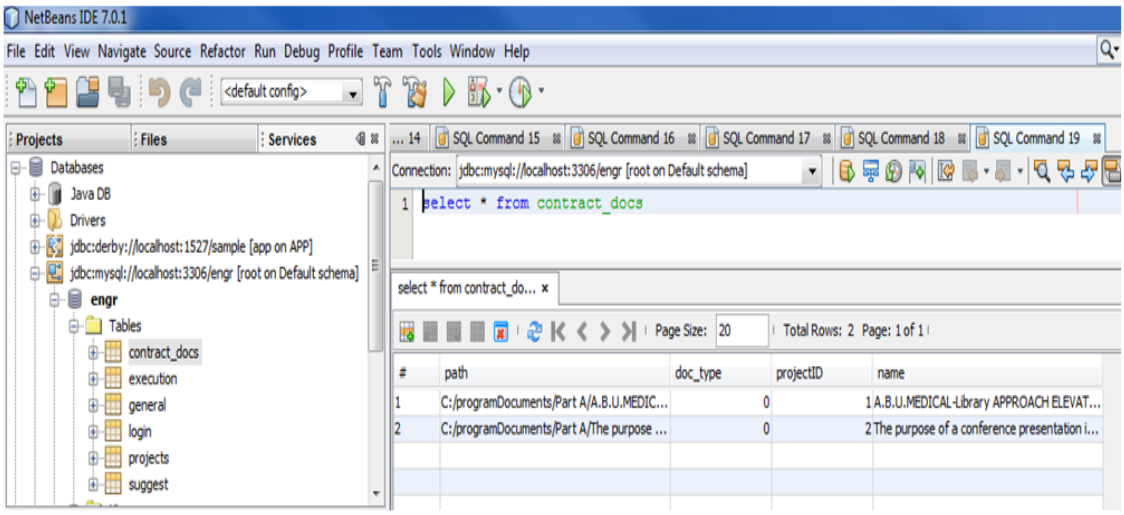


Figure 4.12c: Database arrangement for Contract Documents Categories

iv. Suggestion – a provision is also made where there would be easy way of communicating between administrator and users of the system. This contains the user ID, project ID and the comment/query/suggestion or feedback information as shown in Figure 4.12d.

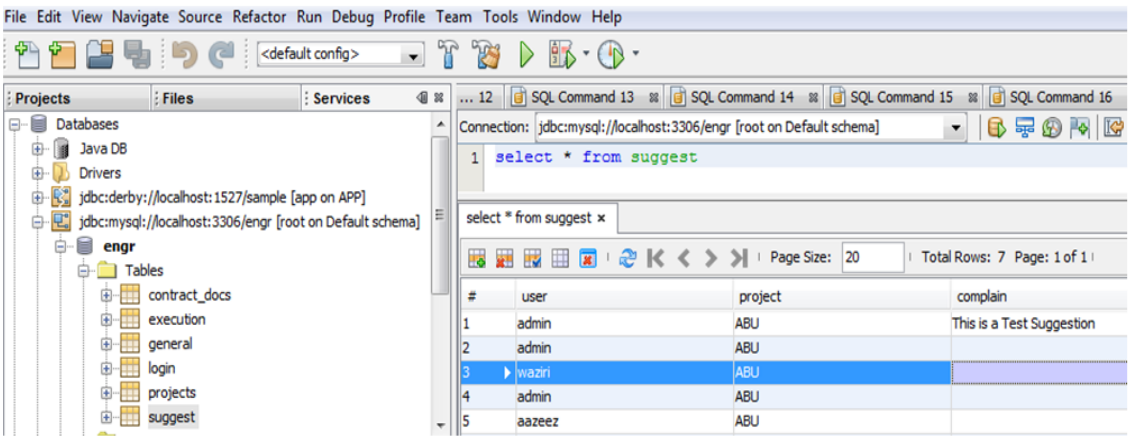


Figure 4.12d: Database arrangement for Suggestions and Feedback

The programming was done based on the contents in the database as explained in item 5.2.5. Each of the contents was treated separately; a snapshot of the code for records

under category Part A of the system is shown in Figure 4.13, while the remaining codes for other components in the database are attached in Appendix III.

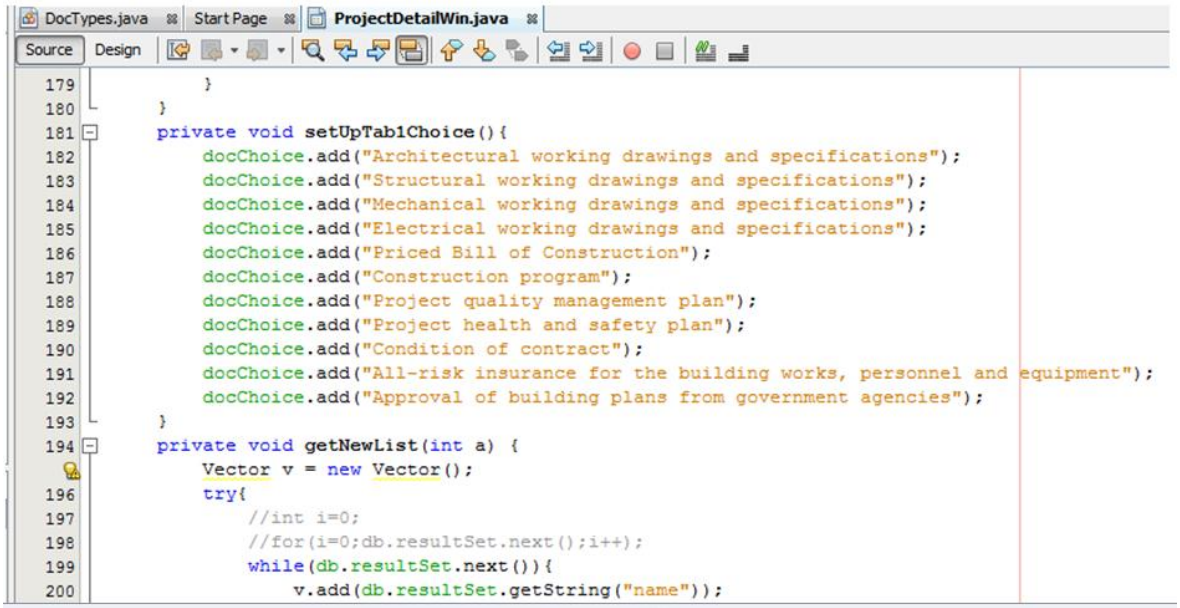


Figure 4.13: Code for Part A Category

4.3.1 Technical Considerations and System Requirements

The goal of EDRMS is not solely to eliminate and organize paper, but to manage all organizational documents and records, both computer-generated and paper-based, and all files, including digital audio and video files. To achieve these goals, technical issues, consisting of seven different requirements shown in Figure 4.14, relating to the implementation of the system was looked into. These technical requirements are *System Compatibility; Networked Systems; Scalability; Hardware requirements (Server requirements and Workstation requirements); Software requirements (Web deployment); Licensing requirements (Floating User Licenses and Named User Licenses) and Scanning Requirements.*

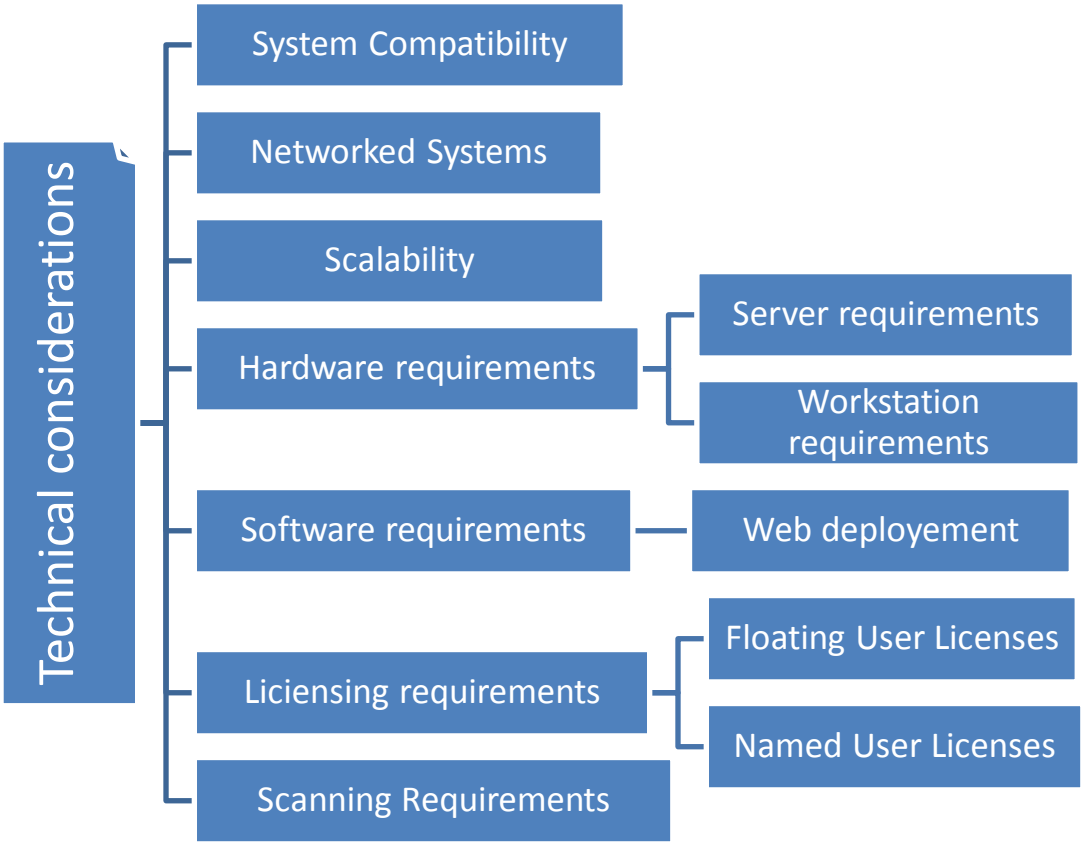


Figure 4.14: Technical Considerations and Requirements

i) **System Compatibility:** Compatibility is the capacity of an EDRMS to work with existing hardware and software systems currently being used in the organisation. To maximize compatibility with existing systems, this prototype EDRMS was designed to:

i. Work with standard window operating systems and support standard database platforms.

ii. Communicate using popular network protocols such as IPX/SPX or TCP/IP.

iii. Have Web deployment capability.

ii) Networked Systems: This facility would be used in office to transmit information between people. This prototype EDRMS was designed to be accessible to all authorized users. Storing documents and records on individual PCs impairs the flow of information between co-workers and wastes valuable time and resources, thus the

EDRMS would have a central repository of records accessible from any PC in the organization.

iii) Scalability: The scalability of a system is used to determine how easily it can grow with an organization. For full scalability, this prototype system was designed to:

i. Support the entire group of organizational users concurrently.
ii. Store all documents and records for the entire organization.
iii. Accommodate a large number of users and documents.
iv. Store information across multiple drives or servers.
v. Support multiple databases.
vi. Integrate with other applications.

iv) Hardware Requirements: This prototype EDRMS was designed to conform to the minimum current hardware in the organisations.

a) The *Server* that was used in this study is MySQL form Oracle Software Inc. this server is adaptable to most of the operating systems used in the building construction firms. The designed system requires as a minimum, the following hardware specification for optimum performance.

HDD: 40GB, RAM: 1GB, Processor: Pentium 4.2 GHz, Operating system: Windows Server 2003 Release 2. Database engine: MySQL 5.5 version.

b) Workstation Requirements

The system was designed to enable most business workstations to handle the installation of this prototype EDRMS and would allow users to scan in, access and work with the document and record management repository. The minimum requirement for the workstation would be:

CPU: Pentium III 1 GHz processor (or faster); Memory: 256 MB RAM; Operating system: Windows XP Professional; Web browser: Internet Explorer 6.0.

v) Software Requirements: The normal business and personal software used in running and processing documents was used in the design of the system. Therefore, there is no need for purchase of any specialised software before the system operates. While the *Web deployment* is often the key to quickly and efficiently rolling out EDRMS software to a large number of users. This can easily be integrated depending on the organisation's needs. A browser-based thin client solution may be used by organization to provide essential access to a large number of employees, whether they are located in different buildings, different states or even different countries.

vi) Licensing Requirements: For optimum of the EDRMS, the organisation Server licensing is an essential part of the document management installation. It determines the types of DBMS the document management server can communicate with; the number of repositories the document management server can support; the number of concurrent users that can access data stored in those repositories; and the set of features (e-mail, audit trail, records management, etc.) that will work with your document management software.

vii) Scanner: this designed prototype EDRM system is designed to allow use of scanned document and records to be converted into digital form, which can therefore be transferred into the database.

4.3.2 Installation Requirements

In order to start using the developed system, the following list of requirements must be met before the application can be run on a computer system.

i. A Java Runtime Environment (JRE) must be present on the computer. A copy is included in this package for those that do not already have it installed in their computer system.

ii. A MySQL Server 5 is also required. A copy is also included in this package. After installation, the server needs to be configured usually accomplished by running the 'MySQL server instance configuration wizard'; this is usually found under MySQL in programs list.

iii. When the above requirements are met, simply run the file named setup.bat and then launch the application by running the 'engr.jar' file.

The snapshots of the installation files are shown in Figure 4.15 and Figure 4.16.

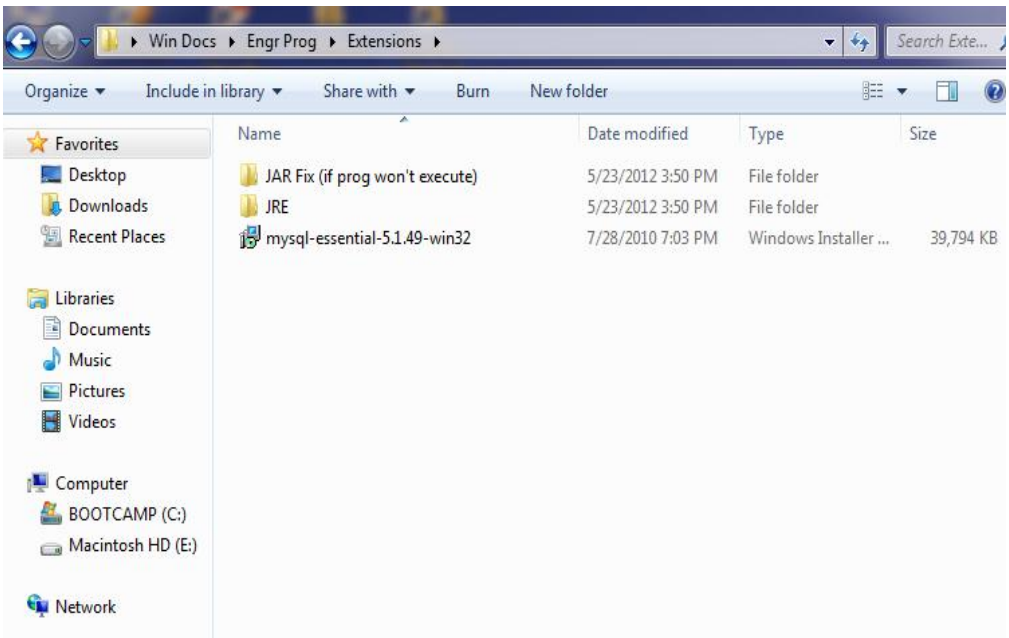


Figure 4.15: Snapshot for Installing JAR and MySQL

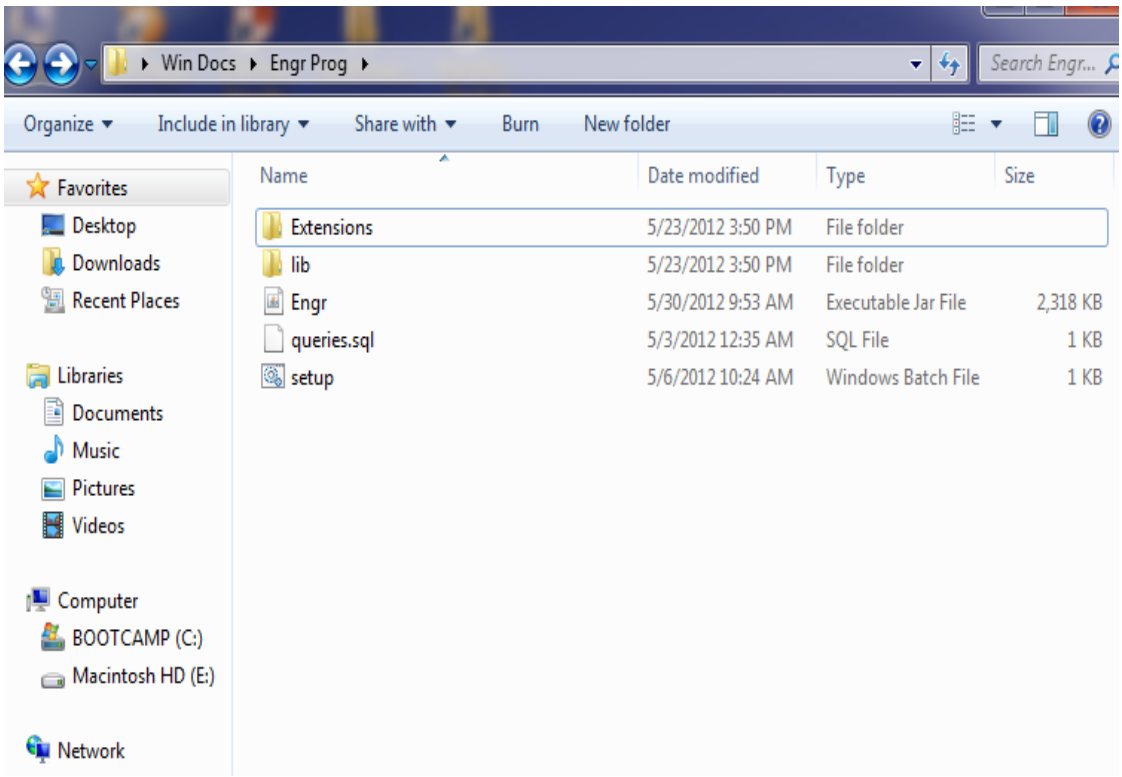


Figure 4.16: Snapshot for Installing and Running the Prototype EDRM System

CHAPTER 5

VALIDATION AND EVALUATION OF THE DEVELOPED EDRM SYSTEM

This section endeavours to fulfil research objective 5.

"*To test, validate and develop a user guide for the prototype EDRM system"*

5.1 TESTING AND OPERATING THE EDRM SYSTEM

As discussed in the previous chapter the prototype was developed using java programming language and the database package opted in the design was MySQL, while the integrated development environment (IDE) package, Netbeans used was for the architecture of the system. Series of exercises were carried out to test the system by following each stage presented in conceptual framework developed in chapter 4. Errors encountered during the testing were debugged and tested adequately before the prototype were presented and demonstrated to the selected participants.

For first runs, a homepage window shown in Figure 5.1a would appear on the screen requesting for username and password. The admin username and password are *admin* and *admin* respectively. Click on 'login', and if the username and password were correct, a window shown in Figure 5.1b would appear on the screen. It either on is not correct, the system will shows a message 'incorrect username or password'. After that, it is recommended to change the Admin Password.

5.1.1 Change Admin Password

After successful login, click file on the window that opens as shown in Figure 5.2a, and select Manage Accounts (This is only visible when logged in as admin; that is using the admin username and password). On this window, the administrator can view complaints

or suggestions from the users of the system. He/she can use the same window to questions; comments on suggestions either received from users or send general messages to users across the same platform.

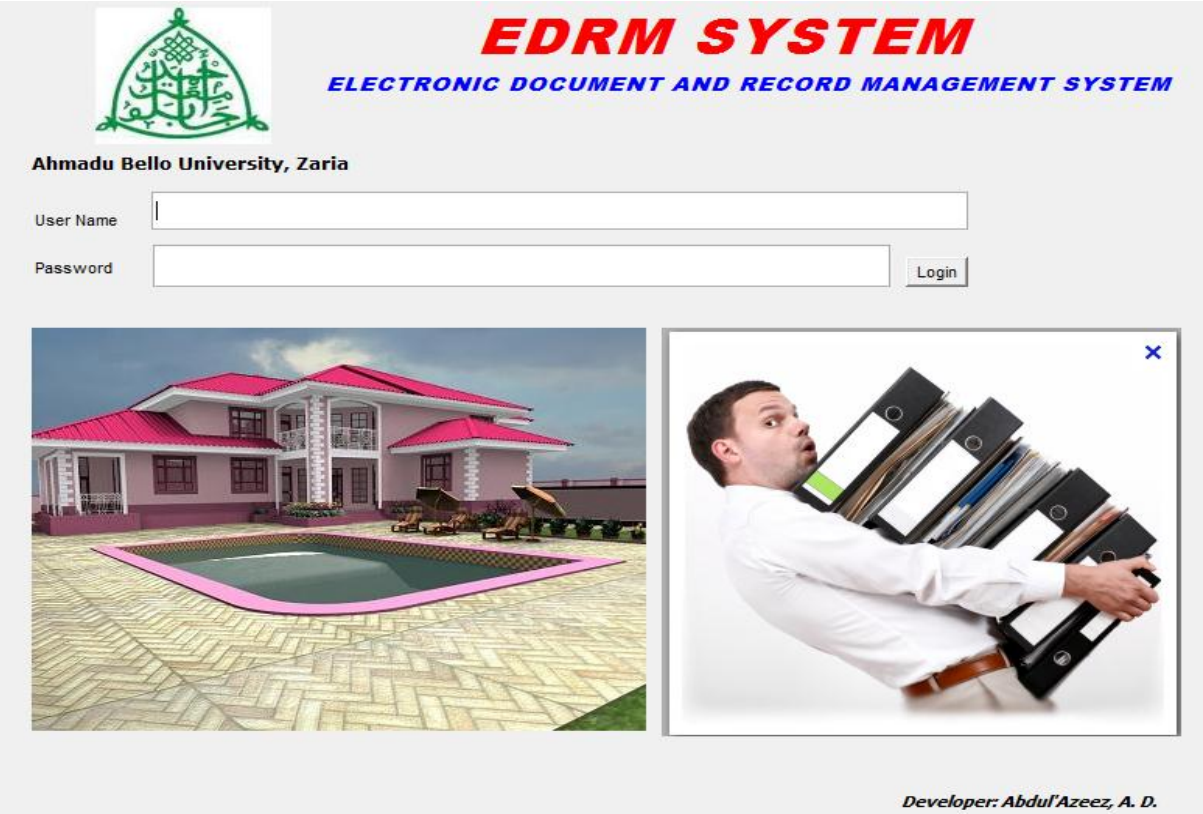


Figure 5.1a: Snapshot for Administrator Login into the Prototype EDRM System

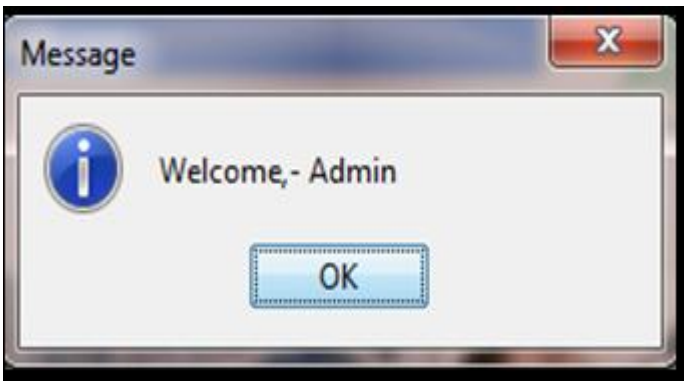


Figure 5.1b: Snapshot for Successful Login in by the Administrator

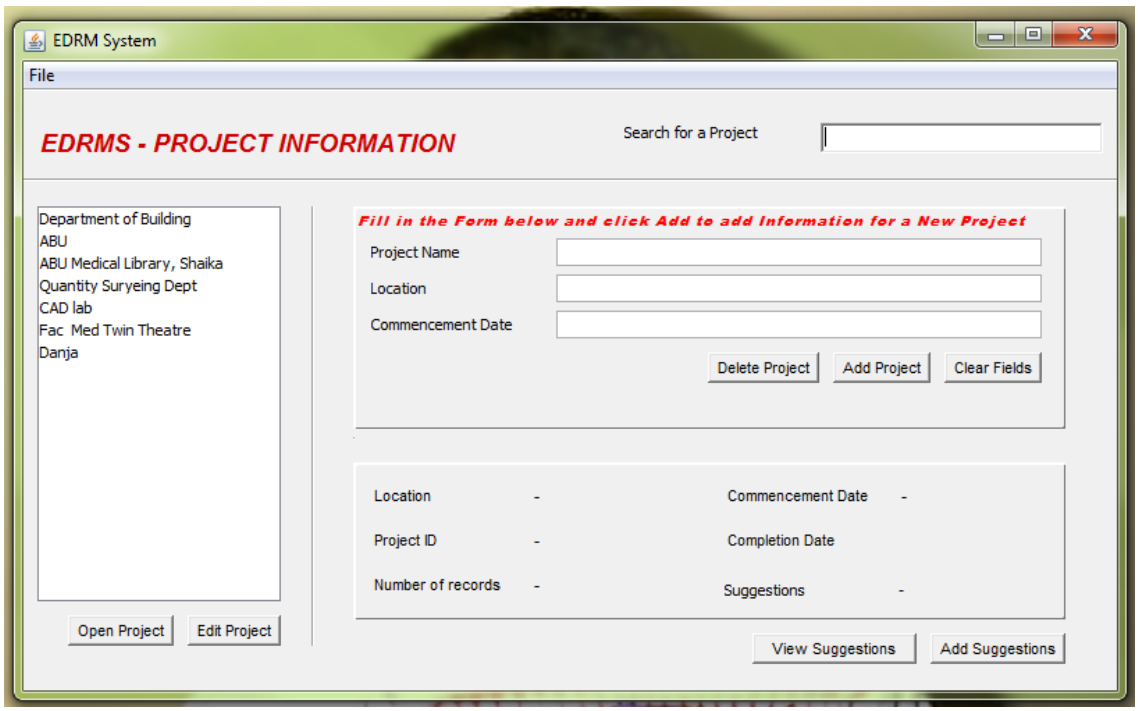


Figure 5.2a: Snapshot for Changing Administrator Password

A new window will open, next to the title of the window, there is a link that is called "Change Admin Password" as shown in Figure 5.2b, upon clicking, it will open a window asking for the old password as well as the new one. Insert the current password followed by the new password. Click 'confirm' and the admin password have successfully been changed to the new password. This same window has a facility for logout. A user is required to logout after using the system.

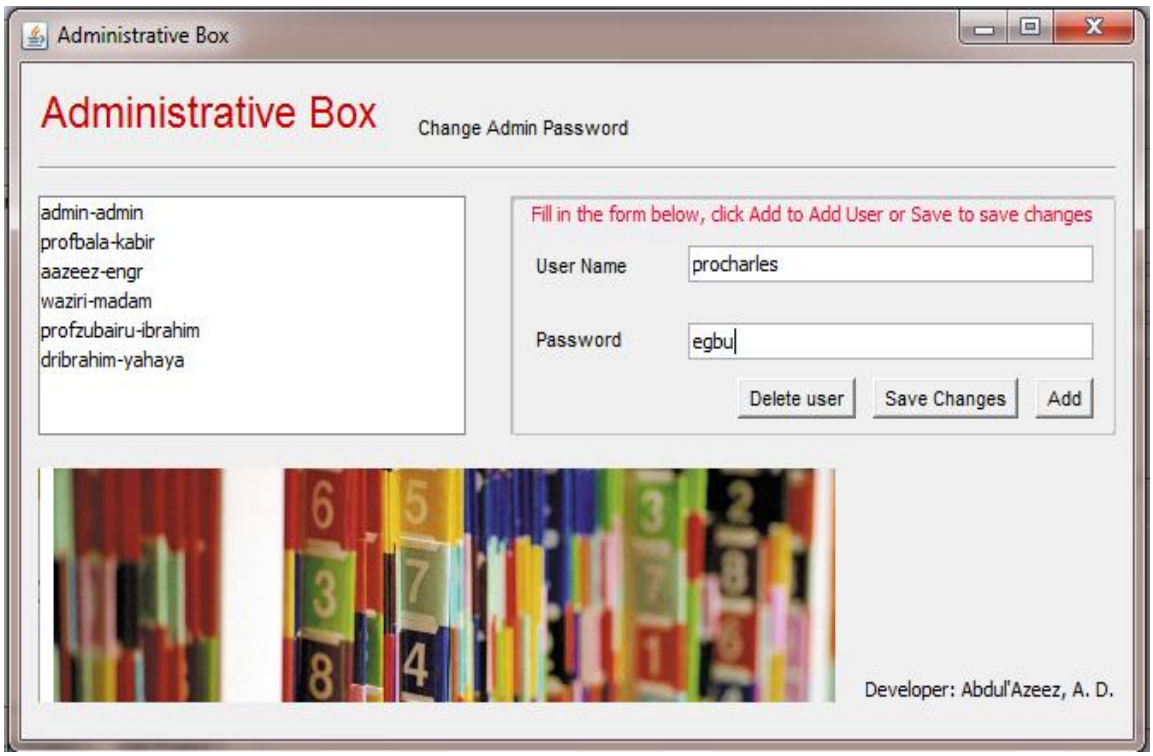


Figure 5.2b: Snapshot for Changing Administrator Password

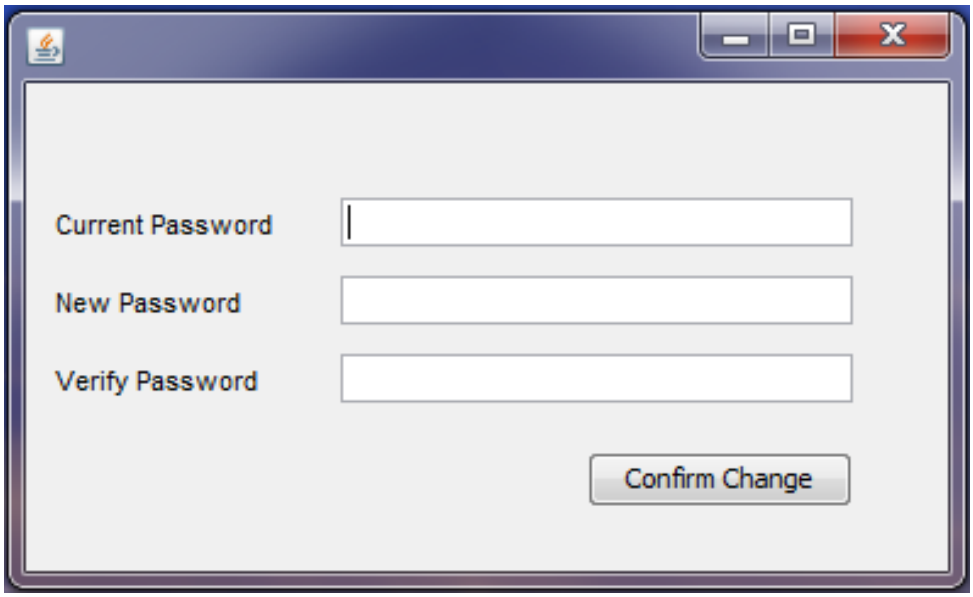


Figure 5.2c: Snapshot for Changing Administrator Password

After typing the new user with the password you click add bottom on the interface,



Figure 5.2d: Snapshot for Changing Administrator Password

5.1.2 Adding, Removing and Editing a User

Admin login required adding a user in the database. Select the Manage Accounts Item from the File Menu, same window shown in Figure 5.2b. There will be a form on the right that will facilitate adding and removing of users. It is here that existing users' data can be modified.

5.1.3 Adding, Removing and Editing a Project

The same window in Figure 5.2a is used for Admin login required for project management. After login, the form to the right will allow adding, editing of projects. To delete a project, simply select the desired project from the list on the left and select delete project button. To edit project description or add date of commencement of project, or add date of completion of project, click edit button in Figure 5.2a. A new window shown in Figure 5.3a will appear, and then type the required information and press save button. Figure 5.3b captured the summary of the project.

Caution must be adhered before performing this action. There must be an approval from the management before a project is edited or remove completely from the database. A

record is removed from the database only if it would be moved to respiratory or may be destroyed permanently.

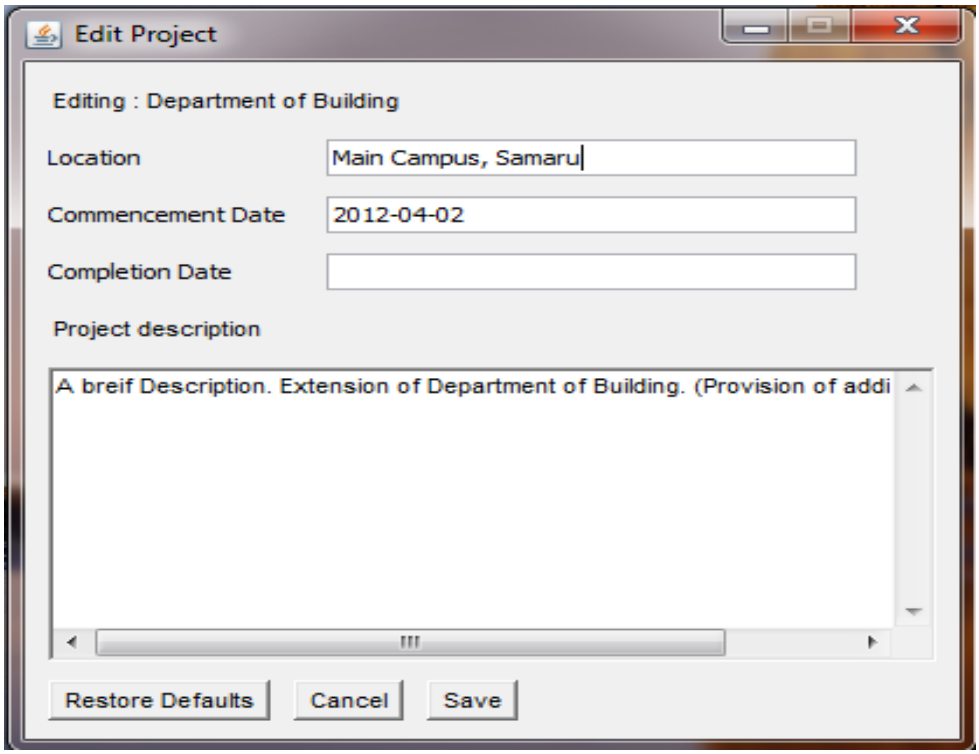


Figure 5.3a: Snapshot for Editing Project Details

5.1.4 Viewing Project Description and Records

From Figure 5.2a, simply select the desired project from the left and select open project button. A new window as shown in Figure 5.4 would appear. The summary description of the project record categories would be displayed. Simply select the category and all records in that category would be displayed for easy selection. If the records are many, simply use ether filter or search and the system would show specific records in needs.

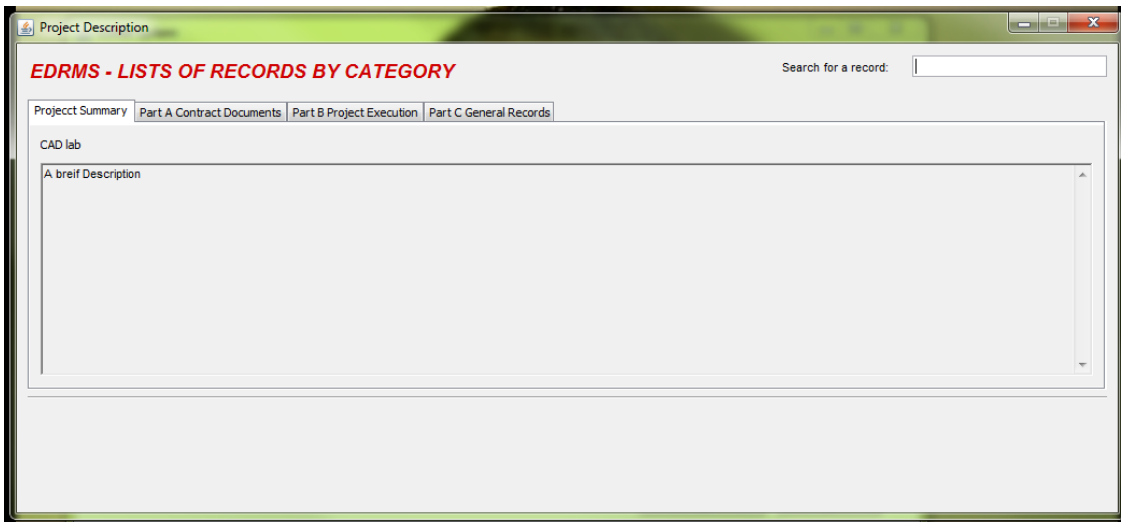


Figure 5.3b: Snapshot for Viewing Project Summary

5.1.5 Opening an Already Stored Record of Any Project

Open the desired project; a window with multiple tabs will open. Select the desired tab that holds the record. There is a list of all records to the left, select the desired and click open record. There is also a search feature at the top of the window that eases searching for a specific record.

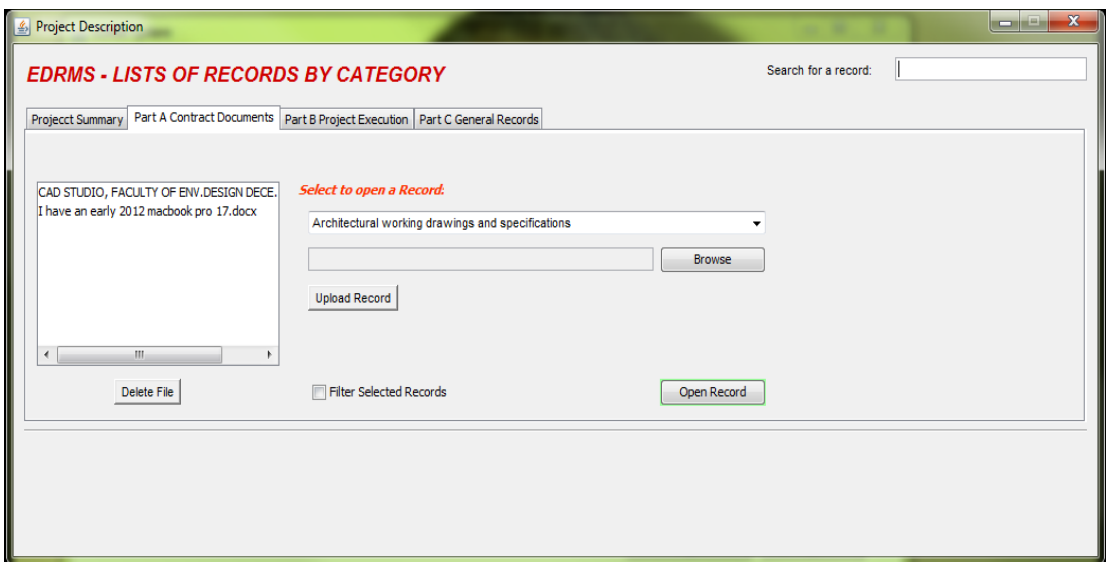


Figure 5.4: Snapshot for Viewing Records Categories

5.1.6 Uploading and Removing a Record

To perform this action, an Admin login required. Simply open the desired project; select the desired section and category. Click browse navigate to the location and select the desired file to upload. Note folders cannot be uploaded, but compressed packages like zip or rar archives can be uploaded. Then select upload. To remove a record, navigate to the record, select it from the list and select delete.

5.1.7 User Section

For first runs, a window shown in Figure 5.5 would appear on the screen requesting for username and password. After successful login in, the user can now have access to all the records in the database, and can view and download these records. The procedure for viewing and download of these records are similar to the ones explained for an Administrator. The user is restricted not to upload; add/change username and password; edit or delete a record in the database for the security of these records.

The windows shown in Figure 5.6a, b, and c are the various actions a user is permitted to perform using this developed system. A provision is also made where a user can directly from his/her system send or view either a comment, suggestions, request or complains directly to the Administrator and from other users of the system.

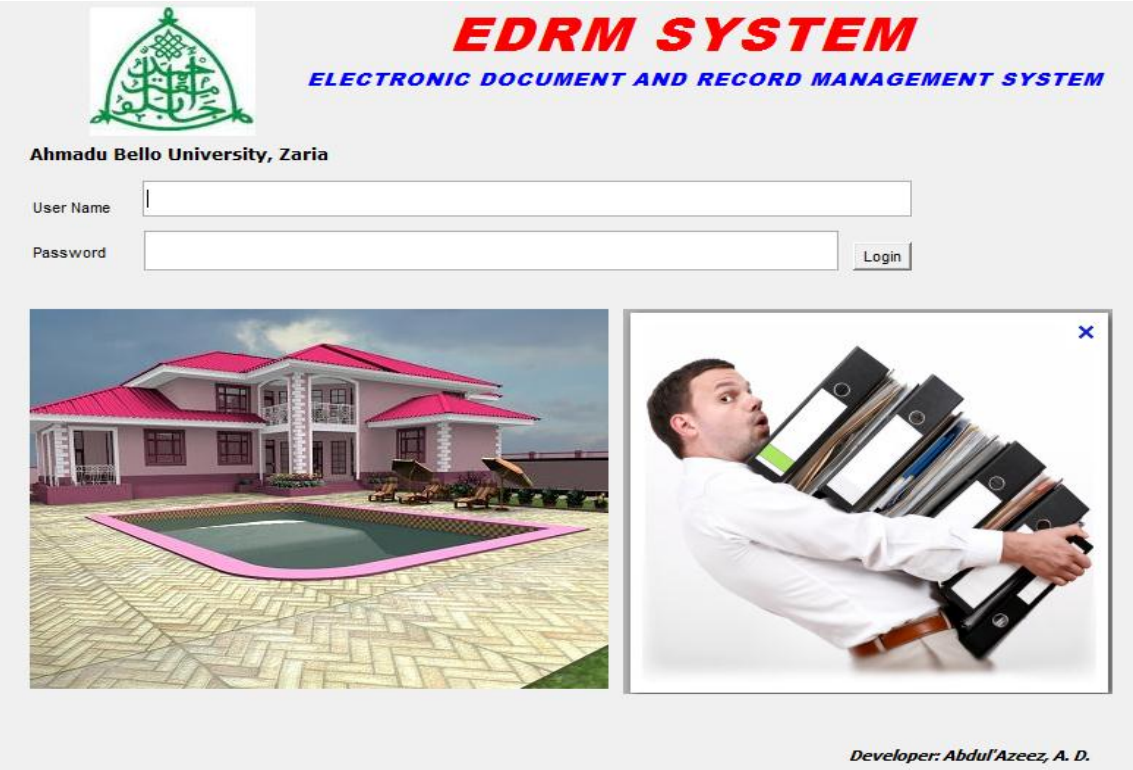


Figure 5.5: Snapshot for requesting Username and Password

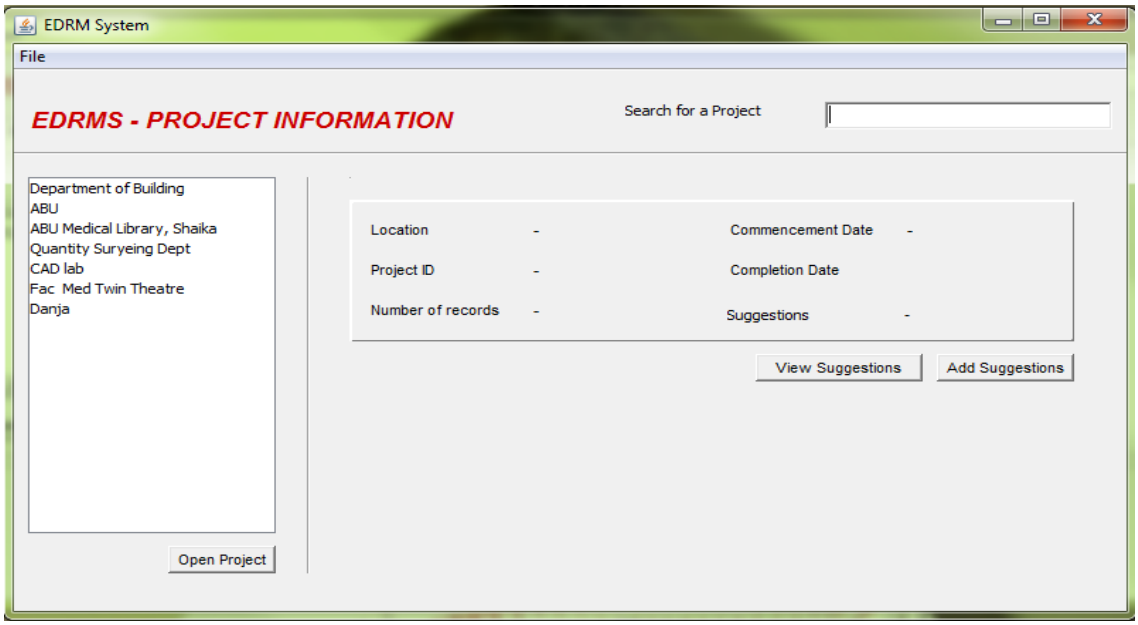


Figure 5.6a: Snapshot for Users Access to Database, Add and Viewer Suggestions

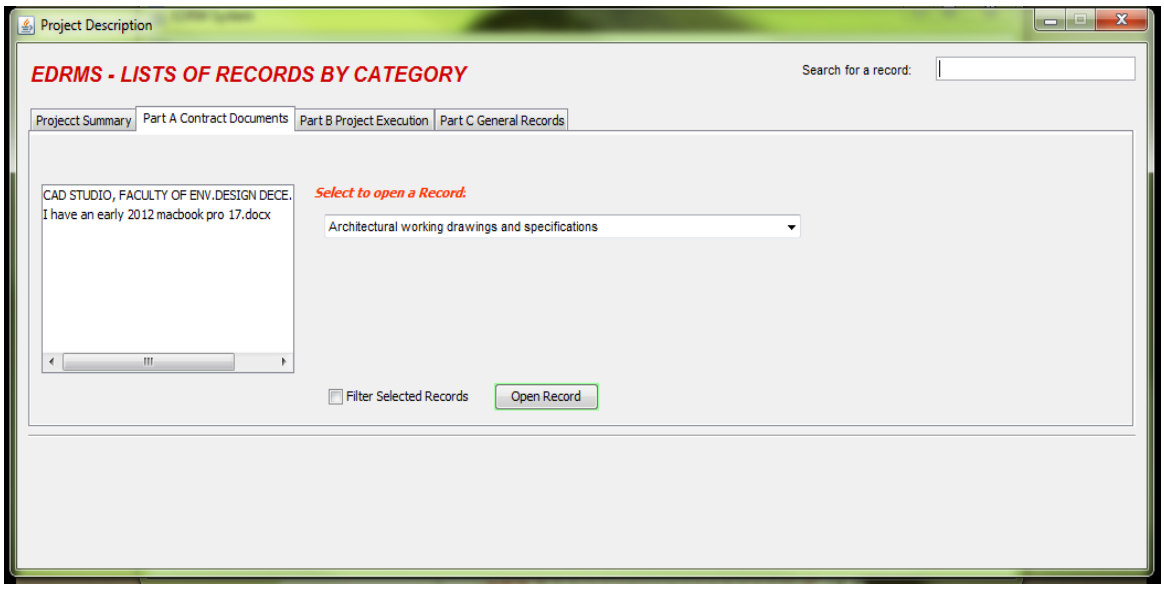


Figure 5.6b: Snapshot for Users Viewing Project Description

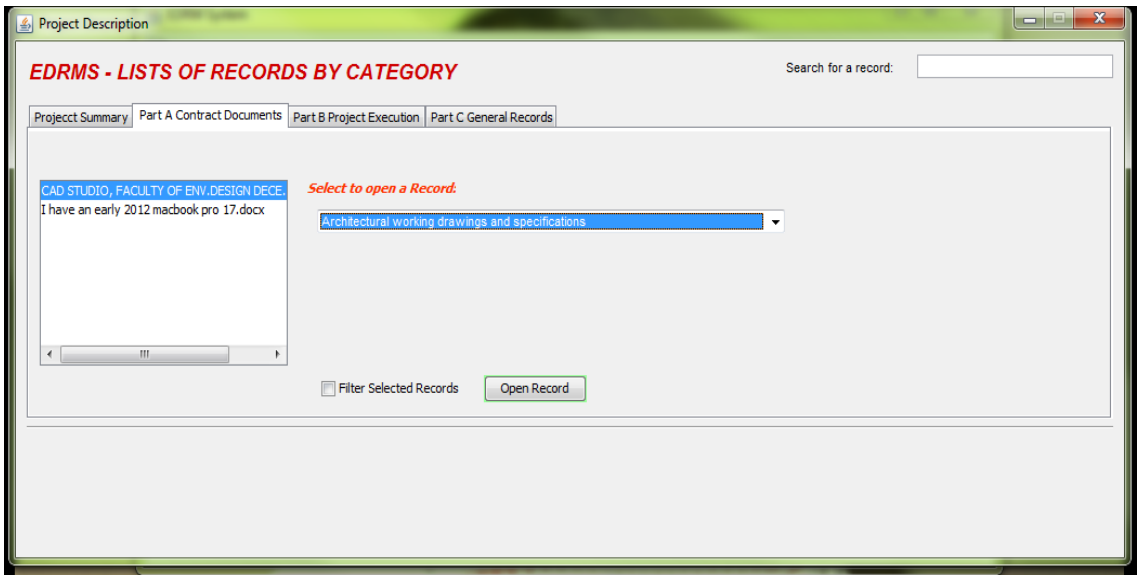


Figure 5.6c: Snapshot for Users Opening of Records

5.2 QUICK USER GUIDE FOR THE EDRMS INSTALLATION AND OPERATION

5.2.1 Step 1 - Installation

Requirements (very important)

Below is a list of requirements that must be met before the application can be run on a computer system.

i. A Java Runtime Environment (JRE) must be present on the computer. A copy is included in this package for those that don't have it installed

ii. A MySQL Server 5 is also required. A copy is also included in this package. After installation, the server needs to be configured usually accomplished by running the 'MySQL server instance configuration wizard'; this is usually found under MySQL in programs list.

iii. When the above requirements are met, simply run the file named setup.bat. Once it's finished, you can launch the application by running the 'engr.jar' file.

5.2.2 Step 2 - Operating the EDRM System

For first runs, the admin user name and password are admin and admin respectively. After that, it is recommended to change the Admin Password.

i Change Admin Password

After successful login, click file on the window that opens and select Manage Accounts (This is only visible when logged in as admin; that is using the admin username and password).

A new window will open, next to the title of the window, there is a link that is called change admin password, upon clicking will open a window asking for the old password as well as the new one. Click 'confirm' and the admin password has successfully been changed.

ii. Adding, Removing and Editing a User

Admin login required adding a user. Select the Manage Accounts Item from the File Menu. There will be a form on the right that will facilitate adding and removing of users. It is here that existing users' data can be modified.

iii. Adding, Removing and Editing a Project

Admin login required for project management. After login, the form to the right will allow adding, editing of projects. And to delete, simply select the desired project from the list on the left and select delete project button.

iv. Viewing Project Description and Records:

Simply select the desired project from the left and select open project.

v. Opening an Already Stored Record of Any Project:

Open the desired project; a window with multiple tabs will open. Select the desired tab that holds the record. There is a list of all records to the left, select the desired and click open record. There is also a search feature at the top of the window that eases searching for a specific record.

vi. Uploading and Removing a Record

Admin login required. Open the desired project; select the desired section and category. Click browse navigate to the location and select the desired file to upload. Note folders cannot be uploaded, but compressed packages like zip or rar archives can be uploaded. Then select upload. To remove a record, navigate to the record, select it from the list and select delete.

5.3 MODEL VALIDATION RESULTS

An essential component of prototype or model development is validation and evaluation. Validation seeks to test the extent to which the prototype satisfies its objectives. Different approaches exist for testing and validating a model, depending on the nature and type of the model (Ibrahim, 2008). This chapter presents the approach taken to validate the prototype EDRMS developed in this study and reports on the results of this validation. It reports on feedback from contractors, clients and academics on the merits of the prototype, its weakness and general issues regarding enhancement and other potential applications. The results reported in this chapter provide a good base for further development of the model.

The main focus of the discussion during the exercises was on the potential value of the system. All participants agreed that the system has the potential to improve management productivity and efficiency by minimizing frequent difficulties experienced in processing and getting access to records on time. It was also agreed that it would enhance learning and research activities, enhance resolution of conflicts and provide an avenue for organizational learning.

However, there was an issue raised regarding the use of the prototype outside the coverage area of this study. The argument here relates to their system of record administration may differ from the one used in developing this prototype. However, one of the participants argued that the system has captured the general construction records management being practiced, but if, there is any area not fully captured, a provision was made where such records can be captured and stored in the system.

5.3.1 Respondent Information

Table 5.1 shows the job descriptions of respondents that participated in the exercise. The four academics, the four project managers and the two site engineers were from contracting organisations and three from the client's representative (two architects, and an engineer). Three of the academics were from Ahmadu Bello University, Zaria and one from Salford University, UK.

Table 5.1: Job Description of Respondents

	Number of Respondents	Per cent
Project Manager	4	30.8
Engineers	3	23.1
Architects	2	15.4
Academics	4	30.8
Total	13	100

5.3.2 Evaluation Results

Respondents were asked to score the model on a scale of 1 to 5 (where 1=very poor and 5=very well) on how well it satisfies the criteria shown in Table 5.2. The relatively small values of the standard deviation indicate that the scores are closely distributed around the means. The table also shows the proportion of respondents against each

score. For all evaluation criteria, the highest proportion of respondents gave a score of 4 (well) out of a maximum score of 5 (very well).

Table 5.2: Model Evaluation

EDRM System Status	Very Poor %	Poor %	Average %	Well %	Very Well %	Mean	Std. Dev.
Applicability in Construction Management	0.0	0.0	0.0	76.9	23.1	4.23	0.439
Practical Relevance to Construction Management	0.0	0.0	7.7	76.9	15.4	4.08	0.494
Comprehensiveness	0.0	0.0	38.5	53.8	7.7	3.69	0.630
Clarity	0.0	7.7	15.4	69.2	7.7	3.77	0.725
Logical Structure	0.0	0.0	15.4	69.2	15.4	4.0	0.577

5.3.3 Applicability in Construction Management

This is a measure of operational validity, defined as the degree to which the model's behaviour has sufficient accuracy for the model's intended purpose over the domain of its applicability (Sargent, 2000). This measure has an average score of 4.23. This is a high score, given that the maximum is 5. The low standard deviation of 0.439 suggests that the majority of respondents gave a score close to the mean value. As shown in Figure 7.2, 76.9% of the respondents gave a score of 4 (well) while 23.1% gave the score of 5 (very well).

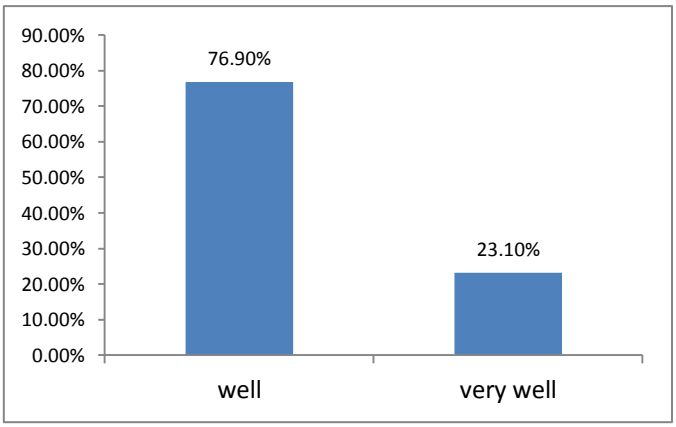


Figure 5.7: Applicability in Construction Management

5.3.4 Practical Relevance to Construction Management

An evaluation to determine whether the model is pragmatic is an assessment of the logical self-consistency and coherence with other concepts or conceptual models in the construction management discipline (Hunt 1990 cited in Martis, 2006). This criterion has a mean score of 4.08 and a standard deviation of 0.494. The least score is 3 and this was given by only 7.7% of respondents. Figure 5.8 shows the results.

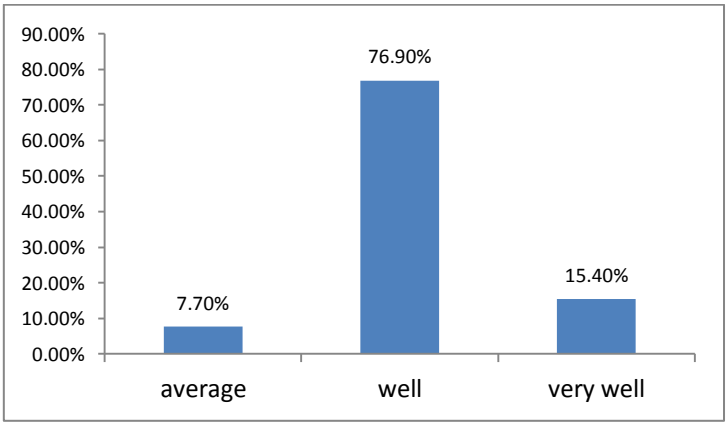


Figure 5.8: Practical Relevance to Construction Management

5.3.5 Comprehensiveness

This is a boundary adequacy test. It assesses whether or not the model includes all the structures necessary to address the objectives or issues for which it was designed. This measure has a mean score of 3.69. As shown in Figure 5.9, the least score3 (by 38.5% of respondents) and the maximum score is 5 (by 7.7% of respondents).

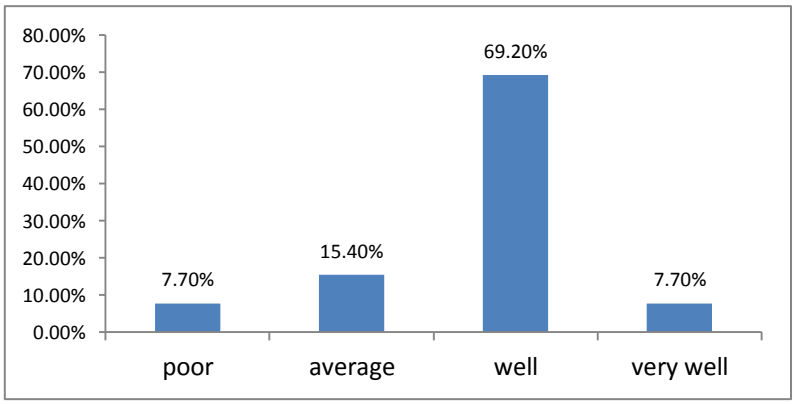


Figure 5.9: Comprehensiveness

5.3.6 Clarity

Martis (2006) defined 'clarity' "as the degree to which the model clearly communicates it implied causality/linkages". It is therefore a measure of intelligibility of the model. This measure (Figure 5.10) has a mean score of 3.77 and a standard deviation of 0.725. The least score is 2 and this was given by only 7.7%.

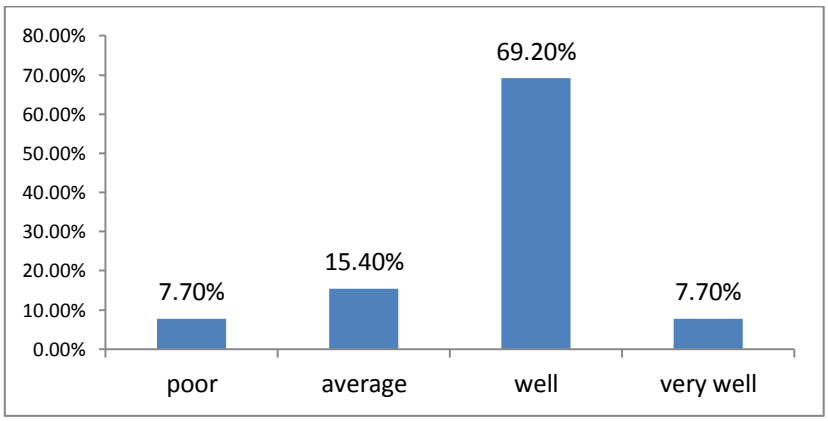


Figure 5.10: Clarity

5.3.7 Logical Structure

This seeks to address questions relating to logical representation of the model. Is the model feedback structure consistent with the characteristics of the real system or, is the logic disjointed and incoherent? In addition, it also assesses the extent to which the model matches the real system. The mean score for logical structure is 4.0 and a standard deviation of 0.577. 69.2% of the respondents gave this measure a score of 4 while 15.4% gave a score of 3.

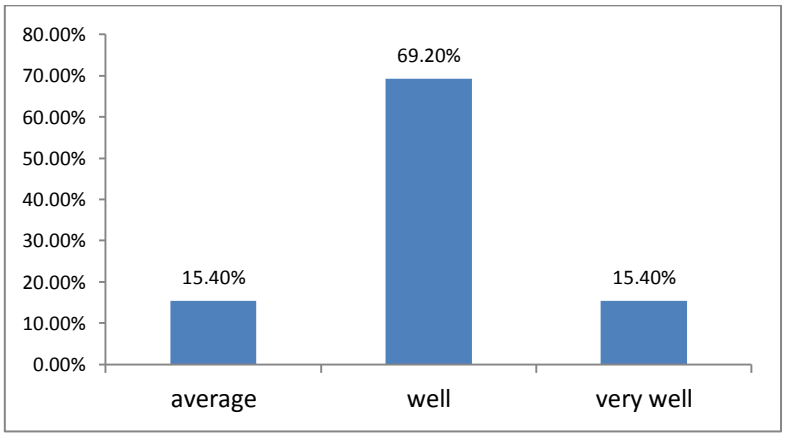


Figure 5.11: Logical Structure

5.4 POTENTIAL TO ADD VALUE TO CONSTRUCTION MANAGEMENT PROCESSES

The various criteria discussed in the previous section was used to evaluate the model, while providing useful pointers as to the validity of the model, do not provide an absolute validity measure. As pointed out by Martis (2006), a model cannot have absolute validity. Rather, the model should be valid for the purpose for which it was constructed and its validity should be judged based on its usefulness. The argument here is that model evaluation is not complete without some assessment of its usefulness. Based on this viewpoint, the model was evaluated based on its potential to add value to improve productivity, provide an avenue for organizational learning, improve

management efficiency, enhance learning and research activities and enhance resolution of conflicts. Table 5.3 gives a summary of the results.

Table 5.3: Potential to Add Value

EDRM System Potentials	Very Low %	Low %	Average %	High %	Very High %	Mean	Std. Dev.
Improve productivity	0.00	0.00	0.00	84.6	15.4	4.15	0.376
Provide an avenue for organizational learning	0.00	0.00	0.00	84.6	15.4	4.15	0.376
Improve management efficiency	0.00	0.00	7.7	23.1	69.2	4.61	0.650
Enhance learning and research activities	0.00	0.00	0.00	61.5	38.5	4.39	0.506
Enhance resolution of conflicts	0.00	0.00	30.8	61.5	7.7	3.77	0.600

5.4.1 Improve Productivity

The mean score of the model in terms of its potential to add value to productivity is 4.15. As shown in Figure 5.12, 84.6% of respondents gave a score of 4 (high potential), while 15.4% gave a score of 5 (given by 15.4% of respondents).

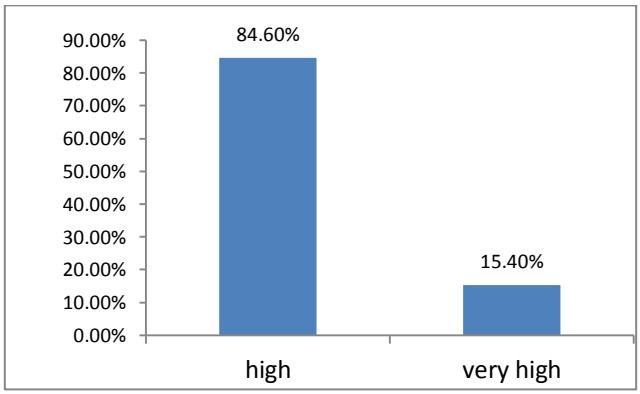


Figure 5.12: Potential to add Value to Improving Productivity

5.4.2 Provide an Avenue for Organizational Learning

The model is potential to add value to providing an avenue for organizational learning has mean score of 4.15 and a standard deviation of 0.0.376. 84.6% of respondents see it

as having a high potential (a score of 4) to add value to provide an avenue for organizational learning.

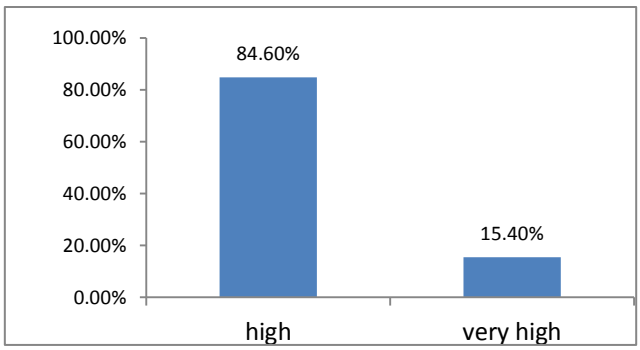


Figure 5.13: Potential to Provide an Avenue for Organizational Learning

5.4.3 Improve Management Efficiency

The model's potential to add value to improve management efficiency has a mean score of 4.61 out of a maximum 5. 23.1% of the respondents gave this a score of 4 (high potential) while 69.2% gave the maximum score of 5 (very high potential).

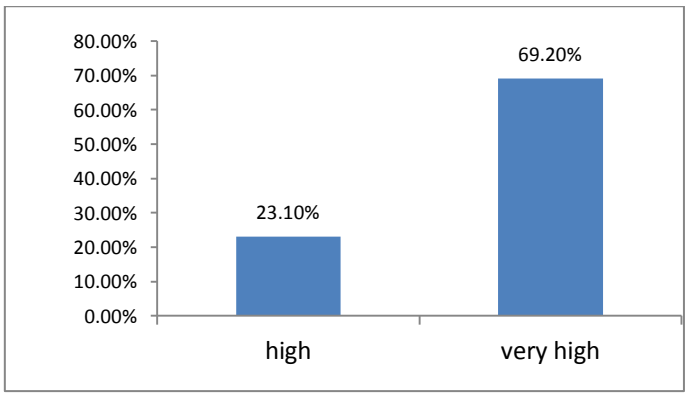


Figure 5.14: Potential to Improve Management Efficiency

5.4.4 Enhance Learning and Research Activities

The model's potential to add value to cash flow analysis has an average score of 4.39. As shown in Figure 5.10, 61.5% of respondents gave a score of 4 (high potential), while a maximum score of 5 was given by 38.5% of respondents.

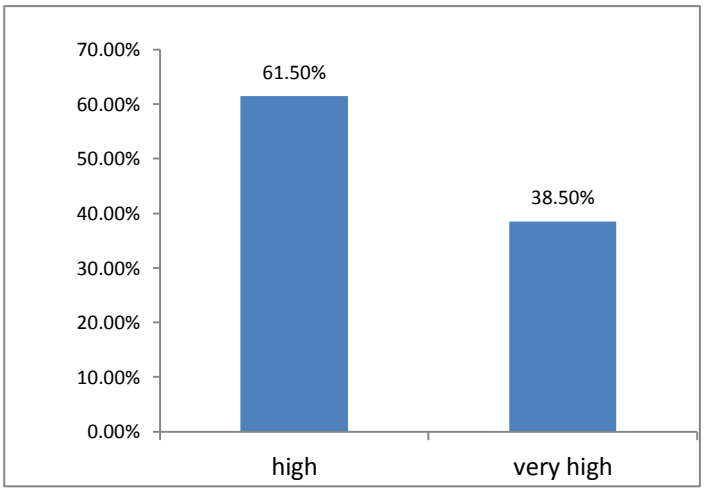


Figure 5.15: Potential to Enhance Learning and Research Activities

5.4.5 Enhance Resolution of Conflicts

The model's potential to add value to Enhance resolution of conflicts has a mean score of 3.77 out of a maximum 5. 30.8% of the respondents gave this a score of 3 (average potential); 61.5% (high potential) while 7.7% gave the maximum score of 5 (very high potential).

The mean score for the evaluation and validation results is shown in Figure 5.16, with Clarity and Enhance resolution of conflicts having the minimum of 3.69 and 3.77 respectively. The maximum mean of 4.23 on evaluation, was obtained from test result of the system applicability in construction management. This is a high score, given that the maximum is 5. The model's potential to add value to improve management efficiency has the mean score of 4.61 out of a maximum 5.

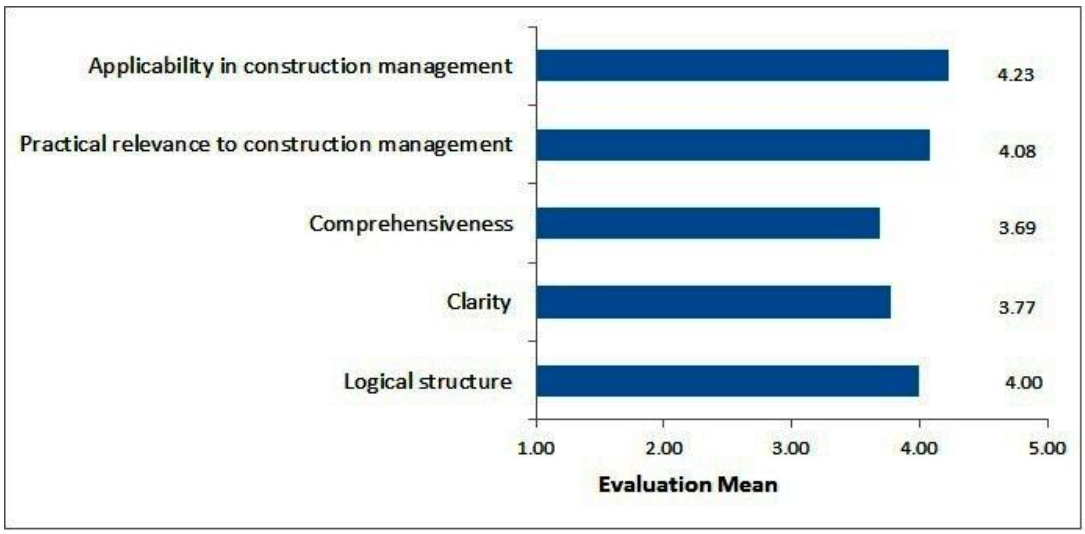




Figure 5.16: Evaluation and Validation Mean

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

As with other social science research, this research has been undertaken in order to improve the ability to change some aspects of the social world. The aim as stated in chapter one, was to develop a prototype electronic document and record management system that small and medium building firms can adopt to enhance record management practices within the building firms. The aim of the study was essentially practical.

6.1 SUMMARY

The summary findings from the research show that 73% of the respondents do not adopt any standard in managing their records. It also shows that all the respondents maintained a collection of records to enable them carryout business activities. Although, according to records management principles, companies ought to keep their minutes and supporting papers because these records contain most information about their operations and are of high evidential value, however, the study found that only 68.3% of the respondents retain such records of enduring value. The study also shows that untrained personnel are assigned to manage records (60%); most records are not stored in Central Store and often scatted in a number of locations (57%); lack of record committee to manage firm's records; no policy to serve as a guide in managing records (53%) were among other findings from this study.

The result shows that challenges being experienced by the building firms in traditional record management system (TRMS), include large storage space required to keep records (67% of the respondents); filing is tedious and time consuming (52%); time consuming in retrieving and searching for records (52%); lack of security (49%) etc..

The result also shows that general software usage by the small and medium building firm, such Microsoft office and CAD application to supplement TRM is satisfactory, while none of the firms uses any type of electronic document management (EDM), electronic record management (ERM) or EDRM systems in managing their records.

In a nutshell, previous researches have not addressed the issue of automating the record management system for small and medium building firms that would be efficient, affordable and require little skills to operate. In order to bridge this gap, this research developed prototype EDRM system for automating record management system using database management techniques. The whole system revolves around the idea of record management practices. Hence, the prototype EDRM system developed in this study facilitates the storage, retrieving, searching, sharing and security of records in the building firms business operations. It also facilitates reporting and communication at various levels in the organisation. Simplicity to learn and use the developed model is another achievement drawn from this study. The following sections present conclusions drawn from this research.

6.2 CONCLUSION

It is clear from the survey findings that the small and medium building firms have problems and challenges in managing records. The extent of the challenges on the current documentation and records keeping management system of the project records identified from the study, poise a serious concern to the building firms. It can therefore, be concluded that these problems and challenges include among others-

i. Lack of standardized method and trained personnel to manage records
ii. Difficulty in searching and retrieving of records

iii. Large storage facilities required for keeping records

iv. Filing system is tedious and time consuming;

v. Records are not secured,

vi. High cost of available electronic document and record management (EDRM) database systems in the market and

vii. High technical skills required using available EDMR systems.

The research also concluded that for an organization to succeed in managing their records adequately there should be a standard establish by the organisation on how to manage records in the organisation. Using established standards such as ISO 15489 and AS4390, by the organizations could greatly enhance records management practice.

Furthermore, the study concluded that for effective record management, there should be; a trained personnel to be in charge of the records; a systematic filing system for easy storing and retrieval; a written user guide on record management and a proper maintenance policy where current and non-current records are given adequate care.

The study also looks at the available software system the building firms are using in supplementing the traditional form of record management system they are practising. This is part of the EDRM system requirements, that is, to identify existing system application so that, the new developed EDMRS could integrate with the already available organisational application systems. These requirement were fully used in developing this prototype EDRMS in this study.

The research has therefore developed EDRM system that addresses the problems and challenges identified in the study. The system was tested and from the results of

validation by industry practitioners showed the developed EDRMS has a high rating in terms of its potential to: -

i. Improve management efficiency;
ii. Improve productivity;
iii. Enhance learning and research activities
iv. Provide avenue for organizational learning and
v. Enhance resolution of conflicts

Similar high ratings were also obtained in terms the developed EDRM system's logical structure, clarity, relevance and comprehensiveness.

6.3 RECOMMENDATIONS

It is recommended that: -

i. Perception on record management needs to be changed, i.e. records management should be perceived as a management tool that helps an organisation to undertake well-informed decision-making. It is no longer only the concern of junior untrained staffs but should be the concern of the organisation as a whole.
ii. Building firms should employ staff with appropriate knowledge in records management.
iii. Record managers should keep their own practices and procedures under constant and critical review in order to respond to changes in technology, legal requirements and business and corporate practice.
iv. Building firms should offer in-service training for staffs and provide IT facilities such as electronic document and record management (EDRM) system so as to enhance firm's efficiency and productivity.

Other recommendation, which this study does not cover is: -

i. Records managers should make their expertise known and available to other professionals and keep their own practices and procedures under constant and critical review in order to respond to changes in technology, legal requirements and business and corporate practice and thus be capable of offering a sound and confidence inspiring service.

ii. There is the need to introduce relevant courses in record management (RM) in institutions offering building construction courses.

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APPENDIX I
QUESTIONNAIRE

Faculty of Environmental Design
Department of Building,
Ahmadu Bello University Zaria, Nigeria

Dear Sir/Madam,

Development for a Prototype Electronic Documents and Record Management System (EDRMS) For Small and Medium Building Firms

Probably most Small and Medium Size Building Firms, in Nigeria have a collection of project documents known as 'records'. Records are internally generated information as a result of business activities. These records should be managed accordingly based on a discipline called records management.

In the current financial crisis, more business organisations would adopt records management if they were aware of the best current practice to prevent the accumulation of useless records in costly offices and filing equipment. However, these building construction firms in Nigeria appear to lack knowledge of managing project records and the methods now widely adopted in developed countries.

It is the absence of this information, which has prompted the attached questionnaire. Completed questionnaires will, it is hoped, form the basis of a published survey of existing practice, challenges associated with it, provide practical suggestions for improvement, and provide an electronic package to address the challenges to enhance the project record managements in the organisations. The questions are design mainly to be answered YES or NO or by means of a tick. I should therefore be glad if you, or another appropriate personnel of your Organisation spend some little time to answer the questions please.

Thank you,

Abubakar Darda'u ABDUL'AZEEZ
Department of Building, A. B. U., Zaria
engraazeez@gmail.com

APPENDIX I (Cont.)

QUESTIONNAIRE

Section 1

1. Name of company/organisation:_____

2. No. of Employees 0 – 9 employees ☐ 10 – 99 employees ☐ 100 – 299 employees ☐
3. Is there any particular standard method your organisation use in record management? Yes ☐ No ☐

Section 2

4. Which of these standard methods your organisation use in record management?
   a) ISO 15489 (the International Standard for Organisation) Yes ☐ No ☐
   b) Australian Standard 4390 Yes ☐ No ☐
   c) My Organisation set its own standard Yes ☐ No ☐
   d) My Organisation do not use any standard Yes ☐ No ☐

5. Does your company possess a collection of project records or documents corresponding to your organisation or 'business archive'? Yes ☐ No ☐

6. If YES to 5, do they contain any of the following? (Please tick).

Part A – Contract Documents/records	**Part B – Documents/records during project execution**
☐ Architectural working drawings and specifications	☐ Setting out Compliance form
☐ Structural working drawings and specifications	☐ Inspection and Testing report forms
☐ Mechanical working drawings and specifications	☐ Foundation/Basement compliance form
☐ Electrical working drawings and specifications	☐ Superstructure compliance form
☐ Priced Bill of Quantities	☐ Services compliance forms
☐ Construction program	☐ Progress Reports, weekly, monthly or quarterly
☐ Project quality management plan	☐ Minutes and supporting papers
☐ Project health and safety plan	☐ Progress photographs
☐ Condition of contract	☐ Finishes compliance form
☐ All-risk insurance for the building works, personnel and equipment	☐ Circular
☐ Approval of building plans from government agencies	☐ Correspondence
☐ Documents on business agreement (Legal records)	☐ Accounting and financial records

7. If YES to 5, are they looked after by
   a) the company archivists? Yes ☐ No ☐
   b) the keeper of document? Yes ☐ No ☐
   c) the company librarian Yes ☐ No ☐
   d) another officer of the organisation? Yes ☐ No ☐
   e) if YES to 7d, by whom?_____

8. If YES to any 7a-d, is the custodian
   a) a trained archivist? Yes ☐ No ☐
   b) a trained librarian? Yes ☐ No ☐
   c) trained in some other more or less relevant way? Yes ☐ No ☐
   d) if YES to 8c, what training has the custodian received? _____
   e) untrained but experience in the care of records? Yes ☐ No ☐

9. If YES to 5, are the records kept
   a) in the company Records Centre? Yes ☐ No ☐
   b) in the company library? Yes ☐ No ☐
   c) in one of the administrative library? Yes ☐ No ☐
   d) if YES to 9c, in which Department?_____
   e) in a number of scattered locations? Yes ☐ No ☐
   f) in one locations not covered by 9a-e? Yes ☐ No ☐
   g) if YES to 9f, where?_____

10. If YES to 5, is general oversight of the records exercised by
   a) the company Records Committee? Yes ☐ No ☐
   b) the company Library Committee? Yes ☐ No ☐
   c) some other organisation? Yes ☐ No ☐
   d) if YES to 10c, by whom? _____

11. If YES to any of 7 or 10, is written advice issued to departments in your company about the management of records
   a) by the company Archivist? Yes ☐ No ☐
   b) by the company Librarian? Yes ☐ No ☐
   c) by some other officer of the company? Yes ☐ No ☐
   d) If YES to 11c, by whom?_____

12. If YES to 11, does this advice take the form of a published handbook, brochure of leaflet? Yes ☐ No ☐

13. If YES to 11, does the advice include guidance about
   a) the removal of non-current records from filing cabinets? Yes ☐ No ☐
   b) the packing of non-current records in transfer cases or other boxes? Yes ☐ No ☐
   c) the listing of non-current records? Yes ☐ No ☐
   d) the storage of non-current records?
      i) in the office accommodation Yes ☐ No ☐
      ii) in the institution archives Yes ☐ No ☐
   e) the 'weeding' of non-current records? Yes ☐ No ☐
   f) the periods of time for which non-currents records of various classes should be kept? Yes ☐ No ☐
   g) the shredding, destruction or disposal of non-current records Yes ☐ No ☐

14. Are any of the officers mentioned in 7, responsible for actually carrying out of the practices mentioned in 13? Yes ☐ No ☐

15. If YES to 14, which practices

13a	Yes ☐	No ☐
13b	Yes ☐	No ☐
13c	Yes ☐	No ☐
13d	Yes ☐	No ☐
13e	Yes ☐	No ☐
13f	Yes ☐	No ☐
13g	Yes ☐	No ☐

Other:_____

Section 3

16. Does your organization face any challenges in using traditional (paper) form of record management? Yes ☐ No ☐

17. If YES to 16, please rate the following challenges as it applies to your organisation

	Challenges	Responses				
		Always	Mostly	Sometimes	Rarely	Never
a)	Records are difficult to locate					
b)	Records are frequently misfiled					
c)	Records access is low					
d)	Records filing is tedious and time consuming					
e)	Lack of security					
f)	Limited user access					
g)	Data redundancy/duplication					
h)	Time consuming for searching of records					
i)	Human error in record storage and exchange					
j)	In case of fire outbreak, records can be totally lost					
k)	Records can be stolen easily					
l)	Records management system is slow and expensive					
m)	Records requires large storage space					
n)	Please list any other challenges apart from the ones in 17 being experienced by your organisation					

18. Does your organization use any software to supplement your processing and management of traditional form (paper) of records? Yes ☐ No ☐

19. If, YES to 18, does the software include the following

Word processing (MS Word)	Yes ☐	No ☐
Spreadsheet (MS Excel, Lotus 123, Super Calc, Estimator, WinQS, etc)	Yes ☐	No ☐
Detailing (AutoCAD, ArchiCAD, Revit, Corel Draw, etc)	Yes ☐	No ☐
PowerPoint	Yes ☐	No ☐
Project Planning (Project Office, Primavera, Suretrak, etc)	Yes ☐	No ☐
MS Access	Yes ☐	No ☐
SPSS (Statistical Package for Social Science)	Yes ☐	No ☐
AccuBuild Construction Document Management Software (ADMS)	Yes ☐	No ☐
Oracle Database Management System (ORDBMS)	Yes ☐	No ☐
Systems Application and Products (SAP)	Yes ☐	No ☐

Others (please specify)_____

20. On which medium are these e-records stored?

a)	hard disk	Yes ☐	No ☐
b)	floppy Disks	Yes ☐	No ☐
c)	magnetic tapes	Yes ☐	No ☐
d)	optical disks	Yes ☐	No ☐

e) compact disks Yes ☐ No ☐

f) other: (Please specify)_____

Section 4

21. What impact EDRMS (Electronic Documents and Recordkeeping Management System) software would have if fully implemented in your organisation?_____
_____

22. Have you any general comments to make about the benefits which your company does or may derive from the practice of records management? If YES please make them below:-
_____

APPENDIX II

Project Records Database Contents

1.	**Part A – Contract Documents**
i	Architectural working drawings and specifications
ii	Structural working drawings and specifications
iii	Mechanical working drawings and specifications
iv	Electrical working drawings and specifications
v	Priced Bill of Quantities
vi	Construction program
vii	Project quality management plan
viii	Project health and safety plan
ix	Condition of Contract
x	All-risk insurance for the building works, personnel and equipment
xi	Approval of building plans from government agencies
2.	**Part B - Execution of construction activities and documentation**
	Record notes, letters and minutes:
a)	Details of informal telephone conversations with:
i	Client
ii	Specialist consultants
iii	Representative of local authorities
iv	Builders
v	Sub-contractors
vi	Suppliers and Manufacturers
b)	Copies of letters:
i	Asking for or confirming points of information
ii	Copies of replies in relation to above
c)	Minutes of meetings formally circulated to confirm information and agreements
d)	Compliance forms/Daily records
i	Setting out Compliance form
ii	Foundation/Basement compliance form
iii	Superstructure compliance form
iv	Mechanical installation compliance form

v	Electrical compliance form
vi	Finishes compliance form
vii	Stop work/removal/discontinuation notice
vii	Reports on any meetings held and their results
ix	Record of visitors to site
x	Equipment and personnel working in each activity, including subcontractors
xi	Descriptions of work being inspected
xii	Decisions made regarding approval of units of material or of work, and corrective actions to be taken
xiii	Description of problems or delays and resolution
xiv	Communications with contractor staff
xv	Construction activities completed and/or in progress
xvi	Progress photos, where applicable
xvii	Progress Reports, weekly, monthly or quarterly
xviii	Any other reports, such as special consultant reports
xix	Signature of the report preparer
e)	Inspection and Testing report forms
i	Description or title of the inspection activity
ii	Location of the inspection activity or location from which the sample was obtained
iii	Recorded observation or test data
iv	Results of the inspection activity
v	Personnel involved in the inspection activity
vi	Signature of the inspector
f)	Accounting Records
i	Pay roll, accounts payable and receivable, etc.
ii	Progress Payment Billings under the contract
iii	Daily Force Account Records, pricing and billings
iv	Contract Milestone Schedule or Master Schedule
v	Short Term Schedules and up-dates
vi	Task schedules and analyses
vii	Original tender estimate
viii	Construction control budget
ix	Actual Cost Reports, weekly or monthly, including Exception Reports

x	Forecast-to-Complete Estimate up-dates
xi	Notice of claims for delays and/or extra cost by contractor
3.	**Part C – Administrative and other Office Documents**

APPENDIX III
SOME OF THE PROGRAM CODES

Code for login as ‘admin’ or ‘user

```
private void login() {
    String pass = getPassword();
        String q = "select DISTINCT name from login where name = '"+userField.getText()+"' and pass = '"+pass+"';";
        try{
            db.resultSet = db.statement.executeQuery(q);
            if(!db.resultSet.next()){
                JOptionPane.showMessageDialog(mainPanel,"User or password doesn't match");
                return;
            }
            k.hide(this);
            isAdmin = checkAdmin();
            if(isAdmin)
                JOptionPane.showMessageDialog(null, "Welcome,- Admin");
            else
                JOptionPane.showMessageDialog(null, "Welcome, - User");
            ProjectWin mainWin = new ProjectWin(this);
            mainWin.setVisible(true);



        }
        catch(SQLException sqle){
            sqle.printStackTrace();
        }
}
    private boolean checkAdmin(){
        return userField.getText().equals("admin");
    }
    public String getPassword() {
        String j="";
        for(int i=0;i<passField.getPassword().length;i++)
            j+=passField.getPassword()[i];
        return j;
    }
    public String getUser(){
        return userField.getText();
    }
```

Code for Login-in Interface

```
package engr;

import org.jdesktop.application.Action;
import org.jdesktop.application.SingleFrameApplication;
import org.jdesktop.application.FrameView;
import javax.swing.JDialog;
import javax.swing.JFrame;
import java.sql.*;
import javax.swing.JOptionPane;

/**
 * The application's main frame.
 */
public class EngrView extends FrameView {
    public SingleFrameApplication k;
    public boolean isAdmin=false;

    public EngrView(SingleFrameApplication app) {
        super(app);
        k = app;
        initComponents();

    }

    public boolean getIsAdmin(){
        return isAdmin;
    }

    @Action
    public void showAboutBox() {
        if (aboutBox == null) {
            JFrame mainFrame = EngrApp.getApplication().getMainFrame();
            mainFrame.setLocationRelativeTo(null);
```

Code for Part B Category

```
private void setUpTab2Choice(){
    docChoice1.add("Details of Informal Telephone Conversations with");
    docChoice1.add("Copies of Letters");
    docChoice1.add("Minutes of meetings formally circulated to confirm information and agreements");
    docChoice1.add("Compliance forms/Daily Records");
    docChoice1.add("Inspection and Testing Report Forms");
    docChoice1.add("Accounting Records");
    setUpTypeChoice(0);
}
private void setUpTypeChoice(int parent){
    typeChoice.removeAll();
    switch(parent)
    {
        case 0:
            typeChoice.add("Client");
            typeChoice.add("Specialist consultants");
            typeChoice.add("Representative of local authorities");
            typeChoice.add("Builders");
            typeChoice.add("Sub-contractors");
            typeChoice.add("Suppliers and Manufacturers");
            break;
        case 1:
            typeChoice.add("Asking for or confirming points of information");
            typeChoice.add("Copies of replies in relation to above");
            break;
        case 2:
            typeChoice.add("Signature of the report preparer");
            break;
        case 3:
            typeChoice.add("Setting out Compliance form");
            typeChoice.add("Foundation/Basement compliance form");
            typeChoice.add("Superstructure compliance form");
            typeChoice.add("Mechanical installation compliance form");
            typeChoice.add("Electrical compliance form");
            typeChoice.add("Finishes compliance form");
```

APPENDIX IV

GLOSSARY OF RECORDS MANAGEMENT TERMS

Access: permission to use and reproduce records. May be limited or qualified (restricted by the agency having legal custody).

Active file: materials, which are maintained in the office of an agency for current daily operations and are referred to frequently.

Active record: a record, which is regularly referred to and required for current use. usually considered those records that are referred to more than once per file drawer per month

Administrative records: records that are created to help an agency accomplish its current administrative functions.

Archival records: records identified as having archival value or potential archival value on the agency records retention schedule.

Archives: (1) the agency responsible for selecting, preserving, and making available archival materials. (2) the building in which an archival institution is located. (3) those records that are no longer required for current use but have been selected for permanent preservation because of their evidential, informational, or historical value.

Archivist: (1) a person professionally responsible for the administration, management, and identification of historical records. (2) a person responsible for or engaged in one or more of the following activities in an archives: appraisal and disposition; accessioning; preservation; arrangement; description; reference service; exhibition or publication.

ASP: An application service provider often providing one or more products and/or services. the advantage of the asp is the opportunity for organizations to, in effect, lease software applications and storage space and to perform transactions without having to maintain software and various electronic repositories. This is a variation on the internet service provider (ISP) concept, extended into a more specialized domain (i.e., recordkeeping software & repositories).

Backing up: making a copy of a computer file for use if the original is lost, damaged, or destroyed. see also archiving and dumping.

Central processing unit (CPU): the component of a computer system that interprets and carries out program instructions, and controls the overall activity of the computer.

Coding: The acts of applying file designations on records for the purpose of classification or condensation.

Computer: an electronic device designed to accept data (Input), perform prescribed mathematical and logical operations at high speed (Processing), and supply the results of these operations (Output). A digital computer processes data as numbers and includes mainframe computers, minicomputers, and microcomputers.

Copy: the reproduction, by any method, of the complete substance of a record; a reproduction of an original.

Custody: the guardianship of records. features of custody differ between (a) physical custody and (b) legal custody. See also legal custody and physical custody

Data: Any material upon which written, drawn, spoken, visual, or electromagnetic information or images are recorded or preserved, regardless of physical form or characteristics.

Database: An electronically stored set of data, consisting of at least one data file, which is sufficient for a given purpose.

Database management system: means a software system used to access and retrieve data stored in a database.

Desktop documents: means text, spreadsheet, presentation, calendar, task list, contact and other documents created through the use of software by individual users for their work-related purposes regardless of where it is stored.

Document: A document is a form of information. A document can be put into an electronic form and stored in a computer as one or more files. Often, a single document becomes a single file. As files or data, a document may be part of a database. When using certain computer application programs such as a word processor, a document is the unit of saved work. Each document is saved as a uniquely named file.

Electronic: means relating to technology as having electrical, digital, magnetic, wireless, optical, electromagnetic or similar capabilities.

Electronic information system: means a system that contains and provides access to computerized agency records and other information.

Electronic record: means a record created, generated, sent, communicated, received or stored by electronic means.

Electronic recordkeeping system: means an electronic system in which records are collected, organized, and categorized to facilitate their preservation, retrieval, use, and disposition.

Electronic Record Management System (ERMS: An ERMS is primarily an application for managing electronic records, though it may also be used to manage physical records.

Floppy Disk: A random access, removable magnetic data storage medium that can be used with personal computers. These types of disks are convenient for storing individual files and small programs.

Long Term Storage: refers to any retention that is needed for longer than 10 years.

Magnetic Media Storage Device: A magnetic storage device is a device that uses a magnetic head to read and write data to and from a “magnetizable” medium. The medium can be as basic as a plastic tape that is coated with fine particles of a metal, such as is found in audio recording and tape storage devices. Other examples include a floppy disk drive, a tape drive and a computer’s hard drive.

Metadata: means information describing the history, tracking, or management of an electronic document. Examples of metadata include: file designation, create and edit dates, comments, authorship, and edit history.

Portable storage media: means any removable storage media. For the purpose of these Guidelines, portable storage media may include: flash drives, thumb drives, USB devices, CD's, DVD's, external hard drives, laptops, and smart phones.

Receipt data: means information in electronic mail systems regarding date and time of receipt of a message, and/or acknowledgment of receipt or access by addressee(s).

Record: means information that is inscribed on a tangible medium or that is stored in an electronic or other medium and is retrievable in perceivable form.

Records Management is a field of management responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records, including processes for capturing and maintaining evidence of and information about business activities and transactions in the form of records.

APPENDIX V

Feedback Form for Package Validation and Evaluation

Evaluation Form for EDRMS: A Project Record Management package for Small and Medium Building Firms

Please kindly provide us with feedback on this EDRM System package. Tick the appropriate box in Table 1:

Table 1 Model Evaluation

EDRM System Status	Very Poor	Poor	Average	Well	Very Well
Applicability in Construction Management					
Practical Relevance to Construction Management					
Comprehensiveness					
Clarity					
Logical Structure					

Kindly assess the package based on the potential benefits it has in adding value to construction management practice by ticking the appropriate box in Table 2.

Table 2 Potential to Add Value

EDRM System Potentials	Very Low	Low	Average	High	Very High
Improve Productivity					
Provide an Avenue for Organizational Learning					
Improve Management Efficiency					
Enhance Learning and Research Activities					
Enhance Resolution of Conflicts					

Thank you for your time and comments