FRAMEWORK FOR DIGITAL PRESERVATION OF ELECTRONIC GOVERNMENT IN GHANA

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ABSTRACT

The global perspective on digital revolution is one that has received a rapturous approval from information professionals, scholars and practitioners. However, such an approval has come at a great cost to memory institutions as the preservation of digital information has proved to be a complex phenomenon to memory institutions. Guided by the multi method design and underpinned by the triangulation of questionnaires, interviews, observation and document analysis, the study examined digital preservation of e-government in Ghana. Findings revealed that the creation of databases, digital publication, emails, website information and tweets were often ocassioned by the use of ICT, e-government, and application of legislations and public policies. It observed that these types of digital records were in urgent need for preservation as most of the ministries and agencies were unable to access their digital records.

While the application of a digital preservation tool (Lots of Copies Keeps Stuff Safe) was a familiar terrain to the ministries and agencies, there was expressed lack of awareness about digital preservation support organisations and digital preservation standards.

The study identified funding, level of security and privacy, skills training and technological obsolescence as factors that pose key threats to digital preservation. It noted backup strategy, migration, metadata and trusted repositories as the most widely implemented preservation strategy across the ministries and agencies. On the other hand, cloud computing, refreshing and emulation were the least implemented preservation strategies used to address the digital preservation challenges .

The study recommends that the ministries and agencies can address many of the digital preservation challenges if they leverage on collaborative and participatory opportunities. Such collaborative and participatory opportunities involve the use of experts from other institutions to share resources and use a common protocol through cloud computing and Open Data. It further recommends that the process of developing a digital preservation policy can be guided by a template document from other jurisdictions.

KEYWORDS

Public sector organisations, civil service, digital preservation, electronic records management, electronic government, electronic governance, collaboration, participation, cloud computing, Open Data.

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It was a journey that started with bubbles of excitement and huge admiration for academia. But that excitement and admiration were short-lived as the journey was tiring, convoluted and tortuous. With the reality that this is the most difficult challenge of my academic career, a step of courage, determination and commitment were taken to brace this challenge. On this lonely journey, the contributions and input of certain individuals towards the completion of the thesis cannot be glossed over. I owe tons of gratitude to the man of ‘’rigour and thorough’’, my supervisor and mentor, Prof. Patrick Ngulube, whose insightful remarks, invaluable comments, constant admonition and guidance shaped this work. Prof, I will forever be grateful and indebted to you. Having you as a promoter has indeed broadened my scope about the nuances of research methodology. I am also grateful to Mrs. Josephine Apenteng, who out of her busy schedules took time to complete the edit task. My sincerest appreciation goes to Mr. Tim Guetterman, the research assistant of Prof. JW. Creswell for keeping a close watch over my progress during the course of my study.

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DEDICATION

This work is dedicated to my late mother, Mary Kyerewah Adu, who sacrificed her all for the education of her children but never lived to reap the benefits. Sisi, (as you are affectionately called) this work is the upshot of your perseverance, penchant and tenacity of purpose to the education of your children while on earth. I did this project for you.

DECLARATION

l declare that this thesis "**A Framework for Digital Preservation of Electronic Government in Ghana"** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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Signature **Date**

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LIST OF ABBREVIATION

AIIM .....Association of Information and Image Management

ARMA.....Association of Records Managers and Administrators

CCSDS.....Consultative Committee for Space Data Systems

DCC .....Digital Curation Centre

DPE.....Digital Preservation Europe

DPC.....Digital Preservation Coalition

DAITSS.....Dark Archives in the Sunshine State

DRAMBORA ..... Digital Repository Audit Method Based on Risk Assessment

DCA .....Dublin Core Application

ERPANET.....Electronic Resource Preservation and Access Network

FEDORA.....Flexible Extensible Digital Object Repository Architecture

GCNet .....Ghana Community Network

ICSTI.....International Council for Scientific and Technical Information

ICT .....Information and Communication Technology

INTERPARES .....International Research on Permanent Authentic Records in Electronic Systems

IPPD.....Integrated Personnel and Payroll Database

IRMT.....International Records Management Trust

LOCKS .....Lots of Copies Keeps Stuff Safe

NASA.....National Aeronautics and Space Administration

NDIIP.....National Digital Information Infrastructure Preservation Programme

NESTOR.....Network of Expertise in long-term SToRage

OAIS .....Open Archival Information Systems

OECD.....Organisation for Economic Co-operation and Development

OCLC.....Online Computer Library Centre (OCLC)

PDI .....Preservation Description Information

PANDORA .....Preserving and Accessing Networked Documentary of Australians

PRAAD .....Public Records and Archives Administration Department

PREMIS .....Preservation Metadata Standard

TELDAP .....Taiwan e-Learning and Digital Archives Programme

TIFF .....Tagged Image File Formats TIFF

TRAC.....Trusted Repositories Audit and Certification (TRAC)

SGML .....Standard Generalized Markup Language

XML.....Extensible Markup Language

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CHAPTER ONE

BACKGROUND TO THE STUDY

1.1 INTRODUCTION

Good governance requires good record keeping as it supports efficiency and accountability through creation, management and retention of accurate data (Adams, 2010). Reinforcing good governance, Lipchak (2002) noted that good governance is sustained when the government manages public institutions in an efficient, transparent and responsive manner. This position is underscored by the fact that the efficient management of any public sector to retrieve information about government services is one of the key criteria for a successful public sector management in areas such as health, education, pensions and human rights.

Citing Lipchak (2003), Ngoepe (2003) argues that transparency and accountability in a democratic society are ultimately achieved by giving the public the right to access information through records management. Thus, many governments, both in the developed and developing worlds have taken the advantage of using new technologies to conduct large amounts of their businesses electronically (Ngulube, 2007). This strategy has often resulted in greater participation of citizens in the democratic institutions of a country and has facilitated the use of technologies such as word processing applications, intranets, email, Electronic Data Interchange (EDI), e-commerce and data imaging to support paperless transactions (Kowlowitz & Kelly, 1997).

Essentially, the use of Information Communication Technology (ICT) has led to the creation of huge amounts of digital data both within the public and private sector (Decman, 2010). However, this vast amount of digital information can be a nightmare, given that electronic records are more complicated, delicate than paper based systems, and therefore threatens the future sustainability of government information (Lyam & Varian, 2003). The tragedies of the terrorist attack on the United States on September 11, 2001 which affected public records (Read & Ginn, 2007), and

the erratic developments in computer hardware and software (Hedstrom, 1998), have necessitated the need for an information infrastructure to ensure longevity of public information.

In Ghana, public sector organizations are creating almost all of their information in digital form and this includes land records, parliamentary records and court records. However, this information is at risk due to technological obsolescence, lack of organizational policies, insufficient resources and fragile storage media. There are reported cases of damaged documents in public institutions as a result of natural disasters such as flood, fire, and computer virus and system failures. The most affected were the Ministry of Foreign Affairs and Regional Integration and the Ministry of Information. The nation has also lost a great deal of valuable institutional memory through poor record-keeping culture of many public institutions (*Daily Graphic*, 2011). The worrying part is the ambivalent nature of successive governments to give cabinet and parliamentary approval to the 'Right to Information Bill'.

Although the enactment of the Public Records and Archives Administration Act, 1997 (Act 535) which established the Public Records and Archives Administration (PRAAD) was meant to anticipate and to cure the malaise of public record keeping in the country, lack of funding and logistics has made it impossible for PRAAD to play its envisaged role. For instance, PRAAD is currently under-staffed and lacks the capacity to digitize its current records system.

The adoption of Ghana's 1992 constitution enshrined the concepts of probity, accountability and transparency in the national life of the country. Other provisions in the constitution recognize the right of the people to know what is going on in government and chapter 12 literally appoints the media as the watchdogs of society. Additionally, Ghana's Vision '2020' (a policy document of the government) espouses an ICT- driven economy by 2020 if rapid economic growth should be achieved. Certainly, all these provisions can largely be operationalised in an environment where people are provided with relevant information to empower them in the decision-making process. In order to address these issues, the Government of Ghana in June 2003 issued a National ICT for Accelerated Development (The Republic ofGhana ICT for accelerated development (ICT4AD) Policy, 2003) Policy Statement, and was approved by Cabinet in early 2004. The

ICT4AD strategy sought to modernize the civil service by implementing electronic government and government initiatives within the wider scope of the institutional reform. ICT4AD was prepared within the context of other key national frameworks, including the ‘’Vision 2020 Socio-Economic Development Framework and Co-ordinated programme for Economic and Social Development of Ghana (2003-2012)’’ **(**National planning development commission of Ghana, 2001). It identified ICT as one of “the process of transforming Ghana into a predominantly information-rich and knowledge based economy’’ and has on many occasions touted the enormous benefits of the ICT revolution that is sweeping the globe. The policy hinges among them on the following in improving public sector governance:

- a technology-based knowledge driven industrial sector;
- a wide-spread development and exploitation of Information Communication Technology (ICT) within the society to support the delivery of health, education, governmental and social services;
- a population that has access to information and communication technology products and services;
- an economy in which the provision and delivery of goods and services of the key sectors of the economy are facilitated by information and communication technologies; and
- facilitating government administration and service-delivery; and promoting electronic government and governance.

Although these noble policies attempt to address the issue of accessibility to information and recognize the potential role of ICT for national development, very little has been done on digital preservation infrastructure. The concept is still evolving and the ministry is yet to demonstrate her full commitment to digital preservation in the government ministries.

The introduction of a digital preservation infrastructure in national development will enhance the service delivery of government, particularly in the area of e-government. This will facilitate data sharing and cooperation between government departments and streamline offline record-keeping process for online publication (Almarabeh & AbuaAli, 2010). Information users on the other

hand, will appreciate data that has been properly saved for a long time, at least fifty years ago. This data could probably be a national historical document, loan agreements and bilateral agreements signed. Our institutional repositories must be created to manage, preserve and maintain digital documents, and the library and archival centres must take a leadership role in fulfilling this agenda. All of the above are useful pointers to the fact that an information infrastructure only exists on paper, probably because no serious effort has been made to implement it or there is a clear sign of ignorance about the enormous benefit of e-government and digital preservation.

Digital preservation aims at ensuring that digital documents remain accessible to users for a long time and for future generations. There is, therefore, the dire need for a trusted system to manage digital records in our public agencies. A trusted information infrastructure is a type of system where legislations govern which documents are eligible for inclusion in the preservation system; who may place records in the system and retrieve records from it; what may be done to the records; how long records remain in the system; and how records are removed from it (InterPARES Project, 2001). Whereas digital approach to public records will ensure long term accessibility of resources to the public, ensure faster and better search possibilities using search tools; e-government on the other hand will facilitate efficient delivery of government services to citizens and business, disseminate government information, improve revenue collection and budgetary controls, and to a large extent reduce corruption.

The creation and standardization of meta-data within an e-government system, therefore, is one of the critical steps in conducting successful data searches across institutions (Almarabeh & AbualAli, 2010). Fundamentally, countries stand to gain from new market opportunities if they create and exploit information for economic gain (OECD, 2010). This explains why most governments around the world are becoming e-government and communicating their information and services through digital means (Rahman, 2010). However, the implementation of e-government and its success go far beyond technology deployment as citizens' participation play a central role and depend on issues related to information provision from government.

Since the process of governance in every democratic culture is of the people, by the people and for the people, government ought to be responsible to the general public. Citizens demand trust, transparency and accountability from their government. Their records, therefore, must be kept and made available when they need them. This study examines digital preservation of e-government with the view of developing an intellectual framework for practitioners and researchers within the public sector.

1.2 DEFINITION AND DISCUSSION OF KEY TERMS

In this study, the researcher envisages that certain key terms and concepts require clarification. These terms and key concepts form the working definition of the thesis. This section attempts to define the scope of these terms as they will be used throughout the study.

1.2.1 Civil service

In this study, the term 'civil service' is used to refer to the ministries, departments and agencies (MDAs) at national, regional and district levels, as well as the specialist services such as Education and Health. Section (4) of the civil service law, 1993, PNDC Law 327 of Ghana describe a civil servant as a person serving in a civil capacity in a post designated as a Ghana civil service in the Office of the President, Ministry, government department/agency at the national, regional and district levels or any other civil service department established by or under the authority of the Law, the emoluments attached to which are paid directly from the Consolidated Fund or any other source approved by the Government (The constitution of Ghana, 1992). The Ghana civil service in this context refers to the 24 ministries of the Government of Ghana.

1.2.2 Digital preservation

Studies are replete with literature on the concepts of information and information systems, but the amount of literature in the field of digital preservation is relatively limited (Quisbert, 2008).

Many authors and writers have successfully tried their best to explain the concept of digital preservation with each writer placing emphasis on the longevity of digital preservation. For instance, Evens and Hauttekeete (2011) define digital preservation as a 'set of management processes and activities that ensures permanent access to digital information, including scientific and cultural heritages' whiles the Centre for Technology in Government (2005) defines digital preservation as the management of government digital information for the purpose of longevity access and use. Decman (2010) similarly, argues that digital preservation embraces a wide range of materials that is represented by bits and bytes. It demands the need for accessibility, authenticity and trustworthiness. As a new field, the subject of digital preservation has gone through phases of development (Quisbert, 2008). According to Hedstrom (1998), the initial focus was on ''hands-on'' software activities, where particular attention was paid to solving and unravelling the problems of media and software obsolescence through migration and emulation. However, the necessity to solve preservation problems through another level of automation popped up. That was when the use of preservation strategies such as metadata, emulation, encapsulation and migration were brought to the fore (CCSDS, 2002; Lazinger & Tibbo, 2001).

1.2.3 Electronic records management

ISO standard 15489: 2001 defines Electronic Records Management (ERM) as the field of management responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records, including the processes for capturing and maintaining evidence of and information about business activities and transactions in the form of records (ISO standard 15489: 2001).

1.2.4 E-government and e-governance

The field of technology has led to the development of many concepts that have become part of our daily lives. Concepts like e-commerce, e-business and e-learning have become a growing phenomenon, which emerged from the field of economics. In the area of public administration e-government has become a cliché and a trite on the corridors of many governments, particularly because it seeks to link citizens to the various agencies of government in order to achieve greater

efficiency in government services. There is a clear distinction to be made between "government" and "governance". Government is the institution itself, whereas governance is a broader concept describing forms of governing which are not necessarily in the hands of the formal government. E-governance addresses a whole spectrum of relationship and networks within government regarding the usage and application of ICTs (Sharma & Gupta, 2003). Whilst a strong stream of literature is dedicated to the study of e-government, there is no clear consensus about what e-government means. There are however, several definitions of e-government among researchers and specialists but the most pervasive and profound definition is where electronic government is seen as government use of ICT to offer citizens and businesses the opportunity to interact and conduct business by using different electronic media such as telephone touch pad, fax, smart cards, self-service kiosks, e-mail / internet. The OECD (2003) also posits that e-government refers to the use of information and communication technologies, and particularly the Internet, as a tool to achieve better government. The concept has given much more meaning to transparency, accountability, and citizens' participation (Mohammed, Tamara & Amer Abu Ali**,** 2009). Gartner (2000) reinforces this point by defining e-government as the ''continuous optimization of service delivery, constituency participation and governance by transforming internal and external relationships through technology, the internet and new media''. He observed that this includes government to citizen, government to employee, government to business, and government to government.

In terms of comparison, e-government is a narrower discipline than e-governance. E-governance covers a broader topic of processes, relationships and networks within government. Bhantnagar (2004) refers to governance as a broader concept that embraces state's institutional agreements, decision making processes, and relationships between government officials and the public.

1.3 RESEARCH PROBLEM

The development of a robust and strategic approach to digital preservation is becoming a pressing need and challenge for most governments around the world (Queens State Archives, 2011). This need is essentially driven by the exponential growth of digital information and the growing reliance on electronic methods for conducting business. These driving factors have

additionally culminated into the use of e-government sites, services and communication (Decman, 2010). Thus, digital data does not only represent the processes, steps and decisions taken by government, but also a source of information for future generations.

Literature in the field of digital preservation points to the fact that the concept is not widespread (Decman, 2010). Few studies, on the other hand, revealed that insufficient knowledge and lack of awareness of electronic record-keeping pose the greatest threat to digital preservation (Dorner, 2009). Quistbert (2008) in his study called on the digital preservation community for a new thinking, new models and framework in order to cope with digital preservation problems.

Other studies carried out by the Cohasset Associates Inc. , the AIIM international organisation, and ARMA international indicates that a lot would have to be done to achieve consistency and credibility in the life –cycle management of electronic records (Cohasset associates Inc. 2005, 2007 & 2009). That is why the planet project in 2009 concluded that more work ought to be done on policies and budgets of digital preservation; and that component-based solutions to digital preservation are needed (Sinclair et al., 2009).

In Africa, a project undertaken in five East African Community countries (Burundi, Kenya, Rwanda, Tanzania and Uganda), found out that records management issues are not being addressed in relation to the e-government and Freedom of Information (IRMT, 2011). Additionally, government information is not properly organized, as records management systems in many countries are collapsing (Ngulube, 2007).

The situation in Ghana is not different from East Africa as various attempts were made in the 1990's by the Public Records and Archives Administration(PRAAD) to improve the management of paper based records. However, the current wave of ICT development requires PRAAD to develop new skills and capacity to manage government records in electronic format (IRMT, 2008). There are reported cases of many public institutions in Ghana lacking the requisite facilities and the human resource capacity for the purpose of good record keeping (Daily Graphic, Friday, November 25, 2011). Few studies on preservation, on the other hand, have rather focused on preservation practices and preservation of microfilms. For instance,

Akussah, (2003) examined the preservation of documentary heritage in Ghana. Festus (2010), study looked at the preservation and security of microfilms at PRAAD and Ampofo (2009) evaluated the preservation practices in the Public Records and Archives Administration. The closest study was undertaken by Boamah (2014) when he examined "Towards effective management and preservation of digital cultural heritage in Ghana". Whiles Boamah's study finds a space in this current study, it lacked an e-government perpectives.

These calls for new models, better policies, component-based solutions; and knowledge gaps in the field of digital preservation underscore the need to thoroughly examine the concept of digital preservation, more especially from the perspective of e-government in Ghana. One can fairly conclude that although some studies allude to preservation issues, none have treated the concept of digital preservation of e-government in Ghana. This study examines digital preservation of e-government in Ghana with the sole intention of proposing a framework for public organisations and practitioners.

1.4 RESEARCH PURPOSE

The purpose of this study was to examine digital preservation of e-government in Ghana with the view of developing a framework for policy makers, practiotioners in government and researchers.

1.4.1 Research objectives

In order to realize the purpose of the study, the study was guided by the following specific objectives:

1. to investigate how digital records are generated in public sector organisations;
2. to determine the current level of awareness of digital preservation;

3. to establish the impact of digital preservation in the planning and delivery of e-government;
4. to identify the key threats and challenges of managing digital records in an e-government environment; .
5. to assess the digital preservation strategies used at the ministries
6. to establish the responsibilities of various stakeholders;
7. to identify best current practices of digital preservation lessons to be learned; and
8. to ascertain the best type of framework that is appropriate for digital preservation in public sector organisations.

As a follow up to the research objectives, the table below demonstrates how the research objectives and questions guided the researcher to adopt an appropriate research methods and research instuments for the study.

Table 1 - 1: Objectives, research questions and possible sources of data

Objective	**Research question**	**Research method**	**Research instruments**
1. To investigate how digital records are created	How are digital records created in the public sector?	Quantitative	Questionnaire
2. To determine the current level of awareness of digital preservation	What are the current levels of awareness of digital preservation?	Quantitative Qualitative	Questionnaire Interview
3. To establish the impact of digital preservation in the planning and delivery of e-government	What is the impact of digital preservation in the planning and delivery of e-government?	Quantitative	Questionnaire and Observation
4. To identify the key threats and challenges of digital preservation	What are the key threats and challenges of managing digital records in an e-government environment?	Qualitative Quantitative	Interview and Questionnaire
5. To establish the digital preservation strategies	What are the digital preservation strategies?	Quantitative	Questionnaire
6. To identify the best current practices of digital preservation and e-government and the lessons to be learnt.	What are the current practices of digital preservation of e-government, and the lessons to be learnt?	Qualitative Quantitative	Interview, Document analysis Questionnaire Literature review
7. To establish the role and responsibilities of stakeholders in the digital preservation community	What are the roles and responsibilities of the various stakeholders?	Qualitative Quantitative	Questionnaire Literature Document analysis

1.5 SIGNIFICANCE OF THE STUDY

In the view of Creswell (2003: 149) the implication and benefit of any study should revolve around researchers, practitioners and policymakers and that the significance of the study should further contribute to scholarly knowledge, improve practice and enhance any policy development. Studies in the information management platform revealed that most researchers have either treated digital preservation or e-government as separate studies with few studies on both. For instance, Lazinger (2001), Gladney (2007), Quisbert (2008) and Yunhe (2010) have extensively examined studies on digital preservation; while Ngulube (2007) and Aikins (2012) have all had a stint with e-government. The trajectory of these studies and the major gap in literature reinforces the need to closely examine digital preservation and e-government as concepts that can be used to ensure information perpetuity and enhance governance.

In examining the extent to which these concepts (digital preservation and e-government) have been used in our national life, the following questions which were previosuly captured in Table 1-1 were considered pertinent to the pursuit of the study and contributed to the scholarly research.

- how are digital records generated in the government ministries?
- what is the impact of digital preservation in the planning and delivery of e-government in Ghana?
- what is the level of awareness for digital preservation within public sector organisations?
- What are the responsibilities and roles of stakeholders?

These and many other issues were quite significant to the study as Ghana is in the process of passing the right to information law. This law will impose a significant amount of pressure and responsibilities on public authorities to grant the public access to any information. To achieve this, public authorities need to know what information they have and put a suitable long term preservation infrastructure in place. Of what value will it be if recorded information cannot be accessed?

It is further anticipated that the study will support the Government of Ghana goals for e government as it will propose some solutions to the establishment of a digital preservation infrastructure which is a key requirement for the management of an e-government system. The study also sinks into the Ghana's vision 2020 and the ICT policy document of the ministry of communication, aimed at ensuring that Ghanaians have access to information and communication technology products and services.

1.6 JUSTIFICATION OF THE STUDY

The International Data Corporation (IDC) in 2012 projected that "from 2005 to 2020, the digital universe will grow by a factor of 300, from 130 exabytes to 40,000 exabytes, or 40 trillion gigabytes. In other words, every man, woman or child would have generated 5,200 gigabytes of data by 2020 (Gantz & Reinsel, 2011). Such a phenomenal growth of information will pose some level of threat to memory institutions. Even though Africa's contribution to the growth of digital records may be insignificant, it is growing (Lor, 2005) and Ghana cannot be insulated from this threat of digital growth as a great deal of valuable institutional memory are lost through poor record-keeping in many public institutions (Daily Graphi*c*, 2011). On the back of these threats, it is hoped that the study would make a significant contribution to the ongoing discourse about the unfettered phenomenal growth of digital records, preservation strategies and data management.

The study underlined two mutually exclusive concepts (collaboration and participation) as part of the strategies to ameliorate the digital preservation conundrum confronted by memory institutions in Ghana. The applications of these concepts as solutions to the digital preservation problems is a novel and currently gaining prominence and acceptance within the archival community (Council of Canadian Academies, 2015:82). Their adoption in this study could not have come at a better time, particularly when public sector organisations are confronted with the challenge of preserving digital records.

In an effort to address the threats to digital preservation, most organisations have resorted to backup strategy as a full blown digital preservation (Corrado & Moulaison, 2014: 4). This is, however, a huge misconception, as backup is just one of the components of digital preservation and cannot be construed as enough to ensure the longevity of digital records. They are rather short to medium term measures adopted for a specific activity. The current study brings clarity to backup strategy and appropriates its use in public sector organisations.

Another justification for this study emanate from the rapid pace of technological developments. In other words, the further technology advances, the more complex digital preservation issues become and the more varied solution are proffered to address the digital preservation conundrum. This study uses the concept of cloud computing and linked Open Data as preservation platforms through which the archival centres at the ministries and agencies can adopt to ameliorate the unending problems of digital preservation. In addition, the combination of digital preservation and Open Data appear to be more relevant at a time when most governments of the world are striving to obtain data to fight poverty, achieve universal primary education, fight HIV and foster maternal health.

Quite a number of studies undertaken in the field of preservation in Ghana have rather focused on the preservation of documentary heritage, preservation and security of microfilms, preservation practices in the public records (Akussah, 2003; Ampofo, 2009; Festus, 2010). Again, findings from a project undertaken in five East African countries revealed that records management issues are not being addressed in relation to the e-government and Freedom of Information (IRMT, 2011). Undertaking this study is therefore justified as it will contribute to the scholarly literature on the concept of digital preservation and address the inadequacies in the knowledge gap in the field of digital preservation with reference to Ghana.

Additionally, the country risks losing vital national records unless urgent measures are taken to rescue deteriorating conditions at the Public Records and Archives Administration (PRAAD) which has the mandate to effectively and efficiently manage public records (Daily Graphic,

Friday, 2011). The study thus provides a template document to guide the actions of public officers to put in a place a framework to salvage the deteriorating conditions at PRAAD.

Further, the study looks at digital preservation in a period where the right to information bill is about to be passed in the parliament of Ghana which will enhance public access to information.

1.7 ORIGINALITY OF THE STUDY

The originality of a study usually leads to new findings, new theories and contribute to knowledge, no matter how small or great it is. Accordingly, this study draws its originality from the evidence of studies on digital preservation in Ghana as most studies have rather focused on the preservation of documentary heritage, preservation and security of microfilms, preservation practices in the public records (Akussah, 2003; Ampofo, 2009; Festus, 2010). The emergence of this study addresses the knowledge gap in the preservation of digital records in a country where little attention has been accorded to digital preservation.

In addition, the study established its originality by responding to the call of Ngulube (2007), Quistbert (2008), Sinclair et al., (2009) and the Daily Graphic *(*November 25, 2011). Thus, government information in many countries are collapsing (Ngulube, 2007; Daily Graphic, *Friday*, November 25, 2011) and records management issues were not being addressed in relation to e-government (IRMT, 2011), new thinking, new models, policies, and framework are needed to cope with the digital preservation problems (Sinclair et al., 2009; Quistbert, 2008).

In the pursuit of achieving originality, the study established the synergy and symbiotic relationship between digital preservation and e-government. The mutual combinations of these two concepts became relevant, particularly when studies on digital preservation have not been elaborated from the perspectives of e-government in Africa (IRMT, 2011). As an understudied area, this study brings new knowledge by assessing the impact of digital preservation on e-government.

The ultimate adoption of the multi-method design led to the triangulation of the questionnaire, interview, observation and document analysis which resulted in the concept of convergence and complementarity. Thus, convergence was achieved when the results from questionnaire converged with statement from interview. On the other hand, interviews, observation and document analysis provided complementary results by deepening, detailing, explaining and extending the results from the questionnaire. The deployment of multiplicity of research methods to a growing and complex phenomenon like digital preservation of e-government brought some level of originality to the study.

1.8 METHODOLOGY OF THE STUDY

The study drew on the multi-method design as it takes congisance of different approaches/method to establish convergence, complementarity and validation. Thus, it combined quantitative and qualitative methods through multiple use of methods which by far, strengthen the robustness of the results. The objective here is to seek answers to the same questions from two or more methods (Chatterjee, 2011).

1.8.1 Sampling

The study explored all the 156 public sector organisations made up of government ministries and agencies with each ministry/agency having a chief director and an Information Communication Technology officer/ record managers. The chief directors were the coordinators of the ministry and therefore acted as the chief advisors to the ministers**.** In addressing the population of the study, 182 respondents, made up of 27 record managers and ICT heads across the 24 ministries and 155 records managers and IT heads in the public agencies (see Appendix 4 and 5). On this score, the heads of ICT and records managers in each ministry and public agencies constituted the targeted population for the current study. A multiple purposive sampling technique was adopted in view of the different sampling strategies it serves. As the name suggests, the multiple purposive sampling technique uses two or more sampling strategies to select units, individuals, groups of individuals and institutions to address specific purposes and research questions

(Teddlie & Yu, 2007). Such a technique, according to Patton (2002), helps to generate greater depth of information. In applying this concept, a purposive sampling technique called the ‘’complete collection’’ (Teddlie & Yu, 2007:93) was used for all the records managers and ICT heads in the government ministries and agencies. This strategy allowed the population of record managers and IT heads to be studied. In other words, the ‘’complete collection’’ ensured that every head of IT and record manager in each single ministry and agency was covered in the study. The study further used a purposive sampling strategy to select government ministries and public agencies for the interview protocol for the directors of the ministries and agencies.

1.8.2 Data collection methods

On the heels of the multi method approach, different types of instruments were used as the strengths of one instrument compensated for the weaknesses of the other instruments. Accordingly, the study employed questionnaires, interviews, document reviews and observations. These data instruments were triangulated to achieve convergence and complementarity and further ensured the robustness of the results.

1.8.3 Data analysis and presentation

Against the backdrop that the initial versions of datasets usually contain some errors during the entry phase (Babbie, 2001), the data collected in this study was audited, cleaned and corrected. This drive ensured the integrity of the data and helped the researcher to be acquainted with the data (Rowley, 2014). However, meaning was made out of the data when it was transformed, coded, mapped and patterns identified (Patton, 2002). The quantitative data was collected and analysed to produce a set of descriptive results whilst the qualitative data was collected and analysed for another set of thematic results.

1.9 SCOPE AND DELIMITATIONS OF THE STUDY

The civil service is a large organisation, the membership of which was drawn from the ministries, district assemblies and government agencies. In terms of scope, this study focused on

the directors and IT officers/records managers of all the government ministries and their agencies in Ghana. These ministries and agencies are scattered and far from one another in the capital and the rest of the regions in Ghana. Additionally, a study of this nature demands a research permit and direct engagement with participants. These anticipated problems were cleared given my position as a lecturer and my working experiences in some of the ministries. Unavailability of the desired persons and time constraint of the researcher were issues worth considering.

1.10 ETHICAL CONSIDERATIONS

All disciplines have standards to which practitioners are supposed to adhere to. Such standards, particularly for social science researchers have existed for many years, with emphasis on ethical consideration covering data protection, confidentiality and protection of the interests of subjects. The application of this ethical consideration rests heavily on an informed consent form. The informed consent form explains in detail the researcher's expectation, the obligation of participants, the implication of disclosure and the level of confidentiality that is guaranteed. The informed consent form further provides the participant and the researcher a mutual understanding to address any question or concerns in the study.

In this current study, participants were personally handed two introductory letters, one to the minister/chief executive of the ministry/agency and the other to the respondents (See appendix 1 and 2), detailing the purpose of the study and the general importance of the study to the Ghanaian Universities and the implementing agencies of e-government. That could not have been done without an assurance that participant's confidentiality and anonymity on any disclosure of information will be guaranteed. The researcher further complied with the University of South Africa research ethics policy (UNISA, 2010) and submitted himself to the ethical conduct guidelines by avoiding any acts of misconduct such as falsification and plagiarism.

1.11 ORGANISATION OF THESIS

This study was organized into seven chapters.

The first chapter covered the general background to the study, definition of key terms; a statement of the problem; the purpose of the study; research objectives; the significance, justification, originality of the study and scope.

Chapter 2 discussed the various institutional repositories initiatives undertaken by public Universities in Ghana and explored the litany of legislative instruments that underscored the need for digital preservation. Information science education, ICT policies and e-government initiatives in Ghana were also discussed.

Chapter 3 presented the conceptual framework of the study. This included records life cycle and records continuum models, the integrated management framework and the Open Archival Information System (OAIS). It reviewed related literature on how digital records were generated in public sector organisations and how their preservation issues facilitate the delivery of e-government. Challenges and strategies of digital preservation were also discussed.

Chapter Four presented the methodology of the study. The chapter focused on the research design, study population and justification, data collection procedures, validity and reliability of the instruments, problems encountered during data collection and evaluation of the research methodology.

Data analysis and findings of the study were captured in Chapter 5. The section discussed the key findings of the study with the quantitative data reported first, followed by the qualitative data.

Chapter 6 interpreted and discussed the findings in chapter five with particular reference to the key variables or themes pertinent to each research question. The findings were juxtaposed with the results of other studies.

Chapter 7 concluded the research process by summarizing the research findings, making recommendations and proposing a digital preservation framework for public sector organisation in Ghana. It brought to the fore the implication of the study to theory, practice and polices and suggested any further future research.

1.12 CHAPTER SUMMARY

The chapter provides the background to the study. It discusses the rationale behind the study and defines key concepts such as digital preservation, e-government, e-governance, civil service, and electronic records management. The purpose and objectives of the study, research questions, methodology, and significance of the study is presented in this chapter. The chapter further highlight the scope and delimitation, and ethical issues of the thesis.

The chapter examines the need for a digital preservation in the public sector more especially from the perspectives of e-government. It reviewed literature on the underpinning problems and existing gaps in digital preservation and e-government in Ghana, and justified the need for an information infrastructure that will enhance the longevity of government records. It proposes a digital preservation framework for the civil service in view of the undercurrent ICT environment the country has plunged into. The detailed description of the research unfolds in the subsequent chapters.

CHAPTER TWO

CONTEXT OF THE STUDY

2.1 INTRODUCTION

This chapter discusses the context and location of the study, which include the political and economic structure of Ghana. It further takes a look at the various institutional repository initiatives undertaken by the public Universities with emphasis on the library and archival science education in Ghana. Additionally, the chapter examines the legislative framework for records management, the proposed information law, the Information Communication Technology policy of Ghana, and the national data centre being put up by the National Information Technology Agency (NITA).

2.2 THE POLITICAL AND ECONOMIC STRUCTURE OF GHANA

This section brings to the fore, the history, geography, political structure and the economic status of the location of the study.

2.2.1 Geography and history

The Republic of Ghana lies almost at the centre of the countries along the Gulf of Guinea. It is the eighth largest country of the region's 16 nations. It occupies an area of 253,540 kilometers, which makes it bigger than the United Kingdom and smaller than the United States of America (Dickson, 1969). It lies in the midway point of the West African coastline between three degrees west longitude and one degree east longitude. Its most southern point, Cape Three Points, is 5 degrees in north latitude and its most northern point is 11 degrees north latitude (Dickson, 1969). This location makes it enjoy a tropical climate in which the main seasonal change is between the wet season and the dry season. To the east of Ghana lies Togo; on the west is Cote d'voire and on the north is Burikina Faso.

On 6th March 1957, the Gold Coast was declared an independent state and was renamed Ghana. It spearheaded the independence movements in Tropical Africa and gave practical effects to it by taking the reins of government from the British.

2.2.2 Political structure and development

Ghana's political structure is anchored on a firm multi party constitutional democracy, even though its political history reveals a checkered history of democratic constitutions. Ghana's 1992 elections heralded the country's return to multiparty democratic electoral politics after more than three decades of political instability, military interventions and authoritarian rule (Institute of Economic Affairs, 2006). Successive elections in 1996, 2000, 2004 and 2008 have each been seen by domestic observers and the international community as significant improvement over all the previously held polls. The executive authority of Ghana is vested in the President and this is exercised in accordance with the provisions of the constitution. This authority empowers the President to set up a cabinet which consist of the Vice-President and not more than nineteen Ministers of State (Republic of Ghana, the 1992, Constitution of Ghana).

2.2.3 Overview of economic status

Benefitting from two decades of comparatively stable democracy and solid economic policy, Ghana's economy was the second fastest in sub-Saharan Africa in 2011. Throughout the global economic crisis that began in 2007, the gross domestic product (GDP) of Ghana grew each year, with a peak increase of 14.4% in 2011 (Bank of Ghana Annual report, 2012). The surge in growth was caused by the exploitation of a massive 3-billion barrel oil field that was discovered in 2007. Potential oil production was estimated to exceed 100,000 barrels per day. As of October 2012, production had peaked at only 86,000 barrels, although plans to expand production were underway (Bank of Ghana Annual report, 2012).

With a population of 24,658,823 made up of 12,633,978 females representing 51.2 percent while males account for 12,024,845, representing 48.8 per cent of the entire population, (Ghana Statistical Service, 2012), Ghana's economy still remain healthy with the local economy mainly

driven by the service industry and manufacturing and half of the workforce employed in the agriculture sector. Together, these sectors generate nearly 75% of the GDP. Nonetheless, the agricultural sector is of critical importance as it is presently the main source of Ghana's exports. Cocoa products alone represent over 50% of all Ghanaian exports. Fruit and fish are also produced for export, though in much smaller quantity. The mining industry can be said to have contributed a significant amount of revenue with manganese, gold, and diamonds representing about a tenth of exports. As the 2nd largest gold exporter in Africa (after South Africa), Ghana has benefitted from high gold prices in recent years. Despite these industries, Ghana's trade balance experienced a deficit of 12.1 % in 2012 in view of her heavy importation of goods and services. (Ministry of Finance Annual Report, 2012).

2.3 CONTEXT OF THE STUDY- CIVIL SERVICE OF GHANA.

In order to appreciate the context and location of the study, the section examines the structure and legislative instrument and national development of the civil service in Ghana.

2.3.1 The structure of the civil service

As the literature has shown, the civil service of Ghana has undergone several reform initiatives starting from 1926 to 1995. These reforms have basically changed the structure, the legislative instruments and the constitutional provision that gave birth to it. Being the closest institution to the seat of government and the main secretariat of the executive branch of government, the service comprised of service in the civil office of government in both central and local governments (Republic of Ghana, PNDC Law, 327, 1992). The civil service is therefore made up of ministries, agencies, departments, regional coordinating councils and district assemblies. In view of the scope of the study, the discussions were centred on the ministries and agencies. The creation of the ministries lies in the bosom of the President as he is backed by the constitution (PNDC Law, 327, 1992) and an executive instrument to establish ministries and re-designate ministries.

Essentially, much of the work of the civil service is carried out through the sector ministries and its allied agencies. These ministries are distinctive in nature in view of the specific roles they play and the ideological position of the government in power. As the highest organization under the civil service, each ministry is organized into 4 broad areas, namely, general administration and finance division for planning, budgeting, coordination, monitoring and evaluating; human resource management; research, statistics and information; and public relations.

In all, there are 24 government ministries and 132 agencies on the official website of the government of Ghana: www.ghana.gov.gh These 132 agencies operate under the aegis or mandate of the 24 ministries. (see Appendix 4 and 5 for list of ministries and agencies). The roles of these ministries are to ensure that their policies dovetail into the national agenda of the government, as decided by the President. Beyond the ministries and agencies, there are departments and districts responsible for the implementation of the policies, plans and programmes. At the apex of the administrative structure of every ministry is a government minister and his deputy appointed by the President, in consultation with the Council of State, and they have the ultimate responsibility for the administration of the ministry. This is followed by the chief directors who oversee the operations of the ministry and consequently provide leadership. It is worthy to note that there are other line directors who assist the chief director in the day to day running of the ministry.

2.3.2 Role of the civil service in Ghana's national development

Ghana's civil service is an important institution in the life of the Ghanaian. As an agent of the state many of the national developmental initiatives have been championed by civil servants. Today, the civil service has come to be regarded as a modern institution bequeathed to mankind in the process of organizing any large human organisation (Ipinlaiye, 2001). Given the huge benefits of technology and the much anticipated information law in Ghana, a statutory obligation will be placed on the civil service to introduce sound records management practices that can ensure long term access to digital records, particularly when information has become the key source of economic growth and a valuable asset that can be leveraged on (World Bank Report,

2006). There is no doubt that information; knowledge and technology are increasingly becoming key drivers for socio economic development worldwide.

Essentially, Ghana's ability to accelerate socio economic development process and gain global competitiveness depends on the extent to which it can use, exploit and sell information, knowledge and technology (Republic of Ghana, ICT4D, 2003). In that regard, the civil service needs to know the records they must preserve, the form it ought to be preserved and the platform it will use to assist government growth and employment. It is in this respect that the current study is investigating the framework for digital preservation of electronic-government in Ghana. The subsequent section takes a look at the legislative framework for records management in Ghana.

2.4 LEGISLATIVE FRAMEWORK GOVERNING RECORDS MANAGEMENT IN GHANA

The introduction of a legislative framework within the civil service forms part of a larger framework for the management of public records in Ghana. Inherent in this framework are acts, legislation, and policies that give clear direction to the management of public records. The following section discusses aspects of this framework in relation to public records.

2.4.1 Financial Administration Act, 2003 Act 654

The Financial Administration Act as it stands, prescribe the responsibilities of persons entrusted with financial management in government, to ensure the effective and efficient management of state revenue, expenditure, assets, liabilities and resources of the government (Republic of Ghana Financial Administration Act, 2003 Act 654). To achieve this, section 30 of the Financial Administration Act, stipulates that each government department maintains adequate records of stores, and that the minister, in consultation with the public procurement board, may make regulations governing the acquisition, receipt, custody, control, issue and disposal of the stores. A follow up to section 54 of the same Act notes that corporations owe it a duty to keep proper books of accounts and proper records in a form as approved by the attorney general. Clearly, the

framers of these Acts had in mind an objective geared towards the principle of accountability, transparency and efficiency. Such principles demand sound records keeping for public by institutions.

2.4.2 Civil Service Act 1993 (PNDCL 327)

Section 20 of the civil service acts empowers directors to implement proper codes of conduct for administrative, financial and operational transactions of the service and to further institute an effective training programme consistent with sectoral policies and programme (Civil Service Act, PNDCL 327, 1993). Such a mandate can effectively be executed if there is a good record system in place where references can be made. The act also provides for the mandatory submission of half yearly reports regarding programme performance, administrative development, and manpower data as may be required (Section 84, Civil service Act, 1993). Again, compliance to these acts can only be effected if there is a proper records management system for public officers.

2.4.3 The Public Records and Archives Administration (PRAAD) (Act 535, 1997)

Up until 1977, the National Archive of Ghana (NAG) operated under the public archives ordinance of No. 35. 1955 (Republic of Ghana, Public Archives Ordinance of No. 35. 1955*)* and was responsible for the core of public records. An ordinance passed by the legislature in the Gold Coast just before independence in 1957, statutorily gave birth and empowered the National Archives of Ghana (NAG) to take charge of the custody and preservation of all public records. In order to streamline and improve the management of public records, series of workshops were held on the management of public records which brought about several amendments to the public archives ordinance of 1955. These amendments led to the new law, the Public Records and Archives Administration Department (PRAAD) Act of 1997, Act 535, with the mandate to preserve Ghana's collective memory in all ministries, departments and agencies (Republic of Ghana PRAAD ACT 535, 1997).

As a department within the office of the head of the civil service, PRAAD is headed by a director and organized into three divisions: archives records, management, training and research. Section 1 of the PRAAD act stipulates that PRAAD takes proper care and effective management of records in public institutions of government. In other words, under the supervision of PRAAD, public offices, institutions and individuals who created and maintained public records follow good record keeping practices. The act again mandates PRAAD to establish and implement procedures for the timely disposal of public records of no continuing value. Clearly, such regulation raises issues of procedures, appraisal, disposal and damage to records. However the disposal of public records at the national archives or any other archival repository must be subject to the agreement of the head of the public office in which they were created.

That notwithstanding, public sector organisations must be guided by the national standards to maintain good records practices. Section 8 of the act enjoins PRAAD to take custody of semi-current records which have been scheduled for further retention and maintain them within a records centre, a situation that compels PRAAD to implement retention schedules with respect to semi-current records in its custody. While the act defined records as 'recorded information, regardless of form or medium', the act implied hard copy rather than electronic records. For instance, the director of PRAAD 'shall accept custody of semi-current records and maintain them within a records centre' (Section 8). The head of every public institution where public records are created and kept shall establish good records keeping practices within the registry (Section 9). In this respect, the act is similar to other national records and archives legislation enacted at about the same time. Since the act was passed, Ghana, like many other countries, has begun the transition to electronic work practices. Desktop and network computers are now commonly used in government offices by secretarial and senior staff and by staff who use large database applications such as the Integrated Personnel and Payroll Database (IPPD2) introduced by the International Records Management Trust (IRMT, 1997).

Throughout the 1990s, PRAAD (previously the National Archives) led a nationwide programme of records management improvement, largely aimed at paper-based systems. However, the current challenges of ICT environment requires PRAAD to develop new skills and capacity to

manage government records in electronic format (IRMT, 2008). Without training and experience in managing electronic records, PRAAD will be unable to fulfil its responsibilities as defined by law. The current wave of ICT development, both within the private and public sectors places a huge responsibility and daunting task on PRAAD to migrate from a paper based system to an electronic platform. That is why this study on digital preservation could not have come at a better time. However, PRAAD is still faced with challenges such as under-staffing and lacks the capacity to digitize its records. Inadequacies in records keeping systems and practices are prevalent in the civil service. These weaknesses clearly show that the very establishment of PRAAD still hangs in a balance.

2.4.4 Freedom of information law

The call for the passage of the Right To Information (RTI) bill has been a subject of debate for the past thirteen years. In 2003, the New Partriotic Party, the then government in power drafted the Right To Information bill to give effect to the right guaranteed in article 21 (1) of the 1992 Constitution of Ghana. Following consultations with civil society organisations and a campaign led by the RTI coalition, the bill was first laid in parliament on 5th February, 2010. It must be noted that as at 2010, the bill was fraught with certain problematic clauses as it failed to take cognisance of record keeping, broad exemptions on information, timelines on providing access to information, the bill's enforcement regime, and fees to obtain access to information. Accordingly, on December 17th, 2014, the Select Committee on Constitutional, Legal and Parliamentary Affairs tabled its report containing the amendments in Parliament which ushered the second reading of the bill on 25th June, 2015, paving the way for discussions to commence on the bill. The bill at its current state has been referred to the next stage of the legislative process (the consideration stage) and has never been considered even though it kept appearing on the agenda of parliament. The delay in the passage of the bill gives a worrying signal, more particularly when Ghana has signed onto the Open Data Government Partnership (ODGP) to promote transparency, empower citizens, fight corruption, and harness new technologies to strengthen governance (World Justice Project Open Government Index Report, 2015). An aprroval to the bill will in many ways make government more accountable and transparent. It

will lay the foundation upon which to build good governance, transparency, accountability, and eliminate corruption.

In 2006, over 68 countries had put in place comprehensive laws to facilitate access to state records, and many more were in the process of enacting such legislation (UNDP report, 2006). This gives credence to the growing recognition that access to information enhances democratic engagement. The right to information law demands the promotion, use and access to public records. An effective records management and a good retrieval systems therefore will give a teeth to the information law says Akoto Ampaw, a member of the civil society in Ghana spearheading the passage of the law (Daily Guide, 2011). He argued that as soon as the law is passed, an obligation will be placed on all public authorities and private agencies covered by the law to create, keep, and organize an effective and efficient system of record keeping. Gupta (2014) similarly argues that the bill should reinforce the Ghana Public Records and Archives Administration Act, which requires public bodies to maintain records. This will eventually give meaning to the right to information when citizens apply for information. In other words, ministries and agencies of government would have to improve their records systems by publishing the materials they have, in order to comply with the provisions of the law. On the flip side, access to information has the potential to increase the demand for records and could compromise the longevity of records if they are not handled properly (Ngulube, 2009: 202). It is not surprising that many of the strongest and successful digital preservation initiatives have been developed in countries where the right to information is very much entrenched such as United States of America, United Kingdom and Australia.

2.4.5 The ICT policy

Underpinning Ghana's aspirations for e-government was a national ICT policy regarded as a National ICT for Accelerated Development (ICT4AD) policy statement (ICT4AD, 2003) which was approved by cabinet in early 2004. The ICT4AD strategy sought to modernize the civil service and its service delivery by implementing electronic government and government initiatives within the wider scope of the institutional reform. ICT4AD was prepared within the

context of other key national frameworks including the 'Vision 2020 Socio-Economic Development Framework and Co-ordinated programme for Economic and Social Development of Ghana (2003-2012) **(**National planning development commission of Ghana, 2001). ICT4AD set out a road map for achieving an information society and economy. It envisaged a programme of infrastructure modernization, expansion and development to bridge the digital divide and meet the Millennium Development Goals. Government ministries and public sector organizations were required to publish their own ICT policy statements in line with ICT4AD. For instance, the policy statements, of the head of the civil service focused, among other areas on:

- establishing ICT leadership programme within the civil service;
- facilitating the development and implementation of a performance-based human resource and personnel management system within MDAs;
- facilitating effective and efficient records and information management within MDAs, from planning and system development to disposal, and to ensure long-term preservation;
- ensuring MDAs maintain, protect and preserve information so that information of enduring value is available for future use; and
- ensuring the effectiveness and efficiency of the management of information throughout its lifecycle by establishing an accountability framework to ensure the appropriate management of information.

Further, effective records and information management, and enhanced personnel management systems were critical components of the national ICT objectives. A requirement of the Audit Service Act, 2000, Section 11 (1) and (5) was that the Auditor General must approve all financial and accounting systems including computerised systems and electronic transactions.

2.5 INFORMATION STUDIES EDUCATION IN GHANA

The quest to train librarians, preservation managers and archivist has been recognized for a long time, with preservation education courses being offered in several library and archives schools in

the United Kingdom, the United States, Australia, Canada and Africa (Akussah, 2005). In Ghana, such formal training is offered in the department of information studies of the University of Ghana and the vocational and technical training institutes. This section examines these two levels of library and archival education in Ghana.

2.5.1 University of Ghana

Coming on the heels of a checkered history, the department of information studies of the University of Ghana is the only University in Ghana, where formal training in library, records management and archives are pursued. As a department under the faculty of social studies of the University of Ghana, the information studies department has gone through several phases of development. Started as the Ghana Library School in 1961, it became the Department of Library Studies in 1965, and later renamed as the department of library and archival studies in 1970. These phases of development occasioned the restructuring of the curriculum of the department in the year 2000, which eventually changed the name to the department of information studies.

Today, the department offers programmes in diploma in librarianship and archival administration, bachelor of arts in information studies, and postgraduate programmes in information studies with emphasis on preservation, disaster planning and vital records and records storage and retrieval. The contribution of these programmes creates some level of preservation awareness among the products of the university. For example, Agyei (1993) emphasized that ‘’on completion of the programme, the prospective librarian or archivist should be able to understand his/her holdings and provide users with what they need.

2.5.2 Vocational training

Up until recently, programmes leading to vocational qualifications in information studies were run by the State Publishing Corporation, the National Vocational Training Institute, City and Guilds and the Institute of Technical Supervision (Akussah, 2005). These institutes provided practical and hands-on training over specified periods of time, depending on the experience and previous knowledge of the student applicant. Students at these institutions were admitted at

different levels depending upon their skill needs (Akussah, 2005). The programme offered by these institutes ranged from lower to advanced levels and vary in duration from months to years.

Students were equipped with the technical knowledge needed to preserve documents and to prevent deterioration of documents. At the end of the programme, accredited certificates of qualification are awarded to students.

2.6 INSTITUTIONAL REPOSITORY INITIATIVES

This section of the study examines the ongoing institutional repository initiatives and preservation strategies undertaken by the various public Universities in Ghana. It focuses on the University of Ghana, University of Cape Coast and Kwame Nkrumah University of Science and Technology presumably because they were the only public universities who had initiated a digital repository as at the time of undertaking the research.

2.6.1 UGspace

UGspace, as the institutional repository of the University of Ghana, is an open access electronic archive for the collection, preservation and distribution of digital materials. Just like any other repository, UGspace was established to facilitate the deposit of digital content of a scholarly or heritage nature to share, preserve and promote the intellectual output of the University in a managed environment. The University believes that proper organisation and planned preservation activities can enhance information perpetuity and break the cycle of information lost. A cursory assessment of the University library website shows that the UGspace houses theses, journals, research articles, reports and heritage materials in their repository.

In order to sensitize the university community about the ongoing Institutional Repository (IR), series of workshops were organized for the community and all its constituents in 2014. Such workshops brought to the fore the need to undertake IR projects to ensure the preservation of its heritage materials (UGspace, 2014).

2.6.2 KNUSTspace

Similar to the UGspace repository, is the KNUSTspace of the Kwame Nkrumah University of Science and Technology. As an open access institutional repository (IR), KNUSTspace offers service to the KNUST community by facilitating the management and dissemination of digital format of academic and research output, and learning and teaching resources that have either been created by or donated to the community. As an interoperable repository, it has integrated a standardised metadata or protocol, like OAI-PMH or Dublin Core to share its contents with other users. The KNUSTspace collects, classifies, preserves and retrieves items submitted to KNUSTspace by all staff and students. It uses the Open Source Software, DSPACE. A software developed by Hewlett Packard (HP) and Massachusetts Institute of Technology (MIT) and widely used for IR. It has a bigger community of users who offer assistance to each other including technical support online. KNUSTspace uses two levels of digital preservation viz; bit preservation and functional preservation. The bit preservation ensures that no single bit of the file is altered although the physical media revolve around it. On the other hand, the functional preservation ensures that the file changes over time, and the material continues to be used immediately in the same original way. The KNUSTspace accepts content format in journal articles, working papers, technical report, conference papers, theses and occasional lectures (KNUSTspace, 2014).

2.6.3 UCCspace

The UCCspace of the University of Cape Coast is equally a university-based institutional repository (IR) developed by the library to manage and disseminate in digital format, the academic and research outputs created by and donated to the University. In developing the IR, the library adopted the Open Access Initiative Protocol for Metadata Harvesting (OAI -PMH) or Dublin Core in order to share its content with other users. Hence, it uses the open source software package “D-Space” developed by Hewlett Packard (HP) and Massachusetts Institute of Technology (MIT). The UCCspace has Journal Articles, Working Papers, Technical Reports, Pre-Prints, Post-Prints, Manuscripts, Conference Papers, Newspaper Clippings, Speeches, Theses

and Dissertations (UCCspace, 2014). Other Universities with IR in Ghana are the University of Winneba, Reagent University and Presbyterian University of Ghana. Collecting content is always the first step in building an IR, however the preservation strategy for building a content should be given much priority.

2.7 ELECTRONIC GOVERNMENT AND THE CIVIL SERVICE IN GHANA

E-government activities in Ghana started far back in the late 1990s (Schuppan, 2009) before the framework for the development of e-government infrastructure was developed in 2008 by Act 771, under an agency called the National Information Technology Agency (NITA Act 771, 2008). This section of the study highlights aspects of activities and projects of e-government implemented in Ghana. Some of the e-government infrastructure or flagships in place and ongoing programmes include Ghana Community Network, National Data Centre, broadband infrastructure, NITA and Integrated Personnel and Payroll Database.

2.7.1 Ghana Community Network

The Ghana Community Network (GCNet) was established to bring an end to the bureaucratic system of duty collection, which was creating traffic of goods at Ghana's port (De Wulf, 2004, 2005). These bureaucratic procedures came in the form of delayed imports and exports for up to four weeks and were further exacerbated by thirteen copies of shipping papers which exporters had to distribute personally to authorities (often 25–32 different offices) to get the required permission. This procedure was not only extremely ineffective, but contributed considerably to corruption. However, with the introduction of GCNet, goods scheduled for import and export were undertaken electronically with a gradual implementation plan at all border crossing points.

The GCNet is part of a single electronic window for online submission, processing, approval and distribution of a wide range of trade related documentation by ministries, departments and agencies. The Ministry of Trade and Industry (MoTI), the Bank of Ghana, the Customs and Excise and Preventive Service (CEPS), Ghana's shipping council, the shipping companies, cargo

enterprises and banks are all integrated into the system. For data exchange and communication between the GCNet and the CEPS, a broadband network created especially for the system is used by importers, exporters, clearing agents and logistics companies to enable them interact with the various MDAs involved in the clearing process. Users may submit applications, receive and respond to queries, submit supporting documents and track the progress of their applications. Further, goods at the airport are dispatched within one day and in the harbour within three days. With GCNet, idle time of ships and the resultant demurrage, have been substantially reduced whiles tax and duty revenues have increased by up to 50% (Sudan, 2005).

2.7.2 Integrated Personnel and Payroll Database

The Integrated Personnel and Payroll Database (IPPD) Project is one of the first, the largest and most complex IT project ever undertaken by the Government of Ghana (IRMT, 1997) and the first of its kind in West Africa. The database is accessible through 300 personal computers and dumb terminals over an Ethernet network using the Transmission Control Protocol (TCP). The IPPD centre provided more reliable and useful information on personnel emoluments of the civil service and further improved the efficiency, responsiveness and timeliness of personnel administration (IRMT, 1997). In 2008, the software of the IPPD was upgraded to accommodate the complex salary demands of the civil service and to accommodate the growing population of the civil service. Till date, the IPPD is the national payroll database system in Ghana. Its introduction across public sector organisations far back in 1997 set the tone for the application of ICT in the delivery of public service and became the eventual precursor of the implementation of e-government.

2.7.3 National data centre

As part of the requirement of the government's policy to preserve data, make information available and accessible to a wider community, the government of Ghana has put up a national data infrastructure to facilitate the consolidation and aggregation of all government's information in a secured environment (NITA handbook, 2008). The infrastructure consists of a primary data spread over all the ten regional capitals of Ghana and supported by a Network Operating Centre

(NOC), Security Operating Centre (SOC) and Storage Area Network (SAN). The NOC monitors and controls applications and network services originating from the data infrastructure, whilst the SOC serves as the nucleus of the Ministries, Districts and Agencies (MDA's) internet and intranet security operations. The SAN, on the other hand, provide the storage areas for all the MDA's. Since the government is a significant holder of data, it is appropriate to put up the national data centre to accommodate the increasing growth of data.

2.7.4 Broadband infrastructure

With a population of 24.6 million, only 1.3 million people, representing 5.3 per cent have access to broadband (National Communication Authority, 2013). However, mobile penetration is about 116 per cent, (National Communication Authority Annual Report, 2015) making it one of the highest in the sub-region. Ghana's broadband infrastructure has received substantial commercial investment in recent years. Compared to 2008, average broadband speeds have quadrupled and large parts of the country have access to high speed 3G mobile broadband services. Figures from Ghana's National Communications Authority (NCA, 2013) reveals that the overall internet penetration rate in the country increased as at the end of August, 2013, presumably because of a high level of infrastructure investment by private companies, such as MTN data centre and the Vodafone fibre optic data centre. With the laying of broadband cables by SAT 3, Main One, Glo1 and the West African Cable System (WACS), it is expected that the cost of bandwidth for broadband will reduce and further improve the quality of voice and data speed. A high level of internet connectivity gives an added impetus to the ministries to store and manage data, which will ultimately accelerate development in e-components of ICT, e-health, e-commerce, e-agriculture and e-education.

2.7.5 National Information Technology Agency (NITA)

As part of the mandate of implementing ICT policies of the ministry of communication, NITA is integrating ICT components into government business processes. In pursuance of this, each government agency is to improve the interaction between citizens and business in the country through an e-government application to be implemented using the public-private partnership.

Under this arrangement, an electronic application and services will lead to the automation of the Ghana Revenue Authority and the Registrar General's Department. NITA, being the implementing agency will spearhead the automation process which will create a more citizen-friendly oriented public service delivery system. The ultimate goal is to improve the efficiency and effectiveness of tax administration, which will further reduce cost and create a more citizen-friendly oriented public service delivery system. time of registering business.

Further, to the development of improving the interaction between government services and her citizens, NITA has developed a Ghana Government Architecture Enterprise (GGAE) document, which will be used by all the ministries, agencies and departments. This will help government agencies to define their businesses and to combine and share data across systems with other analogous agencies. The objective is to help in interagency and intergovernmental data collection and management (NITA Act 771, 2008). Additionally, the electronic service module of the e-Ghana project will ensure that portal infrastructure is deployed across the ministries to provide a platform for content management, document management, and e-forms. This will provide a one-stop source of government information, including government service directory. The e-services module will similarly merge with government services and help to eliminate the difficulty involved in handling complex and bureaucratic processes at interdependent ministries and agencies. (NITA hand book, 2008).

In all, quite a number of government agencies have been earmarked for a pilot phase of the e-Ghana project and these include the Passport office, National Identification Authority, Minerals Commission, Births and Death Registry, Food and Drugs Board, Ghana Tourist Board, Driver Vehicle and License Authority and Criminal Investigation Department of the Ghana Police Service. Indeed, application for government services in these agencies will be done online after the pilot phase of the project is completed. The document reviewed so far indicates that there are attempts to improve ICT capabilities and e-government infrastructure in Ghana but with no corresponding and deliberate action plan for digital preservation infrastructure.

2.7.6 Strategy for digital preservation of e-government in Ghana

The ICT policy document for Ghana seeks to improve public sector management and institutions through the application of ICT (ICT policy document, 2003). Such improvement requires that the capacity of public sector management is built to enhance its accountability to the public and to ensure that all service delivery institutions provide correct and authentic information. A key component of the policy was what led to the introduction of the ICT policy and the e-government Act of 771, which seeks to promote e-government as a means of improving governance and service delivery. Since digital preservation is a key technology underpinning e-government, the government of Ghana is incorporating records management in the design of ICT policies so that public officers can manage, protect and provide reliable information over time.

Whilst this objective is yet to be achieved, computers can be found in most government ministries and agencies with government business and communications conducted electronically through email, the web, desktop computers and networked information systems. This has undoubtedly raised the issues regarding the challenges of the preservation of heritage materials in digital formats from archivists, librarians and other custodians of such materials. In order to make the transition to e-government easier, government has found it expedient to build a system anchored on a digital preservation infrastructure. That is why the national data centre could not have come at a better time.

On the other hand, there is no significant research literature on national digital preservation strategies of e-government in Ghana, except digital preservation of cultural heritage, institutional repository projects and initiatives regarding digital libraries and digital archives as pointed out in Section 2.7. However, the creation and production of digital records within public sector organisations have been growing and one can only assume that basic preservation strategies such as backups, the use of storage media, records retention schedules and other records procedure manuals are probably the preservation strategies used by public sector organisations. This assumption explains why the current study is seeking to identify the strategies for digital preservation of e-government in Ghana.

2.8 SUMMARY

Emerging discourse in this chapter was that the civil service plays a critical role in national development, and their engagement and participation in ICT policies, e-government initiatives, and the much anticipated information law underscores the need for them to adopt effective and efficient records keeping with a particular interest in digital preservation infrastructure. This is so because as an agent of the state, many of the national development initiatives are rooted or carried out through the ministries (civil service) and their capacity to implement, monitor and evaluate national projects demands timely, accurate, authentic and reliable information. A digital preservation infrastructure in this regard provides a seminal drive in actuating e-government initiatives and the developmental agenda of the government. The chapter also alluded to the fact that an obligation is placed on all public authorities and private agencies covered by the information law to create, keep, and organize an effective and efficient system of record keeping, so as to give meaning to the right to information when citizens apply for information. The context of the study as pointed out in this chapter, paves the way for the subsequent chapter to discuss the conceptual framework, digital preservation models and the literature review on digital preservation of e-government.

CHAPTER THREE

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK OF THE STUDY

3.1 INTRODUCTION

Chapter Two (section 2.8) of the current study underscored how Ghana has been making a lot of progress in the e-government environment under an agency called the National Information Technology Agency (NITA Act 771, 2008). It noted that e-government initiatives were aimed at easing the lives of people doing business with the government and to establish Ghana as the economic hub for trade in the West African region. Such initiative can only be implemented effectively if the government of Ghana incorporates digital preservation initiatives in the design of ICT systems. Chapter Two further brought to the fore, the various legislative instruments for records management in Ghana and highlighted some of the ongoing e-government infrastructure in Ghana, as well as institutional repository initiatives and preservation strategies undertaken by the public institutions. In all these, the chapter articulated that digital preservation is a key technology underpinning e-government.

In order to link the context of the study to the literature review and conceptualize the study, Chapter Three discusses digital preservation of e-government in general. It reviews the current ongoing trends in the preservation of digital records, challenges of digital preservation, preservation strategies, preservation practices, and best practices in other jurisdiction. Moreover, it presents the conceptual framework of the key contending theories which are relevant to the current study.

3.2 LITERATURE REVIEW

All empirical studies, be it qualitative, quantitative or mixed methods must essentially be hooked onto a literature (Rocco & Plakhotnik, 2009:121). A literature review therefore is an examination of the research that has been undertaken in a particular field of study. Hart (1998) defines it as

the selection of available documents (published and unpublished) on a topic which essentially contain ideas, data and evidence. These selections of documents must chart a path in order to achieve a certain viewpoint on a topic. The value of the topic is only brought to the fore when it can be connected to other people's work, as no knowledge exists in a vacuum (Ngulube, 2009: 26). It is the best way to establish the importance of the study and the credibility of the researcher (Leary, 2004). The literature review identifies the theoretical structure and may be considered as the sine qua non of research, in that it reveals the existing knowledge gaps and shows the next logical step for the extension of knowledge. In delineating the steps taken in the review of the literature, Creswell (1994:37) suggests that the literature review should meet three criteria: "to present results of similar studies, to relate the present study to the ongoing dialogue in the literature, and to provide a framework for comparing the results of a study with other studies".

To accomplish these criteria, Creswell (2002:86) outlines a five step process: "identifying terms typically used in your literature search; locating literature; reading and checking the relevance of the literature; organising the literature you have selected; and writing a literature review". In other words, the thrust of reviewing literature begins with systematic identification, location, evaluation and interpretation of the existing body of knowledge (Fink, 1998:3). In this light, the review of literature serves many purposes (Ngulube, 2009:28). Rocco and Plakhotnik, (2009:123) enumerated five main functions of literature review and a conceptual framework as: "to build a foundation, to demonstrate how a study advances knowledge, to conceptualize the study, to assess research design and instrumentation, and to provide a reference point for interpretation of findings". These five functions resonates with the purpose of literature review advanced by Ngulube (2009: 28) when he posits that literature review "places the research in a context related to existing research and theory, provides a framework for establishing the importance of the study, and identifies the main methodological and research techniques that have been used".

Essentially, building a foundation requires previous work or existing theory to demonstrate linkage and illustrate trends. Again, demonstrating how a study advances knowledge is

contingent on how the literature identifies the knowledge gaps and addresses them. One way of developing a concept or a theory is by describing the propositions of previous studies, defining the terms and clarifying the assumptions and limitations in order to build a rationale for the study. As has been noted by Kaniki (2002), literature review can thus be historical, thematic, theoretical, empirical or a combination of these could be adopted. Both Ngulube (2003) and Creswell (2003) have underscored the need to link the literature review and conceptual framework as the literature review helps in identifying theories that could be tested for the purpose of developing a theoretical framework. This can precisely be seen from the map of literature below. The purpose of the literature review in this study is to establish the conceptual framework of digital preservation within an e-government environment. In this regard, this chapter reviews how digital records are generated and preserved and its impact in the planning and delivery of e-government. In accomplishing this, the study used a variety of bibliographic sources ranging from Electronic Resources, Abstract International, Library and Information Science Abstracts, Dissertations, the Internet and ocuments from public sector organisations in Ghana.

3.3 RESEARCH MAP OF THE LITERATURE

The literature map below shows the trajectory and the chronological path the conceptual framework and the literature review were organized and presented. It further shows the cascading effects of the core subjects and their divisions into subtitles.

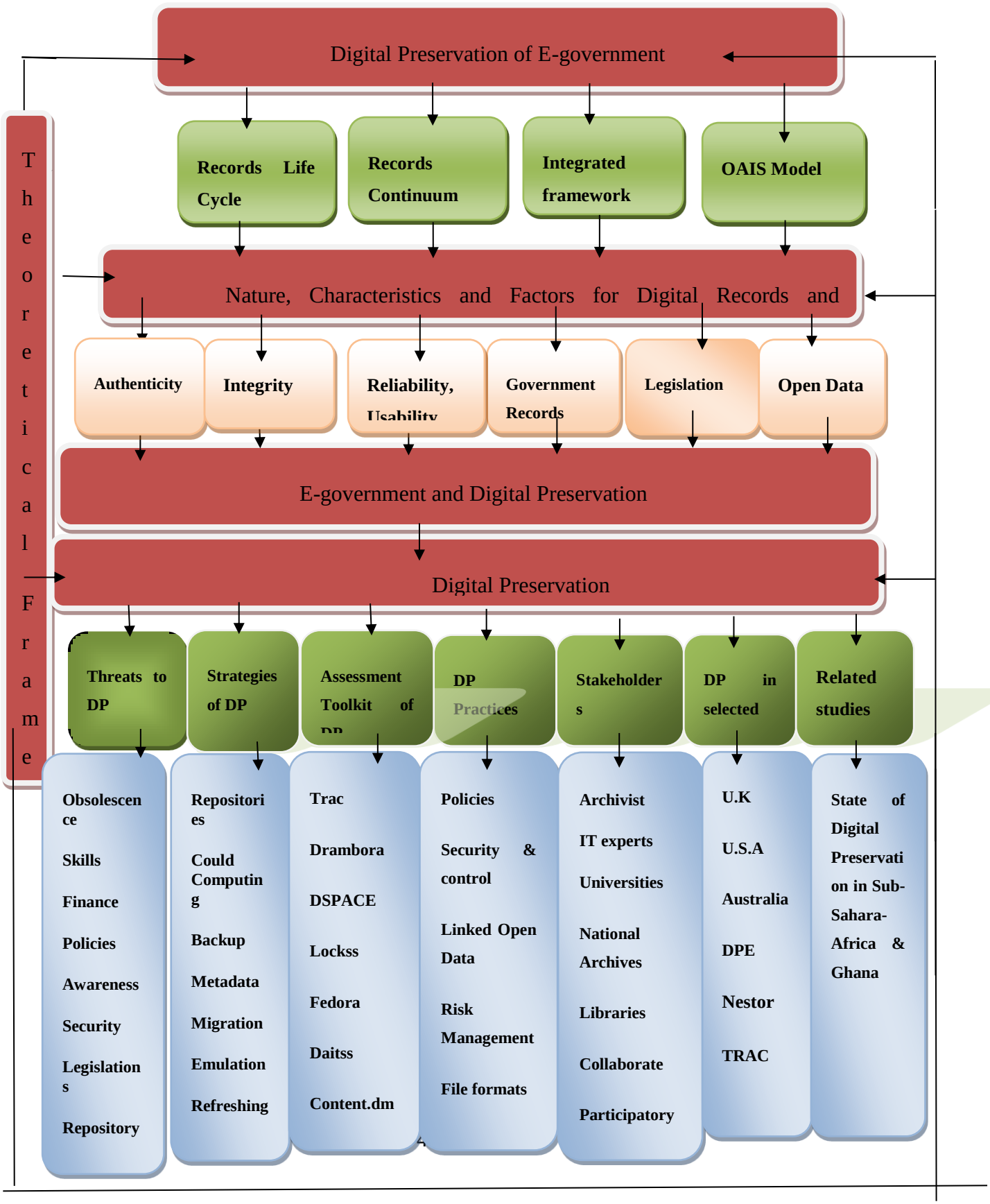

Figure 3 - 1: Literature Map

3.4 MODELS, THEORIES AND CONCEPTUAL FRAMEWORK

For many years, models and theories have been widely used as interchangeable terms in research, albeit Ngulube, Mathiapa, and Gumbo (2015) argue that it is conceptually incorrect to do so. Models are partial representations of theories and cover an aspect of theories (Leijonhufvud, 1997). Whereas a concept can be derived from a given model, a theory can be said to be a set of concepts used to explain a given phenomenon (Silverman, 2000:77). As a set of interrelated concepts, models convey a mental image of a phenomenon or the real world (Powers & Knaap, 2006) and very often leads to the formulation of theories which may be used to describe a phenomenon. Whilst models are the main route for researchers to develop conceptual frameworks, theories are the linchpins of theoretical frameworks (Ngulube, Mathiapa & Gumbo, 2015).

A conceptual framework underpins the theory guiding a particular study and so stems from a theoretical framework (Ngulube, Mathiapa & Gumbo, 2015). Alternatively, the conceptual framework is selected from the theoretical framework which eventually becomes the basis of a research problem (Kumar, 2005:37). Additionally, a conceptual framework provides an environment where the concepts chosen for investigation are appropriated and become useful to the research problem under investigation (Lester, 2005:460). Without a conceptual framework, the researcher can tread on the realm of speculations and absurdity. A study, therefore, anchored on a conceptual framework helps to clarify, explain and justify methodological decisions (Ravitch & Riggan, 2012:9). Creswell (2003) also underscored that theories can be placed deductively (as in quantitative methodology), inductively (as in qualitative methodology) or both deductively and inductively (as in mixed methods) to explain the phenomenon under study.

In this current study, the researcher used a combination of models and framework to give grounded coherence to the study. In this regard, the study used records management and archival science conceptual frameworks, the OIAS model and the integrated records management model. These theories and models were adopted because the issues and variables they raise are very critical and pertinent to the study. Adams (2010), citing Kemoni (2008), observed that various records management models have been developed by national archival institutions, archives

schools, and records and archives management scholars. However, these models originated from the life cycle and continuum approaches, with some focusing on the management of electronic records while others emphasized on the management of both paper and electronic records (Shepherd & Yeo, 2003). Ross (2006) points out, however, that among record-keeping professionals, the life cycle and the records continuum models have dominated discourse, with the life cycle approach challenged by the records continuum model. It can be deduced from these observations that the basic theories or concepts underlying the management of records and archives are the life cycle and continuum concepts. In ascertaining the best framework for digital preservation within the government ministries, the researcher considered it appropriate to use both the records life cycle and the records continuum model, the OIAS model and the integrated records management model to advance the current study, as they are the most dominant theories in the archival and records management field (Chachage & Ngulube, 2006).

These two concepts in part and the OAIS model form the framework for the concept of digital preservation because the main legislation that provides the direction for public records is the PRAAD Act of 1997 (PRAAD Act, 1997) which defines the functions and operations of PRAAD to manage public records throughout their life cycle. Preservation of data has been recognized as a key requirement to e-government implementation as this data would have to be maintained over the medium to long term to demonstrate accountability and transparency (Ngulube, 2007). As more governments are introducing e-government solutions, digital preservation turns into important challenges and the demand to access information turns into e-government challenges in the public services (Riege & Lindsay, 2006). Accordingly, data related problems ought to be addressed in order to reap the full benefits of e-government. This section therefore provides a conceptual foundation for the current study by focusing on the records life cycle, records continuum model, integrated management framework and the Open Archival Information System (OAIS) as the basis for the preservation of public digital records.

3.4.1 Records life cycle theory

The life cycle model was developed in the world of paper records, even though its continued use means that it is still applicable within the electronic environment (Hare & McLeod, 2010). This theory, developed by the National Records and Archives Administration of the United States of America in the 1930s, is grounded on the concept that every record has a life (Penn, Pennix & Coulson, 1994:1). The life-cycle approach to records divides records into various stages during their life. Thus, records are born, used and maintained within the office; and when they are in their old state (disposition stage), they are either transferred to the archives or destroyed (Shepherd & Yeo, 2003). Put differently, records pass through three main phases, that is, through an active or current phase to a semi-active or semi-current state and then to a non-active or non-current stage (Hardcastle, 1989) and (Penn, Pennix & Coulson, 1994). This development has prompted scholars to visualize more stages in the record life-cycle in view of the evolving nature of the model and the advent of information technologies (Chachage & Ngulube, 2006). Citing Goodman (1994), Chachage and Ngulube (2006) list ten stages of the records life cycle concept, namely:

- design and creation of records;
- identification;
- authorization;
- verification;
- validation and auditing;
- circulation;
- access;
- loan and use;
- backup procedures and disaster recovery plans; and

- retention schedules and destruction.

In this way, the theory contributes to the strict demarcation of responsibilities between archivist and records managers as it identifies what will happen to records at different stages. Thus, records managers are the key players in its primary use whiles archivist are the managers of the records for their secondary use.

There are, however, weaknesses with the theory such as its strict demarcation of responsibilities of records (Bantin, 2008:18) and never assigns any particular professional group to their management. It only provides a structure for effective and efficient records management (Penn, Pennix & Coulson, 1994:1). Some theorists have further argued that records ought to be managed right from the moment of creation by the record keepers and archivist, and records managers must rather be seen to be working to gather because there is no clear distinction between records and archives especially in the digital era (Hurley, 1998). No phase of records management can be treated in isolation in the digital environment. All the phases need to be managed in a continuous fashion. As articulated by Shepherd (2006: 55), "successful management of digital records can only be achieved if digital records are managed as a continuous process."

Scholars such as Yusuf and Chell (2000) have all argued that the records life cycle theory cannot be adopted in managing digital records and needed to be replaced by a model which appropriately feeds into the special characteristics of digital records. They underscored the point that as technology devleops, records became susceptible to transformation and conversion, and therefore required coordination between the stages of its life cycle. Whilst the current study concedes the inadequacies of the life cycle theory in managing records, it argues that the aspects of the life cycle provide a congenial environment and an acceptable basis for developing records. In that sense, records that are generated at the government ministries can properly be managed from their creation stage to their final disposition.

3.4.2 Records continuum cycle

Three key names are usually associated with the records continuum model- Jay Atherton, Ian McLean and Frank Upward. Indeed, it was Atherton (1985-1986) who first referred to the records continuum model, although the word continuum was first attributed to McLean (McKemmish & Piggot, 1994). Upward analysis of records continuum and his diagrammatic representation has had a huge influence in the management of records in the electronic environment (Upward, 2000). The current study feeds into the continuum framework which recognizes a record as part of a business process that begins with the record's creation and continues through its use at all stages of its existence (Shepherd & Yeo, 2003: 8). Digital preservation is just one stage of the records management. The weaknesses identified in the records life-cycle and the growing nature of digital information underscored the need for the records continuum model (An, 2001; Flynn, 2001; Upward, 2000). Theorists such as Frank Upward, Sue McKemmish, Barbara Reed and Don Schauderall adopted the records continuum model as an alternative to the records life-cycle to cater for electronic records (Chachage, 2005 & Flynn, 2001).

Australian archivists developed the records continuum theory which, in contrast to the life cycle theoretical approach to records management, has been defined as a "consistent and coherent regime of management processes from the time of creation of records (and before creation in the design of recordkeeping systems) through to the preservation and use of records as archives" (Australia standards, 1996). In the records continuum model, management of records is seen as a continuous process as opposed to the life-cycle model that emphasize on separation of responsibilities. Ian Maclean, who is credited to have started the debate about the records continuum (Upward, 2000: 118) upheld the view that the work of archivists and records managers were connected in view of the continuity between records management and archives.

Others, such as Kennedy and Schauder (1999), Shephed and Yeo (2003) have similarly called for collaboration between records professionals and information systems experts during the systems design. Thus, the inclusive nature of the model makes it possible for archivists and

systems designers to be involved in the creation of records and designing of a system. The model hinges on the fact that records continue to live even after the non-current phase of the record life cycle. It is fair to conclude that the participation of archivists and record managers ensures that records do not disappear from the sub-systems (Chachage & Ngulube, 2006).

As was put forward by Kemoni (2008), the theory has the advantage of: creating the right records which contain the right information in the right formats; organising the records to facilitate their use; systematically disposing off records no longer required; and protecting and preserving records. These are emphasised by the transaction value, evidentiary value and the memory value the theory espouses. Apart from creating records, classifying, maintaining and transferring records to the national archives, the theory is interpreted as both a metaphor and a new worldview, representing a technology-driven pattern shift in records management (Bearman, 1989). This, in essence, makes the theory rather receptive to technology and relevant to the current study. The adaptive nature of the continuum theory makes it suitable for the management of digital records as it is seen as a continuous process. As articulated by Reed (1997), the theory focuses on processes and activities and therefore fits very well with the digital environment.

Kemoni (2008), citing the State Records of Australia (2004), noted that the records continuum model offers an integrated approach to the management of digital records. The model identifies records in stages, but these stages only acted as a point of reference rather than as functions of records management. The model allows records managers and archivists to operate at the appropriate stages of the records continuum to meet their sometimes different but harmonious objectives.

In a diagrammatic fashion, the theory is represented by four concentric circles. As represented in **Figure 2.** The four levels are as follows:

- dimension 1 submits itself to identifying records management actions and ensures that reliablibility; evidence of this is created by capturing records of the related/supporting transactions;

- dimension 2 undertakes the management of "families" of transactions, record series and document processes, hence intellectual control of records relating to the arrangement and description of both records and archives;
- dimension 3 presents records actions which relate to the maintenance and use of records, while archives management actions relate to the description of archives; and
- dimension 4 takes the physical control of records where disposal of records is by destruction, or their transfer to the archives, while archives management actions relate to the preservation and use of archives.

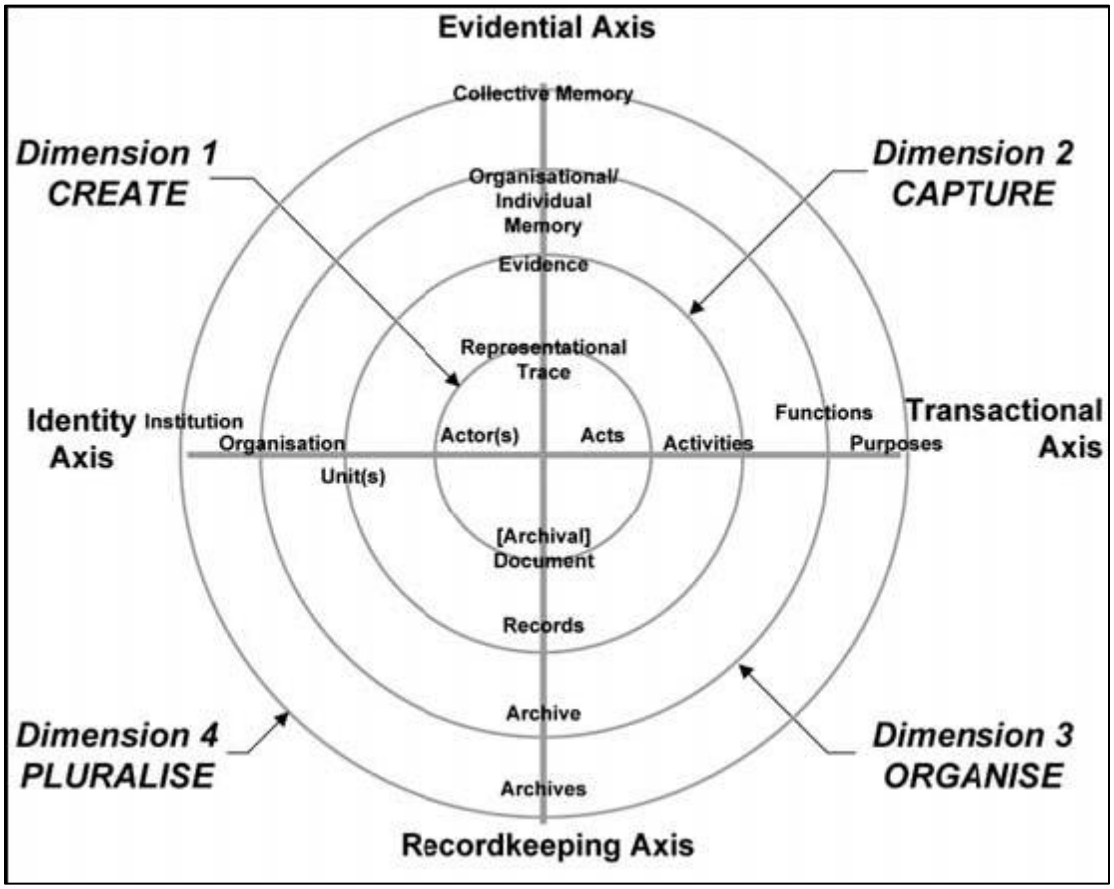

Figure 3 -2:Records continuum model (Upward, 1996)

Scholars such as Bearman (1996), Cooks (2000) and Upward (2000), who favour the records continuum theory argue that it is the appropriate model for the preservation of digital records. Even though the records continuum theory feeds into the current study, it does not rule out the usefulness of the records life cycle theory, especially with the management of paper-based records in organisations. The life cycle theory is still relevant and very much prevalent in the district assemblies of Ghana (Adams, 2010). The records life cycle is not necessarily redundant in the electronic environment, it has support, but may need to be adapted differently and used as an additional strategy to determine how records are preserved.

3.4.3 Integrated Management Framework (IMF)

IRMT (1999), while making a case for an integrated approach posited that the integrated approach is a combination of the life cycle and the records continuum model in an integrated and archive management system. They argued that there is no difference between records management and archival administration in terms of practice, as the integrated records management emphasized on record preservation, and archives records in an accessible, intelligible and usable form so long as they have continuing value. Among the goals of the integrated management approach spelt out by the IRMT (1999) and relevant to the current study are:

- the creation and maintenance of authoritative and reliable records;
- improved access to records and archives through the effective delivery of government programmes and services;
- identify archives of enduring historical and cultural value; and
- transfer such archives to an archival institution.

Such goals, according to the IRMT (1999) can only be achieved by developing policies, procedures, structures, systems and preparing a long-term strategic plan, which takes cognizance of adequate resources, staff, buildings, equipment and funding. In ascertaining the best framework for the preservation of these records, the integrated management approach appears to

appropriately fit or sink into the current study as the study seeks to find out how policies, procedures and structures can be developed to ensure the effective delivery of e-government programmes through the preservation of records. The current study further seeks to identify strategies to safeguard the archival heritage of the government ministries, which is also a core tenet of the integrated management approach.

3.4.4 Open Archival Information System Reference Model (OAIS).

The field of digital preservation is littered with models in digital libraries, digital archives, digital repositories and record keeping systems. However, the most widely used reference in the development of digital libraries, digital archives, digital repositories and record keeping is the OAIS model (Quist, 2008). Ever since the OAIS model was developed, it has had such a huge impact and influence on the development of digital preservation methods. The OAIS model was proposed by the Consultative Committee for Space Data System (CCSDS) and linked to the National Aeronautics and Space Administration (NASA) in the USA (CCSDS, 2002). The model was subsequently adopted as an ISO standard for long term preservation of digital documents (ISO14721:2003). Although it originated from space research, the OAIS reference model is a general, theoretical model describing the organisation of an archive.

The central concept behind the reference model is that of OAIS. The term ‘open’ means that the reference model was developed and released in an open public forum, where interested parties were encouraged to participate. On the other hand, an archival information system is “an organisation of people and systems that have accepted the responsibility to preserve information and make it available to a designated community (Lavoie & Dempsey, 2004). The OAIS reference model focuses on three separate but related parts. The first part describes the external environment within which the OAIS operates and the second part describes the functional components which fulfil the OAIS’s preservation responsibilities. The third part describes the information objects which are ingested, managed, and disseminated by the OAIS (Lavoie & Dempsey, 2004).

Figure 3 shows the conceptual model of the OAIS Reference model. Any system built according to this model should contain six high-level processes.

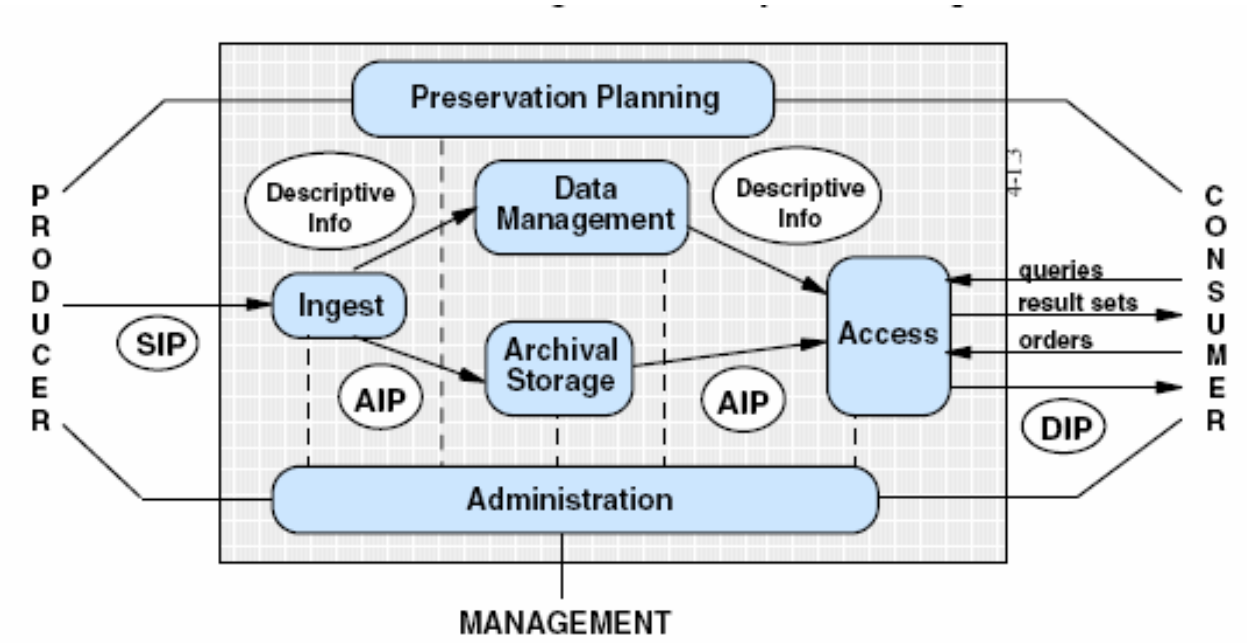

Figure 3 - 3:Functional model of the OAIS. Source: (CCSDS, 2002)

1. the ingest: is the set of processes responsible for accepting information submitted by producers;
2. archival storage: this is the portion of the archival system that manages the long-term storage and maintenance of digital materials;
3. data management: this third part maintains databases of descriptive metadata identifying and describing the archived information in support of the OAIS's finding aids;
4. access: helps the consumer to identify and retrieve information;
5. administration: is responsible for managing the day-to-day operations of the OAIS; and
6. preservation planning: provides recommendations for conversion, migration, and monitors changes in technology.

The application of the OAIS environment fits very well with the current study as the producers in the OAIS environment represent the various government ministries, department and the agencies

who will submit information they have created or generated to the OAIS archive. This information is freely available on the web to consumers (individuals, organisations, systems and the general public) who will make use of the information. Beyond the functional components of the OAIS model, is the information model which is built around the information package. This package is the original target of preservation with metadata which are needed to support the long term preservation and access. They are the Submission Information Package (SIP), the Archival Information Package (AIP), and the Dissemination Information Package (DIP). The SIP is the information package that is transferred from the Producer to the OAIS, while the AIP is the information package that is stored and preserved by the OAIS. DIP, is the version of the information package delivered to the Consumer in response to an access request.

In spite of the influential nature of the model within the archival community, the model has been criticized for its costly nature in terms of time and money, and the potential danger of losing data during the migration process (Ball, 2006). Egger (2006) underscores how the model mixes management functionality with technical functionality and further uses different levels of abstraction to describe its own functionality. Considering the fact that many of the digital preservation initiatives depend on the OAIS model (Corrado and Moulaison, 2014) the current study finds it appropriate to use the OAIS model as it points out the various roles and functions of the active participants of the designated community. In this case, the role of archival institutions, stakeholders and government ministries who have a constitutional obligation, backed by the PRAAD act of 1997, NITA Act 771, ICT policy document and the much anticipated Freedom of Information law, to specifically preserve information and make that information available when needed, resonates with the OAIS environment (Producer, Consumer and Management).

Further, in the face of the phenomenal growth of information in digital forms and its attendant's technological obsolescence, active participation in a long term preservation effort can ensure information perpetuity and minimize the life-cycle cost of long term preservation which the study seeks to advance. Repositories like the OAIS model facilitate the implementation of e-government because it has the capacity to reliably store data, migrate and provide access to

digital data. A major purpose of this reference model is to facilitate a wider understanding of what is required to preserve and access information for the long term which concurs with the study. As has been stated, one of the key objectives of the current study is to establish how digital preservation can be deployed in the planning and delivery of e-government in Ghana. Ultimately, government business will become more paperless, transparent and efficient, and government agencies, organisations and corporations will be able to provide information in real time and offer services to the public through their online portals managed and coordinated at the national data centre.

So far, the key contending theories and models relevant to the study, which sought to develop a framework for digital preservation of e-government have been discussed. One of the key objectives was to investigate how digital records are generated in the ministries of the government of Ghana. The same study sought to ascertain the best framework that is appropriate for digital preservation and further establish the impact of digital preservation in government ministries. On that score, it is instructive to assert that the records life-cycle, records continuum model, and the OAIS model appropriately inform the study as the issues and variables they raise are very critical and pertinent to the study, and further provide grounded coherence to the study. In order to underscore the link between the literature review and the conceptual framework, it is imperative that the empirical literature on digital preservation of e-government is reviewed to provide the conceptual and methodological underpinning to guide the study. The next section deals with reviews of literature on digital preservation of e-government.

3.5 LITERATURE REVIEW ON DIGITAL PRESERVATION OF E-GOVERNMENT IN THE CIVIL SERVICE

As was stated in Chapter Two (section 2.8), Ghana has been making a lot of progress in the e-government environment. So far, the standards, guidelines and practices among government agencies and ministries have started in earnest and Ghana's prospect of becoming a technology-driven knowledge and value based economy will soon be realized. However, the key technology

underpinning this progress in e-government is digital preservation. The following section addresses the key themes as captured on the literature map.

3.5.1 Nature, charateristics and factors for digital records and preservation

Quite a number of authors have discussed the emergence of digital records and how digital records should be preserved within government cycles (Ngulube, 2012; Decman & Vintar, 2013; Sugimoto, 2014; Conway, 2007). These preservation of digital records have been necessitated by ongoing technological changes (Duranti, 2005), the ephemeral character of digital data (Barateiro et al., 2012), the adoption of e-government and a growing shift from paper to electronic publication. Thus, databases, digital publication, emails, website information, transactions, text files, web pages, dynamic web content, geographic information and tweets illustrate the types of digital records created (New South Wales Government, 2011; National Archives of Australia, 2012). However, the tendency to destroy these records is very high as some social media destroy records once such records have been viewed by the general public (Council of Canadian Academies, 2015). Snapchat, Hash, Confide, and Wickr have been viewed as messaging applications that allow messages and images to self-destruct on devices in a short period of time (Crook, 2013). With the caution from the British Library (2005) that the drift from paper to electronic publication will surge by the year 2020, with 40% of UK research monographs available in electronic format only, and a further 50% produced in both print and digital, many archivists and records managers have been planning as to how to preserve electronic information. In this regard, the American Association of Law Libraries had concluded that the need to preserve electronic government information is "yet unmet in any comprehensive manner, either at the federal, state or local level" (Mathew et. al, 2003: 2).

Other studies undertaken by Fayyad and Uthurusamy (2002) reported that the capacity of digital storage in the last decade has increased twice the rate predicted for the growth of computing power. After more than a decade, the situation has not changed as society's ability to capture and store data has far outpaced its ability to process and utilize information (Wimmer, 2004).

Within sub-Saharan Africa, Lor (2005) noted that the volume of digital material being published is relatively small but it is growing and of significance as part of Africa's heritage. The long term implication of this trend and the exponential growth of information is that conscious effort would have to be made to ensure the survival of the digital records and by extension ensure their accessibility. These developments may have prompted several initiatives, projects and conferences in Europe, North America, Asia and fragmented effort in Africa, to bring to the fore the relevance and challenges of digital preservation. For instance, the European Commission in 2005 revealed its 'i2010 digital libraries' initiative as part of its strategy for the digitization, online accessibility and preservation of Europe's cultural and scientific heritages as set out in the 'eEurope' and 'i2010' action plans (Commission of European Commission, 2005). The initiative was aimed at making information resources easier to use in an online and e-government environment. However, shortage of funding and practical barriers stifled the digitization and preservation of the EU's cultural heritage (Decman & Vintar, 2013).

In the U.S, Congress enactment of the National Digital Information Infrastructure and Preservation programme (NDIIPP) legislation in December 2000 mandated the Library of Congress to lead a national crusade and nationwide planning effort for the long-term preservation of digital content, as well as to capture current digital content that is at risk of disappearing (NDIIP, 2005). The rapid response from sub-Saharan Africa led to a three day regional consultation meeting in 2002 with 40 participants from 25 countries made up of national libraries and archives, museums, communities, Universities, producers, preservers and users of digital heritage materials at the UN Conference Centre in Addis Ababa to discuss the looming danger of losing digital records. The IRMT in response to the digital preservation conundrum similarly initiated several training programmes in Africa for information professionals on the management of electronic records. The training programmes were meant to help information professionals manage the anticipated problems of digital records (IRMT, 2008; 2009). Further, studies undertaken by Ngulube (2012); Kalusopa (2011); Lor (2005); Mnjama and Wamukoya (2006) underscore the enormous challenges the sub-region is confronted with when it comes to the management of digital records and the effort Africa is making.

The global awakening and awareness to the issues of digital preservation explains the preparedness of the world to address the undercurrent threats to digital preservation. In essence, ignoring the challenges posed by digital preservation stifles the potential gains society would have received in return for the personal, economic and professional investment in information technology. In fact, majority of cultural institutions, believe that irreplaceable information will be lost if digital preservation issues are not resolved in the near future. Ensuring continued access to the content of digital record calls for collaborations and the application of broad public interest. The following section discusses the characteristics of digital records.

3.5.2 Characteristics of digital records

Just like any record, digital records have certain characteristics that make them unique and identifiable. Such uniqueness can be drawn from the inherent nature of digital records viz: authenticity, integrity, usability and reliability.

3.5.2.1 Authenticity

Following the shift into the digital medium, questions and concerns have been raised as to how the world's digital heritage can be preserved, protected, and made available for current and future generations (UNESCO, 2003). One of such scholarly concern is the authenticity of digital resources. The question of authenticity can be traced to the apparent ease with which documents and images can be manipulated and changed to suit a particular event. This factor underscores the enormous task archivists and librarians have had to adopt in protecting the trustworthiness of digital materials probably because libraries, archives, museums and memory institutions are most often viewed by the general public as trusted, authoritative sources of information and have a reputation for authenticity. Even though much has been done in preserving and making available cultural resources, uncertainty exists as to whether their traditional expertise is sufficient to deal with digital materials (Duranti, 2005).

The term authenticity has different definitions depending on the context of its use (Sharon, 2010). But the Oxford English Dictionary (2010) explains authenticity: (1) as true to oneself; (2)

as original; and (3) as a statement of fact. The second and third categories are of great interest to conservators, textual critics and the current study because of its emphasis on trustworthiness and originality. Duranti (1998, 2005) had noted that authentic documents are those, which attest to events that actually took place or information that is true. In upholding the authenticity of a digital record, the creation, maintenance and receipt of the record must be deemed to have come from sources that are verifiable and should speak nothing but the truth (Sharon, 2010). Katuu (2006) similarly observed that the preservation of authentic electronic records is a continuous process that begins with the record's creation of which the purpose is to transmit authentic records across time and space. Such a process helps to develop trust between the user of archived materials and the institution responsible for preserving those materials.

Again, such characteristics help to prevent unauthorised addition, alteration, deletion, use and concealment of records by unknown people (ISO 15489-1, 2001; Lin, Ramaiah & Wal, 2003:118). According to Kiltz, Lang and Dittman (2007), authenticity can be in two parts: data origin authenticity and entity authenticity. They argued that data origin authenticity, is the evidence of data's origin, genuineness, originality, truth and realness which encapsulate prevention, detection and recovery of record. The second aspect, entity authenticity is the proof that a person or an entity has been correctly identified as originator, sender or receiver of what it claims to be. Whilst the current study considers authenticity as one of the characteristics of digital records, it concedes that authenticity can best be established if the integrity, reliability and usability of a digital record are proven (Mason, 2007).

3.5.2.2 Integrity

Integrity in digital preservation is the condition where a record is said to be whole, complete, consistent, correct, and accurate and unaltered (Kiltz, Lang & Dittman, 2007). This is related to whether the document can be considered to be complete and uncorrupted "... in all its essential respects during the course of its existence." (ISO 15489-1, 2001). The integrity of a digital object is established, when measures such as prevention, tracking and verifying changes of archived objects are pursued. Such method will eventually ensure the sustenance, maintenance, and

preservation of storage media if (a) users use existing programmes, (b) programmers test their programmes on a non-productive machine, (c) control processes are audited, and d) system managers and auditors have access to the system (Bishop, 2004). On the flip side, the integrity of digital records is compromised by the obsolescence of hardware and software unless conscious efforts are made to ensure their usability over time. As integrity goes to the heart of digital records, clear and consistent processes must be used to monitor the integrity of the content, context and structure of all digital objects to ensure reliability and safety of the digital records

3.5.2.3 Reliability and usability

Apart from authenticity and integrity, a record must also be deemed to be reliable and usable. These traits are of crucial importance to archivists whenever appraisal and preservation decisions are being made. Within the context of long term preservation of digital records, usability refers to the extent to which future end users can view and interact with the preserved data (Doyle, Viktor & Paquet, 2007) by way of retrieving, presenting, and interpreting the data correctly (Mason, 2007). On the other hand, reliability reflects to the trustworthiness of a record as a statement of fact. It is established by examining the completeness of the record's form and the amount of control exercised on the process of its creation (Roeder et al, 2008). That is, the digital record must reflect transactions that are accurate, factual (ISO 15489-1, 2001) and dependable in any administrative and business setting. The usability of a record is established when the records can easily be located, retrieved and put to effective use. The IRMT (2009) noted that the key steps in preserving any electronic record are to identify the precise characteristics of the record, which involves identifying the record, validating the record and extracting core metadata about the record. They argued that the process of identification answers the questions, ‘in what format was digital object created and stored?’ what software was used? Is it a digital photograph? For instance, to preserve a word processed document created in Microsoft Word 2000, it is necessary to determine whether the record exists in MS Word 2000 document or MS Word 2007 document.

In essence, authenticity as part of the characteristics of digital records embraces three traits: (a) reliability- where evidence exists to show that records are created and captured as part of the

legitimate business process, (b) integrity- the document is protected from unauthorized alteration (c) usability- the document is capable of being retrieved, presented, and interpreted correctly. These characteristics, together, lay the foundation for the authenticity of a document in digital format.

3.6. Factors for digital preservation

This section of the study examines contributory factors for digital records. These factors include government records and e-government, legislations and Open Data.

3.6.1 Government records and e-government

Following the global upsurge for the adoption of Information Communication Technology (ICT) as a tool to improve government services, there has been a new focus with respect to how information is gathered, managed, processed, stored and accessed. This shift has been occasioned by the large volumes of electronic data government is creating, the expansive nature of government services and web accessibility. Exemplars of digital records, government generate in order to improve public services include: accounting records, procurement records, personnel records, tax records, election registers, property and fixed asset registers, pension records, social security records, land records, birth and death records (Piggot, 2002). In addition, in providing services to the citizenry, government creates hospital records, school records, and monitoring records which are most often in a digital form. These records ought to be properly preserved and made accessible to underpin good governance, transparency and accountability.

The Centre for Technology in Government (2004) notes that e-government embraces four key functions of the government viz:

- e-services: the electronic delivery of government information, programmes, and services over the internet;
- e-democracy: the use of electronic communications to increase citizen participation in the public decision-making process;

- e-commerce: the electronic exchange of money for goods and services such as citizens paying taxes and utility bills, renewing vehicle registrations, and paying for recreation programmes; and
- e-management: the use of information technology to improve the management of government, from streamlining business processes to maintaining e-records and improving the flow and integration of information.

These efforts noted by the Centre for Technology in Government are now seen by government as a necessity rather than an option, as government is able to improve public services through electronic government (Weerakkody & Riddick, 2013) and transform the public sector from being ‘’inward looking and administration focused’’ to becoming outward looking with emphasis on service delivery (Connolly & Bannister, 2008). As a consequence, the delivery of government services through technology demands repositories to be created to feed government websites and to enable citizens walk through a number of public agencies to access the most current information on services, regulations, taxes and forms (Koga, 2006).

Records provide verifiable evidence to fraud that can lead investigators to the root of corruption. Government can only be seen to be transparent and accountable to its citizens if the records it generates are authentic and can be used as evidence to prosecute corrupt public officials. Records are the linchpins for ensuring accountability. When records meet both legal and operational requirements, they are seen as the most trustworthy evidence of an organisation’s transactions and processes (Ashley & Roberts, 2009). The loss of control of records has consequences for all citizens, especially for the poor who are least able to defend themselves. Relevant, accurate and complete public records must exist if governments are to preserve the rule of law and to demonstrate fair, equal, and consistent treatment of citizens. The adoption of e-government has become a global trend and information professionals have no option, except to keep up with this trend to secure and facilitate access to government information`n.

3.6.2 Legislations

Increasingly, the passage and implementation of certain legislations provide the framework and incentives to explore the key factors that impact on digital preservation. For instance, the Public Records Act 2005 of New Zealand mandates the Archives of New Zealand to ensure long term repository of the public sector's electronic records. The Act outlines the requirement for every public office to create and maintain full and accurate records of its affairs. Similarly, the Public Records and Archival Administration Acts 1997 (Act 535) of Ghana mandates public offices, institutions and individuals who create and maintain public records to follow good record keeping practices and implement procedures for timely disposal of public records of no continuing value. Other Acts such as the Library and Archives of Canada Act 2004 (Canada's Library and Archives Act, 2004) requires government agencies to use digital records systems to promote confidence in the use of digital records. Thus, various national governments are supporting the shift to digital records through a number of legislations and changes in policy (Government of Canada, 2012 & Bibliothèque nationale de France, 2014).

In Ghana, substantial pressure from civil society compelled the government in 2003 to take steps towards drafting or creating the legal framework (Right to Information Law (RIL) that allows the public to access information. While calls for the passage of the framework are necessary, they are not sufficient enough to ensure real access to public sector information if proper storage of digital records is not pursued. Poor storage of digital records will render the RIL ineffective and undermine the government's efforts to implement e-government (IRMT, 2011). Countries with advanced experience in RIL such as the U.S.A, U.K, New Zealand, Canada and Australia acknowledge the serious implications of poorly managed records. This is so because the realization of the core tenets of the legislation is contingent on the management of good records-keeping (Mezeba & Sebina, 2003). Accordingly, the implementation plan for RIL includes steps towards ensuring that the records have been preserved well to support RIL. To that effect, the preservation of records provides an appropriate policy for the enactment of the law to create a technical infrastructure in order to give life to the law.

As the official home of the U.K legislation (2012) and the Code of Good Practice on the Management of Records (issued under the Freedom of Information Act 2000) indicates:

‘’FOI is only as good as the quality of the records and information to which it provides access. Access rights are of limited value if information cannot be found when requested or, if found, cannot be relied on as authoritative, or the arrangements for their eventual destruction or transfer to an archives, are inadequate’’.

The exercise of one’s right to request for records hinges on the availability of information about records in the government ministries and public agencies. Clearly, digital preservation has the potential to ensure continued access to records within the ministry or across government. The RIL will fail if records cannot be identified, retrieved and used; if their integrity cannot be established and improperly stored (IRMT, 2011). Digital preservation gives an assurance to the RIL that the government will accumulate and maintain information that is authentic, verifiable and reliable. This assertion resonates with the objective of the current study for the establishment of a digital preservation infrastructure. This section argues that the existence of proper management of government records backed by RIL is an assurance that governance is carried out to reflect and protect the will of the public.

3.6.3 Open Government Data (OGD)

There has been a steady growth of Open Government Data (OGD) publication, trending as one of the vital communication channels between governments and their citizens. As a nascent concept, OGD underscores the need for government to share information and empower the masses with tools to hold governments accountable (World Justice Project Open Government Index Report, 2015). Such an approach to governance allows government to be open and transparent in their day to day dealings with the citizens (Africa Tracking Internet Progress, 2013). Thus, OGD places a responsibility on public authorities and public sector organisations to share information, particularly created and managed by them in order to encourage citizen participation and public policy deliberation. This approach often lead to two assumptions about governments. First, it leads to the assumption that government is prepared to engage with the

citizenry in constructive discussions and to welcome any opposing or divergent views. Secondly, OGD thrives on the assumption that government is prepared to give up some level of control in order to transform the public sector (Marijn, Yannis & Anneke, 2012). These two assumptions demonstrate the extent to which the world is craving for openness in government through the provision of information in a format that can easily be located, understood and reused. (Open Government Partnership, 2011 in Wamukoya, 2012).

In this way, government acts as an open system and interacts with the public by responding to the litany of questions posed by the general public through the power of the internet. Thus, OGD makes use of technology by using and reusing data to enhance transparency and accountability. It is within this context that President Barack Obama of the United States of America, within a day into his administration, presented a memorandum entitled, Transparency and Open Government to the heads of executive departments and agencies. The memorandum states: ‘’My Administration is committed in creating an unprecedented level of openness in Government. We will work together to ensure the public trust and establish a system of transparency, public participation, and collaboration. Openness will strengthen our democracy and promote efficiency and effectiveness in Government’’ (Obama, 2009). To actualize the memmoradum, the White House issued a directive to all federal agencies to take immediate steps to achieve key milestones in transparency, participation, and collaboration (Transparency International Italia, 2014). In the same light, David Cameron of the United Kingdom, on assumption of office, touted the transparent agenda of his government as follows: ‘’Greater transparency across Government is at the heart of our shared commitment to enable the public hold politicians and public bodies to account; to reduce the deficit and deliver better value for money in public spending; and to realise significant economic benefits by enabling business and non-profit organisations to build innovative applications and websites using public data’’ (Cameron, 2010). These directives are clear manifestations of Obama’s and Cameron’s commitment to implementing the principles of transparency, accountability, citizen’s participation, collaboration, and efficiency of the public service which are the key tenets upon which OGD hinges.

In September 2011, Ghana signed onto the Open Government Partnership initiative (OGP), a multilateral initiative that seeks to secure commitments from governments to promote transparency, empower citizens, fight corruption, and harness new technologies to strengthen governance (World Justice Project Open Government Index Report, 2015). The purpose of Ghana's membership is to enhance public services, increase public integrity and increase corporate accountability (Ghana News Agency, 2012). Ghana's participation in the OGP initiative was a consequence of the government commitment to good governance and government prioritization of democratic traditons and values. From the forgoing, OGD advances the concept of good governance premised on transparency, accountability and public engagement. The resultant effect of transparency is open data portal, freedom of information initiatives, transparent electoral process and an open public procurement policy. Accountability on the other hand initiate the setting up of anti-corruption agencies and ombudsmen to hold government accountable. The public can influence the workings of their government by engaging in governmental policy processes and service delivery programs through the principles of public engagement (Heller, 2012). In this way, accurate and reliable information as evidence of government activities and programmes are factors that will drive OGD. The level of openness of information requires accurate, complete, and quality data, for ensuring an effective monitoring and accountability. Clearly, to operationalise the key tenets of OGD, government would have to disclose valuable information on transactions, activities, programmes, the economy and trade to enable citizens take greater ownership and participate fully in the decision making process.

Thus, OGD falls heavily on evidence emanating from government records. However, OGD has the potential to fail if electronic records cannot be retrieved, found and its integrity established (IRMT, 2011). Open government data cannot be complete without the ancillary process of records maintenance, as much of the information generated from government would have to be preserved for the general public. Again, citizen's trust, participation and collaboration will be eroded if government fails to open up her records to the public.

In this regard, a digital preservation infrastructure is needed to enable the public access these data swiftly from a more secured and resilient environment. Wamukoya (2012), in addressing

some of the critical issues in open government proposed (a) an infrastructure of laws, policies and procedures to ensure that a complete and trustworthy record support government decision-making, (b) the positioning of record authority to support Open Data initiatives and (c) the establishment of organisation-wide-records-management programme. A preservation infrastructure is a necessity rather than an option if Open Data will survive. Giving the public access to data depends on the extent to which data have been preserved and made available.

3.7 E-GOVERNMENT AND DIGITAL PRESERVATION

As was stated in Chapter One, records constitute an important cornerstone of governance. As more governments are introducing e-government solutions, digital preservation turns into an important challenge and the demand to access information turns into e-government challenges in the public services (Riege & Lindsay, 2006). This is precisely so, because the size, complexity of governmental structures and the phenomenal growth of data and their storage have become problematic (Koh, Ryan, & Prybu-tok, 2005). Thus, data inconsistencies and the overwhelming growth of data can have an impact on the activities of e-government (Gil-Garcia & Martinez-Moyano, 2007).

In spite of the significant progress e-government has made by way of providing portal-based websites for citizens and firms to access public administration and services (Lee, Tan & Trimi, 2005), their implementation and application processes rest heavily on digital repositories. Government websites have proved to be an efficient way to facilitate communication and deliver services to citizens (Koga, 2006) as they are able to collect, organize and distribute information. Thus, they are the focal points of information exchange and provide their users with features like emails, chat rooms, personalized news and search engines, many of which are retrieved from a digital preservation repository.

IRMT (2011) has noted that in terms of governance, digital preservation programmes must be adapted to take into account the evolving nature of e-government environment. In that sense,

every effort must be made to build digital preservation structures as e-government encourages data sharing between government departments, compact data and stores them in a convenient manner (Almarabeh & Abu Ali, 2010). Even though digital preservation may not have an immediate effect on the delivery of e-services; many services are bonded by processes that continue for a long time (Decman, 2010) and so e-government legislation in many countries have incorporated digital preservation components (CENDI & ICSTI, 2004). Again, Ngulube (2007), citing Lipchak and McDonald (2003:2), underscored that an e-government environment will be elusive if sub-Saharan Africa does not have the capacity to create, manage, share and use electronic information. Ngulube (2012) in another study further noted that digital repositories like the OAIS model has the potential of providing long term preservation and access to records and information created and captured by e-government activities. Thus the implementation of e-government will be a mirage if repositories are not created to feed government websites.

Failure to preserve digital and transactional records as formal corporate records will mean that significant opportunities are lost for exploiting the content to support new ways of working. The full benefits of e-government can only be realised if electronic records are managed and maintained effectively. Luyombya (2010), while addressing the issue of digital records in Uganda, stated that it is not possible to study the outcome of digital government and e-governance processes without touching on digital records, since they appear to be part of the digital era. Nolan (2001) regarded the use of ICT systems as a dominant reform model for the public service when he linked the implementation of ICT to the effective documentation of government services and knowledge sharing. Clearly, the concept of e-government rest heavily on efficient delivery and preservation of digital records. The very goals of e-government were to improve the service delivery of public administration through the use of ICT. The prosecution of these services comes about when data or digital records are created and used. Further, the symbiotic relationship between digital preservation and e-government reinforces the point that these two concepts are inseparable. Whereas digital preservation or repositories feed the websites of governments, the creation and implementation of e-government in public sector organisation degenerates into digital records, hence, the expansion of digital records growth. Support for digital preservation infrastructure to exploit e-government to the fullest is critical as products of

government are most often delivered in the form of policies, management information, regulations, markets and the environment (Wimmer, 2004). To that extent, transaction records and electronic records are generated by new forms of service delivery from businessmen and government departments.

As more and more data are added to the website of government, it becomes obvious that a mechanism ought to be put in place to preserve this data for government and the public to use in the future. However, it is difficult to attempt to estimate the size of digital growth as copious amount of digital content are generated on daily basis (web-based tools such as blogs, YouTube, Facebook and Twitter) (Yoon, 2013). Based on Lyman and Varian (2003) studies, Ganz (2007) established that by the end of 2010, and particularly for that year, the world produced almost a Zettabyte of information. In another study, a report by the University of California, San Diego, assert that the US average user consume around 34 Gigabytes per day (Bohn & Short, 2009). Unsurprisingly, estimates of digital growth and storage is yet unknown in Ghana and Africa, but with a conservative estimate of about 10 to 20 percent of the developed country's production, it will still run into several Gigabytes per day. But Lor, (2005) argues that the volume of digital material being published in sub-Saharan Africa is relatively small but it is growing and very much significant to Africa's heritage. With all these upsurge of digital growth, the storage capacity of the digital universe continues to lag behind (Gantz & Reinsel, 2011).

Quistbert (2008), in his appreciation of the digital preservation problems have had to call on the digital preservation community for a new thinking, new models and framework in order to cope with digital preservation problems. Other studies carried out by the Cohasset Associates Inc. , the Association for Information and Image Management (AIIM) international organisation, and the Association of Records Managers and Administrators (ARMA) international indicate that a lot would have to be done to achieve consistency and credibility in the life–cycle management of electronic records (Cohasset associates Inc., 2007 & 2009). That is why the planet project in 2009 concluded that more work ought to be done on policies and budgets of digital preservation and that component-based solutions to digital preservation are needed (Sinclair et al., 2009).

Clearly, the survival of e-government is inherently rooted in reliable, authentic and trustworthy repositories. The current wave of e-government across most public sectors in the world underscores the pivotal role digital preservation play. Calls from the European Commission and the United States about the need to preserve digital records and undertake a massive digitization of public records concurs with the current study. As was articulated in Chapter Two of the current study, Ghana embarked on its e-government implementation campaign in 2008, after the National Information Technology Agency was established by an Act of Parliament (NITA Act 771, 2008) as the ICT project implementation arm of government. The e-government initiative was aimed to ease the lives of people and businesses interacting with the government and to establish Ghana as the economic hub for trade in the West African Region. Whilst the current study recognizes digital preservation as a key requirement to the government of Ghana's e-government initiatives, it concedes that digital preservation is very complex and characterized by a high degree of uncertainty, in which much experimentation and variety of techniques are employed by different organisations to meet their individual needs. This uncertainty raises the question of challenges which the next section points out. 3.7.1 Challenges to digital preservation

As part of the objectives of the current study, this section elaborates on the challenges and threats of digital preservation with particular emphasis on sub-Saharan Africa. In this current study, the challenges to digital preservation include technological obsolescence, lack of awareness, financial sustainability, policies, copyright issues, legislation, politics, security and privacy issues, and skills training.

3.7.1.1 Technological obsolescence

Apart from the threat of the exponential growth of digital records and the unpredictability level of our ability to store and cope with such inevitable growth, technological obsolescence poses the greatest risk to digital records. In this regard, continuous preservation and accessibility of digital information cannot be guaranteed because of the rapidity of technological changes (Chen, 2001; Baker, 2014) resulting in media volatility, mutability and fragility of digital records. This is so because frequent changes in hardware and software development continue to evolve,

creating media incompatibility and configuration problems. For instance, the software that makes a digital repository is subject to changes and technical limitations. Accordingly, the DSPACE federation cautions their clients that the information assets and the components managed by the DSPACE system will outlive the current system (DSPACE, 2013). These changes in hardware and software which are most often upgraded and replaced every 18 months have important implications for long-term preservation of digital records (Chen, 2007). There is no doubt that the use of eight inch, five and half inch, and three and half inch floppy disks of the 1990's and early part of 2000 are no more in vogue because computers no longer have disk drives which they fit into. Rather, CD-ROMS, DVD's and Pen drives have taken the centre stage of storage devices. The reality is a low quality burnable CD may decay within a space of two years. Again, the technical knowledge required to repair hard drives and the operating system can be daunting whilst softwares needed to upgrade these computers may not necessarily support legally acquired file format (Blau, 2006; PARADIGM, 2008). The challenges confronted by many memory institutions today, is the preservation of both digital data and the technology such as operating systems and media drives for devices like floppy disks and CDs needed to process them (CCSDS, 2012).

The threat of technological obsolescence is further exacerbated by the harsh environmental conditions in sub-Saharan Africa, which is not conducive for electronic machines (Asogwa, 2012). For instance, magnetic and optical media deteriorate quickly when exposed to the vagaries of the weather. Some of the most famous records that almost got lost are the Domesday Book and the 1976 Viking landings on Mars (Jesdadun, 2003). That is why Ngulube (2012) argued that losing digital records is common and is one of the most feared situations. Again, uncontrolled media selection generates variety of different media types used in an organisation, necessitating for many different hardware and software devices to handle them. Kunny (1997) asserts that merely copying bits is not sufficient enough to guarantee preservation if the software to make sense out of the bits is not available. In view of this, the Digital Preservation Coalition of the United Kingdom (2003**)** have had to warn that inappropriate media selection and their preservation can lead to many unpredictable disasters, making documents unreadable. The problem is, it is impossible to predict technological advances relevant to archival institutions.

Technological advancement will continue to permeate and walk on the corridors of information science.

3.7.1.2 Lack of awareness

Lack of awareness about the historical value and significance of digital documentary heritage among corporate and policy makers has been taken for granted for far too long. This supposition is supported by a study undertaken by ERPANET (2003) when it revealed that:

- awareness of the issues surrounding digital preservation is perceived differently across; organisations, and even across different divisions of the same organisation;
- few organisations took a long-term perspective of digital preservation and those that did were either national information curating institutions (e.g. archives) or institutions from telecommunications, pharmaceuticals and transportation sectors;
- most sectors failed to adopt best practices to create higher levels of the regulatory risk exposure than in other sectors; and
- an organisational strategic approach to preservation was rare.

These findings by EPRANET (2003) epitomize the gravity of the problem of digital preservation. However, the solution to this problem is not far fetched as continuous awareness among governments, private sector and other information producers on the need to safeguard the digital memory can be undertaken. The call by the Library of Congress in 2005 under the National Digital Information Infrastructure and Preservation programme (NDIIPP, 2008) inviting heads of state libraries, archives and other corporate institutions for a workshop to develop strategies for the preservation of significant state and local government information in digital form is one form of awareness creation that could be replicated in Ghana.

3.7.1.3 Security and privacy issues

Ethical issues in digital records regarding security and privacy have in recent times become a growing concern and an albatross to many organisations, precisely because records created and maintained in digital form are subject to alteration and changes (Bantin, 2008). Such changes

compromise the essential characteristics of records (ISO 15489) viz: authenticity, reliability, integrity, and authentication at the expense of information accessibility. That notwithstanding, databases containing personal, financial and medical records which are useful to organisations and individuals can, however, pose a threat if proper security protections are not put in place (Asogwa, 2012). Thus, security threats from a wide range of sources such as computer-assisted fraud, sabotage, vandalism, theft, and fire can be caused by faceless individuals and companies who compile and sell personal information about unsuspecting clients from electronic sources such as credit databases, land title files, motor vehicle and medical files. Lin, Ramaiah and Wal (2003:118) noted that ensuring authenticity and reliability of digital records helps prevent unauthorised addition, alteration, deletion, use and concealment of records by unknown people.

Ngoepe, Mokoena and Ngulube (2010) citing Laudon and Laudon, (2005: 526) referred to security as policies, procedures and technical measures adopted to prevent unauthorized access, alteration, theft, or physical damage to information. However, despite the flurry of security measures and policies adopted by organisations, hackers and smart guys are able to access credit cards, bank accounts and even property title documents. Dependence on information systems for services has posed security threats to many organisations at the expense of the very reason they were set up. For instance, while health information may be regarded as the most confidential information, providing access to it is a crucial step towards achieving proper health care. In that case, records of patients must always be accessible and available upon the request of any medical officer. The privacy of health patients under that circumstances cannot be guaranteed as their right to privacy would have to be breached in order to ensure their survival. Apart from breach of privacy on the individual and institutional level, there is another aspect of breach of privacy on the governmental level. Exemplars abound of countries putting in place laws to intercept the private conversation of their citizens. In 2003, California became the first state to require notification of the breach of unencrypted personal information by any governmental entity. California law requires disclosure to an individual any time there is a reasonable belief that there has been an unauthorized acquisition of computerized data that compromises the security, integrity or confidentiality of an individual's information. Such a law definitely compromises the privacy of citizens in that state (Teresa, 2016). The Ghanaian government in a similar fashion is

pushing for the passage of the Postal Packets and Telecommunication Messages Bill. The bill, when passed would allow security agencies to listen, tap, copy, record and intercept telecommunication messages of individuals who pose a threat to national security. Clearly, the privacy of individual can no longer be guaranteed.

3.7.1.4 Knowledge and skills

As cultural heritage institutions grapple with the phenomenal growth of data, they look up to information professionals to unlock, manage and curate these data. While the concept of digital preservation is making waves and gaining grounds in most European countries, lack of skills have become the teething problems to the continent. Basically, many information professionals view digital preservation as a conceptually simplistic exercise and fail to recognize that ‘’digital preservation is an extremely complex, evolving field that requires a great deal of knowledge to understand” (Duff, Limkilde & Van Ballegooie, 2006).

Various scholars in records management have underscored how records managers in sub-Sharan Africa lack the required skills and knowledge in the preservation of digital records. For instance, Kamatula (2010) noted that archivists lack skills, procedures, standards and practices for e-records management. Kemoni and Wamukoya (2000), Iwhiwhu (2005), and Egwunyenga (2009) reinforces the basic skills gaps among African record keepers and their competencies for handling records and archives in the public sector. The International Records Management Trust revealed lack of knowledge, skills and abilities of information professional in the management of digital records (IRMT, 2003; 2008; 2011). Farelo and Morris (2006) re-echoed the continent’s sentiments when they noted that Africa generally have skills shortage and the situation is severely exacerbated by the brain drain syndrome where professionals leave to the developed world in search of greener pastures. As if that is all, the endemic problem of technophobia in most offices in Africa is quite pervasive, particularly, among the older employees. In view of these inadequacies, many traditional librarians, records managers, and archivists are very conservative and have phobia for computers. This may be due to the generation gap between the new and old professionals which led analogue information managers to perceive computers as a

threat to their status as experts. Clearly, the skills gap portends danger to the digital world (Rinehart, Prud'homme, & Huot, 2014). With the study of digital preservation methods becoming an integral part of information science education (Higgins, 2011), the acquisition of skills in technical (systems), metadata (categorical) and collection specialist (Corrado & Moulaison, 2014:56) are needed to empower digital preservationists.

3.7.1.5 Financial sustainability

One primary issue the digital preservation is faced with, is funding, probably because changes in hardware and software often requires transformation of data from one format or configuration to another. Thus the periodic copying of data (refreshing), and construction and maintenance of data (emulation) to support old and obsolete data come with some level of costs, which is far and above the budget of some organisations. That notwithstanding, studies are replete with literature on lack of reliable and comprehensive data on costs for long-term digital preservation (ICST, 2002; Lavoie & Dempsey, 2004; Navarrette, 2009). Accordingly, many heritage institutions are unable to report on the expenses made on digitization (Navarrette & Huysmans, 2009). Although Harvey (2005) points out that there is a "lack of concrete knowledge of how much digital preservation will cost", there is a general impression that any cost is too much. This obvious lack of transparency and accountability raises issues of suspicion and corruption which inadvertently affects any investment in digitisation and storage infrastructure for archival collections.

Apart from this, budget allocations for memory institutions are dwindling as a study undertaken in 2010 in 28 university libraries and three national institutions (LAC, the Canada Institute for Scientific and Technical Information, and the Library of Parliament) in Canada underscored how 84% of respondents reported a decrease in overall funding (Dooley & Luce, 2010). This developing trend explains why funding requirements have always been a critical factor in determining the extent to which memory institutions have pursued digital preservation opportunities (Council of Canadian Academies, 2015). In this regard, Pennock (2008) had noted that the metric of digital preservation is anchored on economic and social models, storage and software costs, and human resource costs as well as the data policies and practices applied by

stakeholders. In addressing part of the challenge of funding, Rosenthal (2010) stresses how Digital Repository Audit Method Based on Risk Assessment Toolkit (DRAMBORA) Digital Curation Centre (DCC) and Digital Preservation Europe (DCC & DPE, 2007) and Trustworthy Repositories Audit &Certification (TRAC) can serve a benchmark in mitigating the element of cost in the preservation planning process.

3.7.1.6 Copyright issues and legal deposits

Till date, issues of copyright remain a major obstacle to the preservation of digital information as it places limitations on attempts to digitize materials. For instance, the practice of making multiple copies of work and migrating them to new technological formats and media (Besek, Coates & Fitzgerald, 2008; Muir, 2006) for their preservation requires explicit permission of rights holders, who must acquiesce to the proposed digitization, copying or transfer of documents. Yet, explicit permission from these right holders, most often does not come easy as they are difficult to identify or locate. As a consequence, many copyrighted collective works are not considered for digitization, which impede their online publication and accessibility (Robrechts & Kerremans, 2009; Ngulube, 2012). Accordingly, adequate digital rights management are needed, including administrative metadata tags (e.g. ownership and level of permission to copy), to reveal the copyright status of works (Coyle, 2005; Muir, 2004).

In furtherance to the endemic problems of digital preservation, Ngulube (2012) underscored the following as part of the digital preservation conundrum in the sub-Saharan Africa:

- the absence of dedicated government departments assigned the responsibility for the preservation of electronic government information;
- the paucity of national strategies for the identification, collection and preservation of online publications; and electronic records;
- the lack of communication between information technology personnel, on the one hand, and archivists and librarians on the other, resulting in the design of systems that do not promote their collective mandate;

- the fact that legislation that is relevant to government's online activity has not been holistically appraised (e.g. archives and freedom of information legislation, electronic and privacy laws, etc.)
- the lack of a sustainable repositories project;
- lack of policies;
- political will and political challenges;
- legal deposits and copyrights issues; and
- infrastructural problems.

The section further elaborates and looks deeper into some of the above factors noted by Ngulube (2012).

3.7.1.7 Sustainable repositories

Institutional repositories (IR) are noted to collect, manage and disseminate digital materials produced at an institution (Chapman, Reynolds & Shreeves, 2009) for long term preservation and future access. However, efforts by many African institutions to establish digital repositories to facilitate the capture, storage, preservation, and dissemination of an institution's intellectual outputs are very much often faced with challenges (Lor, 2005; Ezema, 2011), eventually rendering the repositories unsustainable (Ngulube, 2012). Literature paints a doom and gloomy picture of how these repositories cannot be sustained in Africa. For instance, Ezema (2011) doubts whether African libraries have the capacity to maintain their digital repositories, whiles Lor (2005) and Ngulube (2012) argue about how ineffective Africa's legal deposit is, as it does not cover digital material, online publications and websites. These challenges underscore the crisis and almost hapless state of repositories in Africa.

Issues of copyright in repositories are still looming and have degenerated into permanent problems for the continent. Clearly, whilst the current study recognizes the enormous benefit of information communication technology to the fields of information science, it concedes that

information communication technology has triggered the issues of technical challenges to library and archival professionals.

3.7.1.8 Politics

Politically, various post-election violence and wars in sub-Saharan Africa have, one way or the other impeded the development and progress of national heritage institutions. Memories of the 2007-2008 post-election violence in Kenya still lingers on and has presented plethora of challenges to the cultural and natural heritage of Kenya (Nakamura, 2009). In Burundi, four decades of civil war since 1962 has blurred the country's vision of preserving national heritage (Ndayisaba, 2012). The situation in Burundi led to the lack of recognition for archives and further culminated into obsolete legislation and the inadequacies of professional training. As a consequence, the International Records Management Trust (IRMT) in 2009 initiated a project on''Aligning Records Management with e-Government/Information Communication Technology and Freedom of Information'' to address the aforementioned challenges in records management (Ndayisaba, 2012).

Further, the internal conflicts and civil wars in Somalia, Sudan, Liberia, Sierra Leone, Congo, Libya and Rwanda (Asogwa, 2012) underscore how the sustainability of records and archives management can be daunting. Obviously, precious time meant for developing strategies, policies and legislations for the preservation of digital records will be dedicated to resolving disputes and seeking for peace between the feuding parties. Under such environment, the political will to preserve published electronic government information and records (Ngulube, 2012) can be said to be a far possibility. Additionally, the digital preservation conundrum in Africa has been linked to bribery and corruption as most fraudulent leaders will do everything within their power to foil attempts geared towards the implementation of preservation strategies. This premeditated move is to insulate them from any financial malfeasance when they are brought before any court of law. It is not for nothing that missing files and destruction of vital digital records in government offices are often reported.

3.7.1.9 Lack of effective policies

Preservation policies are the most fundamental issues for any memory institution (Sugimoto, 2014) as they form the pillar of digital preservation programmes and give a sense of direction as to how digital preservation practices should be pursued. Within the sub-Saharan Africa, less attention has been paid to digital preservation policies, even though evidence exists to show that huge volumes of digital records are growing phenomenally and exponentially (Lor, 2005). This situation is exacerbated by the poor, weak and unenforceable preservation policies as observed by Ngulube (2005) and Kanyengo (2006) when they lamented over the sheer neglect of the development of policies in libraries and archives in sub-Saharan Africa. Other studies from Kalusopa and Zulu (2009) and Keakopa (2010) further points to the delay in the implementation of policies and weak policy formulation on digitization, both at the institutional and national levels. Clearly, preservation policies are not often noted and when they are, they are not implemented across the entire organisation. This cultural factor is particularly pervasive in developing countries where a number of organisations do not preserve digital materials properly or do not preserve them at all (Voutssas, 2012).

The lack of effective policies is further exacerbated by weak legislations. For instance, whilst Ngulube (2012) argues that many of the legislations on government online activity have not been appraised in sub-Saharan Africa, Asogwa (2012) noted that the existing legislations covering the creation, management and preservation of records in sub-Saharan Africa has not kept pace with technology as archival laws cover only paper records instead of digital records or both. The archival laws covering the management of records at the Public Records and Archival Administration Department (PRAAD Act 535, 1995) in Ghana make room for only paper records as against the phenomenal growth of digital records in the public sector organisations. The same can be said of Botswana National Archives and Records Act where the definitions of electronic records are not explained. This obvious absence of legislation covering digital records places no responsibility on any public officer as to how to manage digital records. Luyombya (2010) in a study underscored how Uganda records and archives legislation has failed to enforce its archival laws resulting in the lack of appropriate institutional and managerial structures. Such

gaps in institutional legislations on records may inadvertently affect the quest to undertake any digital preservation initiative. It is therefore not a surprise that attempts to pass the freedom of information law and adopt the concept of Open Data government in many African countries have been a difficult task, as these two concepts rely heavily on evidence based on digital records which demands a digital preservation infrastructure.

3.7.1.10 Digital infrastructure

A digital infrastructure serves the needs of public sector organisations to select materials, upload and manage data (Maine Historical Society, 2014). With such a system in place, memory institutions are saved the cost and time of maintaining up-to-date IT systems and acquiring related skills for preserving and making content available (Council of Canadian Academies, 2015). It must also be noted that an additional infrastructure in the form of access to electricity and the availability of broadband can facilitate the archiving of government online publication and assist users to access e-government information fed by repositories. (Ciborra, 2005; Dada, 2006; Maumbe, Owei & Alexanda, 2008; United Nations, 2010). The cascading effect of this is that information use and knowledge creation are enhanced. This development helps to bridge the digital divide among citizens and other users (Mossberger, Tolbert & Stansbury, 2003; Barzilai-Nahon, 2005; Dewan & Riggins, 2005).

It appears the problems of digital preservation are unending as the study can go on and on and point out various other challenges confronted by sub-Saharan Africa. However, there are several approaches that can be explored to overcome these challenges if preservation strategies are put in place. Many of these threats can be ameliorated through the replication of data. For instance, when a set of institutions replicate their holdings and hold these data in trust for each other, the risk of preservation is greatly reduced. The next section discusses in detail preservation strategies.

3.8 PRESERVATION STRATEGIES

The discussion so far in the previous section has established the challenges and the key threats to digital preservation. These challenges, although difficult to address are surmountable if the right policies and technological strategies are put in place. Ignoring the challenges posed by digital preservation defeats the potential benefits and purpose society would have gained from information technology. A number of approaches and strategies have been proposed to address the problem of digital preservation, and the number of tools offering solutions is steadily increasing. However, the primary reason why digital objects become inaccessible lies within their very nature and the environment they operate. The very environments of digital records keep evolving and changing at a rapid pace, which occasions the problems of digital records (Becker, et. al. 2009). This section addresses, the strategies used to overcome the discussed threats and challenges to digital preservation. In general, there are several strategies usually deployed to address the threats to digital records. Some of these strategies are migration, migration by normalization, emulation, refreshing, trustworthy repositories, cloud computing, backup and byte replication and metadata.

3.8.1 Trustworthiness in repositories

In its 2002 report on the development of trusted digital repositories, called 'Trusted Digital Repositories: Attributes and Responsibilities, the Research Libraries Group (RLG)', a research organisation based in the United States, defined a trusted digital repository as an institution designed to provide long-term access to digital resources (IRMT, 2009). They noted that a trusted digital repository must maintain digital resources in a long-term to provide access and security, and should be audited to ensure appropriate performance and quality management. In other words, a trusted digital repository must ensure the reliability, trustworthiness and accuracy of records. It must also be transparent and accountable to users and stakeholders while ensuring the long-term preservation of digital archival records.

In view of these inherent abilities, trustworthiness as a preservation strategy has received considerable attention in the digital preservation field (Dobratz, Schoger & Strathmann, 2007).

Trustworthy digital repository ‘manages digital resources to its designated community, now and in the future’’ (Trusted Digital Repositories, 2002). The ability to manage the identity, integrity and quality of an archive as a trusted source of a cultural record is inextricably connected to a trusted repository. However, while a trusted repository is to preserve data, it ought to be guided by standards, policies and practices (Dale & Ambacher, 2007). The call by Dale and Ambacher (2007) is premised on the numerous threats and risks confronted by digital repositories such as relatively short life of hardware and software, and deterioration of digital media, resulting in the inaccessibility of digital information, external and internal attacks, and orgranisational failures (Ngulube, 2012). Consequently, ‘trusted digital repositories’ are becoming ‘OAIS-compliant’ despite the complex nature of such repositories (Becker, et. al. 2009). For instance, the Trustworthy Repositories Audit & Certification published criteria and checklist which define specific interest for preservation planning (TRAC, 2007). Among them are:

- procedures, policies and their evolvement;
- review and assessment;
- documented history of changes;
- transparency and accountability; and
- monitoring and notification.

The IRMT (2009) argues that there is an increasing popularity for a type of trusted digital repository called the networked trusted digital repository, where several similar institutions, such as different archival repositories, combine their resources to share responsibility for managing the electronic records of many different creators. Other exemplars include the centralized management repository where a national archival institution establishes a trusted digital repository for the preservation of government records or a university archival facility.

3.8.2 Cloud computing

Another strategy which offers solution to the problem of digital preservation is what Decman and Vintar (2013) described as cloud computing. A cloud computing environment is a layered architecture consisting of an Infrastructure as a Service (IaaS) and Software as a Service (SaaS)

(Sugimoto, 2014). In other words, it is the delivery of hosted services over the internet, the content of which comes from somewhere other than the users own computing device, be it a desktop computer, a laptop, a smart phone, or a tablet (Dale Prince, 2011). For many organisations, the cloud represents an attractive model to deliver efficient IT services in which data is stored online without having to run their own computing services.

In cloud computing, data and the entire technical infrastructure of an organisation are moved from corporate data-centers to cloud service providers. This means that data is stored in the cloud in known locations with a specific community of consumers who share the same concerns. This may be operated by one or more of the organisations in the community, a third party, or some combination of them (National Institute of Standards and Technology, 2011). Cloud computing has made significant progress in libraries and archival communities as many services offered by libraries and archives have migrated to the cloud without much of a difficulty. For instance, journal subscription and subsequent access to the content of journals are hosted by third parties. However, the cloud storage providers, like any other company, can go bankrupt and cease to operate or be acquired by another company which will eventually lead to the loss of records or inaccessibility of records. With reported cases of hackers having unauthorised access to an organisation's network (Cloud Security Alliance, 2013), discussions are ongoing as to whether archivists should continue to trust the cloud for the preservation of documentary heritage (Council of Canadian Academies, 2015). These discussions have led Stuart and Bromage (2010) to caution organisation wanting to store their records in the cloud to do due diligence before entrusting their records to a third party. The caution concurs with a study undertaken by the US National Archives and Records Authority (NARA) which estimated that 93 per cent of companies that "lost" their data for ten days or more filed for bankruptcy within one year (Mc Nevin, 2009). Google on the other hand, in addressing these challenges has installed a "server-side" encryption as a default service to its cloud customers (Kirk, 2013) as a way of protecting clients' data.

Despite these disadvantages, the cloud offers countless avenues which libraries and archives may use to offer services to their users or streamline their own processes. Some of the blue sky benefits of cloud computing noted by Dale Prince (2011) are:

- reduced cost: vendors supply storage, software and processing power as there is no need to purchase dedicated storage or servers.;
- scalability: in this instance, a cloud service responds to the fluctuating needs of its clients with respect to storage or server load, distributing the load across the linked servers in its system;
- pay only for what you need: an organisation making use of cloud services pays only for the space it uses and pays for extra space only as its data grows;
- remote access: cloud computing allows users to access data from any location via any device that can be connected to the internet; and
- physical storage center/servers have become obsolete: information centres no longer need to have server rooms or maintain storage arrays. The cloud service vendor provides this and pays for the maintenance of this hardware so that the user does not have to, or the user pays on a by-use basis.

Clearly, cloud computing has a great potential for memory institutions as many organisations are getting their business files into cloud- based document-management solutions. The International Data Corporation (IDC) predicts that by the year 2020, as much as 15 per cent of the information in the ‘’digital universe’’ could be part of a cloud-based service. On the flip side, trusting data to strangers must carefully be considered as one can suddenly lose his or her data.

3.8.3 Backup and byte replication

Backup and byte replication can be used as a preservation strategy to reduce the incidence of damaged document and the extinction of digital records. Under this strategy, digital records are copied and stored in multiple locations to create readily available data (Kichoff, 2008). The

system is typically implemented with commercial software that allows users to retrieve files backed up at specific points in time. In the case of byte replication, identical, multiple copies of files, file systems, or websites are created. These files are stored in different locations across many components without the use of specialized software. A well-managed backup system properly executed can restore a document that would have been lost during disasters (Sugimoto, 2014). Although, backup alone cannot guarantee the perpetuity and longevity of digital records, they provide short to medium term strategies to extend the life of a digital material (Corrado & Moulaison, 2014: 4).

3.8.4 Preservation metadata

One other way of addressing the challenges of digital preservation is developing metadata standards. Accessibility and usability of content in the digital preservation environment are enhanced through the creation and management of preservation metadata (Corrado & Molaison, 2014). Thus, preservation metadata collects, manages and disseminates digital materials produced in an institution (Chapman, Reynolds & Shreeves, 2009) for long term preservation and future access. While all types of metadata are crucial for the preservation of digital collections, preservation metadata has a unique way of ensuring the long-term access and management of the digital collections they support. In this regard, three types of metadata are usually identified for preservation purposes, viz: technical metadata, management, (administrative) metadata, and discovery metadata. Technical metadata gives a description of the physical attributes of digital objects, particularly for preservation and rendering. Management metadata on the other hand, establishes the authenticity, rights, ownership and provenance of the digital object, whiles discovery metadata helps to locate access and use digital content in the long-term.

The IRMT (2009) explains how metadata needs to be maintained not for the purposes of creating record, but also to record any active or passive preservation processes. In ensuring effective preservation of digital document, metadata takes cognisance of provenance, authenticity, preservation activities, technical environment, and rights management (Oehlerts & Lui, 2013).

Metadata further indicates the data, where the data is located, the ownership relationship, and its quality, and conditions. Effective application of metadata has the potential of improving information accessibility and preservation of records. Preserving both metadata and digital resources is crucial to any digital archive as the extinction or loss of a metadata can render the resources of a digital archive inaccessible (Sugimoto, 2014). In this case, the longevity of meta-metadata, which is metadata about metadata, is key in keeping metadata understandable and usable over a long time. It would therefore not be out of place if registries are built to keep information about metadata. The UK National Archives for instance, has built a registry service named PRONOM to keep information about file formats (National Archives of U.K, 2014).

Of equal importance to any digital archive, is metadata interoperability, which is used in building a digital archive or a digital infrastructure (Sugimoto, 2014). The Dublin Core Application (DCA) is a typical example of metadata interoperability as it covers 15 metadata elements related to the content of intellectual property. The most significant work undertaken in the Library sector, specifically on preservation metadata is the Online Computer Library Centre (OCLC) and Research Libraries Group (RLG) Preservation Metadata Working Group (OCLC/RLG Preservation Metadata Working Group, 2002), which has a membership list from several national and university libraries such as the British Library (BL) and the National Library of the Netherlands (KB).

Trending issues in digital preservation reinforces the need to preserve metadata, especially metadata containing technical details about the digital material to be preserved. However, several metadata elements can be represented in several metadata schemas such as the Data Dictionary for Preservation Metadata Standard (PREMIS, 2005), the Metadata Encoding & Transmission Standard (METS) and the Dublin Core.

3.8.5 Migration

Migration is one of the most widely used approaches to preservation as the approach focuses on files, seeks to keep digital objects on current and new media formats; and specifically designed for static digital objects such as images and text (Heslop, Davis, & Wilson, 2002).Techniques

usually deployed during migration and noted by Harvey, (1997), IRMT (2009) and Barateiro et al. (2010) includes:

- converting one file format to another;
- converting data from an old format version to a new one; and
- moving data from one hardware/ software type to another.

As a preservation strategy, migration is useful whenever an operating environment hardware and the software changes. For instance, converting a Microsoft WORD97 document into the current Office 2007 format (within format family migration) or converting Adobe PDF/A. It should also be noted that while the principle of migration seems straightforward, the practice can provide significant challenges. Thus, the formats in which digital objects are created and used may vary and may be meant for specific types of object. For example word-processed documents can vary significantly in their functionality (IRMT, 2009). These changes are results of advances in technology.

3.8.6 Migration by normalisation

Within the scope of digital preservation, normalisation attempts to reduce the number of different formats and seeks to avoid, mitigate or skip the migration cycles by going straight to an open source format that is always available and accessible (Barateiro et. al., 2010). It achieves this by converting the ingested files to specific file formats and eliminates redundant non-key data across tables (Nelson & Nelson, 2002). An example of normalization is the conversion of image files in different formats such as Bitmap (BMP), and Joint Photographic Group or Graphic Interchange Format. As a preservation strategy, normalization transfers records to a digital storage repository referred to as ingest (IRMT, 2009) and migrate records from the original software into an open source so that it can be used without having to rely on the original proprietary software system used to create it. In this case, the open source refers to software for which the source code is freely available on the web. It should be noted that a normalization record is not the original record and some information may possibly be lost during the process of normalization. However, there is a general belief that normalization allows digital objects to be

preserved longer, because they are no longer held in commercial software systems and are stored in formats bound by accepted standards.

3.8.7 Emulation

Contrary to migration, which focuses on the specific file, emulation focuses on the original environment in which a file can be rendered (Lawrence et. Al, 2000) by keeping documents readable for a long time (Borghoff, Rodig & Lothar, 2007). It is an approach that uses one computer device or software programme to imitate the behaviours of another device to obtain the same results (IRMT, 2009). Emulation strategies make use of software or hardware called the emulator to recreate the functionality of obsolete technical environments on modern computer platforms. While migration operates on the objects and transforms them to a more stable or more widely adopted representations, emulation operates on the environment of an object trying to simulate the original environment that the object needs.

Even though emulation delivers the most authentic possible rendition of a digital object, critics argue that emulation can be a very complex strategy to implement, since it requires not only the preservation of the original objects but also detailed knowledge of the original systems (Barateiro et. al., 2010). Others argue that the strategy is too unpredictable and challenging for the user (Boudrez, Dekeyser & Dumortier, 2005). In spite of this, Van Suchodoletz and van der Hoeven (2009) have proposed a more balanced view regarding how emulation in digital preservation can reduce software obsolescence and keep records for a long time.

3.8.8 Refreshing

Refreshing as part of the preservation strategy is the process of copying data from one medium to another of the same type. The whole idea behind refreshing is to keep the system infrastructure updated with the most recent technology (Barateiro et. al., 2010). For example, refreshing may consist of copying information from an old floppy disk onto a CD-ROM disk so that the data can be accessed using the same database management software. Refreshing is necessary because the hardware needed to access and use data is fast changing, meaning the storage media can no

longer be used. For instance, the 3 ½" floppy disks of the early part of 2000 is no more in vogue. With the rapid development in technology, people are compelled to copy the data onto other media, such as CDs or hard drives in order not to lose their records.

IRMT (2009) cautions records professionals to be wary of new media technologies and remain focused on the changes and developments in computer technologies since the media chosen may not in fact be sustainable in the long term. It is for this reason that the National Archives in the UK published a guidance note for selecting storage media, called 'Digital Preservation Guidance Note 2: Selecting Storage Media for Long-term Preservation, to regularly update record professional on suitable storage media (National Archives of U.K, 2014).

3.9 ASSESSMENT TOOLKITS AND SOFTWARE TOOLS FOR PRESERVATION

The preceding section of the current study discussed the various strategies for digital preservation. However, a range of assessment tools and software tools exist to support the variety of preservation strategies such as migration or emulation. Such tools are centred on evaluation criteria, a certification process for digital preservation, risk assessment tools and self-assessment tools. It further supports metadata standards, system concepts, selection and appraisal policies, and format identification for digital preservation. This section of the current study elaborates on issues regarding assessment and certification toolkits for digital preservation.

The first attempt to identify specific evaluation criteria for "trusted digital repositories" came in 2002, when an international working group sponsored by the Research Libraries Group (RLG) and Online Computer Library Center (OCLC) published a set of attributes (OCLC & RLG, 2002) as follows:

- compliance with the OAIS model;
- organisational matters;
- administrative responsibility for operational matters; and

- organisational viability in terms of a long-term commitment to long-term stewardship and financial sustainability, demonstrating the existence of appropriate (and accountable) levels of technical and procedural suitability, and basic system security.

The working group further noted that certification would be an essential part of supporting co-operative networks of repositories and other third-party service providers (e.g. registries of representation information or storage services), and so in 2007, the Trustworthy Repositories Audit and Certification: Criteria and Checklist (TRAC) report was published (TRAC, 2007).The criteria checklist dealt with the organisational and technical infrastructure for trustworthy repositories and covers capabilities of certification for repositories. Among others, it defines criteria in several aspects that are of specific interest for preservation planning. These include:

- procedures, policies and their evolvement;
- review and assessment;
- documented history of changes;
- transparency and accountability; and
- monitoring and notification.

The compilers of the criteria and checklist encouraged repositories to use the checklist as an audit tool for objective evaluation. Other audit and certification initiatives also built on the RLG-NARA Task Force's work. For example, in Germany a working group of the Nestor (2006) initiative published a draft Catalogue of Criteria for Trusted Digital Repositories.

Another assessment toolkit is the Digital Repository Audit Method Based on Risk Assessment (DRAMBORA) (DCC & DPE, 2007). As the name suggests, the toolkit supports and undertakes the self-assessment of a digital repository by identifying assets, activities and associated risks in a structured way. It adapts standard risk assessment principles and tailors them to digital repository assessment. According to the developers (DCC & DPE, 2007), the toolkit can be used as a means of guiding repository administrators and other staff to identify the risks that are associated with the organisation's business continuity and to anticipate, avoid, mitigate and maintain appropriate evidential documentation.

The principles and best practices identified in the TRAC, Nestor and the aforementioned checklists could form the basis for a benchmark standard to which public sector organisations could be assessed. This may be a suitable approach, for third-party repositories to take responsibility for digital storage. Self-assessment tools like DRAMBORA are also a type of control mechanism, although they favour a more informal side of the control continuum. In DRAMBORA, documentation and risk analysis could be used to develop shared organisational cultures that focus on long-term preservation challenges. The subsequent section elaborates on the software tools for digital preservation.

3.9.1 Software tools for digital preservation.

A number of software tools have been developed by organisations to generate technical metadata and support the preservation of digital records. This study focuses on five of these numerous softwares: DSPACE, LOCKSS, FEDORA, DAITSS and CONTENT.DM.

3.9.1.1 DSPACE

DSPACE (2013) was developed by Massachusetts Institute of Technology (MIT) and Hewlett Packard to allow users to deposit digital objects into a repository using a web-based interface. DSPACE is highly library oriented and does not control the creation of authorities, such as names or other index terms, making it difficult to obtain accurate results when searching for records. However, organisations that decide to use DSPACE can develop their own authority controls, thus improving their success of searches.

3.9.1.2 Fedora

Fedora (2014) stands for Flexible Extensible Digital Object Repository Architecture. This software package was jointly developed by Cornell University and Virginia University Libraries and then tested by Yale University and Tufts University. Fedora is designed as a digital storage software system and can both preserve individual digital objects and maintain relationships among different digital components.

3.9.1.3 LOCKSS

LOCKSS (2012) means ‘Lots of Copies Keeps Stuff Safe.’ The software, which was developed by Stanford University Libraries, was initially designed to enable libraries to preserve web content and electronic publications through the automatic capture of web resources. The software conforms to the OAIS model in terms of storage and access and is actively used by libraries and publishers.

3.9.1.4 DAITSS

DAITSS (2014) stands for ‘Dark Archives in the Sunshine State,’ and was developed by the Florida Digital Archive and Florida State University. The software supports the creation of a digital preservation repository by ingesting, managing and disseminating information. The software contains no public interface, but can be used in conjunction with other access-oriented software.

3.9.1.5 CONTENTdm

CONTENTdm (2014) is a commercial, proprietary software programme, designed to ingest batches of electronic records from specific user groups. The software is interoperable with the Online Computer Library Center, which can host the digital repository and make it available via WorldCat.

3.10 DIGITAL PRESERVATION PRACTICES

Preservation is an ongoing process and there is no end point to digital preservation, unless a digital object ceases to be considered worthy of preservation. That explains why preservation of electronic records requires frequent intervention. Such interventions depend on the preservation practices an organisation undertakes. In this study, the basic fundamental preservation practices include: developing a preservation policy, linking Open Data, establishing security and access controls, undertaking risk management approach and choosing file formats.

3.10.1 Developing preservation policies

The literature in the preceding sections has effectively discussed and elaborated on digital preservation activities that will lead to the longevity of digital records. Solutions have been proffered to the inevitable threats of digital records and the strategies that ought to be adopted to ensure the perpetuity of digital records. Contingent to these activities is a preservation policy that will chart the path and outline the roadmap to achieving any long term access and future benefits of digital preservation. A clearly documented and realistic preservation policy is an essential foundation for any sustainable digital preservation programme.

As has been noted, digital preservation is still seen as an unfamiliar field and while digital records are increasingly growing, many procedural policies are being created and implemented only in a few organisations (Beagri et al., 2008). Such policies include:

- the Erpanet policy tool supports policy definition on an institutional level (ERPANET, 2003);
- the Joint Information System Committee on digital preservation policies outlines a model for digital preservation policies with the aim of helping institutions develop appropriate digital preservation policies (Beagri et al, 2008);
- the self-assessment tool developed at the Northeast Document Conservation Center (Becker et al., 2008) aids in preservation planning at a high conceptual level; and
- the British Library's Digital Object Management team has defined a preservation plan for the Microsoft Live Book data, laying out the preservation policies for digitized books (Becker et al. 2008).

This section of the study elaborates on the ERPANET policy and adopts the Beagri et al. (2008) preservation policy model, as a practical guide for developing an institutional digital preservation policy. It outlines the strategy for digital preservation, but more importantly provides pointers for creating a high level policy. In line with these aims, ERPANET (2003) outlines seven core principles a digital preservation policy should cover:

- digital preservation policy should convey the very philosophy and objective of the organisation;
- facilitate the sustainability of an institution's present and future digital holdings;
- demonstrate benefits and effectiveness;
- should be integrated with the risk assessment document;
- should be practicable and not definitive;
- should be characterized by clarity, adequacy, transparency, efficiency and logical organisation of contents;
- should be written in a simple and suitable language;
- reviewed regularly to take into account changes in the organization; and
- should offer achievable solutions and provide for management training.

Beyond these core principles, Erpanet (2003) notes that requirement for cost, roles and responsibilities, and legal requirement ought to be considered to support policy definition at the institutional level. The general principle developed by Erpanet (2003) clearly finds a space into the Beagri preservation policy model as it takes cognisance of the role of stakeholders, cost, copyright issues and other preservation strategies. The Beagri preservation policy is in two phases: a policy level and an implementation level. The policy level highlights some of the key points of consideration needed at the beginning of a digital preservation policy. The implementation level on the other hand, indicates the resources and the infrastructure that ought to be in place to get the policies executed. Below is the Beagri policy model.

Table 3 - 1: Beagri preservation policy model/table

Policy Level		
Clause		**Description**
	Principle Statement	Highlights the role of digital content and collections to be preserved
	Contextual Links	Links to other internal strategies web or e-learning, storage standards.
	Preservation Objectives	States that the policy will deliver a reliable and authentic version to its user community.
	Identify Contents	Lists materials in urgent need for preservation.
	Procedural Accountability	Identify high level responsibilities for the policy and terms of reference for the policy should be made clear.
	Guidance and implementation	Outline the implementation plan and the technical steps to be taken for preservation purposes.
	Version control	The policy should be dated, the author identified and the version tracked.

Implementation Level		
	Clause	**Description**
	Financial and Staff Responsibility	This covers staff training, technical infrastructure, storage media and costing projections. E.g. Yale University (2005)
	Intellectual property	Legal context, access issues and deposit agreements should be considered e.g. Canadian Heritage Information Network (2004)
	Distributed Services	Using third parties or partnering with collaborative institutions (eg. Fedora or DSPACE) UK Web Archiving Consortium (2008).
	Standards Compliance	Statements of OAIS model or TRAC framework may be necessary
	Review and Certification	How often should the policy be reviewed? DRAMBORA follows a self-audit process for certifying a repository, which also includes existing a policy framework (Cornell 2007; DRAMBORA 2008).
	Auditing and Risk Assessment	Audit trails, risk assessment for file formats and protection of data should be stated, e.g. King's College London (2006)

	Stakeholders	Indicate the departments, sections and identifiable parties involved in the policy
	Preservation Strategies	This includes metadata, storage, access, migration

Source: (Beagri, 2008)

The adoption of the Beagri policy by the ministries and public agencies can provide guidance for the implementation of the digital preservation infrastructure in Ghana. Clearly, any long term access to digital records rest heavily on preservation strategies underpinned by digital preservation policies.

3.10. 2 Establishing security and access controls

Security controls are needed to place limitations on user access to computer systems and to have control over the physical storage of electronic records. This measure is adopted to prevent unauthorized access, alteration, theft, or physical damage to information (Laudon & Laudon, 2005: 526 in Ngoepe, Mokoena & Ngulube, 2010) to ensure the integrity and authenticity of the record. Wato (2002) and Lekaukau (2000) argued that technological developments have allowed easy access to records and caution records managers to take the necessary measures to maintain the safety of digital records. IRMT (2009) notes that such necessary measures should cover the following:

- physical infrastructure needed to preserve the digital records must be protected from any accident or damage and that includes physical access controls, intruder detection systems, fire detection and suppression systems, and backup power supplies;
- infrastructure should be protected from intrusions by external hackers and other attacks caused by malicious code or other forms of software designed to infiltrate or attack a computer system; and
- the infrastructure must ensure that internal users from external locations have appropriate access rights to the stored content.

3.10. 3 Linked Open Data (LOD)

Linked Open Data (LOD) is gradually becoming an important preservation practice for digital archives (Sugimoto, 2014). Linked Open Data is a set of principles and technologies that allow raw data to be placed online in a standard, web enabled representation. This principle allows every piece of data to be web addressable and linkable (Zablith, Fernandez & Rowe, 2012). To achieve and create LOD, technologies should be available in a common format such as Resource Description Framework (RDF), to allow easy access to existing databases.

Notable organisations making use of LOD include the British Broadcasting Corporation (BBC), World Bank and Non-governmental organisations (NGOs) such as the World Health Organisation and the U.S. government (Miller & Westfall, 2011). Within the library community, the Library of Congress (LC) has placed the Library of Congress Subject Headings (LCSH), machine-readable cataloging (MARC) relator codes, and geographic materials in linked data space. The same can be said of the Swedish and Hungarian National Libraries, which have put their entire Online Public Access Catalogs (OPACs) on the Web (Miller & Westfall, 2011). The Government of Canada on the other hand, launched an Open Data portal data.gc.ca.; to allow for unrestricted data reuse (Government of Canada, 2011; Comprehensive Knowledge Archive Network, 2013; Government of Canada, 2013). Indeed, various cities and districts throughout Canada have launched their own Open Data websites (Government of Canada, 2014), including the City of Ottawa, which also uses the CKAN platform (City of Ottawa, 2014). Europeana, a world leader in digital opportunities is managing a repository of over 30 million cultural items from 2300 European institutions through the Open Data (Europeana, 2013). Such wide spread adoption of the LOD in the library field would benefit libraries and the greater information community on the Web (Singer, 2009).

In this study, participating repositories such as the ministries and the public agencies must agree on a common protocol and metadata schema for online searches to be able to access different repositories. Thus, it is crucial to link digital archives by semantic links based on LOD across ministries.

3.10.4 Risk management and emergencies

In order to ensure the survival of digital records, repositories must be protected against threats and vulnerabilities such as migration errors, software obsolescence, disk crashes and ‘’bit rot.’’ This form of protection, which is almost equivalent to reducing the risk of digital records underpins the reason why the digital preservation community has adopted the concept of Trustworthy Repositories Audit and Certification (TRAC) and Digital Repository Audit Method Based on Risk Assessment – DRAMBORA to assess repositories. For instance, whilst the Trustworthy Repositories Audit and Certification (TRAC, 2007) Criteria and Checklist identifies potential risks to digital content housed in repositories and provides the benchmark for determining the soundness and sustainability of digital repositories, the DRAMBORA (McHugh, Ruusalepp, Ross & Hofman, 2007) focuses on the risks, classification and evaluation of digital repositories.

In addressing the potential threats and vulnerabilities of digital preservation as pointed out earlier, refreshing, metadata and auditing can be used to offset these threats (Barateiro et. al., 2010). Whilst refreshing will replace components of hardware and hard disks, metadata will verify the integrity and obtain an undamaged copy of documents. Auditing will similarly monitor and review activity of the risk management process.

IRMT (2009) further outlines effective continuity plans to address emergency situations in any repository. The plans include:

- detailed instructions for staff to follow in the event of different types and scales of emergency;

- contact details of key staff including specialists in disaster recovery who may be engaged as contractors;
- instructions for restoring the content of the digital collection from backup copies;
- a complete description of the hardware and software infrastructure to allow the organisation to acquire replacement equipment or new software if required;
- copies of crucial documentation related to the preservation process, such as operating procedures and manuals; and
- access to copies of all the software required to operate the computer systems.

These basic practices can ensure that the digital records so preserved are safe and secured.

3.10.5 Choosing file formats

Many activities of preservation are carried out around file formats (Abraham, 2004) to prevent loss of access or file format obsolescence. File (or data) formats define the rules used by application software to convert bits into meaningful information that can be viewed by a user (Abrams, 2007:51). In other words, they are the principal means of encoding information, the content of which can be found in a computing environment. Accordingly, in choosing file formats, accessibility, interoperability, and sustainability should be the guiding principle (Liu, 2013). File formats can be classified as proprietary, open or standard formats. However, for the purpose of the current study, archival formats include, Portable Document Format (PDF), Tagged Image File Formats (TIFF), Extensible Markup Language (XML) and Standard Generalized Markup Language (SGML)**.** Through the use of file formats, documents submitted electronically can be converted to PDF/A, whiles TIFF can be used for images and textural materials, and further supports scanning and desktop publishing (Liu, 2013).

The PDF particularly preserves the visible characteristics of documents, so that they behave as "electronic paper" (Arms et al., 2014). According to Liu (2013), archival formats can be supported by assigning identifiers and preservation metadata, backup, periodic refreshment and strategic monitoring of format changes. In such situations, libraries and repositories can have a format support policy that is readily available to guide staff and the end user. In order to

minimise the frequency of migration, risk and costs of preservation, the Digital Preservation Coalition (2012) cautions archival community to use file formats which are non-proprietary, tried and tested, and adaptable to different hardware and software. For instance, the open file format have the potential to remain accessible since the software required to read them cannot be affected by license or patent restrictions (Cunliffe, 2011). Even though migration and emulation rely on file format specification, the preservation risks associated with file formats mostly relate to loss of data and cost.

3.11 STRATEGIES AND GUIDELINES IN THE MANAGEMENT OF DIGITAL PRESERVATION IN SELECTED PART OF THE WORLD.

As articulated in the previous chapters, while developments in information technology have unfettered advantages, they also pose significant amount of threat to long term accessibility of digital information. That is why the goal of digital preservation is to maintain, retrieve and use digital collections in the face of the rapidly changing technological infrastructure.

Essentially, the preservation of electronic records started far back in the1960s when Machine Readable Records were initially used (Cox, 1994). Literature reveals that researchers tended not to use the term "digital preservation," preferring instead to speak of the archiving of electronic records or the preservation of data sets (Hirtle, 2008). The concept originally developed in libraries as an aid to ongoing library analog preservation efforts (Hirtle, 2008) and eventually led to the development of several major projects in digital libraries, and development of memory institutions. For instance, the Library of Congress has more than 20 years history of the development of large digital collections of cultural resources. In Europe, Europeana is a huge international collaborative project and its strength is not only in international collaboration but also in the use of Linked Open Data technologies for value addition by third parties (Sugimoto, 2014). In Asia, the Taiwan e-Learning and Digital Archives programme (TELDAP) is a good example of the use of digital archives in education. Quistbert (2008) on the contrary, argued that archiving institutions were the first to give attention to the preservation of digitally recorded information.

Though, these initiatives in digital preservation were very much concentrated in Western Europe and North America, it provides a benchmark for measuring the best practices in digital preservation. Further, there is no question that for archivists, globalization has created a set of shared problems, and possibly shared solutions. For instance, the bits that make up digital documents are the same irrespective of where they are located. To that extent preservation specialists from around the world can learn from one another (Hirtle, 2008).

While the location of the current study is Ghana, preponderance of evidence exists to show that most of the trends, standards and practices of records management in commonwealth countries were influenced by practices in Western Europe and U.S. For instance, Reed (1997) asserts that records management in most commonwealth states have been influenced by the British colonial legacy of the 18th and 19th century registry systems. Similarly, the several workshops put together by the International Records Management Trust, a U.K based organisation on records management in Uganda, Tanzania, Kenya, Sierra Leone, Ghana and other African countries reinforces the influence of records management practices from Europe and U.S on Africa, specifically Ghana (IRMT, 2008 & 2011). Again, at independence, many of the English speaking African countries patterned their archival laws, policies and legislation in line with the old Canadian Archival Act (Asogwa, 2012). In this regard, the current study focuses on the notable digital preservation strategies and guidelines initiated by these countries. Thus, the section will first highlight in brief the entire digital preservation projects undertaken in Europe and further dilate on projects in three specific countries namely United Kingdom, Australia and United States of America.

Essentially, the first ever initiatives in digital preservation on an European level were aimed at raising awareness of long term preservation issues (Digital Preservation Coalition Annual Report, 2003). Starting with ERPANET and Digital Preservation Europe, the European Commission co-funded series of presentations and workshops with the view of creating awareness about digital preservation and identifying potential target group. These presentations brought together different research projects on the European level and they culminated into the establishment of the ‘WePreserve’ initiative. It primarily focused on metadata standards, system

concepts, selection and appraisal policies, while subsequent research on digital preservation emphasized on technical and framework development such as Planets, Caspar, Shaman, Digital Preservation Europe and Protage (Strodl, Petrov & Rauber, 2011). These projects have had great influence on the development of a conceptual framework and international standardization for digital preservation (e.g. PREMIS, OAIS, and TRAC).

The European Commission on ICT programmes, in actuating these projects, committed an amount of 90 million Euro spread over 20 countries in Europe. The first phase of the programme (6^{th} framework programme) started in 2002 and ended in 2006. The second phase (7^{th} framework programme) commenced in 2007 and did run till the end of 2013 (Strodl et al., 2011). Other preservation initiatives were pursued in Asia and North America. As was pointed out, the following prominent national and international initiatives and standards may guide or assist digital preservation decisions in Ghana and particularly sub-Sahara Africa.

3.11.1 United Kingdom

Analogous to these projects is a U.K based Digital Preservation Coalition (Digital Preservation Coalition, 2002) which has succeeded in:

- disseminating information on current research and practice in digital preservation;
- instituting a concerted and coordinated effort to get digital preservation on the agenda of stakeholders;
- playing the advocacy role for appropriate and adequate funding to secure the nation's investment in digital resources and ensure an enduring global digital memory;
- providing a common forum for the development and coordination of digital preservation strategies in the United Kingdom; and
- forging strategic alliances with relevant agencies nationally and internationally and has worked together with industry and research organisations to address shared challenges in digital preservation.

Although the coalition effectively prosecuted its mandate, its activities were essentially centered on an advocacy role and practically failed to develop a trusted system for digital records. In spite of these weaknesses, Ghana could learn from the coalition by adopting a prototype of that to pool the significant stakeholders together to find a practical solution to the preservation of digital records in the country.

The Joint Information System Committee (JISC) just like the DPC (2002) has similarly provided data and preservation services in the arts and humanities and undertaken digital preservation research studies, and published other studies in this field (Beagri, 2003). Mention can also be made of the British library which has been instrumental in pioneering a digital preservation repository to ensure the perpetuity of its collection.

Clearly, the experiences and collaborative effort of the key institutions related to digital preservation in the U.K can be useful lessons to Ghana, particularly the leadership role provided by the National Archives of U.K, the British Library, Digital Preservation Coalition and the Joint Information System Committee. In this regard, the National Information Technology (NITA), the Public Records Archives Administration, staff of records managers across the ministries and libraries of the Universities can draw a road map towards achieving specific objectives in digital preservation as opposed to the current data centre being put together by a single institution like the NITA. Digital preservation thrives on collaborative effort from significant institutions.

3.11.2 United States of America (U.S.A)

In the case of U.S.A, quite a number of projects have been undertaken regarding digital preservation initiatives. Most prominent among these projects are the National Digital Information Infrastructure Preservation programme (NDIIPP, 2008), RLG (Research Libraries Group), OCLC (Online Computer Library Center, 2002), NISO (National Information Standards Organisation, 2010) and the National Archives and Records Administration on Electronics Records Archives. Being the brainchild of the Library of Congress, the NDIIPP (2008) was billed to develop a national strategy to collect, archive, and preserve digital records for the current and future generations. In December 2002, Congress accepted the planning report from

NDIIPP and committed an amount of 35 million dollars out of the 99.8 million dollars to implement many of the recommendations in its report and to establish a national network of preservation partners.

While the NDIIPP is well advanced, several other groups have been supporting work in digital preservation. The National Science Foundation (NSF), for example, has supported several research projects in digital preservation through its digital library funding, and there is an implied preservation component of its National Science digital library initiative. In conjunction with the Library of Congress, the NSF has initiated a meeting of fifty one specialists in computer science, archives, and libraries to develop a research agenda in digital preservation (National Science Foundation, 2002). Importantly, one conclusion that has emerged from digital preservation initiatives all over the world is that no one institution will be able to preserve everything. Without that how can the British Library be able to know if Cornell University, for example, has "preserved" a resource that it no longer needs ? That is why Research library Group (RLG) has joined NARA in an international effort to develop certification criteria for digital archives.

It has so far, emerged that NDIIPP, and other analogous institutions which played pioneering roles in building a digital preservation infrastructure to ensure the perpetuity, authenticity, accessibility and reliability of digital records in the U.S and beyond are worthy of emulation by Ghana and the sub-Saharan Africa as a whole. Lessons from the U.S should help policy makers and leadership in Ghana to make a financial commitment towards this agenda as digital preservation projects are capital intensive.

3.11.3 AUSTRALIA

The National Library of Australia (NLA) remains the institution that has effectively undertaken digital preservation initiatives in a number of local and international collaborations. PANDORA project (Preserving and Accessing Networked Documentary of Australians) and the Council of Australian State Libraries are some of the examples (Cathro, Webb & Whiting, 2009). As a statutory authority within the portfolio of the Department of Communications, Information

Technology, and the Arts, the NLA holdings cover Australia's published and documentary heritage, including oral and folk history. Internationally, the NLA felt that international collaboration at many levels is the key element in the digital preservation environment (Beagrie, 2003). Accordingly, it has worked with the U.S. Library of Congress and contributed to the OCLC/RLG Working Group on Preservation Metadata and the Working Group on Digital Archive Attributes. Through their constructive remarks, the NLA has contributed significantly to the OAIS reference model and other international projects in digital preservation as well as the development of Preservation Management of Digital Material (Beagrie, 2003). Other ancillary preservation initiatives in other jurisdiction include the following:

3.11.4 Digital Preservation Europe (DPE)

The DPE (2006) is an organisation that fosters collaboration between many national and international initiatives across the European Research Area. DPE works to pool the expertise of many in order to "secure effective preservation of digital materials." The organisation defines digital preservation as "a set of activities required to make sure digital objects can be located, rendered, used and understood in the future."

3.11.5 Network of Expertise in long-term SToRage (Nestor)

Nestor is a German competence network for digital preservation (Nestor, 2006), with four working groups working on various subject areas of digital preservation to design criteria for trusted digital repositories called a criteria catalogue (DCC, 2004). Nestor's criteria catalog is based on the principles of adequacy, measurability, documentation, and transparency.

3.11.6 Trusted Repositories Audit and Certification (TRAC)

The programme provides the criteria for building a trusted repository (TRAC, 2007). TRAC is managed by the Centre for Research Libraries and was designed as a set of criteria for the

certification of a digital repository. The audit criteria can also be used for preservation planning to ensure long-term access to valued materials.

3.12 ROLE OF STAKEHOLDERS

The digital preservation conundrum is one that has gained the attention of information professionals, scholars and IT experts in view of the continuous challenges it poses to the digital world. Several propositions emanating from research and practice have underscored the establishment of a ‘’deep infrastructure’’ to underpin or ameliorate the digital preservation challenges confronted by organisations (Day, 2008). One of such proposition is the role stakeholders play in sustaining repositories in the world. Further, digital preservation depends on preservation responsibilities which go beyond archivist and librarians. Accordingly, consideration for stakeholders in this current study took into account national libraries, national archives, university libraries, research libraries and collaborative initiatives in the digital preservation process. This section discusses some of the roles pursued by stakeholders and their collaborative and participatory role for digital preservation.

Fundamentally, national libraries are noted to play key roles in facilitating co-operation in digital preservation activities at the national and international levels, particularly because they seem to be well connected and focused to well-established organisations such as the International Federation of Library Associations and Institutions (IFLA) and the Conference of Directors of National Libraries. For instance, the National Library of Australia (NLA) remains the institution that has effectively undertaken digital preservation initiatives in a number of local and international collaborations (Cathro, Webb & Whiting, 2009). Example of such an initiative is the PANDORA project (Preserving and Accessing Networked Documentary of Australia). The same can be said of the U.S Library of Congress that led a crusade in 2005 under the National Digital Information Infrastructure and Preservation Programme (NDIIPP, 2008), inviting the head of state libraries, archives and other corporate institutions for a workshop to develop strategies for the preservation of significant state and local government information in digital

form. Suffice to mention that the activities pursued by the Library of Congress can be replicated in Ghana to develop a national strategy for the preservation of digital records, as Ghana is bereft of a national digital preservation strategy.

Apart from playing a key role in facilitating the cooperation of digital preservation activities, national libraries also archive particular websites/web pages (Bailey & Thompson, 2006), while others have passed legislation and/or regulations for collecting the Web (Larsen, 2005) and conduct web archiving based on contracts (Phillips, 2005). This particular role appears to be a pressing need to most African states as responsibilities for the archiving of government online publications are usually not given much of an attention (Ngulube, 2012).

With respect to national archival institutions, Akotia (2003) underscored how archival institutions have ensured the proper management of public records by way of promoting the preservation and accessibility of national archival heritage. The National Archives and Records Service of South Africa, 2006), the Public Records and Archives Administration of Ghana (PRAAD, Act 535, 1997) and the Botswana National Archives and Records Services (2009) have played diverse roles in this regard. Beyond these roles, national archives cooperate with other professional associations, international and regional organisations and commercial enterprises to ensure that significant born-digital materials are preserved, by promoting and advocating for digital legal deposit laws.

At the University level, there is a growing interest in establishing institutional digital repositories, in which the intellectual output of the university's staff and students can be deposited for free access and dissemination (Chang, 2003). University of Ghana, University of South Africa and other repository institutions in Africa have put up their own digital repositories. However, the long-term sustainability of such repositories is not certain in Africa as University libraries are highly dependent on donor funding. In addition, University libraries in the have been at the forefront of research, implementing far-reaching preservation policies for digital resources by educating and training information professionals to implement both digitization and preservation practices relevant to the needs of governments and their citizens. That

notwithstanding, University libraries have collaborated with international professional associations and other international bodies to develop academic curricula. One of such professional association is the Consortia of Academic Librarians in Ghana.

Essentially, because digital preservation demands long term commitment and very often a shared responsibility, it thrives on collaboration and strategic alliances. Accordingly, collaborative efforts of the Digital Preservation Coalition (DPC) from the U.K, the Nestor (Network of Expertise in the Long-Term SToRage) from Germany and the Data Preservation for the Social Sciences (DATA-PASS) from the U.S have yielded a lot of dividends to heritage institutions (Day, 2008). Such collaborative effort have focus on metadata standards, file formats (Abrams & Seaman, 2003) advocacy and network with emphasis on interoperability, authenticity, reliability and accuracy of records. Again, the Library of Congress, guided by a strategy of collaboration and iteration, formed a network of partners who undertook the collection and preservation of digital records in the U.S. (NDIIPP, 2008). The same can be said of institutional repositories which through strategic collaboration have had the opportunity to use open source repository software and interoperability tools such as DSPACE, FEDORA, and Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) without having to pay for them (Day, Pennock &, Allison, 2007). Again, the WorldCat through collaborative initiatives receives cataloging information from well over 72,000 libraries around the world (Council of Canadian Academies, 2015:82) and users of Google books can search over two billion records (Waibel & Erway, 2009; OCLC, 2014 in Council of Canadian Academies, 2015).

More importantly, conferences on digital preservation and research have alluded to the various roles archivists and private organisations should play in the whole scheme of digital preservation. One of such conferences is the Vancouver declaration on digital preservation held by the UNESCO in 2012 (UnescoVancouver Declaration, 2012). The conference recommended that archivists:

- develop a roadmap proposing solutions, agreements and policies to ensure long term access and trustworthiness of preservation;

- the roadmap developed should address issues like open government, Open Data, open access and electronic government; and
- encourage their members to take into consideration the reliability, authenticity and copyright ownership of digital records.

The conference further noted that private organisations should:

- cooperate with archives, library, museum and other relevant organizations to ensure long-term accessibility to digital information;
- adhere to recognized metadata standards designed in collaboration with information professionals for description and/or management of digital resources; and
- take digital preservation issues into consideration when participating in national issues

In essence, no one institution can vouch to have the capacity to address the erratic challenges of digital preservation. Collaboration is an essential ingredient to the development process of preserving repositories (Conway, 2007). The future of digital curation depends on the collaborative efforts from all the various stakeholders the study has identified. Therefore, collaboration, participation, strategic alliances, and synergy should form part of the solutions to the unending problems of digital preservation.

3.13 LITERATURE ON THE STATE OF DIGITAL PRESERVATION OF E-GOVERNMENT IN SUB-SAHARAN AFRICA

Africa is said to have made limited progress with respect to legislation, infrastructure, strategies and initiatives in digital preservation of e-government. In the case of legislation, serious weaknesses in archival laws can be traced to the way English speaking African countries had fashioned their archival laws and legislations in line with the old Canadian Archival Act (Asogwa, 2012). For example, the archival laws and legislation in most African countries at independence allocated limited powers to record managers as to what should be retained or disposed off. A limitation that runs contrary to the responsibilities clause in the ISO 15489

(ISO, 2001), which prescribes that records management responsibilities be defined, assigned, and promulgated throughout the organisation and delineates who is responsible for taking necessary action (ISO 15489, 2001).

Kalusopa (2011) citing Reed (1997:1) similarly noted that prior to the 1990s, the management of e-records was not well addressed in most colonial commonwealth states and that computers were only used as facilitative tools to hasten the creation of documents. Others like Afullo (2000), Chisenga (2000), Jensen (2002), Roycroft and Anantho (2003) observed that most articles and essays about information services in Africa refer to the continent's problematic telecommunications, information technology, internet availability, information infrastructure, and library conditions. These factors may have contributed to the digital preservation conundrum in sub-Saharan Africa.

In an audacious attempt to address the issues of digital preservation, the UN organized a three day regional consultation meeting in 2002 with 40 participants from 25 countries made up of representatives from Ministries, National Commissions for UNESCO, national libraries and archives, museums, communities, Universities, producers, preservers and users of digital heritage materials at the UN Conference Centre in Addis Ababa. The objective of the conference was to discuss the digital preservation challenges in Africa resulting from the increasingly large share of information being produced in digital form and the potential loss of the enormous amount of digital information (UNESCO, 2002). Although, the conference proposed specific techniques and policies to be developed to preserve digital records and standards to guide government's preservation efforts in the digital age, such proposals have not inured to the benefit of the continent.

Within the sub-Saharan Africa, Ngulube (2005) had noted that evidence from literature and databases reveal that little empirical research has been conducted on preservation in general. He identified few studies that dealt with preservation issues in SSA as follows: Ojo-Igbinoba (1993), Chida (1994), Kemoni (1996), Mazikana (1992), Peters (1998), Murray (2002), Akussah (2002) and Ngulube (2003). These studies underscore the paucity of literature in digital preservation as

they focused on just preservation issues and not digital preservation. A further cursory assessment of literature on digital preservation on SSA shows the dearth of publications on digital preservation issues. Researchers like Lor (2003), Luyombya (2010), Kalusopa and Zulu, (2009), Keakopa, (2010), Ngulube, (2012) and Mutula, (2008) have in one way or the other undertaken some works on digital preservation of e-government issues.

In a more recent study, Luyombya (2010) examined the framework for effective management of digital records in Uganda by surveying 23 ministries that form the Uganda Public Service (UPS). The study sought to establish the current state of digital records in the UPS and determine the factors hindering the management of digital records. The study adopted a multiple methodology in data collection as in earlier studies (Kemoni 2007; Keakopa, 2007 & Nengomasha, 2009) and drew on the 'records continuum' concept for its conceptual framework. The findings of the study revealed that problems with Digital Records Management (DRM) were due to the absence of ICT facilities with recordkeeping functionality, lack of clear policies, guidelines and procedures, and the fact that the Uganda Records and Archives legislation is not implemented and not properly enforced. The study noted that lack of appropriate institutional and managerial structures can be attributed to the failure to implement the National Records and Archives Act. The study, however, recommended the need for a legal infrastructure, appropriate policies, procedures and guidelines and skilled human resource capacity. Although Luyombya (2010) study failed to address digital preservation from the perspective of e-government, his study provides an insight and smattering knowledge into the methodology and understanding of digital preservation of e-government.

Kalusopa and Zulu (2009) study, which was akin to the findings of Luyomba (2010), revealed weak policy formulation on digitization, weak legislative framework for digital preservation, lack of awareness about the potential of digital preservation by national heritage institutions, dearth of human resources for digitization and lack of common standards on digital heritage materials preservation in Botswana. Like Luyombya (2010) study, even though the study was limited to institutions dealing with digital heritage materials preservation, the outcome of the study sheds more light on the challenges of preservation of digital materials which is akin to the

current study. However, the study failed to address issues of e-government. In examining the trends in long-term preservation of digital information challenges and possible solutions for Africa, Keakopa (2010) noted that the management of digital information in Africa will continue to worsen, so long as technological development is erratic. He observed that the onus lies with archivists, records managers and librarians to come up with new solutions to meet the immediate and future needs of managing digital records in Africa. In examining the trends in long-term preservation of digital information challenges and possible solutions for Africa, Keakopa (2010) noted that the management of digital information in Africa will continue to worsen, so long as technological development is erratic. He observed that the onus lies with archivists, records managers and librarians to come up with new solutions to meet the immediate and future needs of managing digital records in Africa. Accordingly, Keakopa (2010) proposed that:

- Africa should speed up development and implementation of ICT policies as these will guide ICT infrastructure development;
- liberalise the ICT market to promote competition in the provision of ICT facilities and services.
- public-private sector partnership to help deal with accessibility in rural areas;
- higher investment in ICT to narrow the gap between urban and rural areas; and
- reduction of ICT subscription and connection fees, and telephone dial-up charges will further ensure universal affordability.

In another study, Lor (2005) investigated whether repository libraries in developed countries have a role to play in the preservation of the digital resources of developing countries. The study observed that following the growing volumes of digital material being published in Africa and the inability of Africa's repositories to collect and preserve digital materials, repositories libraries in Africa should fall on Western countries to assist in ensuring the long-term preservation and accessibility of digital material from Africa. Even though the study placed much emphasis on South Africa and undertook a conceptual analysis of categories of digital resources produced in developing countries, it provides a caveat and guidelines for institutions in developed countries which are interested in undertaking digital records activities in Africa.

In Botswana, Mnjama and Wamukoya, (2006) observed that electronic records being generated in many public sector organisations in Africa are plagued with challenges hitherto never experienced by archivists and records managers. Reviewing literature on ICT, records management and e-governance, and the challenges faced by archivists and records managers, particularly in developing countries, the study revealed that without proper planning and adoption of various methods, e-records are likely to become inaccessible in the future, thus compromising the principle of accountability and transparency. The study argued that there is every reason for African governments to examine their readiness for e-records before implementing e-government initiatives.

A similar study in Botswana by Mutula (2008) examined the nexus between the digital divide and economic development and discussed attempts being made at continental, regional and country levels to bridge the digital divide in sub-Saharan Africa. It noted the various initiatives in the areas of infrastructure development, legal and policy framework, with a focus on the laying of undersea and terrestrial fiber optic cable to connect with other parts of the world. Mutula (2008), however, admits that an empirical study is needed to determine the impact of the surge in infrastructure and policy development in sub-Saharan Africa with regard to bridging the digital divide.

Perhaps a more recent study by Ngulube (2012) provides a better insight into the current study. Ngulube (2012) study was aimed at investigating the extent to which vital government information in sub-Saharan Africa is being preserved online and what national initiatives should be undertaken to ensure the accessibility of this information over time. The study recommended that trustworthy digital repositories can "provide reliable, long-term access of managed digital resources to its designated community, now and into the future" (Trusted Digital Repositories, 2002).

The study further observed that much is not known about the software that is used to create and store some of the records on government websites as many of the software products are developed with built-in proprietary dependencies, which may have adverse effects on access and

the preservation of the websites. As a consequence, Ngulube (2012) recommended that librarians and archivists should promote the use of the open-source applications and play an active role in influencing governments to create and manage the evidence of democratic governance in ways that facilitate its accessibility and long-term preservation. Whiles Ngulube (2012) study finds a space in the current study, it is conceptual and narrative in approach, and may further need an empirical study.

Voutssas (2012) in another recent study reviewed the current situation of digital preservation in developing countries. The study proposed a framework to analyze the situation in developing countries and summarized the issues in six preservation factors. The findings of the study were that the amount of digital information has increased geometrically without proper knowledge, theories, strategies, policies and proceedings to preserve it, a conclusion not too different from the findings of Ngulube (2012) study.

The section reviewed underscores the point that although most of the studies dealt with the concept of digital preservation and its challenges, none examines the concept in depth, particularly from the perspective of e-government. Ngulube (2012) study was the closest, but was a conceptual study and did not address the emerging digital preservation and e-government issues in Ghana.

3.13.1 State of digital preservation of e-government in Ghana

There is no significant research literature on national digital preservation initiatives in Ghana. However, there are literatures on digital libraries, ICT and fragmented attempts on institutional repository initiatives in some of the public Universities in Ghana, viz: University of Ghana, University of Cape Coast and Kwame Nkrumah University of Science and Technology. On institutional repositories, Kwame Nkrumah University of Science and Technology Institutional Repository services, collects, organizes, and provides open access to scholarly works produced by the University's faculty, staff and students. The University further subscribes to over fifty Databases (E- Resources) through the Consortium of Academic and Research Libraries in Ghana (CARLIGH). The University of Cape Coast on the other hand is equally building institutional

repositories to preserve the intellectual outputs of both the staff and students. In doing this, the University believes, it will increase its global visibility, showcase the academic and research outputs of the University and facilities to preserve UCC's intellectual heritage for posterity. UGSpace is an open access electronic archive for the collection, preservation and distribution of digital materials.

On ICT and digital libraries, Dadzie (2005) investigated the use of electronic resources by the students and faculty of the University of Ghana, in order to determine the level of use, the type of information accessed and the effectiveness of the library's communication tool for information research. Her findings demonstrate that computer usage for information access and usage of some internet resources is on the ascendency among students of the University, whilst the use of scholarly databases was quite low. She attributed the low patronage of the scholarly databases to inadequate information about the existence of these library resources (Dadzie, 2005). Dadzie recommended among others, the introduction of information competency across the curriculum and /or the introduction of a one-unit course to be taught at all levels and the provision of more computers on campus.

In a more recent study, Boamah (2009) examined the conception of digital libraries among information professionals in Ghana. His findings show that there is not a common definition for digital libraries as it lacks a common model. The study concluded that (digital) library literacy should be taken seriously both in schools and at training programmes, and services in digital libraries should be organised for users.

Within the public sector organisations, the creation and production of digital records have been growing. In responding to this growth, the government of Ghana issued a National ICT for Accelerated Development (ICT4AD) Policy Statement, which was approved by Cabinet in early 2004. ICT4AD was prepared within the context of other key national frameworks, including the 'Vision 2020 Socio-Economic Development Framework and Co-ordinated programme for Economic and Social Development of Ghana (2003-2012) (National planning development commission of Ghana, 2001). In addition to this, the government has introduced various

legislations to backup the ICT policy in the country. Such initiatives obviously has culminated in the increased use of computers in the ministries and undoubtedly raised the issues concerning the challenges of the preservation of heritage materials in digital formats from archivists, librarians and other custodians of such materials.

3.14 SUMMARY OF CHAPTER

In an attempt to chart a path for the current study, this chapter dealt with the conceptual framework of the study by using OAIS Reference Model, and the Information and Records Continuum Models. The chapter observed that OAIS Reference Model is conceived as one of the key activities of digital preservation as it contributes to the method of communicating digital preservation. OAIS brings to the fore the need to increase awareness about digital preservation and the activities that have to be carried out in order to achieve the goals of preservation goals. Implicit in the records continuum cycle is the fact that information lives longer than people and organization.

The Chapter further observed that records managers need to integrate records management considerations in the design of web-enabled application systems which will eventually contribute to the development of the metadata standards and further provide access to records generated in the web environment. The Chapter argued that digital preservation of e-government still remain a huge challenge to the continent and the quest to implement e-government will remain elusive if the challenges of digital preservation are not addressed. Beyond that the Chapter points out that the inherent challenges confronted by most African countries in the implementation of digital preservation policies and structures can be daunting if issues of skills training, infrastructure, policies, copyright issues, and brain drain are not addressed. It proposes the adoption of the best global practices of digital preservation to sub-Saharan Africa and concludes by proffering strategies that could be adopted to address the issues of digital preservation.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 INTRODUCTION:

Chapter One of the current study articulated the problem statement and subsequently proceeded with the context and the conceptual framework of the study for Chapter Two and Three respectively. Consequently, the next step was to embark on the empirical research. The empirical research is the direct observation of phenomena that measures the reality and truth about the study (Bhattacharya, 2008). However, it is prudent and proper that the methodology of the study is described and justified. Accordingly, this chapter presents the methodology of the study by focusing on the research procedure used; study population and justification; data collection instruments; validity and reliability of the instruments; data collection procedures; problems encountered during data collection, processing and analysis of data; ethical considerations and evaluation of research methodology.

4.2 JUSTIFICATION OF RESEARCH PARADIGM AND METHODOLOGY

Unquestionably, all research approaches have underlying philosophical assumptions anchored on two contrasting or contending paradigms. Kuhn (1962) referred to such paradigm as an 'accepted ''model or pattern.'' In other words, it is a set of propositions that explains how the world is perceived, and informs a researcher as to what is important, what is legitimate and what is reasonable concerning systematic inquiry (Sarantakos, 1993). Although varying opinions exist as to the present paradigms of inquiry, the most frequently cited and discussed in social science research was offered by Guba and Lincoln (1994), namely positivist and interpretive. These two strongly opposed social realities, over the years have generated coherent and highly differentiated research technique and particularly shaped research methodologies and outcome. The debate about these paradigmatic division dates back from the mid-nineteenth century (Ngulube, 2003; William, Burstein & McKemmish, 2000).

The contending stand point of the positivist and interpretive about the world were centred on different ontological (nature of reality), epistemological (nature of knowledge), axiological (values in inquiry) and methodological (process of research) assumptions which rendered the two paradigms incompatible (Hanson et al., 2005). In other words, paradigm differences influence how we know, our interpretation of reality, our values and methodology in research. Again, paradigm influences the questions researchers pose and the methods they employ to answer them (Morgan, 2007). One of such ensuing arguments which illustrate the paradigmatic division was the famous world view that the world is flat as opposed to the world being round.

The positivist belief is that the social world exists in the same way as the natural world, and the approach of the natural sciences could be applied to the social world (Yates, 2004). On the other hand, the interpretivist place emphasis on the meanings made by people as they interpret the world in a natural setting (William, Burstein & McKemmish, 2000). Methods like informal interviews, inductive reasoning and observations favour the interpretivist (Hitchcock & Hughes, 1995), whilst the positivist researcher's inclination is tilted towards deductive reasoning. Further, the positivist paradigm has been associated with quantitative research methods but authorities argue that qualitative methods are also used, particularly by post-positivists (Meyers, 1999). In the same way, interpretivism is largely associated with qualitative methods, but quantitative methods may be used as well (William, Burstein & McKemmish, 2000).

Over the years, the traditional conception that the paradigms underlying quantitative and qualitative approaches (positivism and interpretivism, respectively) are incompatible was abandoned (Hewson, 2006). Researchers began to realise that qualitative and quantitative methods were not diametrically opposed and divergent to each other as was originally thought. Rather, there is a strongly held view that both quantitative and qualitative approaches have their own distinctive strengths and weaknesses and can be usefully combined to complement one another (Creswell & Garrett, 2008). Similarly, various authors have underscored the need to move research beyond incommensurability, where one set of philosophical assumptions,

particularly dictates a specific methodological approach, which eventually limits one's choice of data collection methods (Howe, 1988; Johnson & Onwuegbuzie, 2004).

Accordingly, the researcher was guided by the philosophy of pragmatism which most often seeks to bridge the gap between conflicting paradigms and cuts across the various paradigms (Johnson & Onwuegbuzie, 2004). Thus, a fluid application of the relationship between philosophical paradigms (assumptions about the social world and the nature of knowledge), methodology (the logic of inquiry), and methods (techniques of data collection) can address the growing and complex nature of the social world (Sharp et al, 2012). Against this backdrop, the current study draws on quantitative and qualitative paradigms by using the multi methods to seek answers to the extent to which digital preservation has been deployed within an e-government environment.

4.2.1 Qualitative, quantitative, mixed method and multi methods debate

As has been pointed out in the preceding section**,** research in the social and behavioural sciences have always been premised on the two major traditions of research: qualitative and quantitative research (Teddlie & Tashakkori, 2003). Over the years they have been used to form the basis of philosophical assumptions and research methodologists have maintained that qualitative and quantitative methods have something to offer (Creswell, 2003; Payne & Payne, 2004) despite their contrasting strengths and weaknesses. Generally, quantitative research ‘’supported by the positivist or scientific paradigm, leads us to regard the world as made up of observable, measurable facts’’ (Glesne & Peshkin, 1992:6).

By far, quantitative studies thrives on statistical and mathematical technique and that includes descriptive studies, exploratory and explanatory studies, operation research studies, citation analysis, bibliometrics, experiments and quasi-experiments (Ngulube, 2005). The argument goes that quantitative research is weak in understanding the context or setting in which people talk and researchers use their personal biases and interpretations. One other major limitation of the

quantitative approach is that measurement typically detaches information from its original ecological "real-world" context (Moghaddam, Walker & Harre, 2003). In all, Golafshani (2003) sums up quantitative research as a paradigm where:

- emphasis is placed on facts and the causes of behavior measured by predetermined instrument;
- reliability and validity are measured with essential tools;
- information in the form of numbers can be quantified and summarized;
- mathematical process is the norm for analyzing the numeric data; and
- final result is expressed in statistical terminologies.

In contrast, qualitative data consists of open-ended information that a researcher gathers through interviews. The analysis of a qualitative study includes aggregating the words or images into categories of information and presenting the diversity of ideas gathered during data collection (O'Cathain, 2010). Thus, qualitative research paradigm can be summarized as follows:

- understanding a phenomenon in a naturalistic or context-specific environment (Golafshani, 2003; Hoepfl, 1997);
- reliability and validity are conceptualized as "trustworthiness, rigour" and quality through triangulation (Golafshani, 2003:604);
- increased involvement of researchers in the research process rather than disassociation; and
- analysis of results enjoys the compatibility of research methods such as interviews and observations with the reward of using both numbers and words (Glesne & Peshkin, 1992:8).

The weaknesses in these approaches and the limitations of the sole use of quantitative or qualitative methods necessitated the use of an alternative method called the mixed method (Creswell, 2003). Other names assigned to this new and growing research method are multi-

strategy (Bryman, 2004), multi-methods (Brannen, 1992), mixed methodology (Tashakkori & Teddlie, 1998). It is a new research paradigm and has received significant attention among scholars even though anthropologists and sociologists argue that its usage dates back from the 1950's (Ngulube, 2010). The paradigm essentially employs the combination of qualitative and quantitative approaches, data collection, analysis and inference techniques in a single study and provides a viable alternative to the quantitative or qualitative paradigm (Johnson, Onwuegbuzie & Turner, 2007; Teddlie, 2003; Creswell, 2007).

The intellectual roots of the paradigm can be traced to the early work of Campbell and Fiske (1959) on mixing methods (Creswell, 2003; Creswell & Plano Clark, 2007; Creswell, Jensen & Shapley, 2003; Collins, Onwuegbuzie & Sutton, 2006; Greene, Caracelli & Graham, 1989; Johnson, Onwuegbuzie & Turner, 2007). Significant contribution to this third methodological movement has been made by many scholars in many disciplines with quantitative, qualitative and mixed methods research all thriving and coexisting (Johnson, Onwuegbuzie & Turner, 2007; Leech & Onwuegbuzie, 2007; Ngulube, 2010). The mixed method research has evolved to the point where it is very often articulated and recognized as the third major research approach or research paradigm (Johnson, Onwuegbuzie & Turner, 2007).

However, there are a number of variations, inconsistencies and controversies within the mixed methods approach that ought not to be ignored. It is also equally instructive to note that the convergence of the qualitative and quantitative approaches have been a subject of debate. While some scholars argued that the integration of both approaches should depend on the research problem, others argue that the conventional divide between qualitative and qualitative method is based on a highly questionable premise. Creswell and Plano Clark (2007) pointed out that conducting mixed methods research is not easy as it requires more work, more resources and is time consuming. Niglas (2004) could not have agreed more with Creswell and Plano Clark (2007) when he noted that the implementation of mixed methods is also time consuming. In addition, mixed methods research requires that researchers develop a broader set of skills that span both the quantitative and the qualitative (Creswell, Jensen & Shapley, 2003; & Teddlie,

2003). Bryman (1988) bemoans the relatively few guidelines about how, when and why different research methods might be combined. Maxwell, (1990) on the other hand, explains how the theoretical debate has blurred the different ways in which researchers are actually combining methods (Maxwell, 1990). Teddlie and Tashakkori (2003) outlined six unsolved issues and controversies in the use of mixed method in social and behavioural science, namely, (a) the nomenclature and basic definitions used in mixed methods research, (b) the utility of mixed methods research, (c) the paradigmatic underpinning for mixed methods research, (d) design issues in mixed methods research, (e) issues in making inferences in mixed methods research, and (f) the logistics of conducting mixed methods research.

In spite of the limitations, Johnson and Onwuegbuzie (2004) have advocated for the use of the mixed method as a legitimate design in educational research. Scholars in several fields such as sociology, education, information science, and health sciences have called for the integration of quantitative and qualitative research methods emphasizing the value, yield, and advantages of mixed methods research (Cook & Reichardt, 1979; Creswell & Plano Clark, 2007; Greene, Caracelli, & Graham, 1989; O'Cathain, 2009; O'Cathain, Murphy & Nicholl, 2007; Patton, 1990; Tashakkori and Teddlie, 2003). Further, the mixed method research is gaining currency as authors like Creswell (2003), Fidel (2008), Ngulube (2010), Ngulube, Mukwatlo and Ndwendwe (2009), Teddlie and Tashakori (2003) have all championed the use of the paradigm in order to enrich research processes.

Calls from Ngulube, Mukwatlo and Ndwendwe (2009) tend to suggest that library and information professionals should embrace the mixed method approach. Again, Ngulube (2010) in his study on the extent of the use of mixed method in sub-Saharan Africa noted that there is a dearth of publications on the use of the mixed method by library and information science scholars and recommended that researchers with a qualitative orientation team up with quantitative specialists to research the same phenomenon in order to enhance the richness of data obtained. Others like Shulha and Wilson (2003) have all canvassed for further development and training on the teaching and use of mixed method research. Creswell (2003) however advised

that a research methodology should take cognizance of the "research problem, the personal experiences of the researcher, and the audiences".

Clearly, there are still ongoing divergent opinions on the choice of the best research methodology but a concrete definition by Ngulube (2010: 254) on mixed methods sums it all:

> MR involves collecting, analyzing, integrating and interpreting qualitative and quantitative data concurrently or sequentially in a single study or in a series of studies investigating the same problem, irrespective of whichever research methodology is dominant, in order to exploit the benefits of combining them and to enhance the validity of findings.

The inconsistencies within the mixed method approach lend itself to what Patton (1990:98) described as the paradigm of choices. According to Patton (1990:98), ''paradigm of choices rejects methodological orthodoxy in favour of methodological appropriateness as the primary criterion for judging methodological quality''. In other words, the paradigm of choices recognises that different methods are appropriate for different situations and research questions. Thus, there is no best research methodology to undertake any empirical study. Rather, researchers adapt appropriate methodologies depending on the type of study.

The debate about mixed method research is further clouded by the thin line between mixed method research and multi methods design, precisely because some scholars have misconstrued the use of qualitative (open ended questions) and quantitative (closed ended questions) in a single study to either mean the use of multiple kinds of data or mixed method research (Ngulube, 2012). Such supposition, according to Ngulube (2012) is occasioned by the use of different data sources to build an accurate picture of a phenomenon. This assumption is not far fetched as scholars such as Priola (2010) and Chatterjee (2011) have often referred to multi method research as mixed method research, a situation Romm and Ngulube (2015:158) described as ''inappropriately used interchangeably''. Clarity on these two terms was, however, brought to

bear when Romm and Ngulube (2015) noted that multi methods as conceptualized by Campbell and Fiske (1959) uses two or more research methods to address a single phenomenon, whiles mixed method research employs the use of two methodologies or two paradigms in a single study. The emphasis here is on ‘’research methods and research methodologies’’. Thus, whereas mixed method research embraces all the research processes such as the techniques, methods and the philosophical assumptions, multi methods research places more emphasis on mixing the various methods (different data sources).

This study adopted the multi methods design with the proviso that multi methods have the propensity to increase the reliability and validity of the current study (Onwuegbuzie & Johnson, 2006) and further demonstrate convergence, or similarity of results from different data sources, thereby allowing the researcher to be confident of his findings (Denzin, 1978; Jick, 1979; Miles & Huberman, 1984).

4.3 RESEARCH DESIGN

The research design prescribes the strategy, structure and principles in achieving the objectives of the study. Alternatively, it evinces the procedures for data collection, analysis and the interpretation of the data (Creswell & Plano Clark, 2007). That is why Creswell (2008) remarked that the progress of an academic field is very much dependent on both the research methods and the data analytical tools adopted by the researcher. This study is largely confirmatory and descriptive. Confirmatory because it was guided by a quantitative paradigm and confirmed by a qualitative inquiry. In other words, whilst the quantitative paradigm becomes the emphasis or priority for the study, the qualitative data set played a confirmatory role.

In order to appreciate the multi methods design for the study, a visual model was captured. The model shows the priority of the methods and the mixing points of the different methods used. This helped the researcher to appreciate where, how, and when to make adjustments. Morse (1991), Creswell et al. (2003) and Creswell (2005) have entreated researchers to present a visual

model showing the research process. The visual model in figure 4.1 is a prototype of what Morse (1991), Creswell et al. (2003) and Creswell (2005) campaigned for.

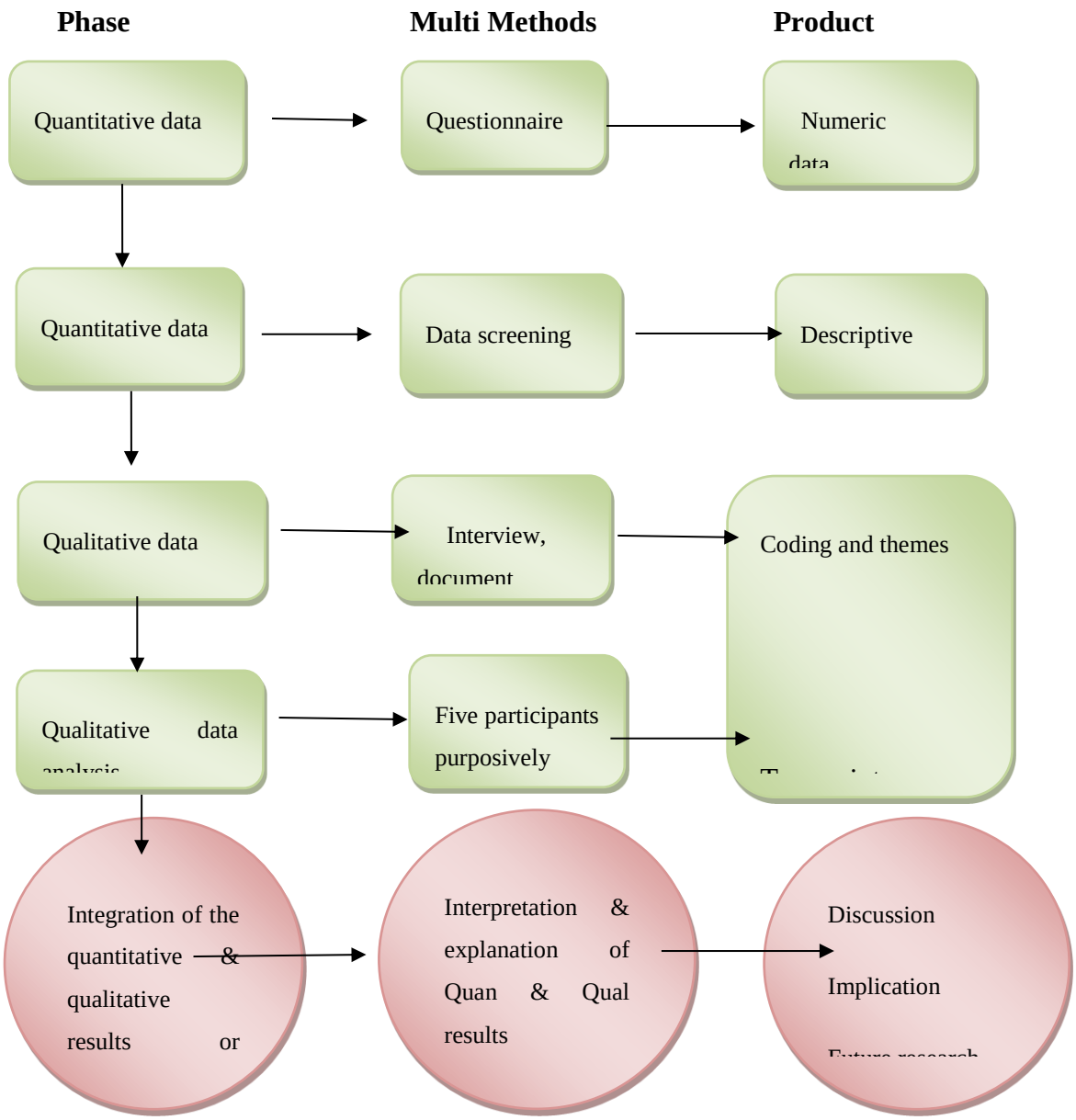

Figure 4 - 1:Multi-Methods Design (conceptualized by the researcher from Creswell et al. (2003), Creswell (2005) and Morse (1991).

4.3.1 Multi method design

The above model in figure 4.1 demonstrates how the study adopted the multi method design. Such an approach brought into the fore three schemes: (a) the priority apportioned to the quantitative and qualitative data (b) the sequence with which the data was collected (c) the stage or phase in which the quantitative and qualitative data were integrated (Morgan, 2008; Creswell et al. 2003). Thus, quantitative data was collected and analysed before qualitative data was collected. In other words, the questionnaire was first collected and analysed (numeric) followed by the interview, document analysis and observation methods. Thus, the collection and analysis of quantitative and qualitative data were undertaken in two consecutive phases in this study. The purpose was to contextualise the statistical data (Byrne & Humble, 2006) and to confirm the results obtained from the quantitative data by refining and explaining the statistical results in detail (Creswell, 2007).

Considering the objectives of the study and the representation of the quantitative data in this multi method approach, the quantitative data (questionnaire) was accorded priority (Ivankova, Creswell & Stick, 2006). This decision was influenced by the purpose of the study to examine the extent to which digital preservation has been explored across the public sector organisations in Ghana. As has been noted, integrating data in a multi method designs usually takes two forms: either the results of the quantitative and qualitative phases are integrated during the discussion of the outcome of the entire study or the quantitative and qualitative phase are integrated during the selection of participants for the second phase of the qualitative data (Ivankova, Creswell & Stick, 2006). In this study, the former was chosen, precisely so because the researcher wanted to fully answer the research questions in order to develop a meaningful picture of the research problem. Such an approach according to Teddlie and Tashakkori (2003) underscores the elaborate nature of the multi method design.

4.3.2 Triangulation

The concept of triangulation equally strikes a cord with multi methods research as it combines two or more methodological approaches, theoretical perspectives, data sources, investigators and

methods to study the same phenomenon (Evers & AnneLoes, 2010; Jick, 1979). By so doing, it increases the accuracy and deepens the understanding of the study phenomenon (Denzin, 1978; Golafshani, 2003); reveals convergence and dissonance in the findings of research (Erzerberger & Prein, 1997) and by far offers a validity procedure where researchers look for multiple and different sources of information (Creswell & Miller, 2000). There are five types of triangulation identified by Denzin, (1978), Kimchi, Polivka and Stevenson (1991), and Evers and AnneLoes, (2010) that are used in multi methods design. They include: (theoretical, data source, multiple, investigator, and analysis). Accordingly:

- data triangulation: is the use of multiple data sources within the same study for validation purposes. These types of data triangulation emanate from the notion that the robustness of data can vary based on the time data were collected;
- theoretical triangulation: is the use of multiple theories or hypothesis to investigate a phenomenon. The purpose is to support or refute findings (Thurmond, 2001). The process of theoretical triangulation could involve the same data set or different data sets;
- investigator triangulation: It involves the use of multiple observers, interviewers, or data analysts in the same study for confirmation purposes (Thurmond, 2001); and
- analysis triangulation: is described as the use of more than two methods of analyzing the same set of data for validation purposes (Kimchi, Polivka & Stevenson, 1991).

Although triangulation has received a lot of attention in the social sciences, it is somehow confusing due to the two levels of triangulation in the research process viz: between- and within-method type of methodological triangulation. The between method involves the combination of qualitative and quantitative methods in studying a single phenomenon. The focus here is to achieve convergent validity and to test the degree of external validity. On the other hand, within method involves crosschecking for the internal consistency (Denzin, 1978). Thus, within method submit to the use of multiple complementary methods within a given single paradigm in data collection and analysis. Suffice to say that the current study adopted the within method type of

triangulation for purposes of internal consistency. As suggested by Begley (1996), Dootson (1995), Redfern and Norman (1994) triangulation:

- enhances confidence in research results;
- permits the validation of instruments and methods (confirmatory purposes);
- provides a better understanding of the phenomenon under investigation (completeness); and
- subdues the naturalistic biases of divergent results.

In this current study, triangulation was accomplished by combining quantitative questionnaire with individual qualitative in-depth interview. Quantitative and qualitative data were triangulated with the questionnaire preceding the interview, observation and review of documents. As was indicated in the preceding section, the questionnaire method was selected as the first method of data collection because it was expected that it would produce varying amount of information and raise notable issues during the ensuing interview. Although the interview focused on a much narrower subject, it provided an opportunity to explore and confirm in greater depth issues and concerns that could not be addressed in the questionnaire.

4.3.3 Justification for a multi method approach

Against the backdrop that it was impossible for one research method to provide a holistic view of complex phenomena (Cowman, 1993; Denzin, 1989; Sandelowski, 2000), the multi method approach was adopted. The choice of multi method design in this study was premised on the assumption that the complementary strength of different approaches or methods has the potential to wipe away the weaknesses of each, eventually yielding more valid inferences than any one method (Levy, 2007). In other words, the flaws of one method are very much the strength of the other. The objective here is to seek answers to the same questions from two or more methods (Chatterjee, 2011). As a general strategy, multi methods considers different approaches as complementary, by advancing the variety of data collection in order to establish convergence and validation. Thus, the study deployed the multi method approach in data collection, data analysis and the interpretation of findings by drawing on the strength of each method. One striking

feature of these justifications is that multi methods is considered useful in shedding light on the phenomenon under investigation from different viewpoints (Coyle & Williams, 2000; Fielding & Fielding, 1986), a situation that would have been impossible if single method was adopted.

4.3.4 Survey

There is consensus that survey research method is the most common and relatively well understood research methods in view of its simplicity and validity (Pinsonneault & Kraemer, 1993). Although some researchers believe that survey research is wholly quantitative and developed within the positivist paradigm, this opinion is not universally shared as data gathered from any survey method may be entirely quantitative or largely qualitative, or may be a mixture. For example, open-ended questions on a questionnaire or asked in an interview will produce text that may be analyzed qualitatively. Alternatively, it is possible to include open-ended questions in a questionnaire, which can yield data of a more qualitative nature.

An overwhelming number of studies in the highest echelons of information science journal (Akussah, 2002; Chinyemba & Ngulube, 2005; Kalusopa, 2011; Luyombya, 2010) have addressed various dimensions of records management and preservation of records by using the survey research design. Similarly, preponderance of evidence shows that surveys have been used in the field of library and information management (LIS) research in the world (Ngulube, 2005; Kemoni, 2007; Tanner, 2000). For instance, Ngulube (2005) underscored that, out of 82 theses that were submitted and approved by the University of Natal during the period 1982 to 2002, the survey method accounted for 56 (69.14%) of the methods used. Clearly, these studies demonstrated that the survey research design has the ability to provide current conditions existing within a particular country's records management system.

Useful as survey research are, they are not without limitations. Scholars point out that the limitations of survey research are centred on:

- researcher's difficulty to decipher respondents perspective (in-depth information) as compared to in-depth interviews or focus groups;
- cost involved in undertaking survey;

- statistical knowledge in sampling and other specialized skills to process and interpret results;
- failure to establish the casual relationship between variables (Ngulube, 2005) and
- problems of self-reporting which increases bias, effects of sampling techniques and non-response rates (Ngulube, 2005:201; Tanner, 2000:84).

In spite of these weaknesses, survey research has the propensity to compare, contrast and interpret findings. The researcher in addressing some of these weakenesses in survey reserach kept himself updated of the stastical issues in sampling and used his funding busary to advance the study. As discussed in the previous section, the choice of a research design is largely determined by the nature of the study. In this current study, the spotlight was on:

- current levels of awareness of digital preservation within public sector organisations;
- the impact of digital preservation in the planning and delivery of e-government;
- threats and challenges to digital preservation;
- digital preservation strategies for public sector organisations and
- role stakeholders ought to play in the preservation of digital records.

The overall purpose was to examine the extent of digital preservation in an e-government environment. Accordingly, the survey research strategy was deemed appropriate as it enabled the researcher to explore the extent to which digital preservation has been used across the government ministries and agencies in Ghana. In confirming the appropriateness of the survey method for the current study, Owens (2002) and Glasgow (2005) opined that surveys are concerned with collecting data directly from people about occurrences, incidences of events, instances in varying circumstances and situations. De Vaus (2001) noted that surveys are descriptive in nature, for they seek to make meaning out of the situation being studied from a descriptive point of view.

4.3.5 Population

A fundamental component to any survey research is the concept of population which embraces an entire collection of entities for inferences to be drawn from (Babbie, 2004; Collis & Hussey, 2003; Litt, 2010; Powell, 1997). However, these possible cases or entities under consideration must fit a certain criteria the researcher has laid out or is interested in studying (Kothari, 2004; Saumure & Lisa, 2008). Thus, guided by the research questions and existing literature, the researcher may be interested in the individuals who are members of groups, organisations, institutions and objects. In this current study, the population of the study was drawn from government ministries and public agencies operating under the aegis of the ministries in Ghana. The government ministries and the public agencies were the focus of the study because they are the implementing agencies for the government of Ghana e-government strategy and the drivers of the ICT policies of government. Additionally, the deployment of ICT across these government agencies in the last few years has occasioned a phenomenal growth in digital records, hence the choice of these government institutions.

4.3.6 Sampling frame

Sampling, as an important research process begins with the process of selecting a segment or a portion of a whole (The American Heritage College Dictionary, 1993 in Onwuegbuzie & Collins, 2007). Similarly, the quality of a sample depends on the quality of the sampling frame, particularly because the frame addresses the units within the population in terms of coverage, its completeness and accuracy (Hall, 2008) and by extension delineates the members of a population. It is for this reason that many researchers rely on a sampling frame to represent all of the elements of the population of interest (Morgan, 2008). The sampling frame for the current study was narrowed to the government ministries and the public agencies.

As at the time of conducting this study, there were 24 government ministries and 132 agencies on the official website of the government of Ghana: www.ghana.gov.gh. These 132 agencies operate under the aegis or mandate of the 24 ministries with their directors, ICT heads; and

records managers. Accordingly, the study took into account, directors, records managers and heads of ICT at the government ministries and agencies in view of the following:

- sensitive nature of the study;
- large part of the questionnaires requires decision makers to respond to;
- these respondents are coordinators within the ministry and act as the chief advisors to the minister on governance issues; and
- heads of IT and records managers in charge of all repositories in the ministry.

Their knowledge and experience in the field were therefore very much critical to the current study. It is worthy to note that whilst the study focuses on these categories of respondents, it is not every ministry or agency that had a records manager or head of IT or both. In all, the study identified 27 record managers and ICT heads across the 24 ministries and additional 155 records managers and ICT heads in the public agencies (see Appendix 4 and 5). On this score, the head of ICT and records managers in each ministry and public agencies constituted the targeted population for the current study. A complete survey or the whole population of record managers and ICT heads received a questionnaire and participated in other data collection methods such as observation. A different strategy was adopted for the directors who were interviewed. Considering the different roles, functions and mandate of the government ministries and public agencies, the researcher adopted multiple purposive sampling approach in addressing the population under these different levels of institutions. The following section explains the trajectory of this approach.

4.3.7 Sampling procedures

The study used multiple purposive sampling techniques in view of the different sampling strategies it serves. For instance, Poorman (2002) adopted the multiple purposive sampling to address the abuse and oppression of women in his study. Several other authors such as (Kuzel, 1992; LeCompte & Preissle, 1993; Miles & Huberman, 1994; Patton, 2002) have used typologies of purposive sampling techniques in myriads of research. As the name suggests, the multiple purposive sampling technique uses two or more sampling strategies to select units, individuals, groups of individuals and institutions to address specific purposes and research questions

(Teddlie & Yu, 2007). Such a technique, according to Patton (2002), helps to generate greater depth of information. In applying this concept, a purposive sampling technique called the ‘’complete collection’’ (Teddlie & Yu, 2007:93) was used for all the records managers and ICT heads in the government ministries and agencies. This strategy allowed the population of record managers and ICT heads to be studied. In other words, the ‘’complete collection’’ ensured that every head of ICT and record manager in each single ministry and agency was covered in the study. The choice of this technique was premised on the fact that the questionnaire largely sought responses from decision makers. Thus, the heads of ICT and record managers were chosen as they are in charge of all repositories in the ministry

Beyond these reasons, the study anticipated that some of the ministries and agencies could shy away from the study because of security and privacy reasons. Therefore, with a narrowed coverage of government ministries and agencies, every record manager and ICT head received a questionnaire. Having established that the complete collection or the complete survey was to be undertaken for the study, no sampling size for the study was considered.

4.3.8 Sampling for directors

The study further used a purposive sampling strategy to select government ministries and public agencies for the interview protocol. These ministries and agencies were selected on a number of factors such as:

- the strategic role they play in the implementation of e-government (NITA);
- the phenomenal growth of their digital records on a daily basis; (Birth and Death and Ministry of Finance);
- the sole recipients of both paper and digital records for the country (PRAAD) and
- the policy initiator of ICT programme for the country (Ministry of Communication).

Directors of these selected agencies and ministries were presumed to be key informants in view of the strategic nature of their operations and the depth of their knowledge which was very much

germane to the current study. Five directors were interviewed in areas such as strategic document and policies in support of digital preservation, digital preservation strategies and security of records.

Many scholars hold the view that non probability sampling cannot generalize findings beyond the studied sample with some degree of confidence (Kidder & Judd, 1986; Zikmund, 1986). However, Lennon, Burns and Rowold (1995) and Onwuegbuzie and Leech (2005) hold a contrary view. For instance, Lennon, Burns and Rowold (1995) suggest that the application of a multi method research to the use of a non-probability sample could produce some fair amount of confidence and generalizability, whilst Onwuegbuzie and Leech (2005) in confirming such supposition, echoes that purposive sampling belongs to the school of quantitative studies and therefore can be used to generalize findings. This view is a far cry of Kidder and Judd (1986) and Zikmund (1986) findings and therefore purposive sampling cannot be said to lack the ability to generalise findings.

4.4 DATA COLLECTION METHODS

Data collection methods refer to the various procedures, techniques and instruments used for the current study. In this study, variety of research methods were deployed and that includes questionnaires, observation schedules and interview. Also, in its application of the multi methods design, the study used different type of instruments to complement the strength and weaknesses of each method. Thus, one technique complement the gaps of the other as the disadvantages of one instrument are the advantages of the other. Details of the four techniques employed, viz: questionnaire, interviews, document review and observation are discussed in the next section.

4.4.1 Questionnaire

Touted as one of the commonly used approaches in collecting data in a survey research, questionnaire has gained a unique spot and place in social science research. While some researchers reserve the term exclusively for self-administered questionnaire, postal questionnaire

or mail questionnaire under the general rubric of questionnaire (McClean, 2006), others describe it as self-completion questionnaire (Bryman & Bell, 2011). However, in this current study, the term questionnaire refers to carefully designed questions given to a group of people to collect data about a particular topic (Trobia, 2008; McClean, 2006). Several scholars in the field of library and information science discipline have used questionnaires to undertake research work, many of which this current study has cited. For instance, Kemoni (2007), Kalusopa, (2011) and Ngulube (2003) used questionnaire in their studies. These scholars may have used questionnaire probably because it eliminates interview biases; it allows respondent to remain anonymous; allow people to express their opinions by merely marking one or more items in a list of options and offers respondents the opportunity to provide uniform responses as each person responds to exactly the same question (Colin, 2010; Fabrigar & Anna, 2007).

Useful as questionnaire is, it is not without limitations. They argued that questionnaire offers little flexibility to respondents and compromise the willingness of respondents who have limited reading and writing abilities to thoroughly complete responses. In many instances, written responses to open-ended questions are viewed as a form of qualitative data even though their validity can be questionable (Colins, 2010). A significant disadvantage of a questionnaire is that the researcher is not present to supervise the completion of the questionnaire. Respondents in this instance can easily avoid filling out the form and return the questionnaire to the researcher. Thus, the smaller the percentage of questionnaires returned, the less confidence and less representative the research.

4.4.1.1 Structure of questionnaire

The structured nature of a questionnaire depends on whether or not it will elicit qualitative or quantitative responses from respondents (Colin, 2010). In other words, the more structured the questions and the more restricted the answers, the more quantitative the responses will be. Conversely, the more open-ended the questions are, the more qualitative the responses. In this study, two broad types of questions were used: open-ended and closed ended questions (Trobia, 2008). The open-ended questions offered respondents the opportunity to express their thoughts freely in their own words. On the other hand, the closed-ended questions restricted respondents

to a set of proposed alternatives in which they were required to select one or more options depending on how the question was posed (Mavodza, 2010). These approaches were adopted because closed-ended questions can be answered quickly, easier to code and analyse, whiles open-ended questions allowed respondents to use their own language to express their own views.

Against this background, the questionnaire was structured to address the research objective as stated in Chapter One, Section 1.4.1. Thus, the questionnaire sought answers for the following objectives:

- how digital records are generated and maintained in public sector organisations;
- the current level of awareness of digital preservation;
- the impact of digital preservation in the planning and delivery of e-government; and
- threats and challenges of managing digital records in an e-government environment.

The questionnaire further attempted to answer the following research questions:

- how are digital records generated and maintained in the government ministries;
- what are the current levels of awareness of digital preservation in the government ministries;
- **w**hat is the impact of digital preservation in the planning and delivery of e-government in Ghana and
- **w**hat are the key threats and challenges of managing digital records in an e-government environment?

4.4.1.2 Length and layout of questionnaire

Length of questionnaire is an important issue for both cost reasons and effects on respondent behaviour. In this study, the questionnaire was divided into 11 sections (see Appendix 3), with each section addressing an aspect of the objectives of the study as stated in Chapter One. In this respect, the issues under the background information included the position held and number of years in that position, name of the ministry or agency, website and phone number. The section on how digital records are generated in the ministries and agencies runs from numbers 1-10 covering the application of ICT and creation of digital records; categories of digital information

generated; procedures for transfer of records; the right to information bill and government legislations and policies. At the same time, the section on current levels of awareness of digital preservation had numbers 11 -21 and addressed issues on standards; format; level of awareness of preservation toolkits and international research projects; awareness of digital growth and types of digital records held in the ministries. The other sections of the questionnaire dealt with thematic areas such as the impact of digital preservation on e-government; challenges of digital preservation; training and staffing; funding; preservation strategies; best current practices and role of stakeholders.

The lengthy nature of the questionnaire pushed many of the respondents to register their displeasure about the questionnaire. However, the researcher concedes that the questionnaire covered and addressed the essential variables in the current study.

4.4.1.3 Pretesting the questionnaire

Pretesting is one of the procedures used to determine whether a questionnaire is valid, reliable and measures the variables it purports to measure (Czaja & Blair, 2005). Alternatively, pretesting marks a specific phase of a research study which precedes the empirical phase of information gathering. The pretesting of the questionnaire helped to eliminate inconsistencies, variations, ambiguity and presented straightforward and easy questions to respondents (Baker & Foy, 2008). This was done by administering a miniature version of the questionnaire on some respondents selected from those to be interviewed in the main study. Pretesting the questionnaire therefore goes to the heart of reliability and validity of the data to be collected, which eventually ensures consistency, dependability and replicability of the data.

The questionnaire was pretested in two public agencies and the University of Ghana. The purpose was to eliminate questions that smacks of ambiguity and vagueness. The feedback from the pretesting helped to determine the breadth and depth of revision needed to be made on the questionnaire, the length of the questionnaire and wording of the questions. Pretesting is thus indispensable if a questionnaire is to pass the test of reliability and validity.

4.4.1.4 Administering the questionnaire

Under the tutelage of a senior researcher, four research assistants from the University of Ghana were recruited to administer the questionnaire by hand to the 182 respondents identified in the government institutions. The adoption of the Total Design Method, which thrives on continuous follow-up, cover letters, pretested instruments and several reminders to respondents yielded some level of positive results as questionnaires were completed and returned within the scheduled time. (Ngulube, 2003: 218 in Kalusopa, 2011). Distribution of the questionnaire commenced on the 27 September, 2014 and by 10 January, 2015, respondents willing to complete the questionnaire had done so and returned them. The long delay in the collection of the questionnaire can be attributed to the extension of the coverage of the study. The initial arrangement for the sample size was 48 government institutions. However the coverage of the study had to be extended to 156 government institutions in order to rope in every single records manager and ICT head.

4.4. 2 Interview

Interviews represent a meeting or dialogue, where a researcher orally asks questions for individuals to answer (Davies, 2006)**.** Amongst the several research instruments in qualitative data collection, interviews are regarded as one of the widely used and powerful method in which researchers try to understand their respondents, probably because content analysis and observation alone do not allow researchers to explore the thoughts, experiences, and feelings of people who have direct experiences with the issue under study (Patton, 1990). In interviews, the researcher assumes that the perspectives of people who have personal experiences with the issue under investigation are a vital source of information. Accordingly, interviews are suitable and very much appropriate to studies that depend on individual views, beliefs and feelings about a subject. Further, interviews simplify complicated questions, allows follow up questions, eliminates ambiguous questions and reduce the chance of participant wanting to lie in their

response (Davies, 2006). However, conducting interviews can be expensive, particularly if the research design requires hiring interviewers, training, and paying for their time and travel.

4.4.2.1 Administering the interviews

In this current study, follow up interviews with a purposive sampling strategy were undertaken with selected directors at the ministries and agencies to gain more insight and validation on issues regarding data preservation, government support for digital preservation and ongoing digital preservation projects at the ministry. This was also supplemented with an interview with personnel at the National Information Technology Agency to understand the impact of digital preservation on e-government and the extent to which data preservation is integrated into the implementation of e-government.

The major themes of the interviews (see Appendix 6) were centred on the following:

- effective data preservation and e-government;
- strategic document or policy in support for digital preservation;
- digital preservation strategies;
- security of records; and
- best practices and strategies.
-

4.4.3 Observation

Observation remains one of the foremost tools in scientific studies from the early stages of human development (Arumugam, Antony & Douglas, 2012). Indeed, development of astronomical theories and the theory of the universe have all progressively evolved through observations. The empiricist tradition suggests that knowledge garnered through experience and the senses must be subjected to the rigours of testing before it can be considered as knowledge (Bryman, 2001). As a data collection strategy, observation relies on first-hand and eyewitness experiences of places, activities and events. Different types of observation are found in social research such as structured and unstructured observation; participant and non-participant

observation. Structured observation involves the collection of data based on a set of predefined rules and procedures (Mc Kechnie, 2008), whiles unstructured is where the researcher enters the field with some vague ideas of what might be important. Again, in participant observation, the researcher assumes some role relevant to that social context where the researcher, observes and interacts with the subjects and gets close to participants to gain an intimate knowledge of the setting. On the other hand, non-participant observation assumes that the researcher record what he has seen and heard without taking part in any activities (Bell et al., 2004).

The use of observation in social science research is exemplified by its ability:

- to identify the origin of the research problem, its location and the people;
- to deploy greater precision on the various elements of the events and reveal what is actually happening as against what people say;
- to be useful to non-verbal communication events.

On the flipside, the epistemological assumptions about observation are subject to strong criticism as noted by Arumugam, Antony and Douglas (2012) such as:

- it is difficult to quantify observational data;
- good memory skills and observational power must be applied at the same time and
- attitude, beliefs and inner feelings about the process cannot be observed, particularly in transactional settings.

In this current study a structured participatory observation strategy (see Appendix 7) was adopted, particularly because participant observation is part of the repertoire of qualitative inquiry. Thus, quite a number of items and equipment used in generating, preserving, and accessing digital records for the purposes of e-government were observed. For instance, tools for accessing digital records, computers, digital cameras, web portals, CD players, pen drives and software for preservation were earmarked. In all, the observation technique generated data that were useful to the questionnaire and interview schedule.

4.4.4 Document review and analysis

Although documents review often serves as key sources of social scientific data, their recognition in social science research is rarely highlighted. In social science research, document review involves the procedures used in analyzing and interpreting data generated from documents and records (Schwant, 2007). These procedures rest heavily on public records (political and judicial reports, government documents, media accounts, television scripts, yearbooks, and minutes of meetings), private documents (medical histories, letters, diaries, school records, personal journals, and memoirs), interview transcripts and transcripts prepared from video records, and photographs (Scott, 2004) and documents created by the researcher from field notes and research journal (Oslon, 2010). In this regard, documents review afforded the researcher the opportunity to examine the digital preservation policies and their best practices and current digital preservation practices.

In the current study, documentary review begun with the researcher identifying and selecting documents on the basis of their usefulness and relevance to the study. Document review was meant to play a secondary and supportive role to the research objective. This move provided a better understanding and diverse wealth of information from wide variety of sources. Some of the documents reviewed in this study included:

- right to information law;
- impact of digital preservation in the planning and delivery of e-government;
- digital preservation policies;
- security risks to preservation; and
- digital preservation and e-government.

4.4.5 Reliability and validity

Reliability and validity, which used to be common concepts within the realm of quantitative research have equally in recent past gained some level of pre-eminence in qualitative research.

Reliability adheres to the notion that the results or outcome of a study can similarly be reproduced in a different study under the same methodology (Joppa, 2000). Thus, reliability is the degree to which the same instrument provides a similar score when used repeatedly. One of the common ways of demonstrating reliability is the use of Cronbach's Alpha. Cronbach's Alpha measures the internal reliability of a set of related items. The measure has a coefficient ranging from 1 to 0. A value of 0.7 or less generally indicates unsatisfactory internal reliability. On the other hand, validity assumes that research instrument must measure what it is intended for (Golafshani, 2003; Hernon & Schwartz, 2009). It is the measure, indicator or method of data collection deemed to be sound or true as far as it can be judged. Mathipa and Gumbo (2015) citing Robson (2001) noted that reliability and validity are inseparable and that it is hardly impossible to consider reliability without validity and vice versa – "unless a measure is reliable, it cannot be valid''.

In quantitative research, there are three dimensions of reliability viz: stability, equivalence, and homogeneity (Thyer, 2001). Thyer (2001) note that these dimensions are tested by test-retest, alternate forms, and split half to determine the reliability of a written instrument. According to Thyer (2001) test-retests is where the researcher determines how similar the results of repeated measures are. He argues that if the same individual's scores are obtained when an instrument is administered a second or subsequent time, then there is no reason to suspect any change on the variables being measured. In that case the researcher may believe that the instrument is reliable.

On the issue of alternate forms, Thyer (2001) noted that it is the situation where the researcher expects the results to be the same irrespective of the different questions or instruments used. The split-half or internal consistency is similar to the alternate forms approach in the sense that two sets of different questions that are functionally equivalent are presented at the same time to determine whether the response will be homogeneous across the halves of the instrument or across the two sets of questions.

Clearly, reliability and validity in quantitative research reveal two strands. That is, reliability thrives on replicability whilst validity thrives on accuracy and measures what is intended to be measured. However, the concepts of reliability and validity are viewed differently by qualitative researchers who strongly consider these concepts defined in quantitative terms as inadequate. Thus, these terms as defined in quantitative terms may not necessarily apply to the qualitative research paradigm (Golafshani, 2003). Again, the question of replicability in the results does not concern them (Glesne & Peshkin, 1992), but rather precision (Winter, 2000), credibility, and transferability (Hoepf, 1997) provide the benchmarks of evaluating the findings of a qualitative research. In this context, the two research approaches or perspectives are essentially different paradigms. Lincoln and Guba (1985) in concurring with Winter (2000) and Hoepf (1997) enumerated four major criteria to meet the test of rigour in qualitative study via: truth value, applicability, consistency and neutrality, prompting questions such as:

- how can one establish confidence in the truth of the findings of a particular inquiry from respondents (truth value)?
- how can one determine the extent to which the findings of a particular inquiry have applicability in other contexts (applicability)?
- how can one determine whether the findings of an inquiry can be repeated if they are replicated with the same subjects (consistency)?
- to what degree can the findings of an inquiry be said to be devoid of biases, motivations interests or perspectives of the inquirer (neutrality)?

These legitimate questions go to the heart of ascertaining the reliability of an inquiry.

Similarly, Hernon and Schwartz (2009), Golafshani (2003), Lincoln and Guba (1985) noted that the main thrust of qualitative research under reliability and validity are credibility, transferability, dependability, and conformity. These criteria offered by Hernon and Schwartz (2009), Golafshani (2003) and Lincoln and Guba, (1985) envelope the issue of validity and reliability from a qualitative perspective. Other scholars in endorsing the concept of dependability with the

concept of consistency or reliability in qualitative research noted that the consistency of data can be achieved when the steps of the research are verified through examination of items such as raw data, data reduction products, and process notes (Campbell, 1996; Clont, 1992 & Seale, 1999). Seale (1999), while establishing good quality studies through reliability and validity in qualitative research, stated that the "trustworthiness of a research report lies at the heart of issues conventionally discussed as validity and reliability".

Varying opinions about triangulation as a better option to the use of validity and reliability in social science research have been mentioned in many circles, albeit Blaikie (1991) argues that it is inappropriate to view triangulation as a validation strategy because empirical procedures are themselves underpinned by different ontological and epistemological assumptions. Further, different data sources combined with different methodologies yield a product that could extend the breadth and depth of understanding (Denzin & Lincoln, 2000; Fielding & Fielding, 1986).With this view, triangulation is an alternative to validation but not a validation strategy.

In this current study, a key strategy that ensured reliability and validity was the voluntary invitation sent to lecturers in information science and experts in methodologist to review and offer their input on the first draft of the questionnaire. The feedback and carping remarks from these experts offered the researcher the opportunity to fine tune the questionnaire for further pre-testing. Thus, the questionnaire was pretested on a sample of respondents made up of ICT officers and records managers at the University of Ghana. These officers were chosen because their background and work schedules are fashioned out just like the ICT officers and records managers at the ministries and public agencies. On the other hand, qualitative data was collected through interviews from directors and other IT officers of the government ministries, National Information Technology Agency and the Public Records and Archives Administration Department. These interviews lasted for one hour and sought for answers that needed further clarification on preservation strategies and challenges that were hitherto not clear in the quantitative data. Further, document review and observation were used to enhance the consistency, dependability, confidence and trustworthiness of the study. The combination of these multiple methods increased the reliability and validity of the research (Onwuegbuzie &

Johnson, 2006). The validity of the responses was verified in several ways by the adoption of the multiple methods. For instance, part of the questions in the questionnaire, interview and observation were the same, cross checked and triangulated to support the findings.

4.5 PROCESSING AND ANALYSIS OF DATA

Data analysis is perhaps one of the integral parts of multi method research as it constitutes a significant progress to the findings and generalization of a study. It unravels the meaning and understanding from various data sets that may be collected during a study. Because the initial versions of datasets usually contain some errors during the entry phase (Babbie, 2001), the data collected in this study was audited, cleaned and corrected. This move ensured the integrity of the data and helped the researcher to be acquainted with the data (Rowley, 2014). Creswell (2007) underscored how quantitative and qualitative data analysis use similar steps to achieve their goals despite their differences in procedures. Quantitative data analysis thrives on statistical and mathematical technique and that includes descriptive studies, exploratory and explanatory studies, operation research studies, citation analysis, bibliometrics, experiments and quasi-experiments (Ngulube, 2005). These traits of quantitative analysis makes it suitable to descriptive, explanatory and evaluative research (Chireshe, 2015) and further useful to the field of information science. The purpose is to contextualise the statistical data (Byrne & Humble, 2006) and to elaborate on the results obtained from the quantitative data by refining and explaining the statistical results in detail (Creswell, 2007;Teddlie, 1998).

As one of the critical steps in the qualitative research process (Leech & Onwuegbuzie, 2007) a substantial body of literature exists to inform researchers about contemporary interview practice (Lee, 2008 & Platt, 2012). Accordingly, in analyzing qualitative data, the researchers must strive to align the theoretical assumptions of the study with the interview data generated and figure out the theoretical assumptions upon which a research project is based on (Roulston, 2014). However, that feat can only be achieved if the data is transformed, coded, mapped and patterns identified (Patton, 2002). Creswell (2007) could not have agreed more with Patton (2002) when

he similarly noted that qualitative data analysis are usually based on three strategies such as preparing and organising the data, coding, and presenting the data in the form of text, tables or figures. Comparative methods, discourse analysis, content analysis and narrative analysis are some of the traits of qualitative analysis. O'Cathain, (2010) underscores how qualitative analysis aggregates the words or images into categories of information and present the ideas gathered during data collection. In a similar fashion, Miles, Huberman and Saldana (2013) caution researchers analyzing qualitative data to employ the strategy of reducing the data, reorganizing the data and representing the data. In spite of the heavy reliance on interviews as a major source of qualitative data (Perakyla & Ruusuvuori, 2011), this study, went every length to use interviews, observation and document analysis as the major sources of qualitative data.

In this study, quantitative data (questionnaire) was analysed statistically using Statistical Package for the Social Sciences (SPSS) to measure and summarise the variables in the study. The purpose is to contexualise the statistical data and elaborates on the results obtained from the statistical data. This allowed a fair representation and interpretation of the study to be made. It was followed by a qualitative analysis where the broad and key themes of the data were identified, evaluated, coded, mapped and entered into one of the popular computer based analysis software for social and management researchers, Nvivo, previously known as NUD*IST. Even though this software has almost the same interface like SPSS, they were used separately. The quantitative data was collected and analysed to produce a set of descriptive results whilst the qualitative data was collected and analysed for another set of thematic results. The results of the qualitative data were used to converge, complement and support the results from the quantitative data.

4.6 EVALUATION OF METHODOLOGY

Ngulube (2005) averred how every research methodology should be evaluated in order to bring to the fore the limitations and strengths of the research design. Accordingly, the study took cognizance of the sampling methods, data collections, the challenges and the successes it

chalked. This study examined digital preservation in an e-government environment in 156 government institutions in Ghana. The multi method approach to the study offered a panoramic view of the inquiry where the quantitative paradigm became the emphasis or the priority for the study whilst the qualitative data set provided a secondary or supportive role. Similarly, the adoption of the complete collection, a sampling strategy enabled the researcher to study every single respondent in the government ministry and agency (Teddlie & Yu, 2007).

A key strategy that ensured the reliability and validity of the questionnaire was the voluntary invitation sent to lecturers of the University of Ghana to review and offer their input on the first draft of the questionnaire. In spite of this effort, the content of the questionnaire appeared to be too technical and voluminous to some of the respondents, as some portions of the questionnaire were left unanswered. In that regard, direct engagement with the respondents to explain the issues and guide them to fill the questionnaire became necessary.

Again, initial responses on the questionnaire from some of the ministries and agencies were evasive as some of the IT heads, IT officers and records managers from the ministries raised security concerns. They were skeptical about the objective of the study and asked for further and better particulars of the researcher and official letters from the UNISA. For instance, there were several government ministries that felt that their preservation strategy for digital records is not for public consumption and remains the exclusive knowledge of the ministry.

Above all, the unavailability of the desired persons and time constraint were some of the issues the researcher was confronted with. The study, thus, recommends that future researchers should use the multi method research to investigate digital preservation of e-government.

4.6. 1 How the limitations of the data instruments were negated

The cumulative cost, time and delays associated with the use of two or more research paradigms pointed out in the previous sections can be daunting. For instance, more time was needed for observation technique. The transcription and analysis for the interview method can be very expensive. The sheer absence of the researcher to supervise the completion of the questionnaire

can equally be frustrating to the respondents. In addressing these limitations the researcher implemented the following:

- A cost effective approach was pursued to offset the expensive nature of the interview approach (Ruth, Mellor, Slaymaker & Cleland, 2013). Thus, concurrent data collection was undertaken in areas where it was possible to do so. For example, the interview and the observation sessions were done at the same time by different research members (Farquhar, Ewing & Booth, 2011). Again, the partial funding from UNISA to post-graduate students on a yearly basis helped to reduce the researcher's cost with respect to the data collection,
- Despite the implication and weaknesses associated with the use of the observation technique in this study, the researcher successively assembled a skilled research team who were knowledgeable in the effective use of observation as a technique (Paterson, Bottorff & Hewat, 2015). The objective here is to avoid the incidence of any delay, and

- The adoption of the Total Design Method, which thrives on continuous follow-up, cover letters, pretested instruments and several reminders to respondents, yielded some level of positive results as questionnaires were completed and returned within the scheduled time. (Ngulube, 2003: 218 in Kalusopa, 2011). In that regard, direct engagement with the respondents to explain the issues and guide them to fill the questionnaire became necessary.

4.7 SUMMARY OF CHAPTER

The chapter discussed the research methodology and underscored how the choice of a multi methods design was possibly the appropriate approach to undertake the current study. Implicit in the research procedures was how the multi method was illustrated to address the various levels of the targeted population. The chapter noted that the triangulation of data and issues of reliability, validity and ethics ensured and enhance the credibility, integrity and consistency of the study.

That notwithstanding, the chapter brought to the fore the various data collection instruments and how they were applied in the study. The subsequent chapter looks into the analysis and presentation of the research results.

CHAPTER FIVE

DATA ANALYSIS AND PRESENTATION OF DATA

5.1 INTRODUCTION

The study investigated digital preservation of e-government across the government ministries and agencies in Ghana with the view of proposing a digital preservation framework or infrastructure for Ghana. As part of the strategy to achieve this, the current chapter presents the upshots of the survey undertaken across the public agencies by providing the results of the data analysis. In the case of the presentation of the results, varying opinions exist as to what constitutes an appropriate response rate. But Lyon, Lancaster and Dowrick (2008), citing Bowling (2002) noted that a response rate of 40% from the general public is deemed to be an accomplishment, and 70% or more should be rated very good. However, in this study, one of the largest concerns the researcher had before embarking on the survey was the perceived fear of low response rate by the participants, which would have eventually affected the confident declaration of the results. Thankfully, the response rate proved to be more than satisfactory as out of the one hundred and eighty two questionnaires distributed across the government ministries and agencies, one hundred and twenty were returned, representing 66% of the population. This could be described as fairly good, judging by the benchmarks of Lyon, Lancaster and Dowrick (2008).

There were also follow-up interviews in selected ministries and agencies, and an observation of the ICT facilities across the agencies and ministries. With respect to the interviews, five directors were interviewed in areas such as strategic document and policies in support of digital preservation, digital preservation strategies and security of records. These directors of the selected agencies and ministries were presumed to be key informants in view of the strategic nature of their operations and the depth of their knowledge, which was very much germane to the current study. Given the range of qualitative and quantitative data, it was imperative to

triangulate the data to address the completeness, reliability, accuracy and convergence of the key themes of the study. Again, the application of the quantitative and qualitative approaches in this multi method research offered a complementary strength of different approaches and wiped away the weaknesses of each approach, eventually yielding more valid inferences than one method (Levy, 2007). The study used descriptive statistics, such as frequencies, percentages, cross-tabulation, pie charts and bar graph to examine digital preservation of e-government across public sector organisations in Ghana. On the other hand, interview data, document analysis and an observation method provided supportive and confirmatory role to the study. The subsequent section discusses the key findings of the study with the quantitative data reported first, followed by the qualitative data.

5.2 CREATION OF DIGITAL RECORDS

Section 3.6.5.1 of the current study underscored how variety of digital records were created across many sectors of government, presumably because of the proliferation of the use of ICT and the application of e-government across many governments of the world. Accordingly, the study investigated how digital records were generated in the ministries and agencies. Question 1-10 of the questionnaire addressed this through the following themes:

- ICT and preservation of digital records;
- categories of digital records;
- other categories of digital records expected from other agencies;
- activities that generate digital records and
- driving factors for digital preservation.

5.2.1 ICT and the preservation of digital records

In a cross tabulation comparing the use of ICT in the preservation of digital records and those in charge of its implementation (Table 5-1), more than half of respondents 64(53.3%) stated that the use of ICT in the preservation of digital records is completely managed by in-house staff as

opposed to 27(22.5%) of respondents who outsourced the management of ICT. In furtherance to that the use of ICT across the ministries and agencies was confirmed by all the selected directors of the ministries and agencies when respondents were interviewed. Interviewees noted that (see Appendix 6 for interview question) the use of ICT support the preservation of digital records and facilitates the preservation and accessibility of data. One respondent noted that: *''ICT helps to make digital records and its preservation accessible by creating records, managing the records, and storing the record in a safe place''.* This response underscores the use of ICT in the preservation of records.

Table 5 - 1: A cross tabulation comparing the use of ICT in the preservation of digital records and those responsible for its implementation (N=120)

Agencies/ministries using ICT in the preservation of digital records					
Primary responsibility for the implementation of ICT	**Yes**		**No**	**Do not know**	**Total**
	In-house staff	64(53.33%)	11(9.17%)	3(2.50%)	78(65.00%)
	Outsourced	27(22.50%)	12(10.00%)	3(2.50%)	42(35.00%)
	Total	**91(75.83%)**	**23(19.17%)**	**6(5.00%)**	**120(100%)**

5.2.2 Categories of digital information generated in the ministries and agencies

The growing phenomenon of digital records is equally having a rippling effect on the type of records being created. The categories and types of digital information in Table 5-2 exemplify the

growing range of digital material that requires preservation attention and effort. In order to establish the type of digital records generated across the ministries and agencies, a follow up question was posed to respondents. Overwhelming majority of respondents noted databases 74(61.6%), digital publication 82(68.3%), email 87(72.5%), website information 108(90%) and document conversion 94(78%) as the categories of digital information generated in their organisation. A handful of respondents stated e-filing 27(22.5%) and data sets 73(60.8%) as some of the categories of digital information they generate**.** The results single out government as one of the key actors in the creation of digital records, primarily because accounting records, procurement records, personnel records, tax records, election registers, property and fixed asset registers, pension records, social security records, land records, birth and death records are all extrapolated from these categories of information to improve public serve delivery. Government in this regard, must make every effort to ensure the longevity of these records.

Table 5 - 2: Categories of digital information generated in the ministries and agencies (N=120)

Categories of digital records	Agree	Disagree	Don't Know	Total
Databases	74(61.6%)	12(10%)	34(28.4%)	120(100%)
Digital Publication	82(68.3%)	3(2.5%)	35(29.2%)	120(100%)
Email	87(72.5%)	4(3.3%)	29(24.2%)	120(100%)
Website Information	108(90%)	6(5%)	6(5%)	120(100%)
Data sets	73(60.8%)	32(26.7%)	15(12.5%)	120(100%)
Audio & Video	73(61%)	31(26%)	16(13%)	120(100%)
Document conversion	94(78%)	19(16%)	7(6%)	120(100%)
E-filing	27(22.5%)	53(44.2%)	40(33.3%)	120(100%)

5.2.3 Other categories of digital material expected from other agencies

As a follow up to the types and categories of digital preservation generated, respondents were to further indicate other categories of digital material expected to be received from other allied agencies and ministries. In Table 5-3, digital materials such as tweets 16(13.3%), website information 17(14.2%) and geographical information systems 16(13.3%) were the most common categories of digital information received from other agencies to be preserved. That notwithstanding, 58(48.3%) of respondents indicated that textual documents, still images, voice

recordings and video are categories of digital information to be received from other ministries. The variety of digital records created underscore the strength of technology. It must however be noted that the tendency to destroy these records is high as they usually do not appear in the mainstream of digital information. For instance, some social media destroy such records once they have been viewed by the general public (Council of Canadian Academies, 2015).

Table 5 - 3: Other categories of digital material expected to be received (N=120)

Digital materials expected to be received	**Responses**
Textual documents	15(12.50%)
Tweets	16(13.33%)
Still images	15(12.50%)
Video	14(11.67%)
Audio/voice recordings	14(11.67%)
Geographical Information Systems data	16(13.33%)
Websites	17(14.17%)
Email	13(10.83%)
Total	**120(100%)**

5.2.4 Activities that generate digital records

When respondents were pressed further to indicate the activities that generate these types of records, respondents noted (Table 5-4) that all the listed activities in one way or the other generated digital records. However, some are deemed to generate more digital records than others. For instance, e-government activities 13(10.8%), new public management policy

12(10%), undertaking research 11(9.2%), evaluating the efficiency of government agencies 11(9.2%) were deemed to have generated more digital records than review of government policies 10(8.3%) and formulation of policies 8(6.67%).

Table 5 - 4: Activities that generate digital records (N=120)

Activities that generate digital records	**Disagree**	**Agree**	**Total**
Initiation and formulation of policies	8(6.67%)	8(6.67%)	16(13.34%)
Undertaking research	7(5.83%)	11(9.17%)	18(15.00%)
Review of government policies	6(5.00%)	10(8.33%)	16(13.33%)
Evaluating the efficiency of government agencies	4(3.33%)	11(9.17%)	15(12.50%)
Government legislation and laws	5(4.17%)	11(9.17%)	16(13.34%)
E-government activities	10(8.33%)	13(10.83)	23(19.16%)
New public management policy	4(3.33%)	12(10.00%)	16(13.33%)
Total	**44(36.66%)**	**76(63.34%)**	**120(100.00%)**

5.2.5 Driving factors for digital preservation

Across many public sector organisations, the emergence of digital records has prompted many policy makers to put in place laws and policies to make it mandatory and constitutional for digital records to be preserved. The study in finding out some of the factors for digital preservation listed three possible factors for respondents to choose from. Table 5-5 shows

respondents unanimously opted for all the three possible factors with core business needs recording 31(25.8%), statutory duty to provide access to information 26(21.7%) and statutory requirements to store information 19(15.8%).

Table 5 - 5: Driving factors for digital preservation (N=120)

Driving factors for digital preservation	**Yes**	**No**	**Total**
A statutory requirement to keep/store/ preserve information	19(15.83%)	15(12.50%)	34(28.33%)
A statutory duty to provide public access to official information	26(21.67%)	15(12.50%)	41(34.17%)
Core business needs	31(25.83%)	14(11.67%)	45(37.50%)
Total	**76(63.33%)**	**44(36.67%)**	**120(100.00%)**

5.2.6 Factors for the growth of digital records

Probing further, respondents noted that the current wave of the right to the information law and government legislations have contributed to the increased demand for information and the growth of digital records. A total of 79(65.8%) of respondents and 41(34.2%) of respondents underscored how these factors have contributed to the growing phenomenon of digital preservation (see Table 5-6). To confirm these results, question eight of the interview protocol, sought from respondents, what the ministry has in place to meet the anticipated demand for information when the right to information law is passed. One respondent remarked that: ‘’*we are very much aware of the responsibility of the ministry when the information law is passed. Whilst*

waiting for the passage of the law, we are creating a department to keep and organize our records system. But to a large extent the data centre being put up by NITA would complement some of the records gap''. Other respondents couldn't have agreed more with the succinct views of the first respondent when they noted that the information law would require them to create and maintain records properly, ''*and that is what they will be doing''* as noted by other respondents.

Table 5 - 6:Contribution of laws to the growth of digital records (N=120)

Legislation contributing to the growth of digital records	**Frequency**	**Percent**
Consideration of the Right to Information Law	79	65.8
Government laws have contributed to the growth of digital records	41	34.2
Total	**120**	**100**

5.3 THE CURRENT LEVEL OF AWARENESS OF DIGITAL PRESERVATION

One of the strategies of examining the extent to which digital preservation of e-government has been deployed across the ministries is to determine and establish the current level of awareness of digital preservation. The level of awareness of the core variables within the digital preservation environment provides in part the very basis to examine the concept of digital preservation. Thus, awareness of the volumes of digital growth, standards, file formats, projects, and toolkits reflects the preparatory stage of digital preservation within the ministries and agencies. Questions 11-21 of the questionnaire addressed the aforementioned issues.

5.3.1 Awareness of volumes of digital material and rate of growth

The survey revealed lack of knowledge about the likely growth of digital material across the ministries and agencies. Few discrepancies about the volume of digital material were registered with some estimating 1.8 GB to 1.8MB. Nevertheless, 94(78.3%) of respondents conceded that they are very much aware of the volume of digital material and can provide rough estimates of the digital records. On the other hand, 26(21.7%) of respondents were explicitly clueless about the likely growth of their digital records (Table 5-7). The reported results finds space in the literature which noted that few organisations take a long-term perspective of digital preservation and that awareness issues surrounding digital preservation is perceived differently across many organisations.

Table 5 - 7: Volume of digital material and rate of growth (N=120)

Volume of digital material and rate of growth	**Moderately aware and can provide rough estimate of terabytes**	**Very aware and can provide rough estimates of terabytes**	**Don't know**	**Total**
Aware of the volume of digital material in your agency	11(9.17%)	30(25.00%)	14(11.66%)	55(45.83%)
Aware of the likely rate of growth of digital material	26(21.67%)	27(22.50%)	12(10.00%)	65(54.17%)
Total	**37(30.84%)**	**57(47.50%)**	**26(21.66%)**	**120(100.00%)**

5.3.2 Level of awareness of digital preservation standards

Disappointingly, the standards for digital preservation similarly recorded low level of awareness in many respects. Table 5-8 shows that apart from General Information Standard Archival Description 17(14.2%) and Documentation-Records Management Processes- Metadata Records 10(8.3%) of which respondents were aware, the rest, Information and Documentation Records Management 15(12.5%), Reference Model for Open Archival Information system 11(9.2%) and Information Technology Security Techniques 6(5%) were either unknown by the respondents or they were now planning to implement those standards. One of the universal rules or models for digital preservation is the Open Archival Information System, which formed part of the conceptual framework of the current study. Respondent's sheer lack of knowledge about the OAIS model underscores the crisis and the almost hapless state of repositories across the ministries and agencies. The OAIS model facilitates the implementation of e-government as it has the capacity to reliably store data, migrate and provide access to digital data. In general, whereas less than half of respondents 54(45%) were aware of the digital preservation standards more than half of respondents 66(55%) were either planning or unaware of the various international standards for digital preservation.

Table 5 - 8:Level of awareness of standards for digital records (N=120)

Level of awareness of digital records standards	Unaware	Aware	Planning	Total
General International Standard Archival Description	8(6.66%)	17(14.17%)	2(1.67%)	27(22.50%)
ISO 15489-1 and/or 2:2001 Information and Documentation Records Management	15(12.50%)	8(6.67%)	3(2.50%)	26(21.67%)
ISO 14721:2003 Reference Model for an Open Archival Information System	11(9.17%)	11(9.17%)	2(1.66%)	24(20.00%)
ISO 17799(ISO 27001 and 27002 Information Technology Security Techniques	6(5.00%)	8(6.67%)	4(3.33%)	18(15.00%)
ISO 23081-1:2006 Information and Documentation-Records Management Processes- Metadata Records	5(4.17%)	10(8.33%)	10(8.33%)	25(20.83%)
Total	**45(37.50%)**	**54(45.00%)**	**21(17.50%)**	**120(100%)**

5.3.3 Actions undertaken to extend the life of digital material

Using multiple options, respondents were to demonstrate their level of awareness in terms of the actions undertaken to extend the life of a digital material across the ministries and agencies.

Contrary to the low awareness level reported in Table 5-8, respondents in this section were able to indicate an explicit response of either ‘’yes or no’’ to the actions undertaken to extend the life of a digital material. However, respondents were still clueless about the activities undertaken to extend the life of a digital material. Thus, 65(54.1%) of respondents Table (5-9) either do not know or do not use file formats, and storage devices to extend the life of a digital material across the ministries and agencies. On the flipside, 55(45.6%) were very much emphatic about the use of storage devices and software with 7(5.8%) of these respondents using file formats, 14(11.7%) using storage media, 7(5.8%) using storage drives and 16(13.3%) and 11(9.2) using software and hardware respectively. Whilst part of the result appears to be positive, it is still disappointing considering the total score for the actions undertaken to extend the life of a digital material. The reported result does not appear to be too different from Table 5-8

Table 5 - 9:Actions undertaken to extend the life of digital material (N=120)

Actions undertaken to extend the life of digital material	**Yes**	**No**	**Don’t know**	**Total**
File formats	7(5.83%)	14(11.67%)	7(5.83%)	28(23.33%)
Storage media	14(11.67%)	8(6.67%)	6(5.00%)	28(23.34%)
Storage drive	7(5.83%)	7(5.83%)	3(2.50%)	17(14.16%)
Hardware	11(9.17%)	5(4.17%)	3(2.50%)	19(15.84%)
Software	16(13.33%)	8(6.67%)	4(3.33%)	28(23.33%)
Total	**55(45.83%)**	**42(35.00%)**	**23(19.17%)**	**120(100%)**

5.3.4 Digital preservation projects, toolkits and software

A range of assessment tools, software tools and digital preservation support organisation exists to support the variety of preservation strategies. Such tools and support organisations also support

metadata standards, selection and appraisal policies, and format identification for digital preservation. On the other hand, self-assessment tools are just one of the ways by which digital repositories can be seen as trustworthy. The study in this regard sought to find out from respondents whether they are aware of such tools and digital preservation support organisations. The survey reported low level of awareness for digital preservation projects, toolkits and software. The awareness level for digital preservation projects, assessment toolkits and software were woefully discouraging. Apart from LOCKSS which 8(6.7%) respondents were aware of, the rest of the digital preservation projects, toolkits and software were unknown to respondents. Table 5-10 shows DRAMBORA 4(3.3%), TRAC 2(1.7%), DSPACE 6(5%) and ARCHIVEMATICA 6(5%). Again, 10(8.3%) of respondent have no idea about Digital Preservation Coalition and Digital Curation Centre. Moreover, PLANET, INTERPARES, Digital Preservation Europe and UK Web Archiving Consortium were reported to be new terms to respondents.

Table 5 - 10:Digital preservation projects, toolkits and software (N=120)

Digital Preservation Projects, Assessment Toolkits and Software Tools	**Familiar**	**Not familiar**	**Total**
Digital Preservation Coalition	5(4.17%)	10(8.33%)	15(12.50%)
Digital Curation Centre	5(4.17%)	10(8.33%)	15(12.50%)
Digital Continuity Project	-	14(11.67%)	14(11.67%)
PLANETS	-	-	
INTERPARES	-	-	
Digital Preservation Europe	-	--	
UK Web Archiving Consortium	-	-	
DRAMBORA	4(3.33%)	13(10.83%)	17(14.16%)
TRAC	2(1.67%)	13(10.83%)	15(12.50%)
LOCKSS	8(6.67%)	7(5.83%)	15(12.50%)
DSPACE	6(5%)	8(6.67%)	14(11.67%)
DAITSS	6(5%)	9(7.50%)	15(12.50%)
Total	**36(30%)**	**84(70%)**	**120(100%)**

5.3.5 Description of archive service

When respondents were asked about the effectiveness of their archive service, Figure 5-1 showed that most respondents 84(70%) describe their archive service as actively seeking digital material whenever it comes to digital preservation planning. Only 36(24%) of respondents actually claimed to be reacting to depositors and turning away digital material, a result that demonstrated the preparedness of the ministries in the event of an unanticipated growth of digital material. However, even the small proportion of the ministries reacting to depositors does not suggest a positive development.

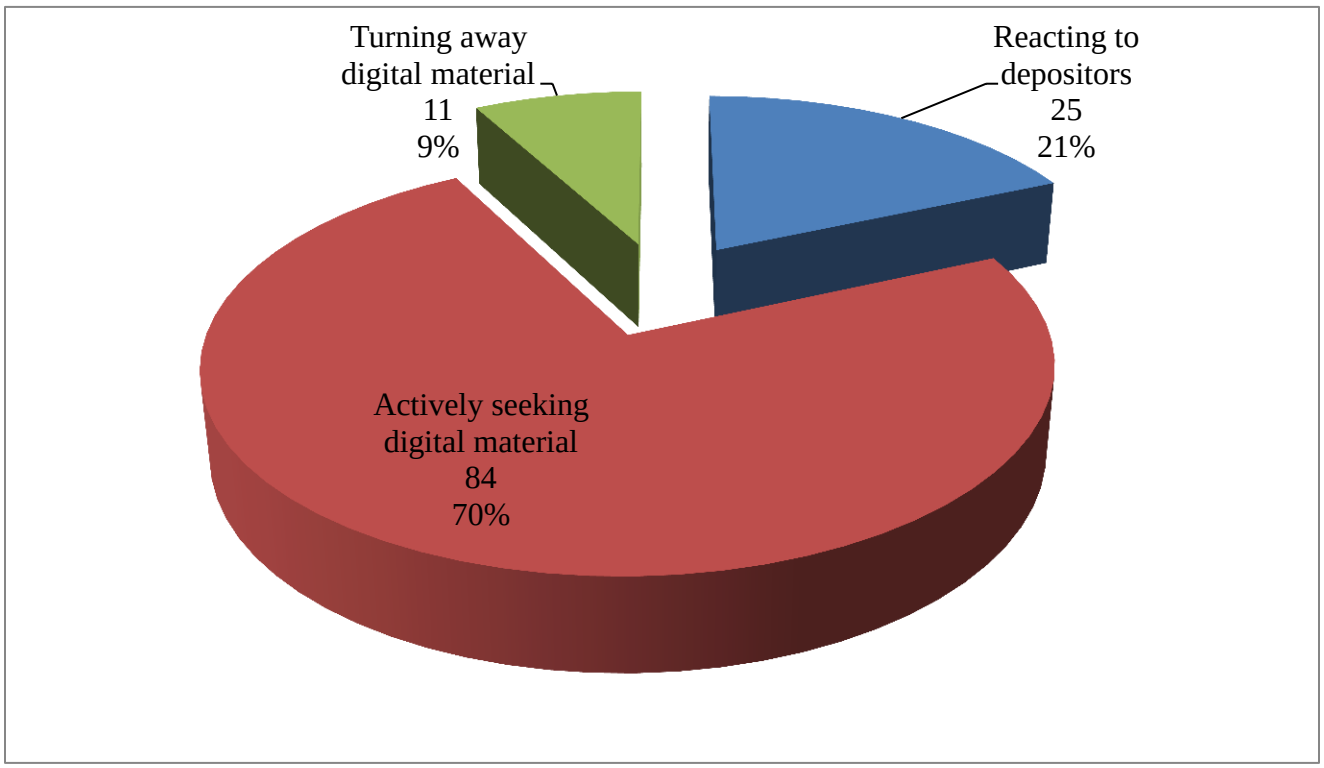

Figure 5 - 1: Description of archival service (N=120)

5.3.6 File formats

File formats are the most basic, yet important aspect of digital preservation as many activities of preservation are carried out around file format to prevent loss of access to a digital material. It is

at the same time a challenging task to find a file format that would be useful for a long time in view of technological obsolescence as many of the file formats have gone through several phases of technological changes and developments. Accordingly, respondents were asked about the type of file formats used in their institutions. A high proportion of respondents indicated PDF 60(50%) with just few respondents opting for HMTL 18(15%), JEPP 16(14%) and TIFF 4(3%) (Figure 5-2). The findings revealed that some formats are most preferred than others primarily because they are trusted files that have a high degree of openness. Clearly, the most preferred text document format for most digital preservation repositories in this study was the PDF as it is certified by the ISO as the open international standard. Thus, through the use of file formats, documents submitted electronically can be converted to PDF. A follow up interview with directors indicated the use of office documents such as Word, Excel and Access as some of the common file formats used in the ministries. This could possibly represent the the 22% of the "others".

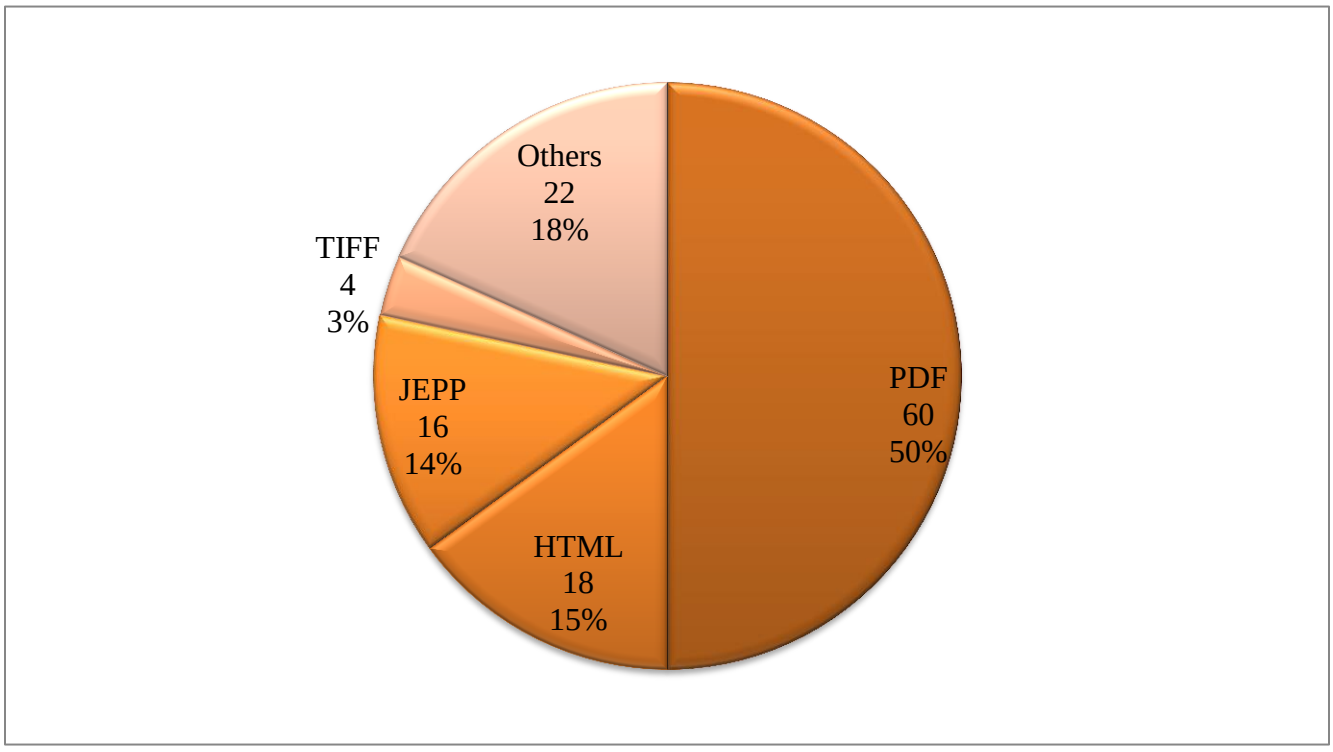

Figure 5 - 2:File formats (N=120)

5.3.7 Digital materials in urgent need for preservation

Among the categories of digital materials (databases, digital publication, emails and website) used across the ministries and agencies, 61(50.8%) of respondents reported of their digital material being in urgent need for digital preservation. However, 59(49.2%) of respondents conceded that their materials are safe and do not necessarily need urgent attention.

Table 5 - 11:Digital materials in urgent need for preservation (N=120)

Urgent need for digital preservation	**Frequency**	**Percent**
Yes	61	50.8
No	59	49.2
Total	**120**	**100**

5.4 IMPACT OF DIGITAL PRESERVATION ON THE PLANNING AND DELIVERY OF E-GOVERNMENT

Section 3.7 of the current study noted that the concept of e-government is predicated on efficient delivery and preservation of digital records. It also underscored how the implementation and pursuit of e-government rest heavily on digital preservation, particularly because data inconsistencies and data inaccuracies have the potential to impact on the activities of e-government. Again, because e-government thrives on data sharing among government departments, it is crucial to ensure the longevity of digital records. On the back of these reasons, question 21-28 examine the impact of digital preservation on e-government. In examining this

impact, respondents were asked about their involvement in the implementation of e-government and whether the application of e-government feed into the use of digital records.

5.4.1 E-government feed into the use of digital records

Table 5-12 shows how 72(60%) of respondents noted their involvement in the implementation of e-government and claimed that the use of e-government feed into the use of digital records. A much lower number of respondents 48(39.8%) were not sure as to whether e-government feed into the use of digital records or not. The reported results show that the delivery of government services through technology demands repositories to be created to feed government websites. In other words, whereas digital preservation or repositories feed the websites of governments, the creation and implementation of e-government in public sector organisations degenerates into another form of digital records.

Table 5 - 12:E-government feed into the use of digital records (N=120)

E-government feed into the use of digital records	**Yes**	**No**	**Not Sure**	**Total**
E-government feed into the use of digital records	36(30%)	8(6.67%)	14(11.67%)	58(48.34%)
Your unit is involved in the implementation of e-government	36(30%)	26(21.66%)	-	62(51.66%)
Total	**72(60%)**	**34(28.3%)**	**14(11.67%)**	**120(100%)**

5.4.2 Types of ICT products

In an attempt to confirm and validate responses from the questionnaire on the impact of digital preservation on e-government, an observation approach was used to investigate the type of ICT products used for digital preservation and e-government. With a list of possible ICT products for

digital preservation and e-government, the researcher ticked the facilities available as he moved from one ministry to another. Table 5-13 shows that apart from video conferencing 3(2.5%) teleconferencing 2(1.7%) and VSAT 2(1.7%) which obtained lower percentage from respondents, the rest of the ICT products for digital preservation and e-government in the view of the researcher were all available across the ministries and agencies. This is a clear demonstration of the application of e-government and digital preservation across the ministries and agencies and an extension of the fact that the full benefits of e-government can only be realized if electronic records are managed and maintained effectively.

Table 5 - 13:Types ICT products (N=120)

Items	**Frequency**	**Percentage**
Desktops	10	8.3
Laptops	7	5.8
Palmtops	4	3.3
Printers	9	7.5
PABX(intercom)	7	5.8
Video Conferencing	3	2.5
Video Cameras	5	4.2
TV	7	5.8
Digital Cameras	8	6.7
Fax Machines	6	5
Email	10	8.3

Internet	9	7.5
Teleconferencing	2	1.7
Website/ Website Portal	6	5
VSAT satellite	2	1.7
Softwares	5	4.2
Tools for Accessing Digital Doc.	5	4.2
Digital Records Security	5	4.2
Storage Media Devices	6	5
Digital Repository	4	3.3
Total	**120**	**100**

5.5 KEY THREATS TO DIGITAL PRESERVATION

Digital records by its very nature, are subject to technological obsolescence and physical threats. Whereas technological obsolescence emanates from the continuous development and changing nature of technology, physical threats deal with the action and inaction of users. By way of identifying the digital preservation problems confronted by the ministries and agencies, the survey (Questions 28-51) investigated the factors that threaten the preservation of digital records under the following themes:

- actions taken when digital records are first generated;
- loss of digital material and timing issues;

- barriers to digital preservation;
- security measures for digital records;
- preservation metadata options that apply to ministries/agencies; and
- current threats to digital preservation in terms of ranking.

5.5.1 Actions taken when digital records are first generated

In order to unravel the problems confronted by the ministries with respect to preservation of digital records, respondents were asked the actions they take whenever they first receive digital records**.** Figure 5-3 shows that while 26(22%) of respondents admitted that no action was taken when digital records first come into their archives, over two-thirds of respondents (62%, 8%, and 8%) would at least check for viruses, copy the digital records to a different storage media and migrate to a current version of file formats respectively. (usually to a file storage server).

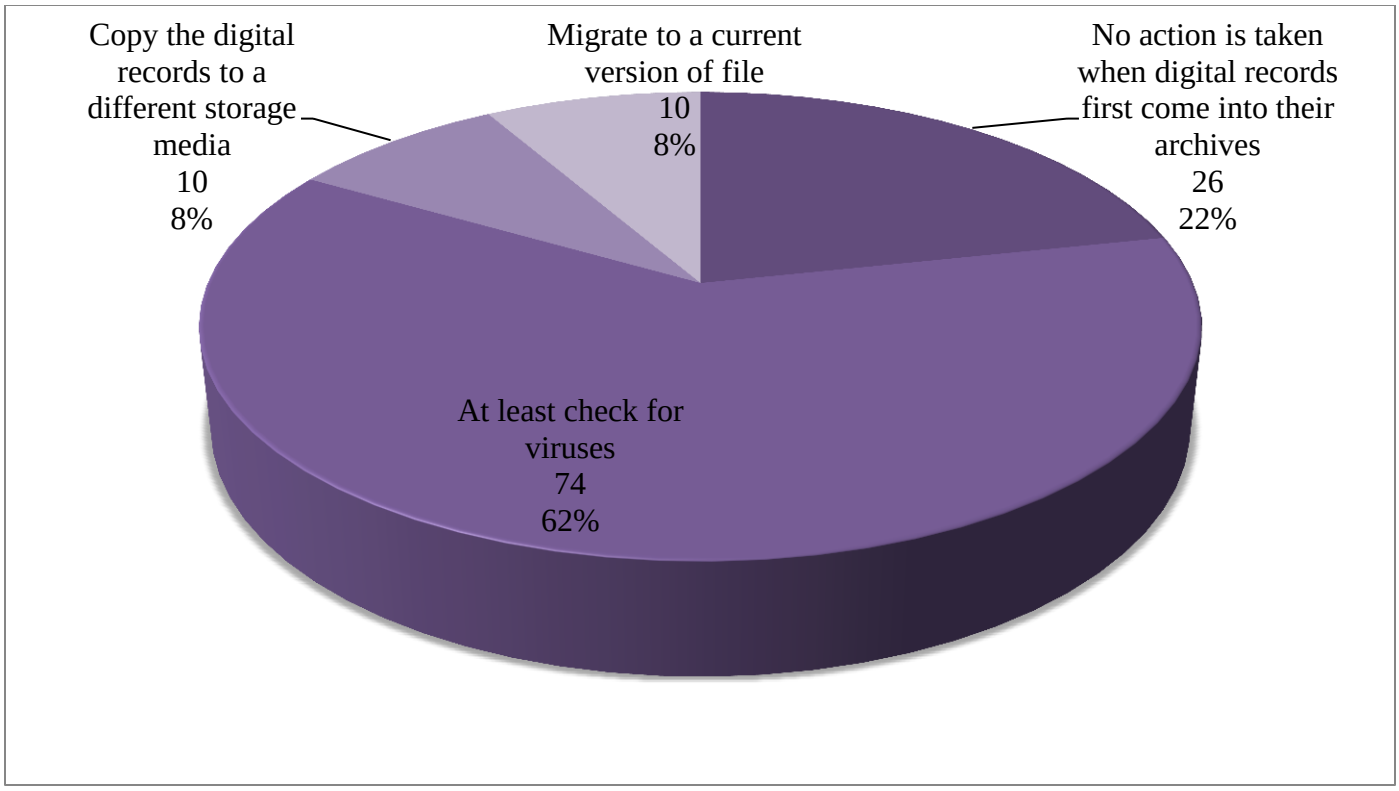

Figure 5 - 3:Actions taken when digital records are first generated (N=120)

5.5.2 Loss of digital material and timing issues

When respondents were asked if their organisation have ever lost any digital material and face timing issues, 52(43.3%) of respondents confirmed that they were either unable to access digital records, or having challenges opening the content of a file, whiles 26(21.7%) of respondents noted that their digital material are plagued with timing issues (Table 5-14). The two scenarios here portend danger for the ministries and agencies as this can insulate politicians from any financial malfeasance when they are brought before any court of law. It also means that transactional records and significant opportunities are lost if desperate attempts are not made to reverse this trend. That is why Ngulube (2012) argued that losing digital records is common and is one of the most feared situations in Africa.

Table 5 - 14:Loss of digital material and timing issues (N=120)

Loss of digital material and timing issues	**Yes**	**No**	**Don't know**	**Total**
Digital material currently being lost	36(30%)	13(10.8%)	23(19.2%)	72(60%)
Organisation facing timing issues	26(21.7%)	12(10%)	10(8.3)	48(40%)
Total	**52(51.7%)**	**25(20.8%)**	**33(27.5%)**	**120(100%)**

5.5.3 Barriers to digital preservation

In order to identify a practical and sustainable solution to digital preservation problems, respondents were asked multiple set of questions on barriers to digital preservation. Unsurprisingly, large proportion 15(12.5%) of respondents identified funding as one of the key barriers, probably because of its rippling effects and impact on the other barriers. Training 14(11.7%) was chosen because of the skills gap among records managers, IT support 12(10%) because of poor IT support and data services (Table 5-15). Organisational aspects 14(11.7%) was also noted as a key barrier to the digital preservation problems, whiles expertise and experience 10(8.3%) was chosen as the least option among the list of barriers to digital preservation. Funding became a critical factor and a compulsive drive in the results of this survey probably because changes in hardware, software and transformation of data from one format or configuration to another often requires funding. Again, the periodic copying of data (refreshing), and construction and maintenance of data (emulation) to support old and obsolete data, come with some level of costs which is far and above the budget of repositories in Africa.

Table 5 - 15:Barriers to digital preservation (N=120)

Barriers to digital preservation	**Yes**	**No**	**Total number of respondents**
Funding	15(12.5%)	2(1.67%)	17(14.17%)
Training	14(11.67%)	4(3.3%)	18(15.00%)
IT support	12(10.00%)	6(5%)	18(15.00%)
Data support	12(10.00%)	7(5.8%)	19(15.83%)
Organisational aspect	14(11.67%)	5(4.16%)	19(15.84%)
Expertise and experience	10(8.33%)	7(5.83%)	17(14.16%)
All of the above	4(3.33%)	8(6.7%)	12(10.00%)
Total	**81(67.5%)**	**39(32.5%)**	**120(100%)**

5.5.4 Current threats to digital preservation in terms of ranking

Again, when respondents were given other possible options and asked to rank the current threat to the preservation of digital records in their ministries and agencies, 31(26.1%), 29(24.1%) and 26(21.6%) of respondents were not happy about the level of security and privacy, skills training and insufficient funding respectively. Although technological obsolescence was considered a threat it only obtained 23(19.1%) as shown in Figure 5-4. However, it is still a considerable threat as frequent changes in hardware and software development continue to evolve, creating media incompatibility and configuration problems. Insufficient organizational commitment

11(9%) was the least of the threats among the options according to Figure 5-4. Funding was ranked third by respondents 26(21.6%) because of the critical role it plays in the creation of digital repositories. Thus, efforts by many African institutions to establish digital repositories in order to facilitate the capture, storage, preservation and dissemination of an institution's intellectual outputs are very much often faced with challenges because of funding.

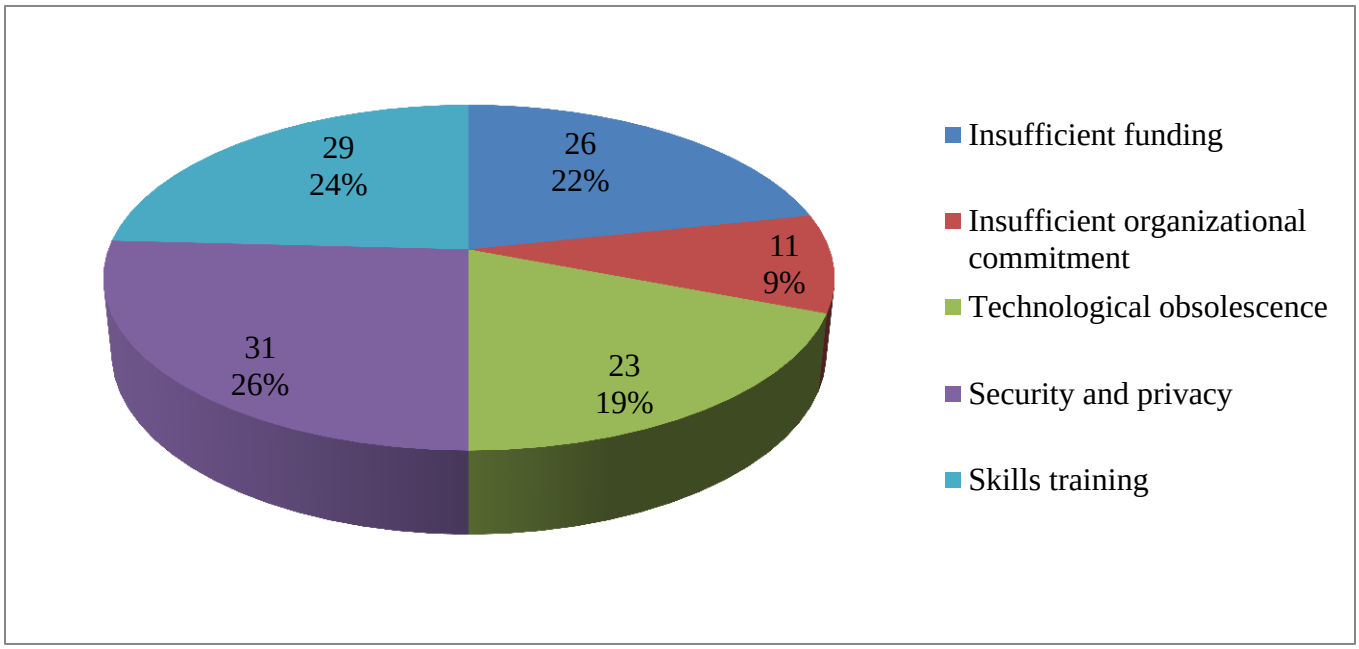

Figure 5 - 4:Current threats to digital preservation in terms of ranking (N=120)

5.5.5 Security challenges with the management of digital records

Whilst the application of user restriction ensures the security and privacy of digital records, respondents had challenges complying with the policies and procedures 42(35%) of the security measure; and security issues on hard drives 41(34.1%). About twenty four percent of respondents reported of having challenges with the management of their emails probably because Figure 5-5 had similarly reported that 37(31%) of respondents emails were monitored. A proportion of respondents 8(6.7%) viewed digital records as paper records. These finding

suggests that some of the respondents needed training in digital records. Ultimately, such a conclusion from respondents poses a security threat to the management of digital records in Ghana.

Table 5 - 16:Security challenges to the management of digital records (N=120)

Security challenges with the management of digital records	**Frequency**	**Percent**
Compliance to policies and procedures	42	35.0
Challenges with the management of e-mails	29	24.2
Records saved on hard drives	41	34.1
Digital records viewed differently as hard copy	8	6.7
Total	**120**	**100**

5.5.6 Security measures for digital records

Dependence on information systems means that organisations are very often exposed to security threats such as computer-assisted fraud, sabotage, vandalism, theft, fire or flood, computer viruses and computer hacking. In order to determine the security measures respondents have implemented in their various organisations, respondents were asked to indicate whether or not they have security measures in place. Table 5-17 indicates that 30(25%) of respondents reported that their organisation have a security and privacy policy in place. About twenty-eight percent of respondents 34(28.3%) noted that a system keeps track of any changes made on the digital records, whiles 14(11.7%) admitted that their emails were monitored. The results show that there is proper security protection for organisation's and individuals financial and medical records. In

the case of the interview of the directors, all five confirmed that there is a strong application of ‘user restriction by way of ensuring the security and privacy of their digital records.

Table 5 - 17:Security measures for digital records (N=120)

Security measures for digital records	**Yes**	**No**	**Total number of respondents**
Your ministry/agency	30(25%)	17(14.2%)	47(39.2%)
A system tracks changes made on digital records	34(28.3%)	10(8.3%)	44(36.6%)
Your emails are monitored	14(11.7%)	15(12.5%)	29(24.2%)
Total	**78(65%)**	**42(35%)**	**120(100%)**

5.5.7 Auditing of digital records

As a form of security measure, respondents were to indicate the frequency with which their digital records were audited. Figure 5-5 shows that more than half 66(55%) of respondents just do not know whether their digital records are audited or not. On the other hand, 31(26%) of respondents reported that their records are audited on a yearly basis, whiles 23(19%) of respondents indicated it is done every two years. The result suggests that much is not done to maintain the digital resources and to ensure appropriate management of digital records. Auditing of digital records means that a trusted digital repository is ensuring the reliability, trustworthiness and accuracy of digital records.

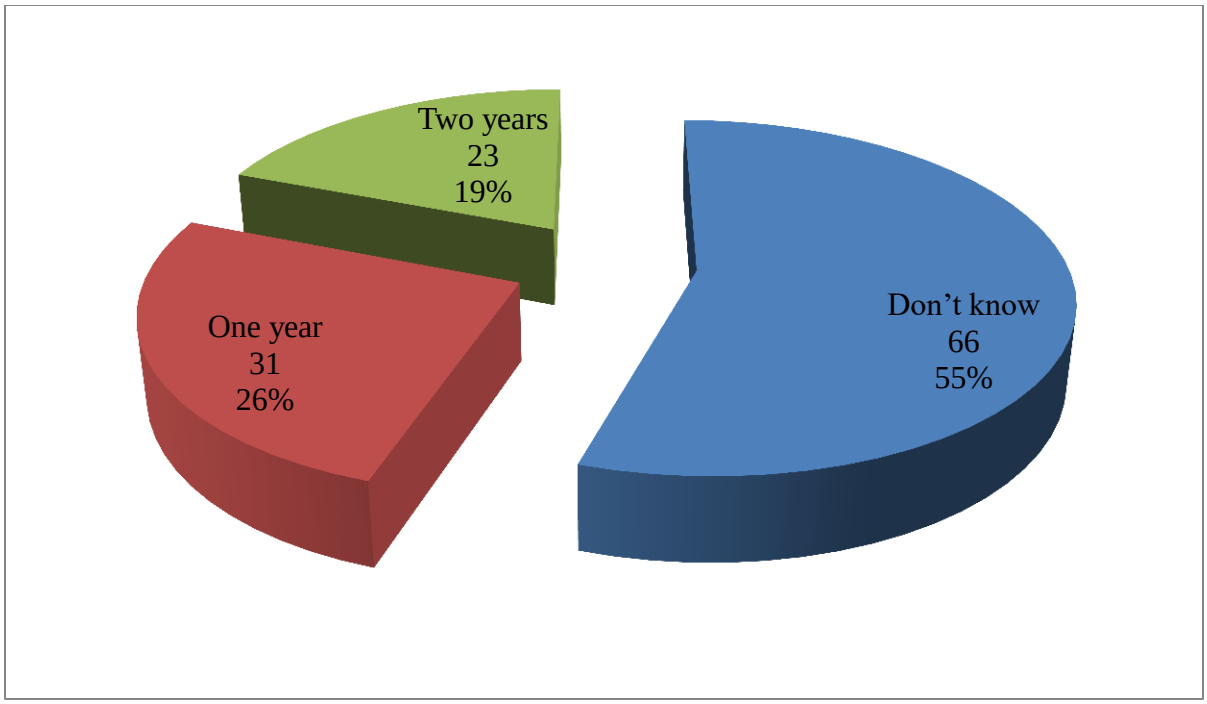

Figure 5 - 5:Auditing of digital records (N=120)

5.5.8 Reliability and authenticity

In order not to compromise the essential characteristics of records, archives have a huge responsibility of guiding the works of records creators whose works they have a mandate to preserve by establishing control measures. Such control measures require that the record so created must be authentic and reliable to reveal the true identity of the record creator. Results from Table 5-18 reveals that majority of respondents have introduced some level of physical security to ensure the reliability and authenticity of their digital materials. Table 5-18 shows that tracking and verifying changes of digital objects was top on the list of respondents with 55(46%), followed by user access restriction through the use of passwords 54(45%).

Table 5 - 18:Reliability and authenticity (N=120)

Reliability and authenticity	Frequency
Use of passwords to prevent alteration and detection of records	54(45%)
Tracking and verifying changes of digital objects	55(45.83%)
All of the above	11(9.17%)
Total	**120(100%)**

5.5.9 Protection of digital records from unauthorized access

While this study concedes that databases containing personal, financial and medical records are useful to organisations and individuals, they can however pose a threat if proper security protections are not put in place. Table 5-19 shows that protection and security of digital records of respondents is widely implemented. With three of the four measures (the use of the identity cards, use of metadata and use of fire walls) receiving about 96% endorsement from respondents.

Table 5 - 19:Protection of digital records from unauthorized access (N=120)

Protection of digital records from unauthorized access	**Frequency**
Through the use of ID cards	62(52.00%)
Use of metadata to control access to records	13(10.83%)
Use of firewalls and digital signatures	40(33.33%)
Others	5(4.17%)
Total	**120(100%)**

5.5.10 Monitoring of emails

As a follow up to the protection of digital records, Figure 5-6 shows that 69% of respondent's emails are not monitored or do not know whether their emails are monitored. On the contrary, 31% indicated that their emails were monitored.

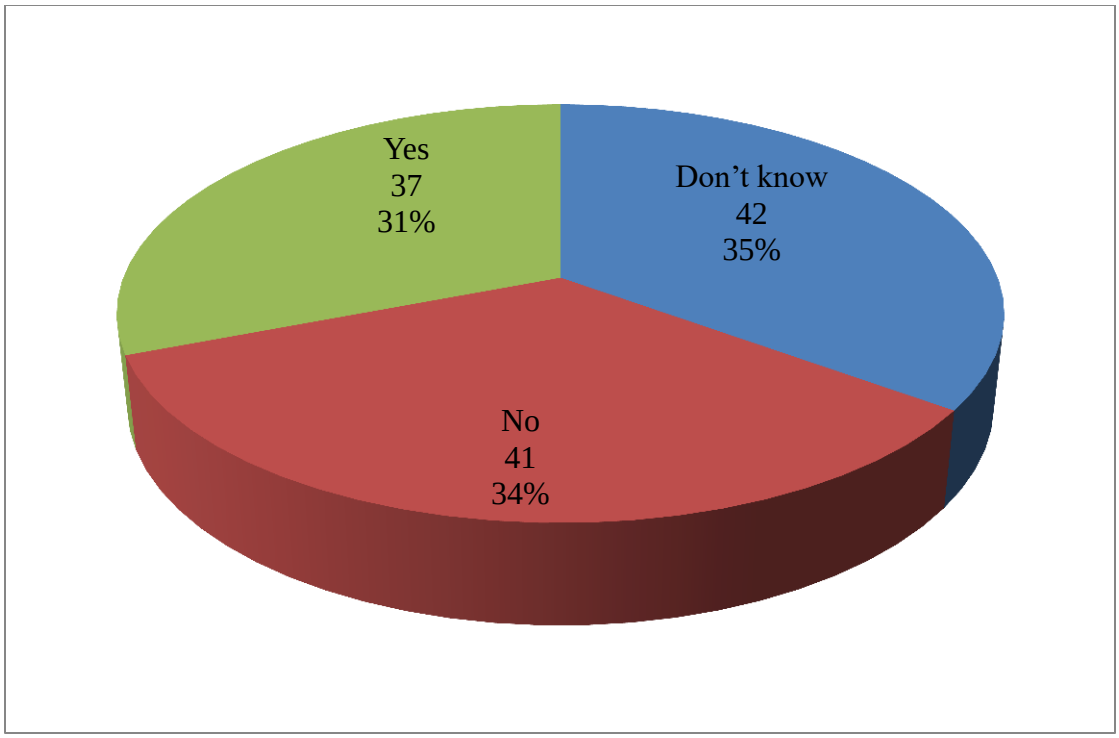

Figure 5 - 6:Monitoring of emails (N=120)

5.5.11 Qualifications of records managers and IT officers

The categories of human resources skills needed for digital preservation can be grouped into three areas: technical (systems), metadata (categorical) and collection specialist (Corrado & Moulaison, 2014:56). The acquisition of skills in these areas demands some level of qualification in IT and Information Science. Table 5-20 shows the diversity of qualifications of records managers and IT officers across the ministries and agencies. Of the one hundred and twenty respondents, 56(46.7%) have Masters’s degree in Information Science and Information Technology. Nearly, 48 (24.2% and 15.8%) have first degree in information science and advanced diploma in IT. Less than a quarter of respondents 16(13.3%) hold a certificate in IT. The results show profound differences in terms of qualifications and practices. Since the information centres of the government agencies are very much oriented and structured to the

delivery of information and very supportive of the freedom of information, respondents with qualifications in diploma and certificate ought to upgrade their qualifications in order to catch up with the developments in technology. It must be stressed that digital preservation depends on talent, dedication, and hard work of the people involved**.**

Table 5 - 20:Qualifications of records managers/IT (N=120)

Qualifications of record managers/IT	**Frequency**	**Percent**
Master's degree in Information Science/IT	56	46.7
First degree in Information Science/IT	29	24.2
Advanced Diploma in IT	19	15.8
Certificate in IT	16	13.3
Total	**120**	**100**

5.5.12 Training and staffing

Against the backdrop that digital preservation is an extremely complex area, evolving field that requires great deal of knowledge to understand, respondents were questioned about their training and staffing needs through the use of multiple questions. Table 5-21 reveals how 25(20.8%) of respondents have never received training in digital preservation yet 28(23.3%) of respondents were assigned digital preservation responsibilities. A further 23(19.2%) of respondents indicated

that they have adequate organisation and technical know-how in digital preservation. In all, the study noted split responses between respondents who have undertaken training and respondents who have never undertaken any training. The study agrees with the empirical literature that training programmes are needed to help information professionals manage the anticipated problems of digital records (IRMT, 2008; 2009).

Table 5 - 21:Training and staffing (N=120)

Training and staffing	**Yes**	**No**	**Total**
Have you undertaken any training in digital preservation your agency	17(14.2%)	25(20.8%)	42(35%)
Does your organization have staff assign to digital preservation responsibilities	28(23.3%)	12(10%)	40(33.3%)
You have adequate organizational and technical expertise on digital preservation	23(19.2%)	15(12.5%)	38(31.7%)
Total	**68(56.7%)**	**52(43.3%)**	**120(100%)**

5.5.13 Training in the field of digital preservation

In an attempt to identify the skill/knowledge gap among respondents in the area of digital preservation; and to enhance the professional practices, respondents were to choose from possible training areas suitable for their training needs. Clearly, more than half of respondents 61(51%) showed preference in the management and preservation of digital records as a way of improving their day to day work schedules. Forty-nine percent of respondents were interested in undertaking training in IT applications in records management, the changing roles of records

managers and the preservation of digital records (Figure 5-7). The result explains why most of the respondents could not apply other preservation strategies to ensure the longevity of their digital records as indicated in Table 5-23. However, it underscores the preparedness of respondents to one way or the other to overcome the problem of technophobia and to upgrade their knowledge in technological tools. Such training programmes have the potential to help information professionals unlock, manage and curate their digital materials. It will further help record managers to integrate records management considerations in the design of web-enabled application systems which will ultimately contribute to the development of the metadata standards and schema.

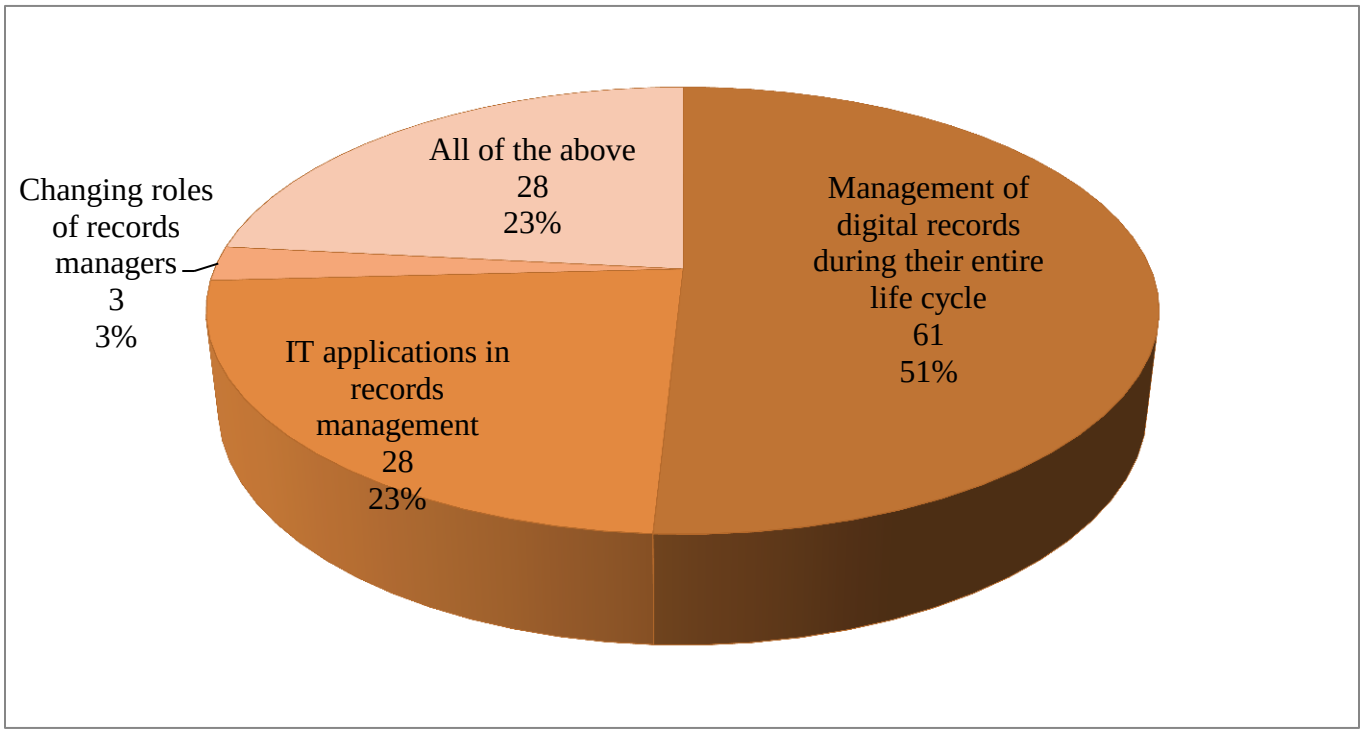

Figure 5 - 7:Training in the field of digital preservation (N=120)

5.5.14 Training methods

To confirm their training methods, Question 41, offered three areas of training methods. For each of the given areas, seminar and workshop 82(68%) topped the list, followed by internships 34(28%) and training in records/archives as depicted by Figure 5-8. Use of consultants appear to be the least option for respondents 4(4%). The high degree of training methods expressed by respondents is striking and reinforces the propositions that digital preservation is complex and requires new skills to face the technological trends.

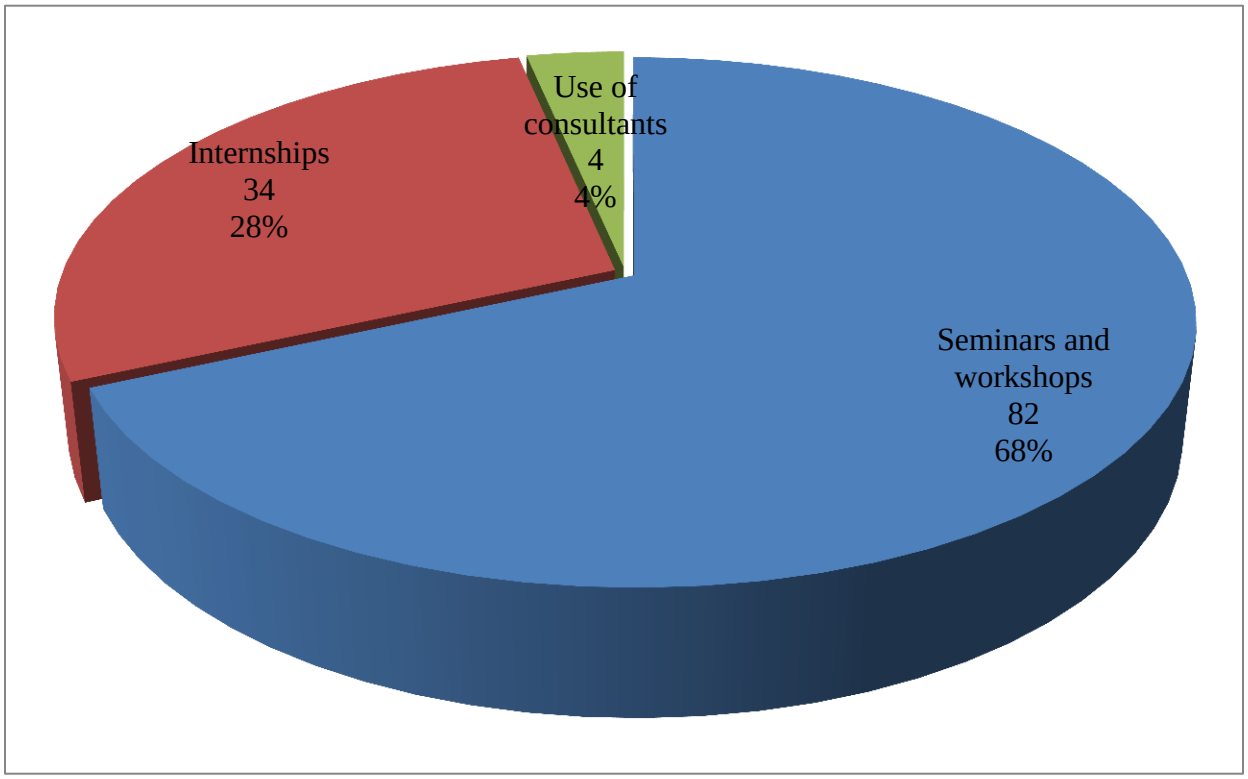

Figure 5 - 8:Training methods (N=120)

5.5.14.1 Interview for training needs of respondents

To validate the responses on the training needs, selected directors of the ministries and agencies were asked about the digital preservation related training that will benefit their organisation. Several training programmes were suggested by interviewees such *as Preservation strategies and tools'', Digitization, copyright issues and metadata, digital records security, digital repositories, standard formats, preservation strategies,* indicating that it is a topic of ongoing importance.

5.5.15 Funding requirements

One of the compelling problems in the digital preservation environment is funding and costing as the long term sustainability of a digital preservation infrastructure depends on it. The reality is, most repositories in Africa have depended on donor funding to ensure their survival in the digital environment (Rosenberg, 1997). This prompted some scholars to question the capacity of repositories in Africa to sustain their digital repositories (Ezema, 2011). In this regard, respondents were to indicate the best phrase that describes their funding situation with respect to digital preservation. Table 5-22 shows mixed responses from respondents as 21(17.5%) of respondents claimed they have no idea of their funding requirement. However, 45(37.5%) and 23(19.2%) of respondents have an estimated cost of their funding requirement and additional funding requirement for digital preservation respectively. An insignificant percentage of respondents 3(2.5%) have detailed costing of funding requirement. The results reveal how respondents can figure out the cost of long term preservation.

Table 5 - 22:Best phrase that describes your ministry/ agency funding requirements

Best phrase that describes your ministry/ agency funding requirement	**Frequency**
This agency does not know its funding requirement	21(17.5%)
This agency has estimated costing of its funding requirement	45(37.5%)
This agency has detailed costing of its funding requirement	3(2.5%)
This agency has additional funding requirement for digital preservation	23(19.2%)
This agency has annual budget for digital preservation	28(23.3%)
Total	**120(100%)**

5.6 DIGITAL PRESERVATION STRATEGIES

Chapter Three of the current study noted the growing numbers of digital material in the digital world. It further brought to the fore the growing numbers of published scholarly literature in digital form and the exponential growth of government digital records as a result of the activities of e-government and government legislations. It alluded to the supposition that without measures to ensure the long-term preservation of digital records, ministries and agencies would be caught up with an attrition process probably because of the ephemeral nature of digital records. In order to examine the state of preservation strategies used by the ministries and agencies, question 52 of the survey listed 9 possible preservation strategies and asked respondents whether each had been implemented in their organisations. Strikingly, backup 23(19.2%), migration 22(18.3%), metadata 18(15%) and trusted repositories 16(13.3%) were the obvious choices of respondent. However, other preservation strategies such as cloud computing 6(5%), emulation 5(4.2%)

refreshing 10(8.3%) and byte replication 12(10%) were the least options of respondents. A growing phenomenon such as Linked Open Data received a disappointing score of 8(6.7%) (Table 5-23). This situation portends a smattering knowledge of Linked Open Data among respondents. It must, however, be noted that backup is just one of the component of digital preservation and cannot be construed as enough to ensure a digital preservation strategy. They are, in essence, medium to short term measures adopted against risk and failures associated with digital files and audio recordings as they protect data from accidental deletion, hackers and virus attacks (Corrado & Moulaison, 2014: 4).

Table 5 - 23:Preservation strategies (N=120)

Preservation strategies	**Frequency**
Migration	22(18.3%)
Emulation	5(4.2%)
Refreshing	10(8.3%)
Trusted Repositories	16(13.3%)
Cloud computing	6(5%)
Byte replication	12(10%)
Backup	23(19.2%)
Linked Open Data	8 (6.7%)
Metadata	18(15%)
Total	**120(100%)**

5.6.1 Other preservation strategies

The study underscored the flurry of technological challenges faced by many memory institutions in their bid to preserve digital records. Such technological challenges included the use of media devices, floppy disks and software. Accordingly, in an attempt to find out other preservation strategies used by respondents, respondents were given multiple options to indicate other preservation strategies adopted in their ministries and agencies. As can be observed in Table 5-24, more than two thirds of respondents 84(70%) preserved their digital records on the hard drives of their computer, on the server file with backup system and on CD-ROM or DVD. Only a handful of respondents use a preservation repository system 14(11.7%), store on a content management system 16(13.3%) and 6(5%) of respondents outsource the preservation of their records to a service provider.

Whilst these strategies are easy to deploy and appear to complement the core preservation strategies indicated in Table 5-23, they are without challenges. It is a known fact that low quality burnable CD may decay within a space of two years. Again, the technical knowledge needed to repair hard drives and operating systems can be very challenging whilst software upgrade may not necessarily support legally acquired file format.

Table 5 - 24:Other preservation strategies used across the ministries and agencies (N=120)

Other preservation strategies	Frequent	Percent
Stored as part of a digital preservation repository system	14	11.7
Outsourced on contract to service provider	6	5.0
Stored on CD-ROM or DVD with backup	23	19.2
Stored on hard drive of computer	33	27.5
Stored on server file with backup	28	23.3
Stored on a content management system with backup	16	13.3
Total	**120**	**100**

5.6.2 Phrases for digital preservation strategies

The survey, in finding out the techniques or the application of these strategies, asked respondents to confirm phrases about preservation strategies. The largest percentage, 11(9.17%), had plans for a digitization programme. More than eight percent of respondents 10(8.3%) undertake regular migration of information from one medium to another. Another, 10 (8.3%) and 9(7.5%) had a data infrastructure and procedures for data migration respectively. The rest used other metadata standards 4(3.3%) and other repositories 7(5.8%) (Table 5-25). Comparatively,

data infrastructure, migration and digitization featured profoundly in the preservation strategies of respondents as opposed to metadata standards and repositories. In all, less than half of respondents 57(47.5%) complied and applied themselves to the aforementioned preservation strategies. On the other hand, 63(52.5%) of respondents do not see these strategies as applicable to their ministries and agencies.

Table 5 - 25:Phrases for digital preservation strategies (N=120)

Digital preservation strategies	**Yes**	**No**	**Total**
Your agency has a data infrastructure for preservation of digital records	10 (8.33%)	8(6.67%)	18(15.00%)
There is a regular migration of information from one medium to another	10(8.33%)	9(7.50%)	19(15.83%)
These procedures for data migration are documented	9(7.50%)	10(8.33%)	19(15.83%)
There are other metadata standards used in the management of information	4(3.33%)	10(8.33%)	14(11.66%)
You are aware of other repositories using different preservation techniques	7(5.83%)	11(9.17%)	18(15.00%)
Any plans to have a digitization programme in your agency	11(9.17%)	8(6.67%)	19(15.84%)
Have you been informed by other organisation to assist you develop a digital preservation programme	6(5.00%)	7(5.83%)	13(10.83%)
Total	**57(47.50%)**	**63(52.5%)**	**120(100%)**

5.6.3 Content of preservation policies

A critical part to the pursuit of digital preservation is the development of content policies as a clearly documented, realistic and achievable preservation policy is an essential foundation for any sustainable digital preservation programme. In examining the content of digital preservation policy for best practices in other jurisdictions, the survey sought to find out from respondents the key considerations of their preservation policies. Table 5-26 shows that due attention has not been paid to strategies such as depository guidelines 4(3.3%), refreshing 5(4.1%), procedures 5(4.2%) and conversion and formatting 7(5.8%). On the contrary, respondents had preference for roles and responsibilities 11(9.2%), scope 11(9.2%), migration 14(11.7%), storage and maintenance 14(11.7%), technical infrastructure 9(7.5%), access and maintenance 11(9.2%) and quality control procedure 12(10%). Clearly, any long term access to digital records rest heavily on preservation strategies underpinned by digital preservation policies. Without the development of policies to ensure the longevity of digital records, the ministries and agencies cannot be said to be undertaking digital preservation.

Table 5 - 26:Content of preservation policies (N=120)

Preservation policy and strategy	**Percent**
Roles and responsibilities	11(9.2%)
Scope	11(9.2%)
Appraisal selection and acquisition	9(7.5%)
Conversion and formatting	7(5.8%)
Refreshing	5(4.2%)
Migration	14(11.7%)
Storage and maintenance	14(11.7%)
Access and maintenance	11(9.2%)
Standards	8(6.6%)
Procedures	5(4.1%)
Technical Infrastructure	9(7.5%)
Depository guidelines	4(3.3%)
Quality control procedures	12(10%)
Total	**120(100)**

5.6.4 Preservation metadata that applies to ministries/agencies

One other way of addressing the challenges of digital preservation is the development of metadata standards to organise and retrieve content in the digital preservation system. While all types of metadata are crucial for the preservation of digital collection, preservation metadata has a unique way of ensuring the long-term access and management of the digital collections. Thus, there are several metadata standards. The study, therefore, sought from respondents the type of preservation metadata that applies to their ministries and agencies. It was encouraging to observe that 58(48.3%) of respondents were reported of using standard digital preservation metadata developed in house to record preservation metadata about their digital objects (Table 5-27). This included technical information, provenance, ownership and information on rights. About thirteen percent uses the library of New Zealand preservation metadata and 9(7.5%) of respondents use other preservation metadata. More than one-third of respondents 37(30.7%) either do not use preservation metadata or don't know about preservation metadata. The findings show that accessibility and usability of content in the digital preservation environment are enhanced through the creation and management of preservation metadata.

Table 5 - 27:Preservation metadata that applies to the ministries N=120

Preservation options that applies to the ministries/agencies	**Percent**
This agency uses a preservation metadata developed in house	58(48.3%)
This agency uses the Library of New Zealand Preservation Metadata	16(13.3%)
This organization uses other Preservation Metadata Standard	9(7.5%)
This agency uses no Preservation Metadata but is planning to	14(11.7%)
Don't know	23(19.2%)
Total	**120(100%)**

5.6.5 Projects for digital preservation- results from interview

In questions four and five of the interview protocol, respondents were asked whether there are any repository arrangements or projects for digital preservation for their ministry or agencies. All five interviewees mentioned the National Data Centre.

5.6.5.1 National Data Centre

As part of the requirement of the Government's policy to make information resources widely available and accessible to the ministries and agencies, the Ministry of Communication, through the National Information Technology Agency (NITA) has set up a National Data Centre infrastructure. This infrastructure will ensure that public sector organisations access data from a more swift and resilient storage system. NITA through the use of the National Data Centre will support, operate and maintain data from all the ministries and agencies of the government. They will provide all the necessary additional supporting ICT services to the MDAs, thus relieving them of the burden of hosting their own applications and allowing them to concentrate on their core businesses. These facilities will be supported by a Network Operating Centre (to provide monitoring and control over all applications and network services originating in the Data Centre infrastructure), Security Operating Centre (to serve as the nucleus of the MDAs intranet and Internet Security Operations) and Several Storage Area Networks (which will provide for the storage needs of all the MDAs that will be hosted by the National Data Centre).

5.7 BEST CURRENT PRACTICES FOR DIGITAL PRESERVATION

Developing preservation policies is the first step to achieving preservation actions as short, medium, or long term preservation of digital records are driven by policies. Policies are also the blue prints that translate into the creation of action plans, guidelines and best practices. A preservation policy charts a path and outline the roadmap to achieve any long term access and future benefits of digital preservation. In order to juxtapose the digital preservation policies of

the ministries against the best international practices, the study examined whether or not the ministries and agencies are aware of any national policy or institutional policy on digital preservation to guide the implementation of digital preservation of e-government.

5.7.1 Digital preservation policies and best current practices

Whilst 24(20%) of respondents admitted that they are aware of a national policy that governs the preservation of public sector records, 18(15%) of respondents conceded that the policy is applied in their agencies or ministries. Respondents were further asked whether there is an established strategy to make digital preservation work in their agencies and ministries. Unsurprisingly, 16(14%) of respondents indicated that they have an established preservation strategy in their institutions. Eighteen percent of respondents noted that preservation policies cover the entire life of the digital records, while 22(18%) alluded to the fact that policies determine the kind of data that can be accepted in their organisations (Figure 5-9). The results reaffirm the supposition that policies, procedures and structures can be developed to ensure the effective delivery of e-government programmes through the preservation of records as noted by the integrated management approach.

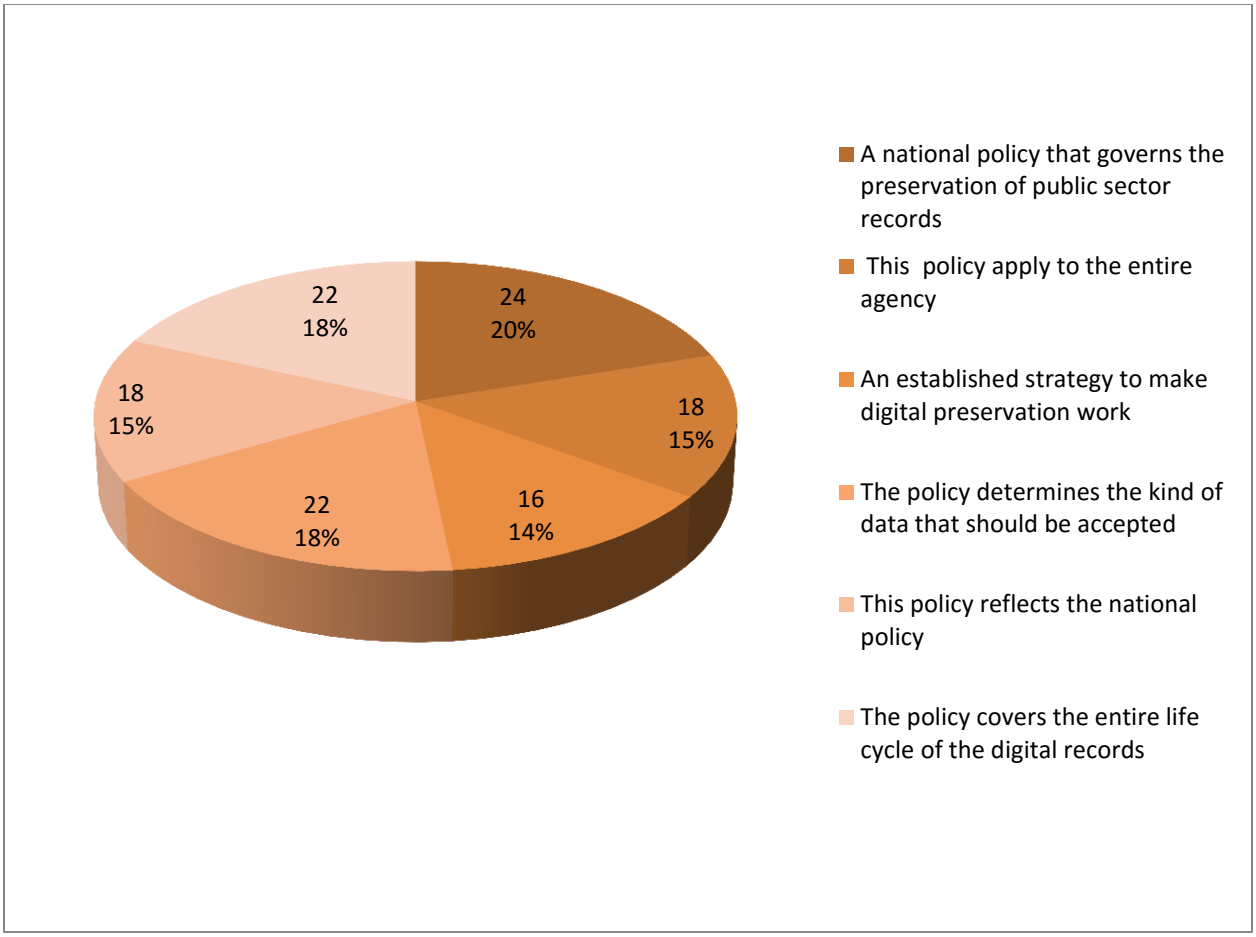

Figure 5 - 9:Digital preservation policies and best current practices (N=120)

5.7.2 Respondents' views on policies and best practices

In question 14 of the interview protocol, respondent's views and suggestions were sought on the national priorities or actions for digital preservation needs. Respondents noted that a legislative instrument or policy for the implementation of a digital preservation infrastructure may be welcome. However, the application of the PRAAD law is not effective and enforceable enough hence there must be a law to keep government records permanently. Another respondent noted that government agencies and ministries need resources to send their records to the data centre. These varied views reinforces the need for an effective legislation for digital preservation in Ghana

5.7.3 The degree to which digital preservation policy affects current needs

When respondents were asked to indicate the extent to which the policy affected their current needs for digital preservation, 12(10%) of respondents indicated that they were adequately affected by the policy, 12(10%) of respondent noted the policy affected their records to a high degree. However, a large proportion of 57(47.5%) of respondents claimed the policy affects their current needs for digital preservation to a high degree as shown in figure 5-9. Another set of respondents 27(22.5%) noted that the policy affects their current needs but to a very low degree.

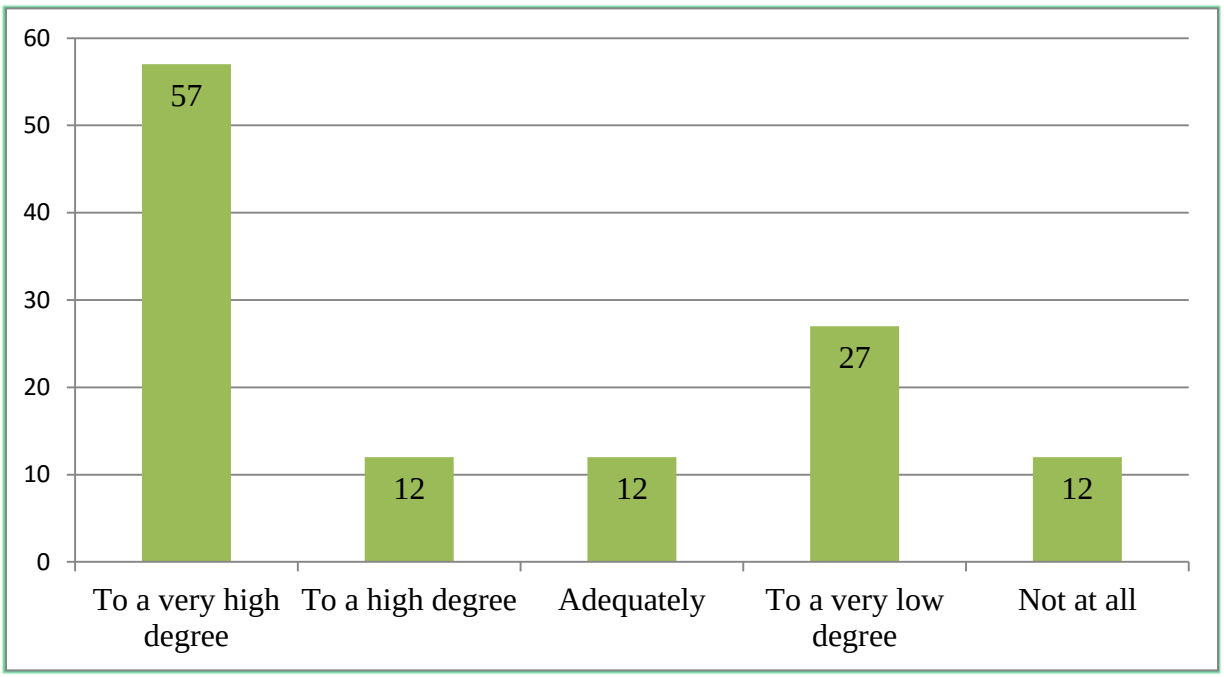

Figure 5 - 10:Digital preservation policies affecting current needs (N=120)

5.7.4 Policy guiding the preservation of digital records

Of the 57(58.8%) respondents in Figure 5-10 who noted that digital preservation policies affected their current needs to a very high degree, 49(44%) conceded that those policies were partially used to guide the preservation of digital records. Nearly half of respondents 47(39.2%) gave explicit response of 'NO' and don't know'' as to whether policies guide the preservation of digital records. The findings concur with the results under the current awareness level of respondents in Section 5.3. However, 24(14%) of respondents noted that the preservation of digital records were guided by policies.

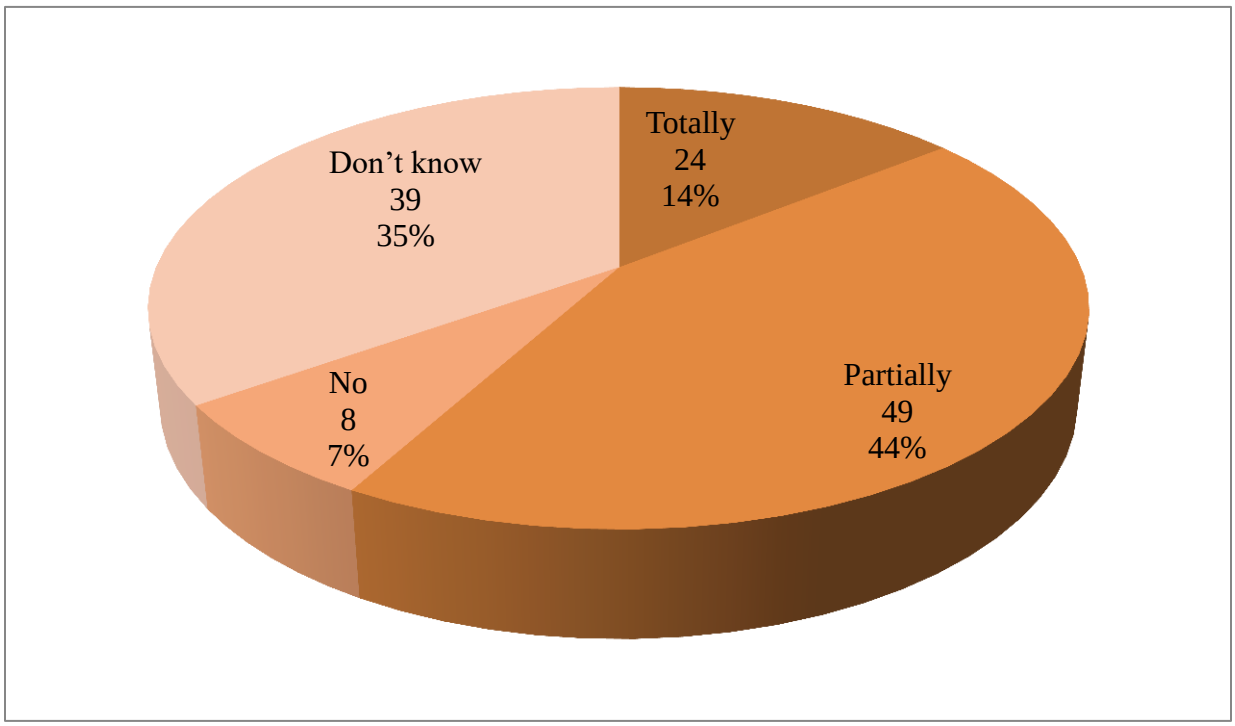

Figure 5 - 11:Policy guiding the preservation of digital records (N=120)

5.7.4.1 Interview results for degree to which digital preservation supports the current needs of the ministries/agencies

Probing further, question nine of the interview protocol asked respondents to explain the extent or degree to which digital preservation supports their current needs in the ministries. Respondents articulated how public officers are held accountable for their actions and inactions through records that have been preserved. For instance, preservation of records supports and assists in the promotions, motivations, dismissals and retirement of staff members. ‘’*Preservation of records is the heart of our civil governance, our land claims and lawsuits are often based on records held by the records manager’’* as noted by one respondent. Clearly, preservation of digital records supports the policies and inquiries of the ministries and agencies. ‘’*To a very large extent the records, policies and initiatives generated by the ministries and agencies are fed onto the website of the ministry’’* noted by another respondents.

5.7.5 Possible collaborative organisation to develop digital preservation programme

Chapter Three of the current study and subsequent sections of this chapter brought to the fore the enormous benefits of collaborating with other institutions to share resources, knowledge and operate on the same technical standards. It further underscored how the collaborative efforts of the Digital Preservation Coalition (DPC) from the U.K, the Nestor (Network of Expertise in the Long-Term SToRage) from Germany and the Data Preservation for the Social Sciences (DATA-PASS) from the U.S have yielded a lot of dividends to heritage institutions (Day, 2008). Such collaborative efforts have focused on metadata standards and file formats (Abrams & Seaman, 2003). Accordingly, respondents were asked to indicate whether they have contacted any collaborative organisations to help them develop digital preservation programmes. Tabe 5-28 shows that 65(54%) of respondents have one way or the other made some overtures to some organisations to collaborate, whiles 55(46%) of respondents have not. This result is positive as collaborative opportunities drive memory institutions to be relevant.

Table 5-28 Possible collaborative organisation (N=120)

Yes	No
65(54%)	**55(46%)**

5.7.6 Digital preservation policy & procedures acceptable for preservation

In Figure 5-12, 56(52%) of respondents reported that there are policies and procedures that determine the acceptability of data for preservation. On the other hand, more than half 64(48%) of respondents either do not know of any policy or do not have a policy at all that guides the preservation of data. These indicated that less attention has been paid to digital preservation policies, even though evidence exists to show that huge volumes of digital records are growing phenomenally and exponentially.

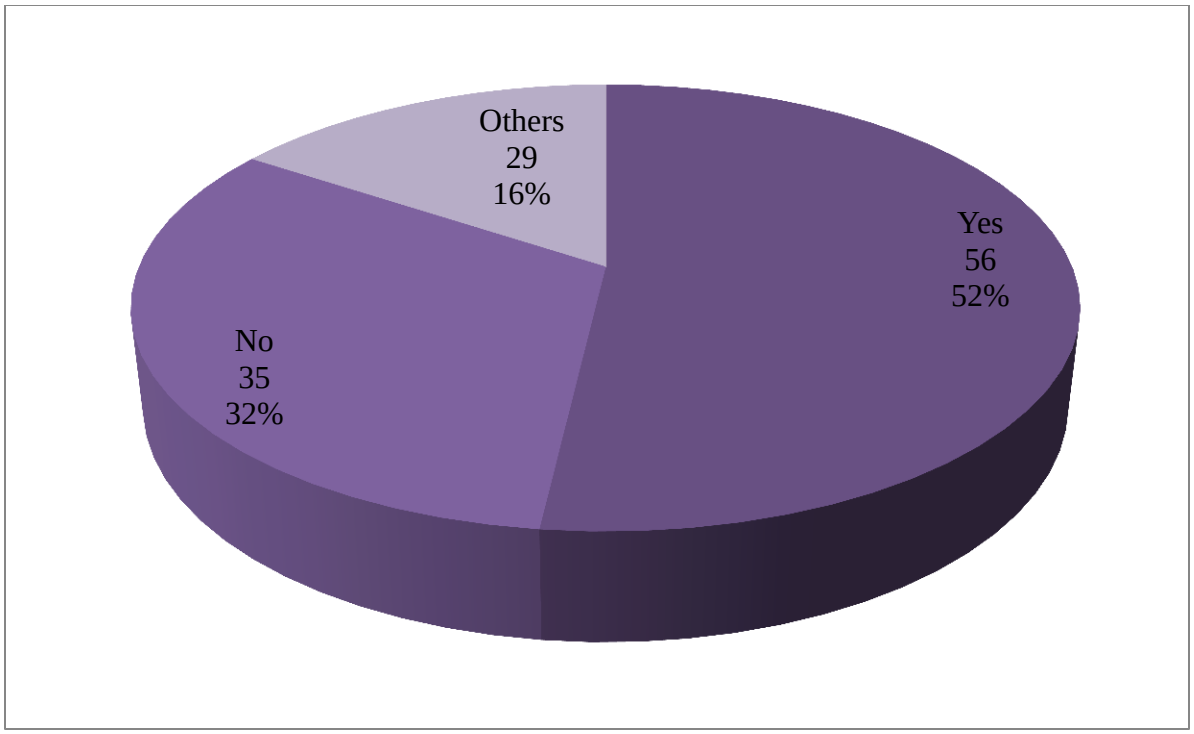

Figure 5 - 12: Policies acceptable for data preservation (N=120)

5.7.7 Strategic document/policy that supports digital preservation

In question five of the interview protocol, respondents were asked to elaborate on any strategic document supporting digital preservation. All five interviewees took time to elaborate on the strategic document that applies to their ministry or agency as follows:

- the Public Records and Archives Administration Act (Act 535, 1997),
- the ICT policy
- civil service act 1993 (PNDCL 327)
- Financial Administration Act, 2003 Act 654

In the case of the PRAAD Act (Act 535, 1997) respondents noted the following:

Interviewee A

> *''Section 8 of Acts enjoins PRAAD to take custody of semi-current records which have been scheduled for further retention and maintain them within a records centre. Section 9 of the act enjoins every public institution where public records are created and kept to establish good records keeping practices within the registry''*

On the ICT strategic document, interview B referred the researcher to ICT policy document which highlights the following:

•*facilitating effective and efficient records and information management within*

MDAs, from planning and system development to disposal, and to ensure long-term preservation

•*ensuring MDAs maintain, protect and preserve information so that information of enduring value is available for future use*

•*ensuring the effectiveness and efficiency of the management of information throughout its lifecycle by establishing an accountability framework to ensure the appropriate management of information*

He concluded that ''effective records and information management is part of the critical components of the national ICT objectives''

Interviewee C mentioned Section 20 of the Civil Service Act when he alluded that

''the act empowers directors to implement proper codes of conduct for administrative, financial and operational transactions of the service. He further noted that compliance to these acts can only be enforced if there is a proper records management system for public officers.

The Financial Administration Act, 2003 Act 654 was also mentioned.

Interviewee D noted that "the Financial Administration Act prescribes the responsibilities of persons entrusted with financial management in government to ensure the effective and efficient management of state revenue, expenditure, assets, liabilities, resources of the government (Financial Administration Act, 2003 Act 654). A follow up to section 54 of the same Act notes that corporations shall keep proper books of accounts and proper records in a form as approved by the Attorney General.

The above references from respondents underline the supportive nature of our laws, acts and legislations for digital preservation. The question however is whether these legislations or acts are enough to ensure the implementation of a digital preservation infrastructure in every ministry and agency.

5.7.8 Document analysis- best current practices

Part of the best current practices of digital preservation were addressed in Chapter Three as a form of document analysis of the current study. This section of the study brings to the fore collaborative opportunities which were partially mentioned in Chapter Three. It is significant to note that the current wave of digital preservation thrives on collaborative opportunities. It is a situation that allows memory institutions and public sector organisations to share information, agree on technical standards for digital preservation and develop open source software that uses similar preservation systems. Indeed solutions to the many challenges of memory institutions can be profited and ameliorated through collaborative opportunities as noted by the Council of Canadian Academies (2015:82). Very well established search engines have pitched camps with memory institutions to enhance their services. For instance, the WorldCat through collaborative initiatives receives cataloging information from well over 72,000 libraries around the world (Council of Canadian Academies, 2015:82). Google books have similarly become a resource library as their users have the opportunity to search over two billion record (Waibel & Erway, 2009; OCLC, 2014 in Council of Canadian Academies, 2015).

These collaborative initiatives by these established organisations usually begin with consistent processes which include: the development of common criteria for content selection and

guidelines for the acquisition of materials. The effect of such guidelines help participating institutions to profit from shared catalogue, best practices and review of the acquisition mission of each individual institution. Several exemplars abound (Europeana, InterPARES project, Archivematica) but in this current study, collaborative effort span from public and private organizations including libraries, archives, museums, companies, government funding bodies, and non-profit organizations.

Such collaborative effort can help the ministries and agencies to incur less cost, facilitate networking, share resources and knowledge. As was noted in Chapter Three, Open Data, Linked Open Data and Cloud computing can be useful in this regard. These can assist the ministries and agencies to access the breadth of knowledge, skills and technical infrastructure and beyond that help them to perform their duties more efficiently.

5.8 RESPONSIBILITIES OF STAKEHOLDERS OF DIGITAL PRESERVATION

The digital preservation conundrum is one that has caught the attention of information professionals, scholars and IT experts in view of the continuous challenges it poses to the digital world. Several propositions emanating from research and practice have underscored the establishment of a "deep strategy'' to underpin or ameliorate the digital preservation challenges confronted by organisations (Day, 2008). One of such propositions is the role stakeholders ought to play in sustaining repositories in the digital world. Against this background, they study sought to establish the role stakeholders and government ought to play in the implementation and development of digital preservation across the ministries and agencies. Accordingly, respondents were asked to indicate in order of importance the responsibilities of stakeholders and government.

5.8.1 Roles of stakeholders

Table 5-29 shows the significant importance respondents attach to best practices 10(8.3%), training and education 10(8.3%) and advocacy 10(8.3%). Collaboration 11(9.2%), funding

14(11.7%) and standards 7(5.8%) were similarly chosen by respondents as very important. The percentage score for collaboration means that the future of digital curation depends on the collaborative efforts from all the various stakeholders. Therefore, collaboration, strategic alliances, and synergy should form part of the solutions to the unending problems of digital preservation.

Table 5-29 Roles of stakeholders (N=120)

Stakeholders	**Very important**	**Important**	**Fairly important**	**Total number of respondents**
Best practices	10(8.33%)	4(3.33%)	1(0.83%)	15(12.5%)
Funding	14(11.67%)	4(3.33%)	4(3.33%)	22(18.33%)
Training and Education	10(8.33%)	6(5.00%)	-	16(13.33%)
Advocacy	10(8.33%)	12(10.00%)	2(1.67%)	24(20.00%)
Standards	7(5.83%)	6(5.00%)	4(3.33%)	17(14.16%)
Coordination/Collaboration	11(9.16%)	8(6.67%)	7(5.83%)	26(21.66%)
Total	**62(51.66%)**	**40(33.4%)**	**18(15.0%)**	**120(100%)**

5.8.2 Government's role

With respect to government role, respondents were very clear in their minds that creating an infrastructure 11(9.2%) and funding 10(8.3) were very important but technological tools 13(10.8%) and legislation 12(10%) for digital preservation were far more important, judging by the percentage score of respondents. Respondents call for the involvement of stakeholders 10(8.3%) and state wide initiatives in digital preservation 10(8.3%) were also significant. The

reported findings lead to two assumptions: stakeholders of digital preservation were prepared to engage with government in constructive discussion and that government operations/activities will be incomplete without the proper maintenance of digital records. The results emphasised the need for collaborative and participatory opportunities in the digital preservation environment. Moreover, it reinforced the concept of Open Data which thrives on citizen's trust, participation and collaboration. The call for technological tools, legislations and infrastructure according to the reported result agrees with the empirical literature when Wamukoya, (2012) proposed that an open government should have (a) an infrastructure of laws, policies and procedures to support complete and trustworthy record (b) record authority to support Open Data initiatives and (c) the establishment of organisation-wide-records-management.

Table 5-30 Government role (N=120)

Government's role	**Very important**	**Important**	**Fairly important**	**Total number of respondents**
Creating infrastructure	11(9.17%)	8(6.67%)	4(3.33%)	23(19.17%)
Involving stakeholders	10(8.33%)	8(6.67%)	1(0.83%)	19(15.83%)
Technological tools	13(10.83%)	7(5.8%)	1(0.83%)	21(17.50%)
Statewide initiatives	10(8.33%)	10(8.33%)	1(0.83%)	21(17.50%)
Legislatives/policy/legal	12(10.0%)	5(4.17%)	1(0.83%)	18(15.00%)
Funding	10(8.33%)	7(5.83%)	1(0.83%)	18(15.00%)
Total	**66(55%)**	**45(37.5%)**	**9(7.50%)**	**120(100%)**

Elaborating on the role of stakeholders during the interview session, respondents stressed how stakeholders can leverage on collaboration to solve much of the problems of digital preservation.

In other words a common approach can be adopted to address the digital preservation conundrum through information sharing, use of Open Data, Linked Open Data and preservation metadata

5.8.2.1 Data freely available

As a follow up to the concept of Open Data, respondents were further asked to indicate whether their website data was made available for use by the general public. Figure 5-13 shows 67(55.8%) of respondents noted that their data was freely available for use, whiles 30(25%) of respondents disagreed with the statement that their data is available. A small portion of respondents 23(19.2%) have no idea about whether their data is freely available to the general public or not. The results emphasized the extent to which the ministries and agencies have made their data freely available to the public and have opened up the opportunity for citizens to assess their performance at various levels. This initiative from the ministries makes them transparent and very much open to the general public as data is shared in a form that allows use and reuse of digital records preserved. With several position papers and international agencies (UN, UK and US agencies) supporting the need for Open Data, data must be well preserved to ensure their use and reuse. Funding agencies in U.K and U.S insist on a data management plan that is related to digital preservation before funding is approved (Corrado & Moulaison, 2014: 187).

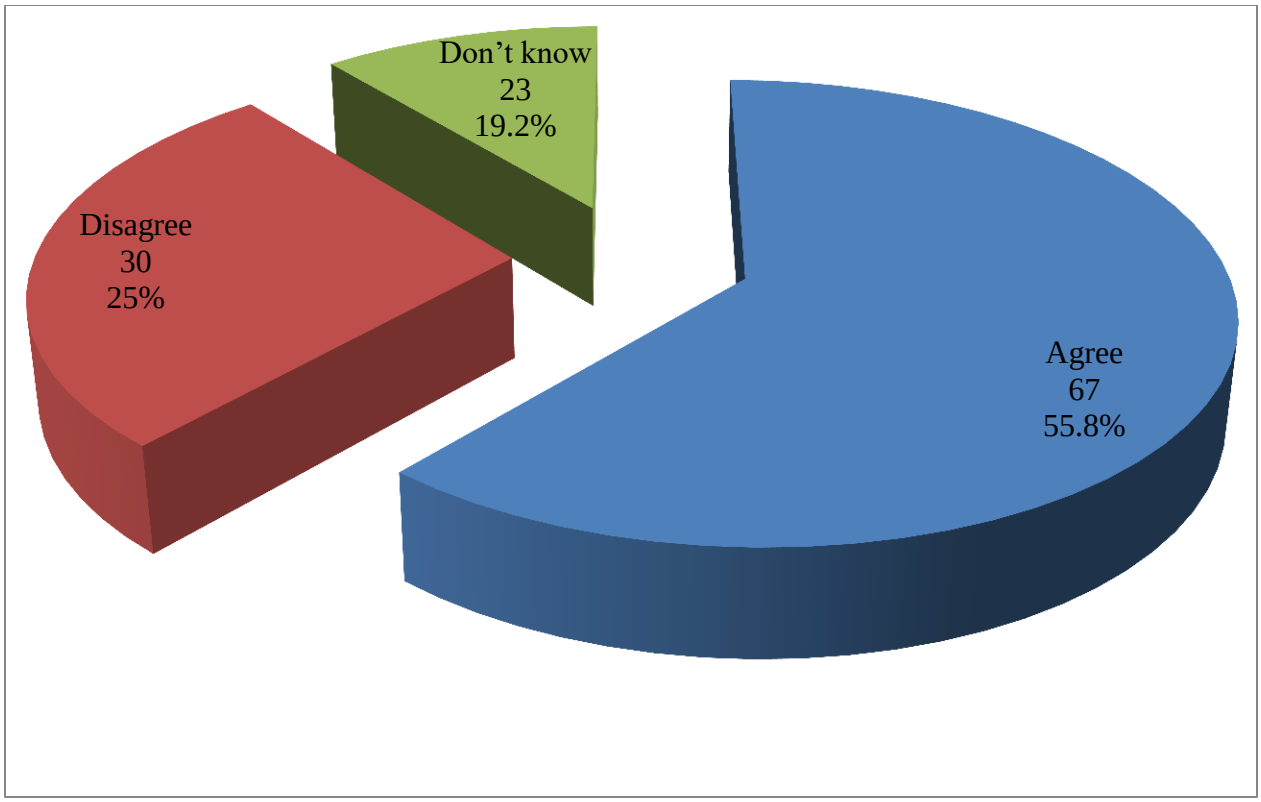

Figure 5 - 13:Data freely available for use (N=120)

5.8.3 Document analysis- role of stakeholders

Stakeholders in this study involved government, memory institutions, national libraries and national archives, Universities, records managers and IT managers in government departments. Chapter Three discussed part of the role of stakeholders in digital preservation environment. It listed a number of institutions which have a stake in the digital preservation environment. Dwelling on the exemplars and experiences from Canada, United Sates and Europe, this part of the study would reinforce and elevate the same discussion in response to one of the objectives of the current study which sought to establish the role of stakeholder in the digital preservation environment, particularly from the perspectives of digital environment.

To start with, the new phase of the digital world has changed the role of archives services and libraries. The Council of Canadian Academies (2015) citing Waibel and Erway (2009) noted that

before the proliferation of the ICT, memories institutions had ‘’created an orderly world within their respective domains through the power of shared practices and standards’’. Sadly enough, this orderly world has been disrupted by digital technology, which demands an appropriate and urgent response. Thus, technology has charted a new path for library and memory institution as opposed to the old order or traditional services they offer.

In response to this new transition, stakeholders (national archives, national libraries) in the digital environment are beginning to change their modus operandi by building trusted relationships with other memory institutions through participatory projects such as national debate on digital preservation infrastructure and acquisition of digital heritage (The Council of Canadian Academies, 2015). In this regard, the call by the Library of Congress in 2005 under the National Digital Information Infrastructure and Preservation Programme (NDIIPP, 2008) inviting heads of state libraries, archives and other corporate institutions for a workshop to develop strategies for the preservation of significant state and local government information in digital form underscores the enormous benefits of building relationships with other memory institutions. The interactive and participatory nature of such projects can help stakeholders to benefit from software developers who design software programmes to enhance the day-to-day functions of participating institutions.

Collaboration is perhaps the next role stakeholders in the digital preservation environment can envisage, as many organisations are addressing their digital challenges through such collaborations. In Canada, the Ontario Council of University Libraries has established scholars portal to provide access to digital information resources shared among 21 Universities in Ontario (The Council of Canadian Academies, 2015). Again the Canadian Research Knowledge Network which was established to coordinate the leadership of stakeholders in the research community has built knowledge infrastructure for Canada’s Universities by acquiring a large scale of electronic content from publishers (Comprehensive Knowledge Archive Network, 2013). These exemplars underscore how participating institutions who are themselves stakeholder can benefit from collaboration.

To remain relevant and up to date with the digital trend, stakeholders in the digital preservation environment are beginning to adopt Open Data policies in an effort to drive innovation. This involves sharing and reusing data through the concept of Linked Open Data Networks and Open Data. For instance, the U.K government, in an effort to make their data public and easy to find has created a central access portal, data.gov.uk.; which includes Linked Open Data and Open Data from Government departments, public-sector bodies, and local authorities are hooked onto the Open Data through the site of U.K. Government. The Government of Canada in the same fashion launched an Open Data portal data.gc.ca.; allowing unrestricted data reuse (Government of Canada, 2011; (CKAN) Comprehensive Knowledge Archive Network, 2013; Government of Canada, 2013). Various cities and districts throughout Canada have launched their own Open Data websites (Government of Canada, 2014), including the City of Ottawa, which also uses the CKAN platform (City of Ottawa, 2014). Europeana, a world leader in digital opportunities is managing a repository of over 30 million cultural items from 2300 European institutions through the Open Data ((Europeana, 2013). These exemplars reinforce how stakeholders can be relevant in these changing times. However, it should be noted that the setting up of Open Data depends on how enthusiastic group or volunteers are keen on sharing resources and the eventual agreement on technical standards.

Stakeholders will be more effective for the preservation of digital records if the preservation process is planned in a collaborative manner. At the same time if programmers make their software open source and participating institution release their data under an open license, knowledge sharing, innovation, and further collaboration can be enabled (The Council of Canadian Academies, 2015).

5.9 SUMMARY OF KEY FINDINGS

The following is a summary of the major findings of the study.

5.9.1 ICT and the preservation of digital records

- ICT facilitates the creation, management, preservation and accessibility of digital records; and

- the use of ICT in the preservation of digital records is completely managed by in-house staff of the ministries.

5.9.2 Categories of digital information generated

- databases, digital publication, email, website information and document conversion exemplified the growing range of digital material that require preservation attention and effort; and
- the results single out government as the main actor because tax records, election registers, property and pension records, social security records, land records, birth and death records are extrapolated from these categories of information to improve public serve delivery.

5.9.3 Other categories of digital preservation

- digital materials such as tweets, website information, geographical information systems data were the most common categories of digital information received from other agencies to be preserved;
- the variety of digital records generated underscore the strength of technology; and
- the tendency to destroy these type of records was high because they usually do not appear in the mainstream of digital information.

5.9.4 Activities that generate digital records

- e-government activities, review of government policies, formulation of policies were deemed to have generated digital records more than new public management policy and evaluation of the efficiency of government agencies; and
- Core business needs, statutory duty and statutory requirement have been initiated to make it mandatory and constitutional for digital records to be preserved.

5.9.5 Other factors for the growth of digital records

- the Right to the Information Law and government legislations have contributed to the increased demand for information and the growth of digital records;
- as a result of the anticipated law, departments were being created to keep and organise the records system; and
- the information law reinforces the need to create and maintain records properly.

5.9.6 Awareness of volumes of digital material and rate of growth

- few discrepancies were noted about the volume of digital material as some ministries misconstrued 1.8 GB to be 1.8MB;
- nevertheless respondents were very much aware of the volume of digital material and can provide rough estimates of the digital records;
- few ministries were explicitly clueless about the likely growth of their digital records; and
- the results explain why few organisations take a long-term perspective about digital preservation and awareness issues.

5.9.7 Level of awareness for digital preservation standards

- there was a high level of awareness for General Information Standard Archival Description and Documentation-Records Management Processes- Metadata Records;
- however, Information and Documentation Records Management , Reference Model for Open Archival Information system and Information Technology Security Techniques were either unknown by respondents or respondents were now planning to implement them; and
- in general, whereas less than half of respondents were aware of the digital preservation standards more than half of respondents were either planning or unaware of the various international standards for digital preservation.

5.9.8 Actions undertaken to extend the life of digital material

- majority of respondents either do not know or do not use file formats, and storage devices to extend the life of a digital material across the ministries and agencies; and
- but then again, file formats, storage media, storage drives and software and hardware were used by 45.6% of respondents to extend the life of their digital materials.

5.9.9 Digital preservation projects, toolkits and software

- the application and use of the digital preservation tool such as LOCKS was a familiar terrain to the ministries and agencies;
- there was expressed lack of awareness about digital preservation support organisation such as Digital preservation Coalition, Digital Curation Centre, PLANET, INTERPARES, Digital Preservation Europe and UK Web Archiving Consortium;
- most of the ministries and agencies were clueless about preservation toolkits such as DRAMBORA , TRAC , DSPACE and ARCHIVEMATICA; and
- many of the ministries have failed to undertake a self-assessment of their digital records.

5.9.10 Description of archive services

- majority of archive services at the ministries and agencies were seeking for digital material as opposed to a small proportion of ministries and agencies reacting to depositors in terms of digital preservation planning.

5.9.11 File formats

- many of the activities of preservation were carried out around file format with PDF, Word, Excel and access being the common file format used in the ministries and agencies; and

- however, few ministries used HTML, JEPP and TIFF as part of their preservation activities.

5.9.12 Digital materials in urgent need for preservation

- there was a split in response between digital materials in urgent need for preservation and digital materials being safe; but there was no doubt that digital materials of the ministries requires some level of preservation effort and attention.

5.9.13 E-government and digital preservation

- overwhelming majority of the ministries and agencies were involved in the implementation of e-government and alluded to the fact that e-government feed into the use of digital records;
- the delivery of government services through technology demands repositories to be created to feed government websites;
- the creation and implementation of e-government in public sector organisation degenerates into another form of digital records; and
- ICT products and facilities meant for digital preservation and e-government were observed to be present in all the ministries and agencies.

5.9.14 Loss of digital materials

- just few ministries conceded that no action is taken whenever they receive digital materials;
- most of the ministries and agencies were unable to access their digital records, were having challenges opening the content of a file and losing their digital records; and
- by implication transactional records and significant opportunities will be lost if desperate attempts are not made to reverse this trend.

5.9.15 Funding

- funding was identified as one of the key barriers because of its rippling effects and impact on the other barriers to digital preservation;
- funding became a critical factor because changes in hardware and software or transformation of data from one configuration to another are often driven by funds;
- the periodic copying of data (refreshing), and construction and maintenance of data (emulation) to support old and obsolete data, come with some level of costs;
- ministries have an estimated cost of their funding and additional funding requirement for digital preservation;
- ministries and agencies expressed their discomfort about the level of security and privacy, skills training and insufficient funding for digital preservation programmes; and
- although technological obsolescence was considered a minimal threat it was seen as the cause of media incompatibility and configuration problems and frequent changes in hardware and software.

5.9.16 Security measures

- there were clear admissions that security and privacy policy measures were in place by way of keeping track of changes made on the digital records and monitoring of emails;
- there was a strong application of ‘user restriction’ in order to ensure the security and privacy of their digital records;
- whilst the application of user restriction ensures the security and privacy of digital records, the ministries and agencies have inherent challenges complying with the policies and procedures of the security measures in place;
- security threats were also noted in records saved on hard drives;

- the ministries hardly audit their records system;
- just an insignificant number of ministries audit their records system annually or bi-annually;
- in order not to compromise the reliability, authenticity and essential characteristics of records, physical security, tracking and verification of digital objects have been introduced; and
- the use of identity cards, metadata and fire walls have been implemented to protect digital records against unauthorized access.

5.9.17 Training and staffing

- nearly half of the records managers and IT officers have first degree in Information Science and advanced diploma in IT, whiles more than half hold Masters's degree in Information Science and Information Technology;
- records managers and IT officers rarely received training in digital preservation yet they were assigned digital preservation responsibilities;
- training programmes were needed to help information professionals manage the anticipated problems of digital records;
- most of the ministries preferred training/skills in areas such as the management and preservation of digital records and IT applications in records management;
- the changing roles of records managers, preservation of digital records, preservation strategies and tools, digitization, copyright issues and metadata, digital records security, digital repositories, standard formats, preservation strategies were also noted to be the training preferences for the ministries and agencies;
- the findings in training underscore the following:

- the preparedness of the ministries to overcome the problem of technophobia and upgrade their knowledge in technological tools;
- to enable them integrate records management considerations in the design of web-enabled application system; and

- overwhelming majority of the ministries preferred digital preservation training to be delivered in seminars workshops and internships.

5.9.18 Digital preservation strategies

- backup migration, metadata and trusted repositories were the most profound preservation strategies being implemented at the ministries and agencies;
- the ministries would at least check for viruses, copy the digital records to a different storage media and migrate their material to a current version of file formats when they first receive digital materials;
- unsurprisingly cloud computing, Linked Open Data, emulation and byte replication were the least implemented preservation strategies;
- other preservation strategies used by the ministries and agencies included: preserving digital records on the hard drives of their computers, storing their digital records on the server file with backup system and on CD-ROM or DVD;
- comparatively, data infrastructure, migration and digitization featured prominently in the preservation strategies of respondents than metadata standards and repositories;
- in spite of the adoption of the aforementioned preservation strategies, more than half of the population of records managers and IT officers at the ministries claimed these strategies are not applicable to their outfit;
- preservation metadata was noted as one of the strategies used in addressing the challenges of digital preservation;

- however, one third of the population of records managers and IT officers either do not use preservation metadata or do not know about preservation metadata;
- a national data centre has been set up to support and maintain data from all the ministries and agencies of the government;
- any long term access to digital records rest heavily on preservation strategies underpinned by digital preservation policies; and
- most of the ministries had roles and responsibilities, scope, migration, storage and maintenance, technical infrastructure, access and maintenance and quality control procedures as part of the content of their digital preservation policies.

5.9.19 Policies

- the acceptability of data in the ministries and agencies were guided by digital preservation policies;
- whilst there were clear admissions of the awareness of a digital preservation policy, just a handful of the ministries conceded the applicability of those policies;
- to a very a high degree, the current needs of the ministries and agencies were affected by the digital preservation policies;
- preservation of digital records supports the policies and inquiries of the ministries and agencies; and
- there are litany of laws, acts and legislations that support the implementation of digital preservation. The question, however, is whether these legislations or acts are enough to ensure the implementation of a digital preservation infrastructure in every ministry and agency.

5.9.20 Collaboration

- most respondents from the ministries have in one way or the other made some overtures to some organization and other memory institutions to collaborate with them;
- digital preservation thrives on collaborative opportunities;
- solutions to the many challenges of memory institutions can be profited and ameliorated through collaborative opportunities;
- collaborative initiatives begins with the development of common criteria for content selection and guidelines for the acquisition of material;
- collaborative effort can help the ministries and agencies to cut down cost, facilitate networking and share responsibilities; and
- collaborative effort span from public and private organizations including libraries, archives, museums, companies, government funding bodies, and non-profit organisations.

5.9.21 Collaboration and participatory opportunities

- the future of digital curation depends on the collaborative efforts from all the various stakeholders;
- the ministries attach great level of importance to collaboration, funding, best practices, training, education and advocacy;
- collaboration, strategic alliances, and synergy should form part of the solutions to the unending problems of digital preservation; and
- creating an infrastructure by the government was very important but technological tools, funding and legislation for digital preservation were far more important to the ministries.

5.9.22 Government

- the role of government in the digital preservation environment leads to two assumptions: stakeholders of digital preservation are prepared to engage with government in constructive discussion and government operations/activities will be incomplete without the proper maintenance of digital records;

- the role of stakeholder reinforces the concept of Open Data which thrives on citizen's trust, participation and collaboration;

- through collaboration stakeholders can leverage on the use of Open Data, Linked Open Data and preservation metadata;
- stakeholders in the digital preservation environment are beginning to adopt Open Data policies to remain relevant and drive innovation; and

- stakeholders are building trusted relationships with other memory institutions through participatory projects such as national debate on digital preservation infrastructure and acquisition of digital heritage.

5.10 CHAPTER SUMMARY

This chapter has presented the findings of the study on digital preservation of e-government in Ghana. There were few surprises in the responses to the survey even though it was reassuring that some of the problems of digital preservation were being addressed by the ministries and agencies. The results indicated that the growing range of digital material such as databases, websites, emails, and digital publication across the ministries and agencies require some level of preservation effort and attention. In this regard, a large proportion of respondents noted that statutory requirement and a constitutional mandate are needed to enforce the preservation of digital records to ensure its accessibility.

As the finding revealed, few discrepancies were noted about the volume of digital material as some ministries misconstrued 1.8 GB to be 1.8MB. Nevertheless respondents were very much aware of the volume of digital material and could provide rough estimates of the digital records. A proportion of the ministries were explicitly clueless about the likely growth of their digital records. It was therefore not a surprise that a segment of respondents were turning away digital materials and reacting negatively to depositors, a finding that suggests a worrying situation to the digital preservation environment in Ghana.

The finding further accentuated that the application of e-government feed into the use of digital records as the delivery of government services through technology demands repositories to be created to feed government websites. It was therefore not out of place when overwhelming majority of the ministries and agencies were involved in the implementation of e-government. Again, ICT product and facilities meant for digital preservation and e-government were observed to be present in all the ministries and agencies. Such a finding was validated by the researcher when he personally undertook an observation tour at the ministries and agencies to observe variety of ICT products used for digital preservation and e-government.

Whilst it was disappointing for the ministries and agencies to be losing digital materials and to be unaware of tools such as DRAMBORA and DSPACE as reported by the survey, it was at the same time heart-warming that ministries and agencies were developing in-house preservation metadata and checking for viruses when digital records were first generated. Moreover, the findings revealed that technological obsolescence, security and privacy continue to fester and stifle initiatives on the development of digital preservation. Additionally, funding, training, data support and organisational support were acting as critical barriers to digital preservation according to the survey. Beyond this, while the ministries and agencies have an idea about the estimated cost of their funding requirement, they were however clueless about the funding requirement.

Results of the survey on solution to the digital preservation conundrum were mixed as preservation strategies such as Linked Open Data, Open Data and Cloud Computing appeared to

be an unfamiliar terrain and unknown to respondents. In contrast, trusted repositories, backup, preservation metadata and migration were quite a familiar terrain to respondents. Such familiarity was confirmed and reaffirmed by more than half of the respondents when they noted that they undertake regular migration of information from one medium to another, had plans for a digitization programme and have a data infrastructure and procedures for data migration.

Clearly, whilst respondents knowledge of the strategic document that support digital preservation is positive, it is not enough to ensure the mandatory preservation of digital records across the ministries and agencies. The emphasis here is implementation and enforceability of the law, which most often is lacking. It was very clear in the findings that government attempt to create an infrastructure for digital preservation was very important but technological tools, funding and legislation for digital preservation were far more important. Again, whilst responses on the loses of digital data across the ministries and agencies were alarming, it was at the same time encouraging that more than half of the survey have policies and procedures that determine the acceptability of data for preservation with most of the respondents introducing some level of physical security to ensure the reliability and authenticity of their digital materials.

Above all, the finding showed that stakeholders in the digital preservation environment can addressed many of the digital preservation challenges if they leverage on collaborative opportunities and remain up to date with the digital trend. Such collaborative opportunities involve using experts from other institutions, sharing resources and knowledge through the concept of Linked Open Data Networks and Open Data. So far, this chapter has managed to broach over the report of the findings of the study. The subsequent chapter discusses and interprets in detail the results of the study.

CHAPTER SIX

INTERPRETATION AND DISCUSSION OF FINDINGS

6.1 INTRODUCTION

The preceding chapter addressed the analysis of the data. In this chapter, the interpretation and discussion of the findings were presented according to the order or sequence of the research questions. In doing that the key variables or themes pertinent to each research question was brought to the fore and discussed. The research questions were:

- how are digital records generated?
- what are the current levels of awareness of digital preservation in the government ministries and agencies?
- what is the impact of digital preservation in the planning and delivery of e-government?
- what are the key threats or challenges of digital preservation?
- what digital preservation strategies are used by the ministries/agencies?
- what are the best current practices of digital preservation?
- what are the roles and responsibilities of stakeholders?

It must, however, be noted that while all the findings of the research questions were based on the questionnaire, interview protocol, observation and document analysis, part of the findings for the research questions six and seven were addressed in Chapter Three. As was highlighted in Chapter One, the overall objective of the current study was to examine the extent to which digital preservation of e-government has been explored across the ministries and its allied agencies with the aim of proposing a framework for public sector organisations in Ghana. The interpretation and discussions were guided by the research questions as follows:

6.2 DIGITAL RECORDS ARE GENERATED

Respondents in this section were to demonstrate how the varieties of digital records were created across many sectors of government under the following themes:

- ICT and preservation of digital records;
- categories of digital records;
- activities that generate digital records; and
- driving factors for digital preservation.

6.2.1 ICT and preservation of digital records

Across many sectors of government, the use of ICT has been observed as one of the factors responsible for the creation and preservation of digital records. Such propositions were advanced by Luyombya (2010), Beagri (2003) and Norlan (2001). Thus Luyombya (2010) alluded to the use of ICT to the generation of digital records, whiles Beagri (2003) and Norlan (2001) linked the implementation of ICT to the effective documentation of government services and knowledge sharing. Like Luyombya (2010), Beagri (2003) and Norlan (2001), the current study observed that the use of ICT supported the creation and management of digital records.

6.2.2 Categories of digital records

The influence of digital technology has culminated into the creation of different type of digital records**.** (New South Wales Government, 2011). The current study noted databases, digital publication, emails, website information and document conversion, as some of the categories of digital information generated in the government ministries and agencies. The finding further exemplified and confirmed the growing range of digital records (such as processed documents, spreadsheets, multimedia presentations, emails, websites and online transactions, text files, web pages, dynamic web content, digital photographs) noted by the New South Wales Government (2011) and the National Archives of Australia (2012). The study stressed that digital materials such as tweets, website information and geographical information systems were the most common categories of digital information received from other agencies to be preserved. Whilst

this finding underscores the strength of technology, there is the temptation or tendency to destroy these types of records as they usually do not appear in the mainstream of digital information. For instance, some social media destroyed records once such records have been viewed by the general public (Council of Canadian Academies, 2015). Snapchat, Hash, Confide, and Wickr are some examples of messaging applications that allow messages and images to self-destruct on devices in a short period of time (Crook, 2013).

6.2.3 Factors for digital preservation and activities that generate digital records

Other identifiable factors responsible for the creation of digital records included laws for public record, new public management, e-government activities and statutory laws. In advancing the study, the literature alluded to the attempts being made by various national governments to support the shift to digital records through a number of legislations and changes in policy (Government of Canada, 2012 & Bibliothèque nationale de France, 2014). It noted that across many public sector organisations, the emergence of digital records has prompted many policy makers to put in place laws and policies to make it mandatory for digital records to be preserved. In accordance with the findings, laws and policies were revealed as a factor for digital preservation as public offices, institutions and individuals who create and maintain public records were made to follow good record keeping practices and implement procedures for the timely disposal of public records. This finding agreed with the various archival laws such as the Canada's Library and Archives Act (2004), Public Records Act of New Zealand (2005) and PRAAD Acts (1997). Again, e-government activities and new public management policy were noted as contributing to the growth of digital records. Piggot (2002) advanced that e-government has contributed to the growth of digital records as government relies on public policy files, accounting records, procurement records and personnel records to demonstrate accountability to its citizens.

The study found out that the introduction of new public management across the corridors of many governments led to the proliferation of digital records, resulting in the phenomenal growth of digital records. On the other hand, statutory laws in many countries enjoin governments to

ensure the longevity of such records for the citizenry (PRAAD Act, 535, 1997; Public Records Act of New Zealand, 2005 & GOC, 2012). These statutory laws, according to the study were meant to meet the anticipated demands of the right to the information law. The finding suggested that as the frontiers of government expand in terms of statutory laws, there should be appropriate strategies to absorb the proportionate growth of digital records. Accordingly, conscious effort would have to be made to preserve these digital records as the growth of digital records continue to lag behind (Gantz & Reisel, 2011). Thus, the creation of digital records across the ministries and agencies will require some level of preservation effort and attention fundamentally because digital records can be inaccessible after few years of creation and formats that are outdated might similarly not be accessible.

6.3 CURRENT LEVEL OF AWARENESS

Chapter Five, Section 5.3 alluded to the fact that the level of awareness of the core variables within the digital preservation environment provides the basis for the examination of the concept of digital preservation of e-government. Accordingly, the study took cognizance of the volume of digital records, the rate of growth, digital preservation standards, digital preservation projects and toolkits.

6.3.1 Volume of digital records and rate of growth

One of the major challenges of dealing with digital data is the sheer volumes of digital records created in every single second. Against this backdrop, scholars have raised concerns about the estimated size of digital growth and storage capacity. For instance, Lyman and Varian (2003) and Ganz (2007) established that the world produced almost a Zettabyte (a zettabyte is a trillion gigabytes) of information in 2010, while other studies undertaken in U.S concluded that the US average user consumed around 34 Gigabytes of data per day (Bohn & Short, 2009), ostensibly because the capacity of digital storage in the last decade has increased (Fayyad & Uthurusamy, 2002). On the contrary, the storage capacity of the digital universe continues to lag behind

(Gantz & Reinsel, 2011). This phenomenal growth of information and the lack of preparation to store them led the study to question respondents as to whether they were aware of their organisation's growth of digital records. The study observed that respondents were very much aware of the volume of digital material and provided rough estimates of their digital records. On the other hand, the study reported that 21.7% of respondents were clueless about the likely growth of their digital records they were holding. These respondents can however be pardoned for their lack of awareness about the sheer volume of digital data as copious amount of digital content are generated on daily basis (web-based tools such as blogs, YouTube, Facebook and Twitter (Yoon, 2013).

6.3.2 Actions undertaken to extend the life of digital material

Having a backup for digital records should form an integral part of any digital preservation programme, particularly in a period where the sheer volumes of digital records cannot be managed and controlled. Although, backup alone cannot guarantee the perpetuity and longevity of digital records, they provide short to medium strategies used to extend the life of a digital material (Corrado & Moulaison, 2014: 4). In this study, a little over 50% of respondents failed to use file formats, and storage devices to extend the life of a digital material across the ministries and agencies. On the other hand, close to half of the respondents were very much emphatic about the use of storage devices, software, file formats, storage media, storage drives and hardware. Whilst part of the result appeared to be positive, it was still disappointing considering the total score for the actions undertaken to extend the life of a digital material. It further reinforced the assertion that many of the IT experts lacked fundamental skills in the area of technology (Rinehart, Prud'homme, & Huot, 2014).

6.3.3 Digital preservation standards

There are several international standards designed for the management of digital preservation. Among them are: the Information and Documentation Records Management, Reference Model for Open Archival Information System and Information and Documentation-Records Management Processes- Metadata Records. The study in ascertaining the respondents' level of

awareness for digital preservation standards observed that the majority of the ministries and agencies were not aware of the aforementioned standards. The OAIS model, which is the universal model for digital preservation and provides access to records created and captured by e-government (Ngulube, 2012) and by extension formed part of the conceptual framework of the current study (Quistbert, 2008) was unknown by majority of the respondents. This result runs counter to the remarks made by Corrado and Moulaison (2014) that many of the digital preservation initiatives depended on the OAIS model. Whilst this supposition by Corrado and Moulaison (2014) hold, it underscored the point that any institution undertaking a digital preservation project ought to be aware and understand the nitty-gritty of the OAIS model. As a model, the OAIS facilitates the implementation of e-government by capturing data, migrating data and providing access to digital data. In addition, it appropriates the roles and function of producers and consumers who are the key actors in the digital preservation community. In other words, the model takes cognisance of collaborative and participatory opportunities pointed out in section 6.7 of the study.

6.3.4 Digital preservation software and projects

In an attempt to address the digital preservation conundrum, many organisations are creating their own digital preservation system, while others have chosen to implement open source or proprietary system. In line with this, the literature identified DSPACE, LOCKSS and DAITSS as some of the prominent software tools used to generate technical metadata to support the preservation of digital records. For instance, DSPACE (2013) allow users to deposit digital objects into a repository, using a web-based interface, whiles LOCKSS (2012) enable libraries to preserve web content and electronic publications through the automatic capture of web resource. DAITSS (2014) on the other hand, supports the creation of a digital preservation repository by ingesting, managing and disseminating information. Although this program/software offers varying degrees of support for digital preservation, open source software can literally fall short in digital preservation (Corrado & Moulaison, 2014). Fortunately in this study, respondents were very much familiar with these software tools. By implication, the ministries and agencies were aware that these tools offer much of the functionality needed for digital preservation.

However, little was known of digital preservation support organisations such as the DPC, DCC, INTERPARES, DRAMBORA, TRAC, UK Web Archiving Consortium, DPE and PLANET, which in many cases offer evaluation criteria, certification process, risk assessment tools and self-assessment tools for co-operative networks of repositories and other third-party service providers (Becker et al., 2009; TRAC, 2007). One would have thought that respondents would be familiar with these digital preservation support organisations and collaborate with them in order to obtain the needed assistance from them. Unfortunately, the awareness level for these support organisations was absent. These findings were similar to the preservation activity reported by EPRANET (2003) which concluded that awareness level for digital preservation in most organisations was rare and that few took a long-term perspective to digital preservation; and many had failed to create higher levels of the regulatory risk exposure to digital preservation.

6.3.5 File formats

Chapter Three of the current study stressed that file formats were the most basic, yet important aspect of digital preservation, as many activities of preservation were carried around file format to prevent loss of access to a digital material. Thus, to ensure the longevity of digital records, it was important to identify the most suitable file format to be preserved in the ministries. Although file format prescribes the rules used by application software to convert bits into meaningful information (Abrams, 2007:51), identifying the right file format for digital records can be daunting in view of technological obsolescence and the evolving nature of technology. In choosing archival file formats, interoperability, and sustainability should be the guiding principle (Liu, 2013). In this study, the most preferred text document format for most digital preservation repositories was the PDF, presumably because PDF/A format is specifically designed for archiving purposes and allows other files to be embedded within; and has a high degree of openness.

Beyond that the PDF preserves the visible characteristics of documents, so that they behave as “electronic paper” (Arms et al., 2014). Thus, through the use of file formats, documents submitted electronically can be converted to PDF. According to the DPE (2012), the use of file

formats can mitigate the frequency of migration, and the level of risk and costs of preservation. In all these caboodle, digital preservationist ought to be decisive in the choice of file formats that are proprietary and non-proprietary and assess their advantages and disadvantages. For instance, files that are preserved in open format have the potential to remain accessible since the software required to read them cannot be affected by license or patent restrictions (Cunliffe, 2011).

6.4 IMPACT OF DIGITAL PRESERVATION ON E-GOVERNMENT

Various scholars have alluded to the assertion that the application and survival of e-government is anchored on efficient delivery and preservation of digital records (Decman, 2010; IRMT, 2011, Ngulube, 2012). For instance, the IRMT (2011) advanced that the process of governance can be effective if digital preservation programme are adapted into the environment of e-government. Decman (2010) on the other hand, posit that many services of e-government are bonded with digital preservation for a long a time, whiles Ngulube (2012) argued that an e-government environment will be elusive if sub-Saharan Africa does not have the capacity to create, manage, share and use electronic information. These allusions emanate from the dependent nature of web portals on digital repositories (Lee, Tan & Trimi, 2005), the creation and implementation of e-government in public sector organisations generate digital records and that products of government were most often delivered in the form of policies, management information, regulations, markets and the environment (Wimmer, 2004). In this way, data inconsistencies and the overwhelming growth of data can have an impact on the activities of e-government (Gil-Garcia & Martinez-Moyano, 2007). Thus, the full benefits of e-government can only be realised if electronic records are managed and maintained effectively.

In examining the impact of digital preservation on e-government, the findings of the study revealed that e-government feed into the use of digital preservation as many of the agencies and ministries have incorporated e-government legislations into their digital preservation activities (CENDI & INSTI, 2004). In other words, the capacity to create, manage, share and use electronic information depends on the mutual combination of digital preservation and e-government (Lipchak & McDonald, 2003:2 in Ngulube, 2007). These findings further agree with Decman's (2010) supposition that many services of e-government are bonded with the processes

of digital preservation which continue for a long time. On the back of these findings, the study suggested that the implementation of e-government will be a mirage if repositories are not created to feed government websites.

ICT Products were also observed to be useful for e-government and digital preservation, a finding Nolan (2001) and Luyombya (2010) reinforced when they remarked that the use of ICT systems was linked to the implementation of government services and knowledge sharing and that it was impossible to examine the outcome of e-governance processes without touching on digital records. Clearly, these findings illustrate that the survival of e-government is inherently rooted in reliable, authentic and trustworthy repositories. IRMT (2011) endorses the idea that digital preservation programme must take congnisance of the evolving nature of e-government environment since it encourages data sharing, cooperation between government departments, streamlines offline record keeping processes, and helps to compact data (Almarabeh & Amer, 2010).

6.5 KEY THREATS TO DIGITAL PRESERVATION

The study in Chapter Three alluded to the myriad of problems, memory institutions were confronted with, which very often runs counter to the very role they play. This allusion is premised on the fact that the amount of digital records keep growing as opposed to the growth of storage capacity, which continues to lag behind (Gantz & Reinsel, 2011). Apart from that for every gigabyte of stored data, a million gigabytes or more of transient data (e.g., digital TV signals that are watched but not recorded) are not preserved. In an agreement with the literature, the study brought to the fore, the continuous loss of digital material in the ministries and agencies, the actions taken when digital records were generated, key barriers to digital preservation, rankings of the current threat to digital preservation, security measures, reliability and authenticity, training and staffing, and funding requirement. The following section explains the key threats to digital preservation.

6.5.1 Loss of digital material and timing issues

The study adumbrated that digital materials belonging to the ministries and agencies were getting lost and were plagued with timing issues and therefore required some level of preservation attention. Exemplars abound in many memory institutions where digital materials almost got lost. Memories of the Domes day Book and the 1976 Viking landings on Mars (Jesdadun, 2003) still reminds us of the momentous effort we need to put in place in order to preserve our digital records. That is why Ngulube (2012) cautioned memory institutions to prevent the loss of digital records as it is common and one of the most feared situations. However, the loss of the digital material in most of the ministries and agencies can be attributed to the necessity to continuously change hardware and software of computers, (Chen, 2001; Baker, 2014) media incompatibility and configuration problems which often lead to unpredictable disasters and make documents unreadable (Digital Preservation Coalition of the United Kingdom, 2003**).**

6.5.2 Actions taken when digital records are first generated

The results proved that majority of the agencies and ministries checked for viruses, copied the digital records to a different storage media and migrated it to a current version of file formats (usually to a file storage server) whenever they received digital records. This strategy agrees with the strategy of IRMT (2009) when they observed that transferring digital materials from one hardware/software configuration to another generation or from one generation of computer technology to another has the potential to provide access to digital objects. In this regard, the ministries and agencies were able to convert a Microsoft WORD97 document into the Office 2007 format (within format family migration), in repeated conversion of a digital object in order to guarantee a more stable or current file formats (Lawrence et al. 2000).

6.5.3 Ranking in terms of current threats to digital preservation

Respondents in this section ranked the current threat to digital preservation in the following order: the level of security and privacy, skills training and insufficient funding, technological obsolescence and insufficient organisational commitment. The overall ranking of the barriers to digital preservation meant that many of the ministries and agencies were fully prepared to move forward with the digital preservation activities, if authorities of the ministries and agencies would assemble very specific and concrete resources such as funding, the necessary infrastructure and equipment, and some training for staff. The sequences with which these aforementioned threats were ranked underscored the debilitating effects of these threats and thus concur with the findings of several scholars. For instance, Bantin, (2008) argued that digital records are subject to alteration and changes with respect to security. Duff, Limkilde and Van Ballegooie (2006) noted that a great deal of knowledge is needed to understand the issues of digital preservation and skill training whiles Chen (2001) and Baker (2014) observed that continuous changes in technology was a major problem to digital preservation. In addressing these issues, the availability of funding can enhance the continuous changes in hardware and the commitment level of management to the activities of digital preservation, particularly when many of the problems of digital preservation are solved through collaborative opportunities (Council of Canadian Academies, 2015). The study observed in Figure (5-7) that 61(51%) of respondents need training in the management and preservation of digital records, (46%) of respondents need training in IT applications in records management and the changing roles of records managers. The call for training underscored skills gap as one of the major threats to digital preservation.

6.5.4 Security measures for digital records

Although the emergence of digital technology has made the conduct of businesses and government activities easier and quicker, it has without doubt brought in its wake security issues. With several reported cases of hackers having unauthorised access to an organisation's network (Cloud Security Alliance, 2013), discussions are ongoing as to whether archivists should continue to trust the cloud for the preservation of documentary heritage (Council of Canadian

Academies, 2015). In the same way, records created and maintained in digital form are amenable to alteration and changes (Bantin, 2008). Such alteration according to the ISO 15489 compromises the essential characteristics of records (ISO 15489) viz: authenticity, reliability, integrity and authentication at the expense of information accessibility. These potential risks posed by digital technology prompted Google in 2013 to announce the "server-side" encryption as a default service to its cloud customers (Kirk, 2013). Thus, data meant for cloud storage will be encrypted following receipt by Google. In this study, the undercurrent security threat did not find a space in the findings as the ministries and agencies have put in place measures such as security and privacy policy, user restrictions and monitoring of emails to prevent unauthorized access, alteration, theft, or physical damage to information (Shepherd, 1994; Laudon & Laudon, 2005: 526 in Ngoepe, Mokoena & Ngulube, 2010). Measures such as this prevent attacks from computer hackers and faceless individuals who compile and sell personal information about unsuspecting people. These efforts help to guarantee information confidentiality, availability, integrity, and authentication over the long term. The results strongly revealed that respondents have focused their security initiatives on those measures best suited to their organisational structure and resources.

6.5.5 Auditing of digital records

The ISO 1548 1:2001 Information and Documentation – Records Management – Part 1: General was the first international standard devoted to the management of digital records. As part of the strategy of auditing digital records, the ISO 1458 1:2000 prescribes documentation of records, tracking, retention and disposition of records. Such prescription can only be effective, if there is an internal monitoring, appropriate modifications of the system, and internal and external audit of the records system. In compliance with this strategy, respondents were to indicate the frequency with which their digital records were audited. The result suggested that much was not done to maintain the digital resources to ensure appropriate management of digital records as more than half 66(55%) of respondents could not state whether their digital records were audited or not. Corrado and Moulaison (2014) held the view that auditing of digital records means that a

trusted digital repository is ensuring the reliability, trustworthiness and accuracy of digital records.

6.5.6 Reliability and authenticity

In order not to compromise the essential characteristics of records, archives have a huge responsibility of guiding the works of records creators whose works they have a mandate to preserve by establishing control measures. Such control measures require that the record so created must be authentic and reliable to reveal the true identity of the record creator. Findings on reliability and authenticity showed how respondents have introduced some control measures to protect the true identity of their records. Control measures such as tracking and verifying changes of digital objects and user access restriction through the use of passwords were the most common ones. The objective here, was to ensure that the record so created was deemed to have come from sources that were verifiable (Sharon, 2010) and reflected transactions that were accurate and factual (ISO 15489-1 2001). This measure helps to develop trust between the user of archived materials and the institution responsible for preserving those materials. The finding was concomitant to the study of Lin, Ramaiah and Wal (2003:118) when they advanced that ensuring authenticity and reliability of digital records helps prevent unauthorised addition, alteration, deletion, use and concealment of records by unknown people. The study identified that respondents used preservation metadata developed in-house to ensure the authenticity and reliability of their records. This approach usually includes provenance, authenticity, preservation activities, technical environment, and rights management (Oehlerts & Lui, 2013).

6.5.7 Training and staffing

Whilst respondents have staff assigned to digital preservation responsibilities and have adequate organisational and technical expertise in digital preservation, they however lacked training in digital preservation. This result reinforced the assumption that digital preservation was viewed as a conceptually simplistic exercise even though it required a great deal of knowledge to understand (Duff, Limkilde & Van Ballegooie, 2006). Preponderance of evidence exists to show that lack of training for digital preservation professionals have created some level of knowledge

gaps. For instance, studies undertaken by Kemoni and Wamukoya (2000), Iwhiwhu (2005), and Egwunyenga (2009) underscore the basic skills gap among record keepers in Africa. The IRMT had also echoed in 2003 that record professionals lack the capacity and training to articulate digital records issues in order to provide guidance and influence policy makers and planners (IRMT, 2003). This problem was further underscored by Feralo and Morris (2006) when they discovered that Africa generally have skills shortage and the problem is severely exacerbated by the brain drain syndrome where professional leave to the developed world in search of greener pastures. In view of this, the IRMT (2008) have had to call for re-education and retraining of information professionals in Africa. The literature observed that in terms of technical astuteness, information professionals in the developed world were far ahead of their counterparts in Africa. This assertion contradicted the finding when the ministries and agencies proved that they have adequate technical expertise to manage their digital preservation activities. The problem however was, lack of training has brought about the skills gap.

6.5.8 Preferred format for training and training needs

In addressing the training needs of respondents, the study identified seminars and workshops, internships and use of consultants as part of the training formats for respondents. Whilst the study revealed seminars and internship as the top most possible options for their training formats, preference for training areas such as preservation strategies and tools, digitization, copyright issues and metadata, digital records security, digital repositories, standard formats and preservation strategies were noted. Evidence from the results proved that digital preservation is extremely complex field and requires great deal of knowledge to understand (Duff, Limkilde, & Van Ballegooie, 2006). The findings further resonates with the problems identified by Kamutula (2010) when he concluded that archivists lack skills, procedures, standards and practices for e-records management.

6.5.9 Qualifications of records managers and IT officers

The study of digital preservation methods have now become an integral part of information science education (Higgins, 2011) because of the rapid changes in technology, with its attendant

growth in digital records. Thus, the acquisition of skills in technical (systems), metadata (categorical) and collection specialist (Corrado & Moulaison, 2014:56) are needed to empower digital preservationist. However, the acquisition of skills in these areas requires some level of qualification in IT and Information Science. The reported findings showed the diversity of qualifications of records managers and IT officers across the ministries and agencies as 46.6% of respondents had Masters's degree in Information Science and Information Technology. Nearly, 40% had first degree in Information Science and advanced diploma in IT. Just a small proportion of respondents 15.8% held a certificate in IT. Whilst the reported finding appears to be encouraging and commendable, it showed profound differences in the areas of qualifications. One can safely conclude that the 15.8% of respondents who held a certificate in IT and Information Science lacked skills, procedures, standards and practices for digital preservation and lacked the competencies for handling records and archives in the public sector. Scholars such as Kemoni and Wamukoya (2000), Iwhiwhu (2005), Egwunyenga (2009) and Kamatula (2010) have similarly echoed the problem of skill gap among records keepers in Africa.

However, 46.6% of respondents with qualifications in IT and Information Science was not suggestive of the fact that these respondents can deliver every digital preservation project. Rather, training on the job, talent and dedication will determine the extent to which they will catch up and cope with this emerging discipline (Corrado & Moulaison, 2014:65). Since the information centres of the government agencies were very much oriented and structured to the delivery of information and very much supportive of the freedom of information, respondents with qualifications in diploma and certificates ought to upgrade their qualifications in order to catch up with the developments in technology.

6.5.10 Funding requirement

Funding requirements have always played a critical factor in determining the extent to which memory institutions have pursued digital preservation opportunities (Council of Canadian Academies, 2015) as changes in hardware and software and transformation of data from one format or configuration to another often required funding. That is why Pennock (2008) explains

that the metrics of digital preservation is anchored on economic and social models, storage and software costs, and human resource costs as well as the data policies. Many of the digital preservation initiatives identified in the current study were undertaken by national institutions as opposed to smaller institutions, precisely because the cost structure for a digital preservation project is usually far beyond the means of these smaller institutions. Apart from this, budget allocations for memory institutions are dwindling as a study undertaken in 2010 in 28 university libraries and three national institutions (LAC, the Canada Institute for Scientific and Technical Information, and the Library of Parliament) in Canada underscored how 84% of respondents reported a decrease in overall funding (Dooley & Luce, 2010). The situation in Africa is also not different as most repositories in Africa have depended on donor funding to ensure their survival in the digital environment. This has prompted some scholars to question the capacity of repositories in Africa to sustain their digital repositories (Ezema, 2011**).**

The empirical study in the same fashion observed funding as a compelling and ongoing problem across the ministries and agencies. Thus, whilst large proportions of the respondents were very much aware of the estimated cost of their funding requirements, they pointed out that funding was a current threat to their repositories. Conversely, a small proportion of respondents revealed that they have no idea about their funding requirement and their annual budget for digital preservation. This finding agrees with other studies which underscored the difficult nature of obtaining reliable and comprehensive data on costs for long-term digital information (ICST, 2002). Similar studies have further alluded to the incapacity of heritage institutions to report on the expenses made for digitization (Navarette & Huysmans, 2009). Rosenthal (2010) stresses that bit preservation is a question of budgets, so methods for planning and undertaking assessment such as DRAMBORA, DCC, DPE and TRAC are very important in mitigating cost in the preservation planning process.

6.6 DIGITAL PRESERVATION STRATEGIES

To facilitate the interpretation of the study, results in this section were reported in two folds: the most widely implemented preservation strategy and the least preservation strategy implemented.

6.6.1 Most implemented preservation strategy

Accordingly, the study identified backup, migration, metadata and trusted repositories as the most widely implemented preservation strategy across the ministries and agencies.

6.6.1.2 Backup strategy

Section 5.6 of Chapter Five alluded to backup as one of the component of digital preservation adopted as a medium to short term measure against risk and failures associated with digital files and audio recordings. It underscored the fact that backup protects data from accidental deletion, hackers and virus attacks (Corrado & Moulaison, 2014: 4). On the back of these benefits, backup received a rapturous approval from respondents on the assumption that the creation of backup copies was more of a day-to-day operational requirement. Again, backup facilitates the creation of proprietary file formats as the study had pointed out previously. For instance, Microsoft's Windows 7 operating system can restore backup files created on a computer running Windows Vista or Windows 7. Backups provide the platform for digital records to be copied and stored in multiple locations to create readily available data in the event of emergency or equipment failure or any other catastrophe (Kichoff, 2008). The literature illustrated that backup was implemented with commercial software that allows users to retrieve files backed up at specific points in time. The study found out that digital resources properly stored can be robust during disasters (Sugimoto, 2014).

6.6.1.3 Migration

Acknowledged as one of the core strategy for long term preservation, migration is the most widely implemented strategy for digital preservation ostensibly because it is specifically designed for static digital objects such as images and text (Heslop et al., 2002; Kirchoff, 2008).

In agreement with the literature, the results of the study observed preservation strategy as the most widely implemented strategy. This finding is hinged on the fact that migration helps users to access data using new computing technologies (Harvey, 1997; IRMT, 2009) and transforms the digital content from its existing format to a different format (Kirchoff, 2008; Harvey, 1997; IRMT, 2009) as confirmed by the literature. The migration strategy further explains why 74% of respondents described their archive service as actively seeking digital material whenever it comes to digital preservation planning.

6.6.1.4 Metadata

As an essential part of a digital preservation strategy, metadata has been identified as one of the most widely implemented strategies for the preservation of digital records because it takes cognizance of provenance, authenticity, preservation activities, technical environment, and rights management, (Oehlerts & Lui, 2013) and keeps information about file formats (National Archives of U.K, 2014). Beyond that metadata indicates the data, where the data is located, the ownership relationship, and its quality and conditions. Sugimoto (2014) underscored how the preservation of both metadata and digital resources are crucial to any digital archive as the extinction or loss of a metadata can render the resources of a digital archive inaccessible. Thus, metadata facilitates the retrieval and usability of digital information. In this current study, of the 120 respondents, 15% of respondents reported of using metadata as digital preservation strategy with ‘’metadata developed in-house’’ as the most frequently used to record preservation metadata. The percentage score obtained by the ministries and agencies who develop in-house preservation metadata underscore the capacity of the staff in undertaking digital preservation initiative. The result agrees with Corrado and Moulaison (2014) that accessibility and usability of content in the digital preservation environment are enhanced through the creation and management of preservation metadata.

6.6.1.5 Trustworthiness in repositories

A trusted digital repository is an institution designed to provide long-term access to digital resources (IRMT, 2009). It collects, manages and disseminates digital materials produced in an

institution (Chapman, Reynolds & Shreeves, 2009) for long term preservation and future access. By so doing, it ensures the reliability, trustworthiness, transparency and accuracy of records. Evidence from the study revealed 13.3% of respondents' highlighted trustworthiness in repositories as their preservation strategy. This result is built on the notion that trusted repositories have the potential to ensure the reliability, trustworthiness and accuracy of record as pointed out by Dobratz, Schoger and Strathmann, (2007), McHugh, Ruusalepp, Ross and Hofman (2007). The results suggested that the ministries and agencies have the capacity to facilitate the capture, storage, preservation and dissemination of the ministry's intellectual output. Exemplars in the digital preservation environment show how repositories in Africa cannot be sustained. Lor (2005) and Ngulube (2012) argued about how ineffective Africa's legal deposit is, as it does not cover digital material, online publications and websites. These challenges underscore the crisis and almost hapless state of repositories in Africa.

6.6.2 Least implemented preservation strategy

On the other hand, refreshing, emulation and cloud computing were the least implemented preservation strategy.

6.6.2.1 Cloud computing

The study found out that cloud computing was among the least implemented preservation strategies in the ministries and agencies. This revelation brought to the fore, the low level of awareness among respondents as reported by the study in Sections 6.2. Several scholars have hinted about the countless benefits of the cloud. For instance, Dale Prince (2011) demonstrates how archives can reap the benefits of using the cloud through the services they offer, and to streamline their work processes. On the other hand, the international Data Corporation (IDC) predicts that by the year 2020, as much as 15 per cent of the information in the ''digital universe'' could be part of a cloud-based service (Kabata, 2012). However, the evidence from the study failed to appreciate the benefits of cloud computing. Whilst the reasons were unknown, caution by Stuart and Bromage (2010) that organisations wanting to store their records in the

cloud have to do due diligence before entrusting their records to a third party may probably be the reason why it was the cloud was one of the least implemented preservation strategies.

6.6.2.2 Refreshing and emulation

The survey suggested that refreshing and emulation were part of the least most implemented preservation strategies. By implication, replacement of old technologies were hardly undertaken to overcome technological obsolescence. This result runs contrary to the findings of IRMT (2009), when they advised records professionals to be wary of new media technologies and developments in computer technologies since the media chosen may not in fact be sustainable in the long term. Although emulation keeps documents readable for a long term (Borghoff, Rodig & Lothar, 2007) it was the least preservation strategy adopted simply because of cost.

6.6.2.3 Phrases for digital preservation strategies

The survey, in confirming the techniques or the application of the strategies in Section 6.5 noted that overwhelming majority of respondents have a data infrastructure for preservation of digital records with regular migration of information from one medium to another. It further emerged that the ministries and agencies have plans to undertake digitization programme in their institutions. However, these same ministries and agencies have failed to document their data migration policies and were not aware of other repositories using different preservation techniques. In addition, the ministries applied themselves exclusively to the metadata standards built in-house and were not aware of any digital preservation organization that can help them to develop a digital preservation programme.

6.6.3 Digital preservation project/ infrastructure

Digital preservation infrastructure is gradually gaining prominence in view of its capacity to address many of the challenges of digital preservation. A digital infrastructure serves the needs of public sector organisations to select materials, upload and manage data (Maine Historical Society, 2014). With such a system in place, memory institutions are saved the cost and time of maintaining up-to-date IT systems and acquiring related skills for preserving and making content

available (Council of Canadian Academies, 2015). In congruence with this assertion, the current study observed that the government of Ghana and the National Information Technology Agency has set up a National Data Centre infrastructure to maintain data and ensure that public sector organisation access data from a more swiftly and resilient storage systems. The National Data Centre is supported by a Network Operating Centre (to provide monitoring and control over all applications and network services originating in the Data Centre infrastructure), Security Operating Centre (to serve as the nucleus of the ministries and agencies intranet and Internet Security Operations) and Several Storage Area Networks (which provide for the storage needs of all the MDAs that will be hosted by the National Data Centre). The National Data Centre, as touted by the government is a preservation strategy to curb the incidence of data loss across the ministries and agencies. This development will make it possible for preservationist to archive government online publication as opposed to the assertion underscored by Ciborra, (2005), Dada (2006), Maumbe, Owei and Alexanda (2008) and the United Nations (2010) that the initiative of users to access e-government information fed by repositories will be impeded.

6.6.4 Other preservation strategies

The challenge for many memory institutions is the preservation of both digital data and the technology such as operating systems and media drives for devices such as floppy disks and CDs needed to process them (CCSDS, 2012). Whilst the study admitted that digital preservation was not just a technical problem that can be partly solved via different technologies, it held the view that the adoption of backup, storage devices, CD-ROM and software can facilitate digital preservation. This view was endorsed by more than two thirds of respondents 70% who preserved their digital records on the hard drives of their computers, on the server file with backup system and on CD-ROM or DVD. Whilst these strategies were easy to deploy and appear to complement the core preservation strategies indicated in Table 5-23, they are without challenges. For instance, Blau (2006) and Paradigm (2008) argued that low quality burnable CD decay within a space of two years and the technical knowledge needed to repair hard drives and the operating system can be very challenging.

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6.7 BEST CURRENT PRACTICES FOR DIGITAL PRESERVATION

In addressing the current practices for digital preservation, the study brought to the fore policies, laws, collaborative and participatory opportunities both in Ghana and other jurisdictions.

6.7.1 Digital preservation policies and best current practices

Evidence from the study showed that although respondents were fairly knowledgeable and aware of a national policy governing the preservation of public sector records, such policy was not applied in their agencies and ministries. It was therefore not a surprise that the ministries and agencies had failed to adopt a blueprint of digital preservation policy, which will guide the acceptance of digital data, entire life cycle of digital records and an established strategy to make digital preservation work. These findings were in direct contrast with the integrated management framework which emphasized on policies, procedures, structures, systems and a long-term strategic plan (IRMT, 1999) and the functional model of the OAIS which dwelt on ingest, data management, access and administration as captured in the literature review. However, it concurs with the findings in the literature about the sheer neglect of the development of policies in archives in sub-Saharan Africa (Ngulube, 2005; Kanyengo, 2006), the delay in the implementation of policies and weak policy formulation on digitization, both at the institutional and national levels (Kalusopa & Zulu, 2009; Keakopa, 2010). It further reinforces the view of Pennock (2008) that 'the costs and benefits of developing a coherent and sustainable digital preservation policy still remains unexplored. Whilst the study concedes a policy deficit across the ministries and agencies, it suggested that the process of developing a digital preservation policy can be guided by a template document from other jurisdictions which can used as the basis to start one.

6.7.2 Content of preservation policies

Amidst the few ministries and agencies observed by the study to have a preservation policy, the content of their policies showed a significant absence of policies on refreshing, standards,

conversion and formatting. Encouragingly, there were policies on role and responsibility, scope, migration, storage and maintenance, technical infrastructure, access and maintenance, and quality control procedures. Policy on role and responsibility, procedures, and standards were found to corroborate with the preservation model of Beagri policy (2008). Beagri (2008) underlined that policy on standards provides the basis for national and organisational policies whiles procedures ensures the accessibility and authenticity of digital records over time. Others, such as storage and maintenance, migration and technical infrastructure were reaffirmed in the ERPANET (2003) policy document.

6.7.3 Respondents views on policies and best practices

It was revealed that a legislative instrument or policy for the implementation of a digital preservation infrastructure may be welcomed. It amplified that whilst the application of the legal deposit within PRAAD law was positive, it was not enough to ensure the longevity of government records as the legislative requirement to manage digital records and promotes the proper maintenance of digital records have not been appraised as suggested by Ngulube (2012). Also, the existing legislation for the creation, management and preservation of digital records has not kept pace with technology. The finding resonates with the study Kalusopa and Zulu (2009), which revealed weak policy formulation on digitization, weak legislative framework for digital preservation, lack of awareness about the potential of digital preservation by national heritage institutions and lack of common standards on digital heritage materials preservation in Botswana. Calls from the literature on the need for the right to the information law agree with the findings of the study and reinforce the need for an effective legislation for digital preservation in Ghana.

6.7.4 The degree to which digital preservation policy affects current needs

Evidence from the study proved that digital preservation policy affected the current needs of the ministries and agencies. It emerged that so long as preservation of records support and assist in the promotions, motivations, dismissals and retirement of staff of the ministries, digital preservation could be said to have an effect on their current needs. The effects of these findings

concur with the core values of ERPANET policy (2003) which underscored that digital preservation policy should offer achievable solutions and provide for management training, facilitate the sustainability of an institution and convey the very philosophy and objective of the organisation.

6.7.5 Possible collaborative organisation to develop digital preservation programme

Section 5.3.4 and Table 5-10 of Chapter Five alluded to respondent's lack of awareness about digital preservation support organisation, a response that revealed that no such collaborative effort has been initiated by any of the ministries and agencies. In a sharp contrast to this finding, the literature brought to the fore projects of digital preservation and support organisations such as DPE (2006), Nestor (2006), DRAMBORA and DCC which have fostered collaboration between many national and international initiatives. Such collaboration were either to design criteria for trusted digital repositories called a criteria catalogue (DCC, 2004) or set criteria for the certification of a digital repository (TRAC, 2007). That notwithstanding, collaborative efforts from the (DPC) from the U.K, the Nestor from Germany and the DATA-PASS from the U.S have yielded a lot of dividends to heritage institutions (Day, 2008). These collaborative efforts have focused on metadata standards; file formats (Abrams & Seaman, 2003) advocacy and network, with emphasis on interoperability, authenticity, reliability and accuracy of records. Again, collaboration explains how many organisations are applying the concept of Linked Open Data, a concept that allows raw data to be placed online in a standard, web enabled and to be web addressable and linkable (Zablith, Fernandez & Rowe, 2012). Notable organisations hooked onto Linked Open Data include the British Broadcasting Corporation (BBC), and the World Bank.

6.7.6 Strategic document/policy that supports digital preservation

Through document analysis and results from the interview, the concept of convergence and complementarity were established through the supportive nature of laws for digital preservation. It identified the PRAAD Act (Act 535, 1997), the ICT policy, Civil Service Act 1993 (PNDCL 327) and Financial Administration Act, 2003 Act 654. It noted that section 8 and 9 of PRAAD

Act empowers PRAAD to take custody of semi-current records which have been scheduled for further retention and maintain them within a records centre in order to ensure good record keeping practices within every ministry and agencies. In spite of the effectiveness of PRAAD in ensuring the sanctity of records management in Ghana, it has been plagued with many problems. One of such problem is the lack of appropriate institutional and managerial structures (Luyombya, 2010) to implement the archival acts to the fullest. Inherent in the ICT document is the protection, preservation, and maintenance of information of enduring value and future use. Thus, the document espouses that the implementation of e-government across the ministries and agencies is underpinned by an efficient and effective records management through the ICT policy document. This result concurs with the study of Norlan (2001), Ngulube (2007) and Luyombya (2010).

Like PRAAD (Act 535, 1997), the empirical findings alluded to Section 20 of the civil service Act which mandates directors to implement proper codes of conduct for administrative, financial and operational transactions of the service. Compliance to these acts can only be enforced if there is proper records management system for public officers. On the other hand, the financial administration act, 2003 Act 654 underline the responsibilities of persons entrusted with financial management in government, to ensure the effective and efficient management of state revenue, expenditure, assets and liabilities, resources of the government (Financial Administration Act, 2003 Act 654). These Acts, legislations and laws if followed properly can ensure accountability and transparency.

6.7.7 Document analysis on best current practices

The study identified collaborative and participatory opportunities as one of the best current practices adopted by advanced countries like Canada and United States. It advanced that memory institutions and public sector organisations can share information, agree on technical standards for digital preservation and develop open source software to solve many of the challenges they are confronted with. It revealed that various search engines such as WorldCat and Google books have pitched camps with memory institutions to enhance their services. For instance, whereas

WorldCat through collaborative initiatives receives cataloging information from well over 72,000 libraries around the world (Council of Canadian Academies, 2015:82), users of Google books can search over two billion records (Waibel & Erway, 2009; OCLC, 2014 in Council of Canadian Academies, 2015). This result reaffirms and corroborate with the literature where the Joint Information System Committee (JISC) of the United Kingdom and Digital Preservation Coalition (2002) have collaborated and participated in many digital preservation initiatives and projects such as the Cedars projects, Arts and Humanities Data Service, and the National Preservation Office in U.K (Beagri, 2003). The study concludes that Linked Open Data and cloud computing can be adopted for the ministries and agencies with the concept of collaborative initiatives.

6.8 RESPONSIBILITIES OF STAKEHOLDERS OF DIGITAL PRESERVATION

One of the objectives of the current study was to establish the role stakeholders and government ought to play in the implementation and development of digital preservation across the ministries and agencies. With a convergence of documentary evidence and the questionnaire, the study established the role and responsibilities of stakeholders. Stakeholder in this study was described as a person, group or organisation that had interest or stake in memory institutions. Because this definition was somewhat generic and could be affected by other organisations, the study took into account national libraries, national archives, university libraries, research libraries and ICT managers. The results on the role of stakeholders showed the significant importance respondents attach to best practices, training and education, and advocacy, collaboration, funding and standard in terms of order of importance. The choice of best current practices as a role was premised on the numerous developments undertaken by the digital preservation support organisation such as PANDORA project and the Council of Australia State Libraries (Cathro, Webb & Whiting, 2009).

With respect to collaboration and advocacy the UNESCO Vancouver Declaration (2012) proposes that stakeholders of digital preservation collaborate with international professional associations and other international bodies to develop academic curricula for digitization and digital preservation. In the area of training and education, it was recommended that stakeholders

develop training programme for information professionals to reposition them to implement both digitization and preservation practices relevant to the needs of governments and their citizens (UNESCO Vancouver Declaration, 2012). In view of the heavy dependence on donor funding for digital preservation, stakeholders would have to cooperate with government and seek the assistance from other digital preservation support organisation. The study observed that creating an infrastructure 9.2% and funding 8.3% for digital preservation were very important but technological tools 10.8% and legislation 10% for digital preservation were far more important. On the heels of these findings, the study called for a better and appropriate dialogue between stakeholders and government as government operations/activities will be incomplete without the proper maintenance of digital records.

The study underscored the adoption of collaborative and participatory opportunities in the digital preservation environment and reinforced the concept of Open Data which thrives on citizen's trust, participation and collaboration (UN e-government report, 2014). That notwithstanding, the call for technological tools, legislations and infrastructure according to the reported result agreed with the literature when Wamukoya, (2012) proposed that an open government should have (a) an infrastructure of laws, policies and procedures to support complete and trustworthy record (b) record authority to support Open Data initiatives and (c) the establishment of organisation-wide-records-management.

6.8.1 Open Data

One of the tools used to determine the extent to which data has been made available for use and re-use is the concept of Open Data (UN e-government, 2014). The concept underlines free access to public data and offers the citizenry the opportunity to evaluate the performance of various administrative institutions and public agencies. The underpinning consideration of this concept in this study was premised on the fact that digital preservation embraces and seeks the longevity of digital records and their accessibility for future use. Accordingly, the study sought among other factors to find out the extent to which the various ministries and agencies have made their preserved data available to the general public. In this regard, respondents in the current study

were to indicate whether their website data were made available to the general public for use. As highlighted in Figure 5- 13, 67(61%) of respondents noted their data as freely available for use whiles 30(28%) disagreed with the statement that their data was available. A small portion of respondents 13(11%) have no idea about whether their data was available or not**.** The results illustrate the role the ministries and agencies can play in the delivery of data to the public and the opportunity for citizens to assess their performance at various levels.

This initiative from the ministries makes them transparent and very much open to the general public as data was shared in a form that allowed use and reuse of digital records. In spite of the opportunities offered by Open Data to the citizenry, its real impact will not be realized without a preservation strategy. With several position papers and international agencies (UN, UK and US agencies) supporting the need for Open Data, data must be well preserved to ensure their use and reuse. Funding agencies in U.K and U.S insist on a data management plan that is related to digital preservation before funding is approved (Corrado & Moulaison, 2014: 187). In addition, stakeholders in the digital preservation environment are adopting Open Data policies to remain relevant with the digital trend. For instance, the U.K government, in an effort to make their data public and easy to find has created a central access portal, data.gov.uk.; which includes Linked Open Data and cloud computing. Open Data from Government departments, public-sector bodies, and local authorities are hooked onto the Open Data through the site of U.K. Government. The Government of Canada in the same fashion launched an Open Data portal data.gc.ca.; allowing unrestricted data reuse (Government of Canada, 2011; Comprehensive Knowledge Archive Network, 2013; Government of Canada, 2013). Various cities and districts throughout Canada have launched their own Open Data websites (Government of Canada, 2014), including the City of Ottawa, which also uses the Comprehensive Knowledge Archive Network platform (City of Ottawa, 2014). Europeana, a world leader in digital opportunities is managing a repository of over 30 million cultural items from 2300 European institutions through the Open Data (Europeana, 2013). These exemplars reinforce how stakeholders can be relevant in these changing times. However, it should be noted that the setting up of Open Data depends on how enthusiastic groups or volunteers are keen on sharing resources and the eventual agreement on technical standards.

6.9 CHAPTER SUMMARY

On the heels of the empirical data presented in Chapter Five, this chapter interpreted and discussed the empirical research findings. The interpretation and discussion were guided by the benefits of triangulation which espouses, convergence and complementarity. It established that the creation of digital records was occasioned by the use of ICT, e-government activities, legislations and public policies through which digital materials such as tweets, website information and geographical information systems were created. Whilst these materials underscore the strength of technology as a result of the types of digital records created, it conceded that the tendency to destroy these types of records is high as they usually do not appear in the mainstream of digital information.

Although there were reported discrepancies in the volume of digital records as to the likely growth of the digital records the ministries were holding, a large majority of respondents were aware of the volume of digital material and provided rough estimates of the digital records. However, little was, known of digital preservation support organisations such as the DPC, DCC, INTERPARES, DRAMBORA, TRAC, UK Web Archiving Consortium, DPE and PLANET.

The study underscored the symbiotic relationship between e-government and digital preservation by establishing that whereas e-government provides the channel and medium to enhance the use of digital preservation in public sector organizations, digital preservation make repositories available for use. This supposition explains why the agencies and ministries have incorporated e-government legislations into their digital preservation activities.

The key threats to the development of digital preservation were loss of digital material, technological obsolescence, security measures, training and staffing, and funding requirement. However, it established that the most widely implemented preservation strategy were backup, migration, metadata and trusted repositories as against the least implemented such as refreshing, emulation and cloud computing were the least implemented preservation strategy. It stressed that ministries and agencies had failed to document their data migration policies.

CHAPTER SEVEN

SUMMARY FINDINGS, CONCLUSION AND RECOMMENDATIONS

7.1 INTRODUCTION

This study, so far has presented and discussed the findings of the framework for digital preservation of e-government across the ministries and agencies in Ghana. An introduction to the study embracing the research objectives and definition of key terms was provided in Chapter One, whilst Chapter Two contextualised the study by alluding to the various institutional repositories initiatives undertaken by public Universities in Ghana; and explored the litany of legislative instruments that underscored the need for digital preservation. Information science education, ICT policies and e-government initiatives in Ghana were also discussed in Chapter Two. Chapter Three conceptualized the study by discussing and reviewing related literature. The research methodology as captured in Chapter Four and it explained the adoption of the multi method design. Thus, the study combined quantitative and qualitative methods which by far, strengthened the robustness of the results. On the other hand, the triangulation of the questionnaire, interview, observation and document analysis brought to the fore the concepts of convergence (results from questionnaire converged with statement from interview) of complementarity (interviews, observation and document analysis provided complementary results by deepening, detailing, explaining and extending the results from the questionnaire). Data collection methods and the statistical procedures used in analysing the data were also captured in Chapter Four. Chapters Five and Six presented the findings, interpretation and discussion of the emerging study. Moving forward, this section provides the summary, conclusions and recommendations of the study. The implication of theory, practice and policy, and suggested future research are also presented at the tail end of the chapter.

7.2 SUMMARY FINDINS OF THE STUDY

The main objective of this study was to examine the extent to which digital preservation of e-government has been explored across the ministries and agencies in Ghana, with the view of developing an intellectual framework for public sector organisations, practitioners and policy

makers. In order to address this, the study responded to the calls by Ngulube (2007), Quistbert (2008), Sinclair et al., (2009) and the Daily Graphic *(Friday*, November 25, 2011). Thus, government information in many countries are collapsing (Ngulube, 2007; Daily Graphic, Friday, November 25, 2011) and records management issues were not being addressed in relation to e-government (IRMT, 2011), new thinking, new models, policies and framework are needed to cope with the digital preservation problems (Sinclair et al., 2009; Quistbert, 2008). Seven objectives were generated to address the overall aim of the study as noted in Table 1 of Chapter One.

Using the OAIS model (CCSDS, 2002) and the integrated management model, a conceptual framework was built to inform the study. Thus, whereas the integrated management framework placed emphasis on the development of policies, procedures, structures and systems to ensure the longevity of records, the OAIS model helped to explain how it can facilitate the implementation of e-government by storing the data, migrating the data and providing access to digital data. The combination of the models and theories underscored the influence of digital preservation of e-government in public sector organisations. The OAIS model was further used to investigate how the ministries and agencies created digital records and posted those records on their websites. The integrated management framework on the other hand, questioned the resources, equipment and funding for the ministries and agencies. The preceding section explains the seven objectives of the study under the following key themes.

7.2.1 Creation of digital records

The study established that the creation of digital records was occasioned by the use of ICT, e-government activities, legislations and public policies. It observed that several attempts were being made by various national governments to support the shift to digital records through a number of laws and changes in policy (Government of Canada, 2012 & Bibliothèque nationale de France, 2014). Evidence from the study suggested that ICT facilitates the preservation and accessibility of digital records by creating records, managing the records and storing the records at a safe place. E-government activities and new public management policy were noted to have

contributed to the growth of digital records through public policy files, accounting records, procurement records and personnel records to demonstrate accountability to its citizens (Piggot, 2002). The findings showed that the by-product of these records often fall into several categories viz: databases, digital publication, emails, website information and document conversion, which were managed by in-house staff and often driven by factors such as e-government activities, legislations and new public management policy.

The study discovered that digital materials such as tweets, website information and geographical information systems were the most common categories of digital information received from other agencies to be preserved. Whilst the result underscored the strength of technology as a result of the types of digital records created, it conceded that the tendency to destroy these types of records was high as they usually do not appear in the mainstream of digital information. Against the backdrop of the tendency to destroy these records, the study observed that many public sector organisations and policy makers have put in place laws, legislations and policies to make it mandatory for digital records to be preserved. The study underlined that these categories of digital records required some level of preservation effort and attention. Accordingly, statutory laws were needed to enforce the preservation of digital records to ensure its accessibility. The study further stressed that as the frontiers of government expand, new legislation will be needed to meet the phenomenal growth of digital records.

7.2.2 Current level of awareness

Findings on the current level of awareness of digital preservation were mixed. On one hand, the study reported a demonstrable knowledge of the volume of digital records even though there were reported discrepancies of the volume of digital records respondents were holding. These discrepancies could be attributed to the sheer volume of digital records and the copious amount of digital records created in every second, such as web-based tools, blogs, YouTube, Facebook and Twitter (Yoon, 2013). On the other hand, the woeful level of awareness of digital preservation standards, particularly with the OAIS model, questions the very basis upon which digital preservation was built on. Since many of the digital preservation initiatives depend on the

OAIS model (Corrado & Moulaison, 2014) it will not be out of place to champion the use of the model across ministries and agencies. That notwithstanding, respondents were familiar with software tools needed for the preservation of digital records. The study's emphatic findings on respondents' profound knowledge about DSPACE, LOCKSS and DAITSS, as some of the prominent software tools used to generate technical metadata to support the preservation of digital records beamed some level of hope to the digital preservation community in Ghana. Whilst the study admits that respondents need to acquaint themselves with other software tools, the findings appear to be positive. That optimism was further demonstrated by respondents' continuous use of storage devices, software, file formats, storage media and hardware to extend the life of a digital material with PDF as the most preferred text document format for most digital preservation repositories.

Little was, however, known of digital preservation support organisations such as the DPC, DCC, INTERPARES, DRAMBORA, TRAC, UK Web Archiving Consortium, DPE and PLANET. These support organisations in many cases offer evaluation criteria, certification process, risk assessment tools and self-assessment tools for co-operative networks of repositories and other third-party service providers (Becker et al., 2009; TRAC, 2007). However, the gross lack of knowledge about these support organisations underscored the point that little was being done to collaborate with other support organisations to improve the digital preservation environs in the ministries and agencies.

7.2.3 Impact of digital preservation on e-government

Within the context of e-government, it became apparent that many of the ministries and agencies had incorporated e-government legislations into their digital preservation activities, precisely because the relationship between digital preservation and e-government has always been symbiotic. Thus, whereas e-government provided the channel and the medium to enhance the use of digital preservation in public sector organisations, digital preservation had made repositories available for the use of e-government by way of creating the capacity, managing and sharing the use of electronic information. The combination of these two concepts undercored their dependent

nature (Lipchak & McDonald, 2003:2 in Ngulube, 2007). This supposition was reinforced, when the study noted that many of the ICT products across the ministries and agencies were used for the purposes of e-government and digital preservation. There is always the temptation to conclude that without digital preservation, e-government cannot survive. This is however on the contrary, as the survival of e-government depends on the reliability and trustworthiness of digital records.

7.2.4 Key threats to digital preservation

The study highlighted plethora of challenges with respect to digital preservation. Such challenges included: loss of digital material and timing issues, funding issues, level of security and privacy, skills training and technological obsolescence.

Just like any organisation, funding was observed as one of the compelling and ongoing problem across the ministries and agencies, particularly because funding has cascading effects on every single element that drives digital preservation. For instance, changes in hardware and software; and transformation of data from one format or configuration to another often require funding. Apart from funding, digital materials belonging to the ministries and agencies were reported to be getting lost and were plagued with timing issues and therefore required some level of preservation attention. The thrust of the digital losses were attributed to the necessity to continuously change hardware and software of computers, (Chen, 2001; Baker, 2014) media incompatibility and configuration problems.

These losses may have prompted many of the agencies and ministries to check for viruses, copy the digital records to a different storage media and migrate the record to a current version of file formats in order to reverse the trend. In spite of these efforts, many of the IT experts and information professionals lacked training in digital preservation as it was viewed as a conceptually simplistic exercise (Duff, Limkilde & Van Ballegooie, 2006). This false impression left a section (15.8%) of the IT experts and information professionals with a skill gap, as they only hold a certificate in IT. Their commitment level to the issues of digital preservation was demonstrated when they opted for training in preservation strategies and tools, digitization,

copyright issues and metadata, security of digital records, digital repositories, standard formats and preservation strategies in training format such as seminars and workshops, internships and use of consultants. The study supported the view that qualifications in IT and Information Science were not suggestive of respondent's ability to deliver every digital preservation project. Rather, training on the job, talent and dedication determine the extent to which digital preservationists will catch up and cope with this emerging discipline (Corrado & Moulaison, 2014:65). This view was in direct contrast with majority of respondents who held Master's and First degree in IT and information Science. The study further observed that despite the threat posed by security in the area of digital preservation, efforts were being made to put in place measures such as security/privacy policy, user restrictions and monitoring of emails to prevent unauthorized access, alteration, theft, or physical damage to information.

Additionally, control measures such as tracking and verifying changes of digital objects and user access restriction were used as part of the measures of ensuring reliability and integrity of records. Further, preservation metadata developed in-house was an inherent strategy used in ensuring the authenticity and reliability of their records. In all, findings under threat to digital preservation were ranked in the following order: the level of security and privacy, skills training and insufficient funding, technological obsolescence and insufficient organizational commitment. The sequences with which these threats have been ranked, underscore their debilitating effects on digital records.

7.2.5 Digital preservation strategies

In its application of digital preservation strategies, the study came up with the most widely implemented digital preservation strategy and the least implemented digital preservation strategy. Thus, whereas backup, migration, metadata and trusted repositories were noted as the most widely implemented digital preservation strategies across the ministries and agencies, refreshing, emulation and cloud computing were seen as the least implemented. In other words, preservation strategies such as emulation, refreshing and cloud computing appeared to be an unfamiliar terrain and unknown to respondents. In contrast, trusted repositories, backup,

preservation metadata and migration were noted to be a familiar terrain to respondent. Backup as a preservation strategy received a rapturous approval from respondents on the assumption that the creation of backup copies was more of a day-to-day operational requirement. On the other hand, the percentage score obtained by the ministries and agencies who develop in-house preservation metadata underscored the capacity of the staff in undertaking digital preservation initiative. The split approval/decision between respondents in the case of trustworthiness in repositories provided two results. Thus, on one hand, trustworthiness in repositories as a preservation strategy received considerable attention in the digital preservation field (Dobratz, Schoger & Strathmann, 2007; Ross & McHugh, 2006). On another hand, a section could not maintain their digital repositories.

The use of refreshing, emulation and cloud computing as the least implemented preservation strategy pointed to two facts. The replacement of old technologies were hardly undertaken to overcome the problem of technological obsolescence. Again, respondents were heeding to the caution by Stuart and Bromage (2010) that organisations wanting to store their records in the cloud, should do due diligence before entrusting it to a third party. In spite of these drawbacks, the study held the view that refreshing and emulation keep documents readable for a long term, while cloud computing streamlined work processes in archival institutions. Other ancillary preservation strategies noted in the study were the use of storage devices, CD-ROM, software, hard drives of their computers and server file with backup system. The study noted that while these strategies are easy to deploy and appeared to complement the core preservation strategies, they were without challenges since low quality burnable CD may decay within a space of two years and software upgrade may not necessarily support legally acquired file format (Blau, 2006; Paradigm, 2008).

Again, while the ministries applied themselves exclusively to the metadata standards built in-house, they were not aware of any digital preservation organisation that could help them develop a digital preservation programme. The ministries had failed to document their data migration policies and were not aware of other repositories using different preservation techniques. It was

revealed that creating an infrastructure for digital preservation was very important but technological tools, funding and legislation for digital preservation were far more important.

7.2.6 Best current practices

The study identified digital preservation policies, collaborative opportunities and laws as part of the strategies of ensuring best current practices. In the case of digital preservation policies, the awareness level for a national policy for digital records was high even though such policies were not applied in the ministries and agencies. This factor explains why the ministries have failed to document a preservation policy which should guide the acceptance of digital data, entire life cycle of digital records and an established strategy to make digital preservation work. Among the few ministries and agencies noted to have a preservation policy, roles and responsibilities, migration, storage and maintenance, technical infrastructure, access and maintenance and quality control procedures were part of the content of their policies. However, there was a policy deficit in the area of scope, refreshing, standards, conversion and formatting. That notwithstanding, it indicated that the PRAAD (Act 535, 1997), the ICT policy, Civil Service act 1993 (PNDCL 327) and Financial Administration Act, (Act 654, 2003) documented in the law books of Ghana have to be enforced and upgraded to meet international standards. The study suggested that compliance to these acts can only be enforced if there is a proper records management system for public officers. On the other hand, interviews of respondents on the application of the PRAAD law demonstrated the weakness of the law to ensure the longevity of government records and the proper maintenance of digital records (Ngulube, 2012).

As a second step towards best practices, references were made to collaborative and participatory opportunities undertaken by digital support organisations such as DPE (2006), Nestor (2006), DRAMBORA and DCC. These support organisations have fostered collaboration between many national and international initiatives to design trusted repositories. The study emphasized that collaboration as a best practice can help the ministries and agencies to adopt the concept of Linked Open Data, a concept that allows raw data to be placed online in a standard, web enabled and to be web addressable and linkable. This will facilitate the sharing of information, agreement

on technical standards for digital preservation and develop open source software to solve many of the challenges of digital preservation. The study drew on exemplars from various search engines with emphasis on WorldCat and Google books which have pitched camps with memory institutions to enhance their services. For instance, WorldCat through collaborative initiatives receives cataloging information from well over 72,000 libraries around the world (Council of Canadian Academies, 2015:82), users of Google books can search over two billion records (Waibel & Erway, 2009; OCLC, 2014 in Council of Canadian Academies, 2015).

7.2.7 Roles and responsibilities of stakeholders

With documentary evidence captured in Chapters Three, Five and Six, the study stressed the following as part of the roles and responsibilities of stakeholders in the digital preservation environment. It must, however, be noted that best practices appear to intertwine and overlap with the very role of stakeholders.

7.2.7.1 Best practices

The choice of best current practices as a role was premised on the numerous developments undertaken by the digital preservation support organisations such as PANDORA project and the Council of Australia State Libraries (Cathro, Webb & Whiting, 2009).

7.2.7.2 Funding

The dwindling fortunes of libraries and archival institutions on donor funding suggested that they would have to cooperate with government and seek the assistance from other digital preservation support organization.

7.2.7.3 Training and education

Stakeholders develop training programme for information professionals to reposition them to implement both digitization and preservation practices relevant to the needs of governments and their citizens (UNESCO Vancouver Declaration, 2012).

7.2.7.4 Advocacy and collaboration

With respect to collaboration and advocacy, the UNESCO Vancouver Declaration (2012) proposes that stakeholders of digital preservation collaborate with international professional associations and other international bodies to develop academic curricula for digitization and digital preservation. The call by the Library of Congress in 2005 under the NDIIPP (NDIIPP, 2008) inviting head of state libraries, archives and other corporate institutions for a workshop to develop strategies for the preservation of significant state and local government information in digital form can be adopted by the ministries and agencies. It emphasized that stakeholders build trusted relationships with other memory institutions through participatory projects such as national debate on digital preservation infrastructure and acquisition of digital heritage.

Moreover, the study argued that stakeholders in the digital preservation environment have adopted Open Data policies in an attempt to drive innovation. It cited examples from the U.K government and the government of Canada where citizens can access a central access portal, data.gov.uk. including Linked Open Data, the cloud and an Open Data portal data.gc.ca. allowing unrestricted data reuse (Government of Canada, 2011; Comprehensive Knowledge Archive Network, 2013; Government of Canada, 2013). These exemplars reinforce the relevance of stakeholders in the digital preservation environment. Similarly, findings on Open Data in this study illustrate the role the ministries and agencies can play in the delivery of data to the public and the opportunity offered to citizens to assess the performance of the ministries at various levels. This makes the ministries transparent and very open to the general public as data is shared in a form that allows use and reuse of digital records. In spite of the opportunities offered by Open Data to the citizenry, its real impact will not be realized without carefully planned preservation of data. Exemplars in Canada and U.K underscore the pervasiveness and prominence of Open Data as Government departments, public-sector bodies, and local authorities are hooked onto the Open Data. In the same way various cities and districts throughout Canada have launched their own Open Data websites (Government of Canada, 2014), including the City of Ottawa, which also uses the CKAN platform (City of Ottawa, 2014).

7.3 CONCLUSIONS ABOUT RESEARCH RESULTS

The following conclusion was guided by the research questions and took cognisance of: creation of digital records, current level of awareness of digital preservation, impact of digital preservation on e-government, digital preservation challenges, strategies of digital preservation, best practices for digital preservation and role of stakeholders of digital preservation.

7.3.1 Conclusions about the creation of digital records across the ministries and agencies

The first objective averred that the use of ICT support the preservation of digital records and facilitates the preservation and accessibility of data by creating records, managing the records, and storing the records in a safe place. It argued that the day to day activities of the ministries and agencies such as the use of ICT, implementation of e-government, and application of legislations and public policies have culminated into the creation of databases, digital publication, emails, website information and document conversion. It revealed that tweets, website information and geographical information systems were the most common categories of digital information received from other agencies to be preserved. It concluded that the tendency to destroy these types of records was high and therefore required some preservation effort and attention. Accordingly, statutory requirement and a constitutional legislation were needed to ensure the preservation of these digital records. Thus, policy makers have put in place laws, legislations and policies to make it mandatory and constitutional for digital records to be preserved. It advances the view that as the frontiers of government expand in terms of legislation and statutory laws, there should be appropriate strategies to absorb the proportionate growth of digital records.

7.3.2 Conclusions on the current level of awareness of digital preservation across the ministries

The second objective investigated the current level of awareness of digital preservation. It established that there was a demonstrable knowledge of the volumes of digital records created in the ministries even though there were reported discrepancies of the volume of digital records.

The study questioned the very basis upon which digital preservation was built on, as a large proportion of the respondents were clueless about the OAIS model. While the study emphatic findings on respondents' profound knowledge about DSPACE, LOCKSS and DAITSS as technical metadata to support the preservation of digital records was commendable, it bemoans of respondents gross lack of knowledge of the digital preservation support organisations (DRAMBORA, DPE and PLANET and TRAC) and digital preservation standards. However, it stressed that respondent's continuous use of storage devices, software, file formats, storage media and hardware to extend the life of a digital material with PDF as the most preferred text document format for most digital preservation repositories can ensure the perpetuity of digital records. It concluded that there was a need to champion the use of the OAIS model across the ministries and agencies.

7.3.3 Conclusions on the impact of digital preservation on e-government in the ministries

The third objective examined the impact of digital preservation on e-government. It emphasized that digital preservation will continue to underpin e-government now and in the foreseeable future. Such an assumption was augmented by the symbiotic nature of e-government and digital preservation, and explains why many of the ministries and agencies had incorporated e-government legislations into their digital preservation act and further explains why many of the ICT products across the ministries and agencies were used for the purposes of e-government and digital preservation. Such a finding was reinforced by Nolan (2001) and Luyombya (2010) when they argued that the use of ICT systems is linked to the implementation of government services and knowledge sharing and that it is impossible to examine the outcome of e-governance processes without touching on digital records. It noted that there is always the temptation to conclude that without digital preservation, e-government cannot survive. This is however on the contrary, as the survival of e-government depends on reliable and trustworthy of digital data for the continuous update of online information.

7.3.4 Conclusions on key threats to digital preservation across the ministries and agencies

It identified loss of digital records, funding issues, level of security and privacy, skills training and technological obsolescence as the key threats to digital preservation. It emerged that digital materials belonging to the ministries and agencies were getting lost and were plagued with timing issues. Reasons for the loss of the digital material were attributed to the necessity to continuously change hardware and software of computers, (Chen, 2001; Baker, 2014), media incompatibility and configuration problems which often lead to unpredictable disasters and make documents unreadable (Digital Preservation Coalition of the United Kingdom, 2003**).** To address this phenomenon, many of the agencies and ministries were checking for viruses, copying their digital records to a different storage media and migrating their records to a current version of file formats whenever they receive digital records for the first time.

In spite of the threat posed by security and privacy issues in the area of digital preservation, efforts were being made to put in place measures such as security/privacy policy, user restrictions and monitoring of emails to prevent unauthorized access, alteration, theft, or physical damage to information. Thus, control measures such as tracking and verifying changes of digital objects and user access restriction were the most common ones. However, much was not done to audit the digital records of the ministries to ensure appropriate management of digital records as more than half 66(55%) of respondents just do not know whether their digital records were audited or not. The results strongly suggested that respondents have focused their security initiatives on those measures best suited to their organisational structure and resources.

The study concluded that the ministries and agencies have staff who were technically astute to manage their digital preservation activities. However, lack of training hampered their initiatives in undertaking digital preservation projects. In a limpid response to their preparedness to overcome this problem, a large proportion of respondents have undertaken degree programmes in IT and Information Science. There were preferences in training areas viz: preservation strategies and tools, digitization, copyright issues and metadata, digital records security, digital repositories, standard formats and preservation strategies in training format such as seminars and

workshops, internships and use of consultants. The study subscribed to the view that qualifications in IT and Information Science were not suggestive of respondents ability to deliver every digital preservation project, but rather, training on the job, talent and dedication determine the extent to which digital preservationist will catch up and cope with this emerging discipline (Corrado & Moulaison, 2014:65).

Although respondents were very much aware of the estimated cost of their funding requirements, funding was noted as a current threat to their repositories. Funding has cascading effects on every single element that drives digital preservation as changes in hardware and software; and transformation of data from one format or configuration to another often required funding. Above all threat to digital preservation was ranked in the following order: the level of security and privacy, skills training and insufficient funding, technological obsolescence and insufficient organisational commitment. The overall ranking suggested that many of the ministries and agencies were fully prepared to move forward with the digital preservation activities.

7.3.5 Conclusions on digital preservation strategies across the ministries and agencies

The fifth objective explored the digital preservation strategies employed at the various ministries and agencies. It identified backup strategy, migration, preservation metadata, trustworthiness in repositories, cloud computing, Linked Open Data, refreshing and emulation. It concluded that whilst emulation, refreshing and cloud computing appeared to be an unfamiliar terrain and unknown to respondents, they were however familiar with trusted repositories, backup preservation metadata and migration. In confirming the application of these strategies, a data infrastructure, a digitization programme and a regular migration of information from one medium to another have been put in place to actuate these strategies. It unravelled that the ministries had applied themselves exclusively to the metadata standards built in house and were not aware of any digital preservation organisation that can help them to develop a digital preservation programme. It stressed that ministries and agencies had failed to document their data migration policies. Other preservation strategies noted in the study were the use of storage devices, CD-ROM and software as more than two thirds of respondents 70% preserve their

digital records on the hard drives of their computers, on the server file with backup system and on CD-ROM or DVD.

7.3.6 Conclusions on best practices of digital preservation for the ministries and agencies

The sixth objective examined the best current practices for digital preservation. It identified the digital preservation policies, collaborative opportunities, legislative instruments and act as part of the strategies of ensuring best current practices. It drew widely on international examples whose memory institutions are advanced and were at the forefront of adapting to the digital preservation environment. As a form of best practice, there was a high awareness level for a national policy for digital records even though such policies were not applicable to the ministries and agencies. This development explains why the ministries and agencies do not have a blue print of digital preservation policy, which will guide the acceptance of digital data, entire life cycle of digital records and an established strategy to make digital preservation work. The few ministries and agencies noted to have a preservation policy, had a policy deficit in the area of scope, refreshing, standards, conversion and formatting. Whilst the study identified areas for improvement in the policies of the ministries and agencies it reinforces the need for training on preservation strategies and tools.

It stressed on collaborative and participatory opportunities undertaken by digital support organisations such as DPE (2006), Nestor (2006), DRAMBORA and DCC. These support organisation have fostered collaboration between many national and international initiatives to design trusted repositories. It further drew on exemplars from various search engines such as WorldCat and Google books which have pitched camps with memory institutions to enhance their services. It underscored how DRAMBORA and DCC have the potential to foster collaboration between national and international initiatives to design trusted repositories.

7.3.7 Conclusions on roles and responsibilities of stakeholders

The seventh objective was to determine the role and responsibilities of stakeholders in the digital preservation environment. It noted funding, training and education, advocacy, collaboration and

legislation as some of the roles stakeholders ought to champion. It emphasized stakeholders to build trusted relationships with other memory institutions through participatory projects such as national debate on digital preservation infrastructure and acquisition of digital heritage. Just like best current practices, it drew on exemplars from the U.K government and the government of Canada where citizens can access a central access portal, data.gov.uk. including Linked Open Data, the cloud and an Open Data portal data.gc.ca. allowing unrestricted data reuse (Government of Canada, 2011; Comprehensive Knowledge Archive Network, 2013; Government of Canada, 2013).

7.4 RECOMMENDATIONS

Identifiable recommendations pertinent to the study were made to address each of the research objectives of the study.

7.4.1 Recommendation on the creation of digital records in the ministries and agencies

The current study established that various categories of digital records were created as a result of the use of ICT, e-government activities and promulgation of new laws which eventually led to the production of emails, websites and online transactions and text files. However, the study observed that these categories of digital records can be destroyed as they do not fall into the mainstream of digital information. With a high probability that these records can be destroyed, public sector organisations and policy makers must put in place legislations to make it mandatory and constitutional for digital records to be preserved. It recommends that as the frontiers of government expands, new legislation will be needed to meet the phenomenal growth of digital records. It cautions that irreplaceable information will be lost if digital preservation issues are not resolved in the near future. Ensuring continued access to the content of digital record therefore calls for collaborations and the application of broad public interest.

7.4.2 Recommendation on current level of awareness of digital preservation across the ministries and agencies

There were reported cases of low awareness level for the OAIS model, digital support organization (DRAMBORA and DPE) and software tools for digital preservation. The study recommends a monthly or better still, annual meeting inviting heads of libraries, archives of the ministries and agencies and other corporate institutions for a workshop to develop strategies for the preservation of significant state and local government information. Such workshop will bring to the fore, some insight into the use of OAIS, DRAMBORA and important issues affecting the digital preservation community. For instance, insight into repositories like the OAIS model can facilitate the implementation of e-government as it has the capacity to reliably store data, migrate data, provide access to digital data and by extension facilitate a wider understanding of what is required to preserve and access information for the long term. On the other hand, Digital Repository Audit Method Based on Risk Assessment (DRAMBORA) can be used as a means of guiding repository administrators and other staff to identify the risks that is associated with the organization's business and to anticipate, avoid, mitigate and appropriate evidential documentation. With the constitutional obligation, backed by the PRAAD act of 1996, NITA Act 771, ICT policy document and the much anticipated Freedom of Information law, public officers have a mandate to preserve information and make it available when needed. The OAIS model is therefore an appropriate model to assist in this direction.

7.4.3 Recommendation on the impact of digital preservation on e-government for the ministries and agencies

The study proposes an appropriate balance between digital preservation and e-government**.** This is because the implementation of e-government will be a mirage if repositories are not created to feed government websites. The study recommends a stronger integration and cooperation between various government agencies to improve transparency, accountability and participatory governance as no single ministry can effectively address the issues of digital preservation.

7.4.4 Recommendations on key threats to digital preservation across the ministries and agencies

In spite of the numerous challenges faced by the ministries and agencies, staffs were fully prepared to move forward with the digital preservation activities, if authorities of the ministries and agencies would assemble resources such as funding, the necessary infrastructure and equipment, and training for staff. The study recommends that the continuous loss of digital records can be ameliorated through the replication of data. This is where a set of institutions replicate their holdings and hold these data in trust for each other to reduce the risk of digital loss. The study suggests backup, refreshing, metadata and auditing of digital records to reduce the incident of data loss (Barateiro et. al, 2010). Whilst refreshing will replace components of hardware and hard disks, metadata on the other hand will verify the integrity and obtain an undamaged copy of documents. Auditing will similarly monitor and review activities of the risk management process. Backup also means that digital records will be copied and stored in multiple locations to create readily available data. Thus, well-managed backup system, properly executed, can restore a document that would have been lost during disasters. However, concrete results from a backup strategy can be obtained if there is:

- detailed instructions for key staff to follow in the event of different types and scales of emergency;
- contact details of key staff and for any emergency services, including specialists in disaster recovery who may be engaged as contractors;
- instructions for restoring the content of the digital collection from backup copies;
- a complete description of the hardware and software infrastructure in place to manage the digital objects;
- copies of crucial documentation related to the preservation process, such as operating procedures and manuals; and
- access to copies of all the software required to operate the computer systems.

The study holds the view that the digital preservation topics suggested by respondents for training can enhance their development.

7.4.5 Recommendation on digital preservation strategies for the ministries and agencies

Evidence from the study showed that cloud computing, emulation and refreshing were the least implemented preservation strategies across the ministries and agencies, a situation that suggested that information professionals were probably not up to date with the current technology, particularly with cloud computing. With the current dwindling fortunes of funding for digital preservation, the study recommends cloud computing to the ministries and agencies as they will pay for the space they use and extra space only as its data grows. Again, the cloud can allow users to access data from any location via any device that can be connected to the internet. This feature is important because of the increased need for globalization.

7.4.6 Recommendation on best practices of digital preservation for the ministries and agencies

There is no question that for archivists, globalization has created a set of shared problems, and possibly shared solutions. For instance, the bits that make up digital documents are the same irrespective of where they are located. To that extent, preservation specialists from around the world can learn from one another (Hirtle, 2008). The study recommends that the process of developing a digital preservation policy can be guided by a template document from other jurisdictions since many of the public sector organisations do not have a digital preservation policy. Whilst the study identifies areas for improvement in the few ministries and agencies noted to have policies, it reinforces the need for training on preservation strategies and tools. The study is calling for stronger enforcement and penalties for agencies and ministries that do not comply with legislations that underscore the need for preservation of digital records. The situation where digital preservation policies place no responsibility on any public officer as to how to manage digital records can be detrimental. Luyombya (201l) in a study underscored how Uganda Records and Archives legislation has failed to enforce its archival laws resulting in the lack of appropriate institutional and managerial structures. The adoption of the Beagrie policy by

the ministries and public agencies can provide guidance for the implementation of the digital preservation infrastructure in Ghana. Clearly, any long term access to digital records rest heavily on preservation strategies underpinned by digital preservation policies

7.4.7 Recommendation on role and responsibilities of stakeholders

As an addendum to the roles and responsibilities pointed out in Chapters Three, Five and Six, participating repositories such as the ministries and the public agencies must agree on a common protocol and metadata schema for online searches. The study recommends that the experiences and collaborative effort of the key institutions related to digital preservation in the U.K can be useful lessons to Ghana, particularly the leadership role provided by the National Archives of U.K, the British Library, DPC and the JISC. In this regard, the National Information Technology Agency (NITA), PRAAD, staff of records managers across the ministries and libraries of the Universities can draw a road map towards achieving specific objectives in digital preservation, as opposed to singular being undertaken by NITA to build a digital preservation infrastructure. Digital preservation thrives on collaborative effort and no single institution can do it alone. Lessons from the U.S should help policy makers and leadership in Ghana to make a financial commitment towards this agenda as digital preservation projects are capital intensive.

Again, the study recommends that Ghana adopt a prototype of the activities of DPE by pooling significant stakeholders together to find a practical solution to the preservation of digital records in the country. The DPE has succeeded because it undertakes the following activities:

- disseminating information on current research and practice in digital preservation;
- instituting a concerted and coordinated effort to get digital preservation on the agenda of stakeholders;
- playing the advocacy role for appropriate and adequate funding to secure the nation's investment in digital resources;
- providing a common forum for the development and coordination of digital preservation strategies in the United Kingdom; and
- forging strategic alliances with relevant agencies nationally and internationally.

I recommend the results of this study to policy makers and government officials considering what digital preservation infrastructure can do to the development of Ghana.

7.5 PROPOSED FRAMEWORK FOR DIGITAL PRESERVATION OF E-GOVERNMENT

This part of the study proposes a digital preservation framework for (Figure 7-1) public sector organisations in Ghana. The framework builds on the existing body of knowledge on digital preservation and draws on aspects of the elements within the OAIS model, the integrated management framework and the model developed by the panel of experts on memory institutions from Canada. The proposed framework takes cognisance of three connecting circles embracing participation, collaborations and supporting factors. It identifies two main areas of opportunities viz: collaborative opportunities and participatory opportunities, many of which the study discussed in Chapters Three, Five and Six. The third circle underscored the supporting factors needed at both national and institutional levels to realise the aforementioned opportunities.

In the case of the participatory opportunities, the framework evinces that because of the continuous expectation of users/consumers in the form of the quest to access government activities, share ideas and experiences through websites, social media and other collaborative platforms, memory institutions have no option than to provide visitor centric services that encapsulate online access portals for content and tools. Thus, contributions from the public ranging from sharing and making input in the development of digital preservation of e-government are some of the ways of making memory institutions relevant. Such an arrangement fosters trusted relationship between memory institutions and potential users.

Underpinning collaborative opportunity is the need for memory institutions to adopt an agreement on technical standards for digital preservation such as cloud computing, Open Data and open software. Such collaborations will help record creators, businessmen, ministries and agencies to streamline their preservation process, enhance their visibility and ensure the

longevity of their records. The final lap of the framework underscored the need for the development of policies, procedures, structures and systems to take care of adequate resources, staff, ICT infrastructure, equipment, legislation and funding. These actions will inevitably facilitate the management of data and guarantee the long term storage of archival materials. Thus the day to day operations of the system will eventually improve access to records and archives; and ensure effective delivery of government programmes and services. The study suggests that these three connecting circles are inseparable and very much dependent on each other. Their combination, therefore, is central to the success and future of archival institutions in Ghana.

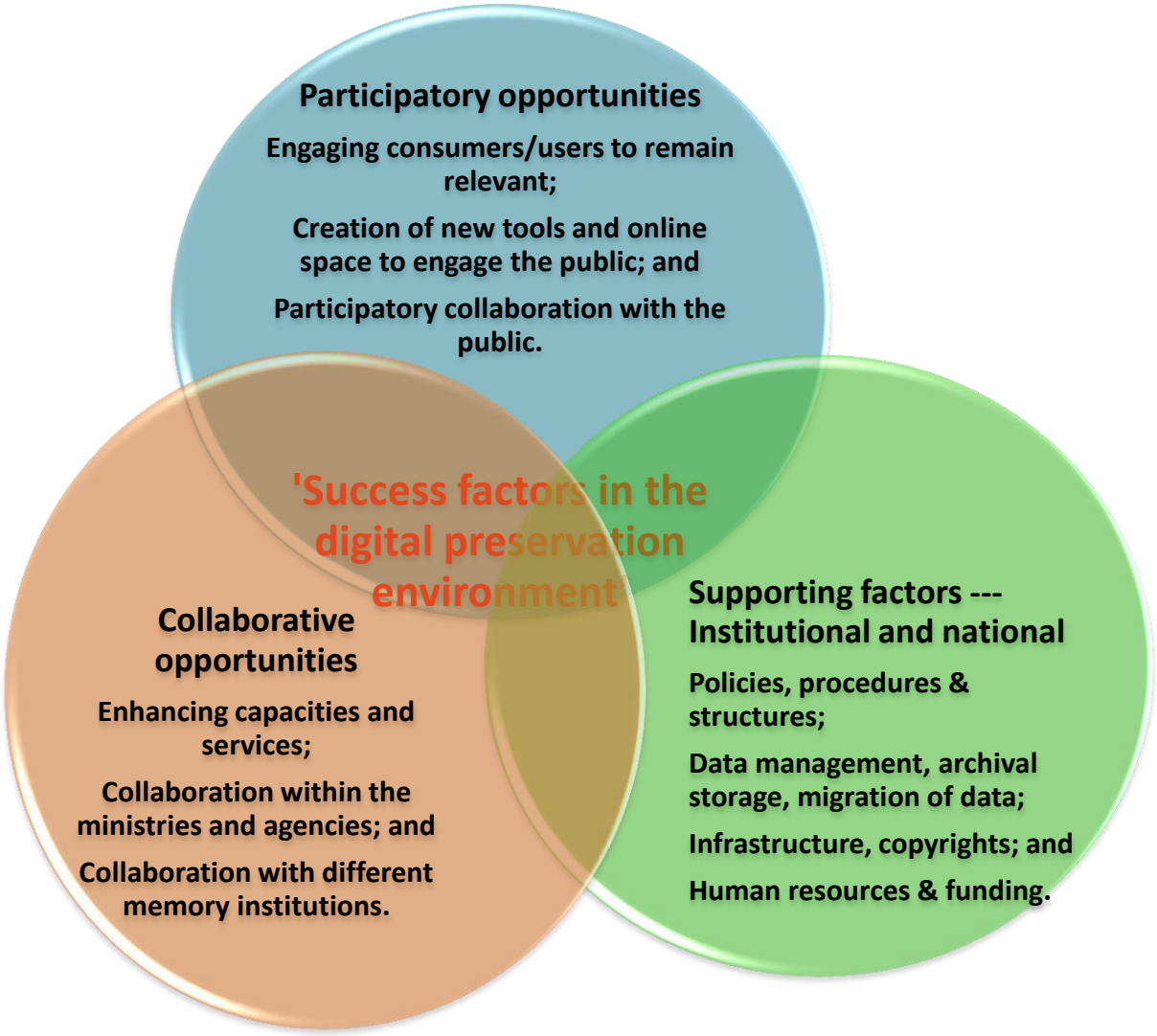

Figure 7 - 1:Proposed digital preservation framework for public sector organisations in Ghana

7.6 IMPLICATION FOR THEORY, PRACTICE AND POLICY

As was pointed out in the literature, the integrated management framework and the OAIS model were the bedrock upon which the study was built. These frameworks helped to address the eclectic questions surrounding the conceptual and contextual issues of digital preservation, particularly with the extent to which the concept has been deployed across public sector organisations in Ghana. The study, therefore, add to the existing conceptual underpinnings that have dominated the debate about data management, archival storage, preservation strategies, challenges and best practices of digital preservation of e-government.

The further technology advances, the more complex preservation issues become and the more solutions are suggested. This study has contributed to the numerous solutions that have been proffered to address the digital preservation conundrum through collaborative and participatory opportunities as depicted in the proposed model in figure 7-1.

With respect to policy and practice, the current study brought to the fore the true state of digital preservation across the ministries and agencies, particularly in a period where the government of Ghana is brooding(limbo) over whether to pass the right to information law or not. With the Ghana's vision 2020 (a policy document of the government which espouses an ICT- driven economy by 2020 if rapid economic growth will be achieved) inching closer, (National planning development commission of Ghana, 2001), the study will support the Government of Ghana's goals for e-government as a digital preservation infrastructure is a key requirement to the management of an e-government system. In other words, the proposed framework will guide the actions of public offices to salvage the dwindling fortunes of digital records at the ministries and agencies.

Further, the study has presented a framework for digital preservation of e-government, which will eventually provide the very basis upon which digital preservation will be built. It is hoped that the aforementioned recommendations will be integrated into the ICT policy document of the ministry of communication and implemented accordingly. This work will serve as a strong reminder that governments of Ghana need a good understanding of governance, technology and

regulatory policies in driving the information society. It thus add to the body of knowledge and brings to clarity, the synergy and the symbiotic relationship that exist between ICT, digital preservation and e-government.

7.7 SUGGESTION FOR FUTURE RESEARCH

In this study, collaborative and participatory opportunities were noted to ameliorate the unending problem of digital preservation. Such a solution was to elevate archival institutions to be relevant and proactive to the changing needs of users. Accordingly, these two concepts were very much elaborated to justify their relevance. The researcher holds the view that much of the justification for the adoption of the two concepts were not equally elaborated as collaboration was given much more attention than participation. For this reason, further enquiry could be undertaken to examine the participatory opportunities of archival institutions in the area of digital preservation.

The target of the study was to cover every single public sector organisation in Ghana. However, that was not meant to be as out of the 182 respondents earmarked for the study, only 120 responded to the call. Future research should examine the whole population by addressing the 182 respondents. In addition, five directors were purposively selected for the interview protocol. That number could possibly be increased for any subsequent research to add more rigour and robustness to the qualitative part of the study.

One of the main strength of the multi-methods design is its ability to provide a more comprehensive picture about a phenomenon. Such a comprehensive picture is obtained through the use of different levels of data to complement the strength and weakness of each data. However, one of the limitations of this study was the lack of extensive discussion of the multi method design. Although new models for multi methods designs have popped up, there is still lack of studies on multi method research.

Future research should examine closely the implication of Open Data government within the context of digital preservation. Whilst digital preservation looks forward to the longevity of

digital records and its accessibility, Open Data focuses on the utility of these records through online services, reuse and distribution for the purposes of transparency and citizens' participation.

In an attempt to address the overall objective of the study, much of the literature, discussions, interpretation and recommendations were centred on issues of digital preservation in archival institutions. Suffice to say that little was discussed about digital preservation in academic institutions. An in-depth study into digital preservation in libraries will be illuminating.

7.8 FINAL CONCLUSION

The study investigated digital preservation of e-government with the view of proposing a framework for public sector organisation in Ghana. In order to address the core variables of the study, a number of factors were raised namely: creation of digital records, awareness level of digital preservation, impact of digital preservation on e-government, challenges, digital preservation strategies, best practices and role of stakeholders in the digital preservation environment. Evidence from the study proved that the creation of digital records were occasioned by the use of ICT, e-government activities, legislations and public policies through which digital materials such as tweets, website information and geographical information systems were created. The study underscored the symbiotic relation between e-government and digital preservation and backed that claim with the use of ICT products meant for digital preservation and e-government in the ministries and agencies. To address the digital preservation challenges faced by the ministries and agencies, the study called for the adoption of the concept of collaboration and participation through the use of linked Open Data, Open Data and cloud computing.

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APPENDICES

APPENDIX 1: Cover Letter for Pre-testing the Questionnaire for the survey

UNIVERSITY OF SOUTH AFRICA

SCHOOL OF ARTS

DEPARTMENT OF INFORMATION SCIENCE

Dear Sir/Madam,

I am a PhD student at the University of South Africa (UNISA) in the Department of Information Science and currently undertaking a study on Digital preservation of e-government in public sector organisations in Ghana. This study seeks to examine the framework for digital preservation of e-government with the view of developing an intellectual framework for practioners and researchers within the public sector. Whilst the study recognizes digital preservation as a key requirement to the government of Ghana e-government e-initiatives launched in 2008, it concedes that digital preservation is very complex and characterized by a high degree of uncertainty, in which much experimentation and a variety of techniques are employed by different organisations to meet their individual needs. As a result, findings of the study will be used among others to seek support for public sector organizations in the area of digital preservation and develop a framework to address the digital preservation problems in Ghana.

The study was cleared by the UNISA Research Ethics Committee and an official permission granted by the Ministry of Communication and Technology to carry out the research in Ghana.

This questionnaire is being circulated across the Ministries, the National Information Technology Agency and the Public Records and Archives Administration.

As part of the measures of ensuring the validity and reliability of the questionnaire, the researcher is conducting a pre-test on the questionnaire. The researcher therefore craves for your assistance in the area of comments, carping remarks and suggestions on the questionnaire as he looks forward to use the questionnaire for the study.

You are kindly guided by the following checklist as you peruse the questionnaire

1. Are there any typographical errors? [ ] Yes [ ] No

2. If your answer is “Yes”, please indicate them in the questionnaire.

3. Are there any mispelt words? [ ] Yes [ ] No

4. If your answer is “Yes”, please indicate them in the questionnaire.

5. Do the item numbers make sense? [ ] Yes [ ] No

6. If your answer is “No”, please, provide some suggestions below:

.....
.....
.....

7. Is the type size big enough to be easily read? [ ] Yes [ ] No

8. If your answer is “No”, please, provide some suggestions below:

.....
.....

.....

9. Is the vocabulary appropriate for the respondents? [ ] Yes [ ] No

10. If your answer is “No”, please, provide some suggestions below:

.....
.....
.....

11. Is the survey too long? [ ] Yes [ ] No

12. If your answer is “Yes”, please, provide some suggestions below:

.....
.....
.....

13. Is the style of the items too monotonous? [ ] Yes [ ] No

14. Are the skip patterns too difficult to follow? [ ] Yes [ ] No

15. If your answer is “No”, please, provide some suggestions below:

.....
.....
.....

16. Does the survey format flow well? [ ] Yes [ ] No

17. If your answer is “No”, please, provide some suggestions below:

.....
.....
.....

18. Are the items appropriate for the respondents? [ ] Yes [ ] No

19. If your answer is “No”, please, provide some suggestions below:

.....
.....
.....

In the event of any queries about the study, I can be reached on **+233246790429**

Your assistance will be highly appreciated.

Kofi Koranteng Adu (Phd Candidate)

APPENDIX 2: Request Letter to Undertake Research on Digital Preservation of E-government across the Ministries and agencies

29 April, 2014.

The Minister,

Ministry of Communication

Dear Sir,

RESQUEST TO UNDETAKE RESEARCH ON DIGITAL PRESERVATION OF E-GOVERNMENT ACROSS THE PUBLIC AGENCIES IN GHANA.

In 2003 the Government of Ghana issued a National ICT for Accelerated Development (ICT4AD) Policy Statement, which was approved by Cabinet in early 2004. The ICT4AD strategy among others sought to modernize the Civil Service by implementing electronic government and government initiatives within the wider scope of the institutional reform.

Ever since the framework for the development of an e-government infrastructure was developed, Ghana has been making a lot of progress in the e-government environment. Such development has culminated into the implementation of e-government across the ministries and allied agencies. Suffice to say that the construction of the National Data Centre for the storage of government data, digital data storage for the Births and Deaths Registry, immigration records, national identification records and other departments and agencies reinforces the pivotal role of data to the e-government initiative.

A decade after the approval of the ICT4AD strategy, no empirical study has been undertaken to examine the extent of e-government implementation and digital preservation. This letter serves to request for your approval to conduct a research study on digital preservation and the implementation of e government in your Agency.

Whilst the study recognizes digital preservation as a key requirement to the government of Ghana e-government initiatives, it concedes that digital preservation is very complex and characterized by a high degree of uncertainty, in which much experimentation and a variety of techniques are employed by different organisations to meet their individual needs. As a result, findings of the study will be used among others to seek support for public sector organizations in the area of digital preservation and develop a framework to address the digital preservation problems in Ghana.

Your Agency will benefit from the information obtained and the resultant recommendations for its management decision-making and problem solving. The results of this study will further assist officials of the National Information Technology Agency to strategically position the planning and delivery of e-government in Ghana

The researcher is a Phd candidate in the Department of Information Science at the University of South Africa. The study is about **"A Framework for Digital Preservation of e-government"**. The purpose of the study among others is to assess the extent of e-government implementation, establish the impact of digital preservation in the planning and delivery of e-government, and determine the current level of awareness of digital preservation.

In completion of the study the researcher will donate a copy of the dissertation to your Agency of Communication. Confidentiality is assured on the data collected for the study.

Thanking you in anticipation for your forthcoming positive response

Yours faithfully

.

Kofi Koranteng Adu

Phd Candidate: University of South Africa

Cell Number: 0246790429

APPENDIX 3: Survey Questionnaire for ministries and agencies

Questionnaire for Records Managers/IT Heads for the Government of Ghana Agencies/Ministries

A Framework for digital preservation of e-government in Ghana

Instructions: Please tick against appropriate choice(s) for each question and/or complete the entry spaces (where applicable).

Contact Information

Position held.....

Number of Years/Experience in the position.....

Name of Agency / Department..... .Website.....

Contact details: [Phone Number, Fax, Email] .....

Section 1: How Digital Records are Generated

1. Do you have an overall department/ section or unit with responsibility for the management of ICT in your agency/institution?

a) Yes
b) No

2. Who has primary responsibility for the introduction and implementation of ICT in your agency ?

a. In-house Staff
b. Consultant
c. Others explain ....

3. Is your agency using ICT in the preservation of records?
a) Yes
b) No
c) Do not know

4. Does the application of ICT lead to the creation and use of digital records in your institution?

a. Yes
b. No
c. Not Sure

5. If yes, what categories of digital information are generated by your agency? Please tick as appropriate.

Digital information	**Examples**	**agree**	**Disagree**	**Don't know**
Databases	e-government transaction databases, agency records database format, electronic filing			
Digital publications	Government publications, web based publication, information about agency			
Email	agency email, public records in email format, instant messaging			
Websites	Web content of value, agency websites			
Data sets	Voter list, data files			
Audio & video	Digital video and photos, digital recordings, public broadcasting,			
Document conversion	Digital images			
E-filings transaction	Courts records, vital records, deeds, wills			
Cultural heritage	History and culture, indigenous languages			

6. Do procedures exist for regular transfer of records from current to semi-current or non-current storage?

a) Yes
b) No

7. Have you considered whether the right to information bill will increase demand for public sector information?

a) Yes

b) No

8. If yes, what strategy has your agency put in place to meet this anticipated demand?

a) Put up a digital preservation infrastructure
b) Improve the agency information service delivery
c) Undertake digitization of our records
d) All of the above

9. Has factors like government legislation, policies and amendment to laws in your agency contributed to the growth of digital records?

a) Yes
b) No

10) Which activities below often generate records for the agency? Please tick the applicable options.

Activities of the Agency	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
Initiation and formulation of policies					
Monitoring, coordinating government policies and plans					
undertaking research as may be necessary for the effective implementation of government policies;					
Review government policies and plans;					
Evaluating the efficiency and effectiveness of agencies under agency					
Government legislations and laws					
E-government activities					
New public management or policy					

SECTION 2: Current levels of awareness of digital preservation

11. Would you describe your Archive Service as:

a) Actively seeking digital material

b) Reacting to depositors

c) Turning away digital material?

d) others, specify ....

12. How are digital records currently preserved in your agency?

a) Stored as part of a digital preservation repository system

b) Outsourced on contract to a service provider

c) Stored on CD-Rom or DVD

d) Stored on tape (other than backups)

e) Stored on tape drive or hard disk of computer, with backup

f) Stored on server file storage, with backup

g) Stored on a content management system, with backup

g) Via the internet

13. In which standard format are digital records held in your agency? Tick as appropriate

a) PDF
b) HTML
c) JPG
d) TIFF

14. Do you consider any of these as being in urgent need for preservation?

a) Yes
b) No

15**.** What level of awareness does your organisation have of the volume of digital material it is currently maintaining?

a. Moderately aware and can provide a rough estimate of terabytes of:
b. Very aware and can provide a rough estimate of terabytes of:
c. Don't know

Comment

....

---------- ---------- ---------- ---------- ---------- ---------- ----------

16. What level of awareness does your organization have as to the likely rate of growth of digital material to be maintained in the future? (Choose one and provide a numerical value)

a). Moderately aware and can provide a rough estimate of terabytes per annum of:

b). Very aware and can provide a rough estimate of terabytes per annum of:

c.) Don't know

Comment

... ...

... ...

17. Which of the following types of digital material does your agency hold or expect to receive? Please tick any which apply

Items	**Yes**	**No**
Textual documents		
Databases		
Still images		
Video		
Audio		
Geographical Information Systems data		
Websites		
Email		
All of the above		

18. Which of the following research projects work on digital preservation are you familiar? Please tick any which apply:

a) Digital Preservation Coalition [DPC]

b) Digital Curation Centre [DCC]

c) Digital Continuity Project

·d) PLANETS

·e) INTERPARES

g) Digital Preservation Europe [DPE]

g) UK Web Archiving Consortium [UKWAC]

On a scale of 1 to 4 where 1=unaware, 2=aware, 3=planning, 4=have implemented/change in practice.

19. Which of the following standards are you familiar with? Please assign the numbers as they apply.

Item	1	2	3	4
1. General International Standard Archival Description [ISAD(G)]				
2. ISO15489-1 and/or 2:2001 Information and documentation. Records management				
3. ISO14721: 2003 Reference Model for an Open Archival Information System [OAIS]				
4. ISO17799 (ISO 27001 and ISO27002) Information Technology. Security Techniques				
5. ISO 23081-1:2006 Information and documentation – Records management processes -- Metadata for records				

20. Are you familiar with any of the following preservation assessment toolkits and software tools? Please tick as appropriate.

PRESERVATION TOOLKITS AND SOFTWARE TOOLS	**FAMILIAR**	**NOT FAMILIAR**
1. DRAMBORA		
2. TRAC		
3. LOCKS		
4. DAITSS		
5. DSPACE		
6. ARCHIVEMATIOCA		
7. FEDORA		

Section 3: Impact of digital preservation on e-government

21. Which of these digital information drives the delivery of e-government in your agency/ministry? Please tick as appropriate.

Digital information	**Examples**	**Yes**	**No**
Databases	e-government transaction databases, records database format, electronic filing		
Digital publications	Government publications, web based publication, information about agency		
Email	agency email, public records in email format, instant messaging		
Websites	Web content of value, agency websites		
Data sets	Voter list, data files		
Audio & video	Digital video and photos, digital recordings, public broadcasting,		
Document conversion	Digital images		
E-filings transaction	Courts records, vital records, deeds, wills		
Cultural heritage	History and culture, indigenous languages		

22. How often is your agency portals/website uploaded with information?

a) Daily
b) Weekly
c) Monthly
d) Yearly

23. What is the major use of e-government in your organization?

a. facilitate online information from districts to regions

b. improve decision making

c. transaction purposes

d. communicate government information

e. all of the above

f. Others specify ... ...

24. Does the application of e-government feed into the creation and use of digital records in your institution or vice versa?

a) Yes

b) No

c) Not sure

25. If yes, explain how that happens

... ...

27. Is your ministry involved in the implementation of e-government?

a) Yes
b) No

28. IS your ministry data freely available for use?

a) Yes

b) No

Section 5: Challenges or threats to digital preservation

28. Does your organization face any timing issues or deadlines that affect digital preservation? (For example, deteriorating media or decreasing file storage space).

a. Yes

b. No

c. Don't know

If yes, please describe

Comment ... ...

... ...

29. Is digital material currently being lost or at risk of being lost in your organization?

a. Yes
b. No

c. Don't know

30. What do you see as the main barriers to your practical and sustainable solution to digital preservation in your agency? Please tick the applicable options.

Items	**Yes**	**No**
1. Funding		
2. Training		
3. IT support		
4. Data Support		
5. Organisational aspects		
6. Expertise and Experience		
7. All of the above		

Comment ... ...

31. Please rank the following factors as current threats to the loss of digital materials at your organization. 1=greatest threat, 5=smallest threat. Use each ranking only once (For example, do not rank two factors as #1).

Current loss or threat to digital material		
Insufficient funding for digital preservation		
Insufficient organizational commitment		
Technological obsolescence		
Security and privacy issues		
Skills training		

Section 6: Security and privacy

32. Does your agency have an information security and privacy policy?

a) Yes
b) No

33. If yes, which type of records does the policy affects ... ...

Digital information	**Examples**
a)Records	Born digital official records, legal records, working documents, legislative records
b)Databases	e-government transaction databases, agency records database format, electronic filing
c)Digital publications	Government publications, web based publication, information about agency
d)Email	agency email, public records in email format, instant messaging
e)Websites	Web content of value, agency websites
f)Data sets	Voter list, data files
g)Audio & video	Digital video and photos, digital recordings, public broadcasting,
h)Document conversion	Digital images
i)E-filings transaction	Courts records, vital records, deeds, wills
j)Cultural heritage	History and culture, indigenous languages
All of the above	

34. Is there a system in place for tracking changes made on your records?

a) Yes
b) No

35. How does your agency protects digital records from unauthorized access and tempering/viruses. Tick as many options that apply to your agency/ministry?

a) Through the use of ID cards and encrypted passwords
b) Use metadata is used to control access to records

c) Use of firewalls and digital signatures

d) Others specify ... ...

36. What security challenges does your agency/ministry experience with respects to digital records?

a) Compliance to policies and procedure

b) Challenges for the management of e-mails

c) Records saved on hard drives

d) Digital records viewed differently as hard copy records

37. Are your emails monitored in your agency?

a) Yes

b) No

SECTION 7: Training and Staffing

38. Have you undertaken any training in digital preservation in your agency?
a) Yes
b) No

39. What training do archivists/records managers/librarians in your agency require to develop their skills in the field of digital preservation?

a) Management and preservation of digital records during their entire life cycle

b) IT applications in records management

c) Changing roles of records managers

d) All of the above

e) Other, please specify .....

4**0.** If yes, which of the following options indicate the highest level of records and information management education/professional training by any personnel in your agency?

A) Master's in Information science/IT

B) First degree in information science/ Information Technology

C) Advanced Diploma

D) Certificate in IT

41. Which of the following will meet your training needs in digital preservation management?

a) Seminars and Workshops

b) Internships

c) Use of consultants

d) Training in records/archives and colleges

e) Others specify

42. Does your organisation have staff specifically charged with digital preservation responsibilities?

a) Yes

b) No

c) Don't know

Comment ... ...

43. Does your agency have adequate *organizational and technical* expertise to develop and maintain a digital preservation programme

a) Yes
b) No
c) Don't know

Comment ... ...

44. Are there any additional staffing requirements for digital preservation programme? Please explain
... ...

45. Which of the following best describes your training needs in digital preservation?

a) Managing digital records during their entire life-cycle

b) IT applications during digital preservation

c) Changing roles of records management

d) All of the above

Others specify ... ...

SECTION 8: Funding

46. Which phrase best describes your agency funding requirements for digital preservation? (Please choose one)

☐ a) This agency has estimated costing of its funding requirements for digital preservation

☐ b) This agency does not know its funding requirements for digital preservation

☐ c) This agency has detailed costing of its funding requirements for digital preservation

47. Has any specific funding been allocated for digital preservation in your agency?

a) Yes

b) No

c. Don't know

Comment ... ...

48. Has any potential or additional funding sources for digital preservation been identified?

a. Yes

b. No

Comment

49. Do you have an annual budget for digital preservation activities? (Digital preservation can include but not be limited to migration, scanning, emulation, refreshing, metadata creation and related activities.

a) Yes

b) No

50. If yes, what is your annual budget? ..._____

51. If you do not have a regular budget for digital preservation, or if the budget is demonstrably insufficient, does this create a risk that you can measure?

Section 9: Digital Preservation Strategies

52. What preservation strategy is used by your agency in the preservation of records? Please tick the applicable options.

Preservation Strategies	Yes	No
1. Migration		
2. Migration by normalisation		
3. Emulation		
4. Trusted Repositories		
5. Cloud Computing		
6. Repositories		
7. Byte Replication		
8. Backup		
9. Linked Open Data		
10. Metadata		

53. Does your agency have a data infrastructure/facility for the preservation of digital records?

a) Yes

b) No

54. Is there regular migration of information from one medium to another or from one system to another?

a) Yes

b) No

55. Are these procedures for data migration documented?

a) Yes
b) No

56. How do you deal with issues of reliability and authenticity (as evidence) of digital preservation in your agency?

a) Use of passwords to records to prevent alteration and deletion of records
b) Tracking and verifying changes of digital objects very often
c) All if the above

... ...

57. Which of the following options regarding preservation metadata currently applies at your agency?

a) This organization uses a preservation metadata standard developed in house

b) This organization uses the National Library of New Zealand Preservation Metadata Standard

c) This organization uses the OCLC/RLG Preservation Metadata framework

d) This organization uses some other preservation metadata standard

e) This organization uses no preservation metadata, but is planning to,

please specify ... ...

f) This organization uses no preservation metadata, and currently has no plans to do so

g) Don’t know

Comment ... ...

58. Are there any other metadata standards in use in your organization for the management of information?

a) Yes,
b) No
c) Don't know

59. How often are your digital records audited for compliance with international best practice?

a) One year
b) Two years
c) Don't know

60. Are you aware of other repositories using different preservation technique or strategies?

a) Yes
b) No

61. Are there any backup strategies for the preservation of digital records in your agency?
a) Yes
b) No

62. Do you have any or do you plan to have any digitization programme in your agency?

a) Yes
b) No

63. In selecting the preservation technique, did you consider what its effect might be upon the intellectual integrity (e.g., authenticity and reliability) of the digital material?

a) Yes
b) No

64**.** Has your organization worked with, or been informed in any way, by other organizations in developing your digital preservation programme?

a) Yes

b) No

c) Don't know

d) Not applicable

Comment ... ...

65. Has your organization undertaken any actions to extend the life of digital material that is threatened by obsolescence of file formats, storage media, and the supporting hardware/software? (Please tick the appropriate choice for each of the following components)

a) File Formats

i) Yes – please describe

ii) No

iii) Don't know

b) Storage Media

i)Yes

ii) No

iii) Don't know

c) Storage Drive

I) Yes – please describe

ii) No

iii) Don't know

d) Hardware

i) Yes – please describe

ii) No

ii) Don't know

e) Software

i) Yes – please describe

ii) No

iii) Don't know

Any further comment ... ...

66. What repository arrangements has your organization established for the ongoing maintenance and access to your digital material? (Please tick all that apply).

Items	Yes	No
1. Developed a depository in house		
2. Contracted a third party organization for depository		
3. Outsourced the development and maintenance of a depository		
4. Shared the development and maintenance of depository services with another government organization		
5. Created or acquired the software to implement the depository		

Other, please describe

Comment.

... ...

... ...

67. What future plans does your agency have with respect to the preservation of digital records?

... ...

... ...

68. How are digital records handled when they are generated from your agency or first come into your agency? Please check any of the following which apply,

a) No action taken, digital records are stored on their transfer media in the Archive Service strong room

b) Checked for viruses

c) Checked to see if the digital records are readable/can be opened\

d) Check files against deposit documentation

e) Copied to different storage media

f) Migration to current versions of file formats

Section 10: Best Current Practices of Digital Practices

69. Is your organization's responsibility for digital preservation driven by one or more of the following? (Please tick all that apply)

Items	**Yes**	**No**
1. A statutory requirement to keep/store/preserve material?		
2. A statutory duty to provide public access to official information?		
3. Core business needs		
4. Don't know		
5. Other, please specify		

70. Has your agency identified possible collaborative organizations that will help develop your digital preservation programme?

a) Yes

b) No

71. Is there any national policy governing the preservation of public sector records?
a) Yes
b) No

. 72. Does your agency have a digital preservation policy or strategy?

a) Yes

b) No

c) Don't know

73. If yes, does this policy or strategy apply across your entire agency?

a). Yes

b) No

c. Don't know

Comment ... ...

74. Has this policy or strategy been used to guide the development and management of a digital preservation programme?

a. Totally
b. Partially
c. No
d. Don't know

Comment ... ...

... ...

75. To what degree does this policy or strategy meet your organization's current needs?

a. To a very high degree
b. To a high degree
c. Adequately
d. To a low degree
e. To a very low degree
f. Not at all

Comment

... ...

... ...

76. Do these policies, regulations or procedures cover the entire life cycle of the digital records?

a) Yes
b) No
c) Don't know

77. Do you have any particular established policy to make preservation of digital records work?

... ...

... ...

78. Does this policy reflect the national policy?

a) Yes

b) No

79. Do you have policies and procedures in place which determine the kind of data that is accepted for storage/preservation by your organization, and how and when it needs to be submitted?

a) Yes
b) No
c) Others, specify ... ...

80. Which of the following areas are included in your digital preservation policy or strategy? (Please tick all that apply)

Preservation policy or strategy	Yes	No
1. Roles and responsibility		
2. Scope		
3. Appraisal, selection and acquisition		
4. Conversion and reformatting		
5. Refreshing		
6. Migration		
7. Storage and maintenance		

8. Access and maintenance		
9. Standards		
10. Procedures		
11. Technical Infrastructure		
12. Depository guidelines		
13. Quality Control or performance indicators(implementation)		

Section 11: Role of stakeholders

81. Please indicate in the order of importance the responsibilities and roles of stakeholders where 5= least important, 4=slightly important, 3= fairly important, 2= important, 1= very important

Roles and Responsibilities of stakeholders	1	2	3	4	5
1. Best practices					
2. Funding					
3. Training/education					
4. Advocacy					
5. Standards					
6. Coordination/Collaboration					
Roles and Responsibilities of Government					
1. Creating infrastructure					
2. Involving stakeholders					
3. Technological tools					
4. State wide initiative					
5. Legislation/policy/legal issues					
6. Funding					

82. Is your organization aware of any national priorities or actions for digital preservation that are needed, which are not being action?

a) Yes

b) No

c) Don't know

Comment ... ...

83. What are your agency's suggestions/recommendations or views on priorities or actions for national digital preservation needs ?

Comment ... ...

APPENDIX 4: List of records managers and it heads in the ministries

No.	Ministry	Records Managers	IT Head	Total
1	Foreign Affairs and Regional Integration	0	1	1
2	Roads & Highways	0	1	1
3	Youth & Sports	0	1	1
4	Lands and Natural Resources	1	1	2
5	Education	1	1	2
6	Water Resources	0	1	1
7	Science, Technology and Environment	0	1	1
8	Trade and Industry	1	1	2
9	Health	1	1	2
10	Defense	0	1	1

11	Transport	0	1	1
12	Energy	0	1	1
13	Communication	1	1	2
14	Information	0	0	0
15	Chieftaincy	1	0	1
16	Finance and Economic Planning	0	1	1
17	Food and Agriculture	1	1	1
18	Justice and Attorney General	1	1	2
19	Local Government and Rural Development	1	0	1
20	Tourism, Culture and Creative Arts	1	0	1
21	Employment and Labour Relations	0	0	0
22	Gender, Children and Social Protection	0	1	1
23	Fisheries	0	0	1

24	Interior	0	1	1
Total number of Records Managers and IT Heads				**27**

APPENDIX 5: List of records managers and it heads in the public agencies

No.	Agency	Records Managers	IT Heads	Total
1.	Ghana Tourism Authority	0	1	1
2.	Customs Excise and Prevention Service	1	1	2
3.	Rent Control Authority	0	0	0
4	Statistical Department	0	1	1
5	Ghana Immigration Service	1	1	2
6	Electricity Corporation of Ghana	0	1	1
7.	Ghana Library Board	1	1	2
8	George Padmore Libary	1	1	2
9	Public Records and Archives Administration	1	1	2
10	Ghana National Museums	1	1	2
11	Ghana Civil Aviation Authority	0	1	1

12	Environmental Protection Agency	1	1	2
13	Volta River Authority	1	1	2
14	Korle Bu Teaching Hospital	1	1	2
15	Ghana Water Corporation	1	1	2
16	National Board for Small Scale Business	0	1	1
17	Ghana National Procurement Authority	0	1	1
18	Gratis Foundation	0	0	0
19	Ghana Heavy Equipment	0	0	0
20	Rural Enterprise Project	0	0	0
21	Ghana Road Fund	0	1	1
22	Development of Urban Roads	0	1	1
23	Development of Feeder Roads	0	1	1
24	Passport Office	0	1	1
25	Birth and Death	0	1	1

26	Ghana Air Force	0	1	1
27	Ghana Navy	0	1	1
28	Ghana Arm Forces	0	1	1
29	Ghana fire Service	0	1	1
30	National Information Technology Agency	0	1	1
31	National Communication Authority	0	1	1
32	Ghana Post Company	0	1	1
33	Postal and Courier Services	0	1	1
34	Parliament of Ghana	1	1	2
35	Public Works Department	0	1	1
36	National Identity Authority	0	1	1
37	Bank Of Ghana	1	1	2
38	Social Security and National Insurance Trust	1	1	2
39	Accountant and Controller Department	1	1	2

40	Ghana Cocoa Board	1	1	2
41	National Lotteries	0	1	1
42	Food and Drugs Board	1	1	2
43	Ghana Free Zone Board	0	0	0
44	Ghana Investment Promotion Council	1	1	2
45	Data Protection Centre	0	1	1
46	IT Enabled Services	0	1	1
47	National Labour Commission	0	1	1
48	Fair Wages and Salaries Commission	0	1	1
49	Ghana Youth Employment and Entrepreneurial Development	0	0	1
50	Hotel Catering Tourism Training	0	0	1
51	Ghana Tourism Federation	0	0	0
52	Ghana Tourist Development	0	0	0

53	The National Sports Council	0	1	1
54	National Youth Council	0	1	1
55	National Sports College	1	1	2
56	The National Youth Employment programme	0	1	1
57	Ghana Export Promotion Council	0	1	1
58	Ghana Standard Board	1	1	2
59	Council for law Reporting	0	1	1
60	Legal Aid Board	0	1	1
61	Law Reforms Commission	0	0	0
62	Serious Fraud Office	0	0	0
63	Ghana School of law	1	1	2
64	Registrar General Department	1	1	2
65	Securities and Exchange Commission	0	1	1

66	Institute of Accountancy Training	1	1	2
67	Ghana Revenue Authority	1	1	2
68	Electoral Commission	1	1	2
69	Ghana Highway Authority	0	1	1
70	Micro Fianace and Small Loans Centre	0	1	1
71	Public Procurement Authority	0	1	1
72	Ghana National Theatre	0	1	1
73	National Symphony Orchestra	0	0	0
74	Bureau of Ghana Languages	0	1	1
75	National Dance	0	0	1
76	National folklore Board	0	0	0
77	Bulk Oil Storage and Transport Limited (BOST)	0	1	1
78	National Health Insurance Authority	1	1	2

79	Ghana Police	1	1	2
80	National Lotteries Authority	0	1	1
81	Crop Services Division	0	1	1
82	Agriculture Extension Services	0	1	1
83	Plant Protection and Regulatory Service	0	1	1
84	Agriculture Engineering	0	1	1
85	Animal Protection	0	1	1
86	Veterinary Services	0	1	1
87	Fisheries	0	0	0
88	Institute of Local Government	1	1	2
89	Driver and Vehicle License Authority	1	1	2
90	Tema Oil Refinery	0	1	1
91	Energy Foundation	1	1	2
92	National Petroleum Authority	0	1	1

93	Energy Commission	1	1	2
94	Ghana Cylinder Manufacturing Company	0	1	1
95	Ghana Oil Company Limited	0	1	1
96	Kwame Nkrumah Memorial Park	1	1	2
97	Ghana National Petroleum Corporation	0	1	1
98	W.E.Du Bois	1	1	2
99	Veterinary Council	0	1	1
100	Lands Commision	1	1	2
101	Survey Department	1	1	2
102	Land Title Registry	1	1	2
103	Forestry Commission	0	1	1
104	Mineral Commission	0	1	1
105	Mines Department	0	1	1
106	Ghana library Authority	1	1	2

107	School Feeding programme	0	1	1
108	The Wildlife Division	0	1	1
109	Geological Department	0	1	1
110	Council for Technical and Vocational Training	0	1	1
111	West African Examination Council	1	1	2
112	Ghana Book Development Council	0	1	1
113	National Accreditation Board	0	1	1
114	National Council for Tertiary Education	1	1	2
115	Grains Legumes and Development	0	0	0
116	Centre for Scientific and Industrial Research	1	1	2
117	Office of the Administrator of School Land	0	0	0
118	Land Valuation Board	1	1	2
119	Timber Industry Development Division	0	1	1

120	Ghana National Commission	0	1	1
121	Funds and Procurement Unit	0	1	1
122	Ghana Academy of Arts and Science	0	1	1
123	The National Board for Professional and Teacher	0	1	1
124	Centre for National Distance Learning and Open Schooling	0	1	1
125	Food Research Institute	0	1	1
126	Ghana Atomic Energy	1	1	2
127	Audit Service	1	1	2
128	Ghana Irrigation Development Authority	0	0	0
129	Ghana Meteorological Agency	0	1	1
130	Ghana Investment Fund for Electronic Communication	0	1	1
131	Ghana India Kofi Annan Centre	1	1	2
132	Information Service Department	0	1	1

Total number of Record Managers and IT Heads	**155**

APPENDIX 6: Interview protocol

Interview Schedule for Directors of the Ministries/Agencies in Ghana.

A Framework for Digital Preservation of e-government in Ghana.

Section A: Contact Information

Name of Ministry/Agency ... ...

Website Address ... ...

Contact details: [Phone Number, Fax, Email] ... ...

1. Does your ministry use ICT in their operations?

The use of ICT was confirmed by all the selected directors of the ministries.

2. If yes, what types of ICTs are used in your operations?
3. In your view, does the use of ICT support the preservation of digital records? How?
4. Are there any repository arrangements or projects for digital preservation in your ministry?
5. If yes, kindly elaborate on any strategic document that could be interpreted as supporting digital preservation?
6. What are the digital preservation related training skills that will benefit your ministry/agency?
7. The success of e-government depends on effective data preservation? To what extent is your ministry preserving data to support the e-government project?

8. Are there any preparatory steps your ministry has put in place to meet the anticipated demands for information when the right to information bill is passed into law? Please explain
9. Security and privacy are ethical issues in records management. How is your ministry addressing these issues in the preservation of records?

10. What measures are in place to ensure the integrity and authenticity of your ministry records? If yes, what are these measures?

11. To what degree does the preservation of digital records support your current needs in the ministry?.
12. What future plans does your ministry have with respect to the preservation of digital records?
13. What are your ministry's suggestions or views on priorities or actions for national
    a) Digital preservation needs

    b) Role of stakeholders ?

14. Does your ministry have any additional comments regarding digital preservation, or any issue raised in this survey?

Comment

APPENDIX 7: Observation checklist

OBSERVATION CHECKLIST

UNIVERSITY OF SOUTH AFRICA

SCHOOL OF ARTS

DEPARTMENT OF INFORMATION SCIENCE

A FRAMEWORK FOR DIGITAL PRESERVATION OF E-GOVERNMENT

NAME OF AGENCY ....

ADDRESS ... ...

EMAIL ... ...

DATE OF OBSERVATION ....

No.	Digital Preservation, E-government Resources & infrastructure	Responses	
		Available	Not Available
1	Desktop Computers		
2	Laptops		
3	Palmtop		
4	printers		
5	PABX(Intercom)		
6	Video conferencing		
7	Video Cameras		

8	Digital Cameras		
9	TV Sets		
10	Video CD Player		
11	Fax Machine		
12	E-mail		
13	Internet		
14	Website/Web Portal		
15	Tele-conferencing		
16	VSAT Satellite Terminal		
17	Equipments for creation, storage and processing of digital records		
18	Softwares		
19	Tools for accessing digital records		
20	Digital Records Security measures		
21	Storage media devices		
22	Digital repository		

APPENDIX 8: Approval letter from the ministry of communication to undertake the study

*In case of reply the **number** and **date** of this letter should be **quoted***

Tel No: +233-(0)30-266-6465
Fax No:+233-(0)30-266-7114

Republic of Ghana

MINISTRY OF COMMUNICATIONS
P. O. BOX M.38
ACCRA

8th May, 2014

My Ref. No:

Your Ref. No:

RE:- REQUEST TO UNDERTAKE RESEARCH ON DIGITAL PRESERVATION OF E-GOVERNMENT ACROSS THE 25 MINISTRIES IN GHANA

We respectfully forward herewith, a document dated 29th April, 2014 received from Mr. Kofi Koranteng Adu, Ph.D. candidate at the University of South Africa seeking to undertake a research on Digital Preservation of e-Government across the twenty-five Ministries as part of his thesis.

2. We are to inform that, National Information Technology Agency grants him audience and provide the needed assistance to the gentleman to facilitate the assignment.

3. Thank you.

For : MINISTER
PATRICIA DOVI SAMPSON (MRS.)
DIRECTOR, RSIM

THE DIRECTOR- GENERAL
NATIONAL INFORMATION &
TECHNOLOGY AUTHORITY
ACCRA

Cc: Mr. Kofi Koranteng Adu
Accra Polytechnic
Box 561
Accra