

**UTILISING ARTIFICIAL INTELLIGENCE EMBEDDED CLOUD
COMPUTING TECHNOLOGY TO MANAGE THE ARCHIVES AT
THE COLLEGES OF EDUCATION IN GHANA**

by

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DECLARATION OF ORIGINALITY

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I, Patrick Cudjo Dogli, declare that *Utilising Artificial Intelligence embedded Cloud Computing Technology to Manage The Archives at the Colleges of Education in Ghana* is my own work. I confirm, and I subjected the thesis to an originality check and that it complies with the accepted standards of originality. Additionally, I have not previously submitted this work, or any portion of it, for assessment at UNISA or any other higher education institution for a different qualification.



21 November

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Signature

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ABSTRACT

Artificial intelligence embedded cloud computing technology refers to the integration of artificial intelligence capabilities directly into cloud computing and storage infrastructure to enable scalable and intelligent processing of data to protect digital archival records and ensure records can be accessed remotely. The purpose of this study was to investigate the utilisation of artificial intelligence embedded cloud computing technology in managing digital archival records at the colleges of education in Ghana. The theories underpinning this study are the Technology Fit theory and the Digital Transformation theory. The study adopted a convergent mixed methods research design, combining quantitative and qualitative data collection techniques, including questionnaires, interviews, observations, and document reviews. The population sampled included College Secretaries, Human Resource Officers and Information Technology Officers of the sampled Colleges of education. Quantitative data were analysed descriptively using tables and charts, while qualitative responses were quoted verbatim and thematically interpreted. The findings revealed significant challenges in records management practices within the colleges of education, including policy voids, outdated archival systems, infrastructural inadequacies, and limited technical skills among staff. Despite these challenges, respondents demonstrated a generally positive perception toward the adoption of artificial intelligence technologies, citing benefits such as enhanced automation, metadata creation, efficient retrieval, and reduced human errors. However, usability and effective integration of artificial intelligence systems were found to be contingent on user training, intuitive interface design, and institutional readiness. The study further identified critical skill gaps in digital and artificial intelligence literacy, and the absence of cloud-based infrastructures as major hindrances.

Based on the findings, the study recommends the adoption of an artificial intelligence-powered cloud computing framework tailored to the Ghanaian College of Education context. This framework encompasses policy reforms, infrastructure development, capacity building, and user-centred system design. The proposed framework aims to transition the current fragmented, paper-based systems into a

resilient, digitised and intelligent archival management ecosystem capable of supporting the data demands of modern educational institutions.

Keywords: Artificial intelligence, cloud computing, digital archives, colleges of education, Ghana

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Come and see what the Lord has done, his awesome deeds for mankind!

Psalm 66:5

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Patrick Cudjo Dogli

November 2025

DEDICATION

This study is dedicated to the glory of God, to my late father, Emmanuel Dogli (MD), my family, Madam Felicia Kumi, Madam Georgina Asemiah, Sese Dogli, Kafui Dogli, Dzifa Dogli, Nancy Agyekum, Sena Dogli, Bright Ameyaw, Enyonam Dogli, Delali Dogli, Madam Veronica Dogli and Mr Philip Amati.

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LIST OF ABBREVIATIONS

5IR	Fifth Industrial Revolution
AECCT	AI-Embedded Cloud Computing Technology
AI	Artificial Intelligence
ATU	Attitude Towards Use
B.Ed	Bachelor of Education
CoE	College of Education
CSP	Cloud Service Provider
DM	Data Mining
DPA	Data Protection Act
DTT	Digital Transformation Theory
ERMS	Enterprise Resource Management System
ES	Expert System
FAQs	Frequently Asked Questions
GTEC	Ghana Tertiary Education Commission
HI	Human Intelligence
IAM	Identity And Access Management
IoT	Internet of Things
IRMT	International Records Management Trust
IT	Information Technology
LIS	Library and Information Science
MFA	Multi-Factor Authentication
ML	Machine Learning
MMR	Mixed Methods Research
NIST	National Institute of Standards and Technology
NLP	Natural Language Processing
OAES	Object Analysis for Embedded System
OCR	Optical Character Recognition
PNDC	Provisional National Defence Council Law
PRAAD	Public Records and Archives Administration Department

RBAC	Role-Based Access Control
RMU	Records Management Unit
SOP	Standard Operating Procedure
SPSS	Statistical Package for the Social Sciences
TAM	Technology Acceptance Model
TRA	Theory of Reasoned Action
UNISA	University of South Africa
USA	United States of America

CHAPTER 1: INTRODUCTION: SETTING THE SCENE

1.1 Introduction and background of the study

Intelligence-embedded cloud computing technology (AECCT) has emerged as a visionary solution for digital archive management, holding unparalleled potential for the successful preservation, organisation, and access of digital archival records during the Fifth Industrial Revolution (5IR). AECCT refers to the alignment of artificial intelligence (AI) abilities with cloud computing and storage infrastructure for better management, preservation and retrieval of electronic archival records while guaranteeing availability over geography (Akter, Michael, Uddin, McCarthy & Rahman 2022; Goudarouli, Sexton & Sheridan 2019; Modiba & Shekgola 2024; Zhang, Liu, Chu & Zhao 2025).

The Fifth Industrial Revolution (5IR) is a technological paradigm that involves the incorporation of leading-edge, AI-based digital technologies and human intelligence (HI) in an integrated manner, in order to enhance organisational productivity and efficiency across industries (Nel-Sanders 2023; Hussain, Li, Hussain, Attar, Alhomoud, Alsagri & Alzubi 2025). 5IR also involves new technologies such as AI, cloud computing, blockchain technology, the Internet of Things (IoT), etc. These technologies can also play a role in the effective management of digital archival technology (Oladokun, Enakrire, Ajani & Jibrin 2025).

AI denotes the practical operational ability of machines to perform tasks, solve problems and act autonomously in complex environments, often learning and adapting through experience (De Zúñiga, Goyanes & Durotoye 2023). According to Sofia, Montserrat, Emilia, Giuditta, Fernando and Blagoj (2020), AI systems are man-made systems that collect, comprehend and reason with information to decide on the best actions. Such systems can use symbolic rules, learn numerical models, and change their behaviour by observing the effects of previous actions.

Furthermore, AI includes the use of AI-assisted programs and applications for managing digital archival documents (Modiba & Shekgola 2024). AI systems use machine learning algorithms and intelligent systems to process and manage digital archival records automatically, while protecting them from cyberattacks and making them easily accessible (Wang 2019; Buchanan, Howitt, Wilson, Booth, Risling & Bamford 2021; Hussain et al. 2025).

AECCT, as defined by Mohamed, Mahri, Veerasamy, Karickom and Sulaiman (2025), is the convergence of AI and technologies such as machine learning, neural networks, and big data analytics with cloud computing platforms and services to enhance automation, scalability, and intelligent decision-making in digital systems. Modiba and Shekgola (2024) assert that AECCT provides a secure means of storing and accessing digital archives.

Contemporary records administration and archival procedures have increasingly adopted AECCT solutions to address the growing complexity of managing digital data (Makridakis 2017; Nel-Sanders 2023). Organisations worldwide recognise the groundbreaking potential of AECCT for handling, categorising, storing and retrieving archival documents, as these technologies offer greater functionality than traditional records administration storage and retrieval systems (Lu, Li, Chen, Kim & Serikawa 2018; Modiba 2021).

The use of AI capability in cloud computing systems has proved highly advantageous in dealing with electronic records management systems (ERMSs), offering automated solutions that encapsulate effectiveness, while reducing the need for manual intervention (Dwivedi, Hughes, Ismagilova, Aarts, Coombs, Crick & Williams 2021; Modiba 2021; Modiba 2024; Ali, Naeem & Bhatti 2020).

The management of digital archival records has become increasingly complex as organisations generate vast volumes of digital information that require systematic preservation and retrieval capabilities (Abdulai 2000). Globally, institutions, particularly educational institutions, are considering the implementation of AECCT to enhance their archival management, recognising its capabilities for automating document conversion, storage and disposal in line with predetermined retention periods (Maharani & Mu'arif 2025). The integration of AI capabilities within cloud computing infrastructure offers significant advantages for educational institutions seeking to enhance their records management systems while ensuring compliance with archival standards and accessibility requirements (Modiba 2024; Kabel, Zhou, Zotoo & Su 2021; Oladokun et al. 2025).

To achieve optimal digital archive management in these institutions, there is a need to integrate AI capability into cloud computing systems that have become standard for hosting and managing digital data repositories (Gul & Bano 2019). Utilisation of AECCTs allows for centralised storage of information through sophisticated architectural systems, permitting individuals and organisations to utilise powerful infrastructure that includes substantial computing power and large-scale data storage capacity without user administration or maintenance (Sriram 2022). Shibambu and Ngoepe (2020) also argue that cloud computing has achieved unmatched growth rates in the data storage market since its origin, indicating a fundamental transition from traditional local storage methods, such as external drives and compact discs, to centralised cloud-based repositories (Sriram 2022).

In the era of AI, cloud computing involves an integrated and dynamic infrastructure that provides intelligent data processing, storage and delivery of scalable computing resources through distributed networks, allowing organisations to utilise cloud computing beyond the limitations of traditional on-site systems.

Cloud computing enhanced by AI capabilities ensures automation, data analytics, and optimised decision-making, transforming the cloud from a passive utility system to a cognitive ecosystem with the capacity to learn from data, predict

trends, and automate decisions (Pillen & Eckard 2022; Mosweu, Luthuli & Mosweu 2019; Erickson 2024). Prangon and Wu (2024) attest that integrating cloud computing and AI transforms the Internet of Things (IoT) and the provision of digital services by allowing point source data processing, reduced latency and improved responsiveness across different industries, including archival management. This is particularly relevant to digital archival management as organisations use AECCTs to scan large numbers of stored records for increased storage capacities, preservation and retrieval.

Digital archives are large collections of digital records that are methodically stored for current access and future use. They consist of diverse digital historical data, e.g. textual documents, graphics, audio files and video files. Any mishandling of such archives may result in catastrophic institutional data crises (Adu & Ngulube 2016). To enable improved storage longevity and reliability, some institutions previously used magnetic tapes as storage devices. However, this practice results in security risks, such as theft and vandalism, due to physical accessibility requirements. AI integration demonstrates significant opportunities for the secure and effective management of digital archival records in cloud environments (Rolan, Humphries, Jeffrey, Samaras, Antsoupoya & Stuart 2019).

Ghani, Badshah, Jan, Alshdadi and Daud (2020) opine that current cloud storage solutions face significant challenges in the effective management and preservation of digital archives. The usefulness and integrity of data in archives are subject to high risk by data security violations, long-term data durability challenges and format obsolescence issues (Islam, Patamsetti, Gadhi, Gondu, Bandaru, Kesani & Abiona 2023). Additionally, the absence of AI standardised metadata and indexing routines presents enormous challenges in the effective searching and retrieving of desired records.

With the fast-paced technology advancements, ensuring effortless archival data migration across various cloud platforms and solving possible vendor lock-in issues have become fundamental concerns for institutions using archival data

(Jaillant & Zhao 2025; Kirui, Ongare & Asenahabi 2025). Mantri (2020) and Chatzieleftheriou, Stefanovici, Narayanan, Thomsen & Rowstron (2020) argue that these challenges call for comprehensive solutions with a focus on data accessibility, longevity and interoperability in archiving digital records.

Through the application of a revolutionary solution that converges cloud computing systems and AI capabilities, AECCT utilisation can address current issues with archival records (Jha, Prashar & Nagpal 2021; Habib, Sharma, Ibrahim, Ahmad, Qureshi & Ishfaq 2022). Studies such as those conducted by Ayodeji and Kumar (2019) and Modiba and Shekgola (2024) demonstrate that organisations can leverage AECCT to detect, organise and render digital archival records effectively. Oseji and Sani (2022) further observe that the application of advanced machine learning (ML) algorithms and scalable cloud infrastructure can enhance storability, recoverability, searchability and accessibility. Utilisation of AECCT in digital records management systems provides for rapid detection of deteriorating digital records and supports proactive restoration through the utilisation of adaptive preservation methods. The integration of AI and cloud computing systems allows organisations to address primary archival problems, thereby providing a resilient means of future-proof digital archiving (Noto La Diega 2022).

This research explores the possible use of AECCT in managing digital archival records in higher education institutions. The study employs the use of the following theories to explore the use of AECCT to manage digital archival records: Task Technology Fit Theory and the Digital Transformation Theory. This chapter presents the background of the study, states the research problem, identifies the research objectives and questions and defines the major concepts and constructs utilised in this research.

1.2 Context of the study

The focus of this study is public colleges of education (CoEs) in Ghana, which are teacher-based training institutions tasked by law to educate professional teachers

for the education service. There are 46 strategically located public CoEs across the 16 regions of Ghana. However, thirteen of them were considered for the study, due to the colleges' affiliation with the University of Education, Winneba, for mentorship, mentoring and continuous professional development. These colleges adhere to the same standards and administrative practices, as well as a similar population size, which represents approximately one-third of the total number of colleges of education in Ghana. The study focuses on the following colleges: Ada College of Education, Agogo Presbyterian Women's College of Education, Akatsi College of Education, Bagabaga College of Education, Bia Lamplighter College of Education, Komenda College of Education, Mampong Technical College of Education, Nusrat Jahan Ahmadiyya College of Education, Presbyterian College of Education Aburi, S.D.A. College of Education Asokore, St. John Bosco College of Education, St. Louis College of Education and Wiawso College of Education, which are located within the sixteen regions of Ghana.

The colleges of education – formerly referred to as “teacher training colleges” – offered a two-year, post-middle certificate “B” and a three-year certificate “A” (Alu 2019). The teacher training colleges were subsequently upgraded to diploma-awarding colleges, and, in 2018, they were upgraded to the colleges of education to offer a four-year Bachelor of Education (B.Ed.) degree programme (Buabeng, Ntow & Otami 2020). This was possible due to the Colleges of Education Act (Act 847) (Republic of Ghana 2012a). The implications of the Act are that all the CoEs in Ghana offer the same education programmes.

Electronic records management systems (ERMSs) in the colleges of education, where the College Secretary manages the Records Management Unit (RMU), are not properly configured to reflect the institution's current status: archival records must be handled using AI technology (Collins & Halverson 2018). Such digital archives contained in these information units (RMU) can be managed effectively with the use of cloud computing technology, where information is pulled from

archival records automatically and scanned, grouped according to appropriate classification with variations (clustering), stored and retrieved based on request.

Future references for both students and the academic staff, encompassing academic and non-academic topics, are systematically archived (Modiba, Ngulube & Marutha 2023). Upon successful completion of the qualification and graduation, the records and academic progress of the student and the lecturer are maintained in the archives. The Records Management Unit (RMU) chronicles and stores these records. Over the decades, colleges have accumulated data on thousands of students, ranging from initial applications and admissions through to programme completion and certification. Grade data, together with demographic and non-demographic data, is stored on magnetic tapes and hard disks for future reference (Borg & Smith 2018). Qualifications, employee promotion, and advancement are kept by using an electronic records management system (ERMS).

As data in the archive is prone to security threats, theft, and vandalism, the data's security requires a storage location outside the college's information technology (IT) facility, free from both hardware and software threats (Atieh 2021). Speed, precision and ease of data access from the archive pose significant challenges in the CoEs, as the information is stored on media with low processing speed and high response time. Moreover, retrieving information from these storage media necessitates physically accessing each medium and manually scanning files to locate the required data. Consequently, information access is highly cumbersome, except for the individual responsible for archiving the records (Paechter 2013).

1.3 Problem statement

Archival records at Ghana College of Education (CoE) are managed manually due lack of cloud based electronic systems, hence storage of paper based archival records causes chaos in terms of poor storage that lead to almost impossible access to such archival records when retrieved. Hence, archival records are always missing and damaged due to inadequate storage and this led to been

difficult to manage and access such archival records. In some educational institutions in Ghana, manual filing systems result in slow retrieval of records, duplication of information, weak security controls, and inconsistent preservation practices (Ngulube, 2022). Shibambu and Ngoepe (2020) further alluded that many organisations relying on manual records management led to archival storage problems.

Introducing electronic records management though provides space but the space is always limited. Excessive usage of electronic records management system (ERMS) can lead into system crash, data loss and also duplicates that emanate from saving one archival record twice and this can exacerbate the limited storage on ERMS. Mosweu, Luthuli and Mosweu (2019) alluded that even for organisations using ERMS experience difficulties in preserving archival records on local servers due to limited storage capacity especially if such system is not integrated with cloud storage facilities. Modiba and Shekgola (2024) further alluded that ERMS systems can experience crashes caused by system overload if not integrated with cloud.

Integrating cloud into ERMS or digital repository address the issues of space – since cloud can provide huge storage capacity suitable for big organisations such as CoE. Though cloud can offer enough space for Ghana CoE, but such cloud storage can be hacked, digital archival records can duplicate, and the college can also experience authorised access to archival records. The college can lose students and important archival records due to weak security of the cloud computing. Shimabu (2022) alluded that although cloud storage can be the solution, but organisations have to be careful of challenges such as authorised access, duplicates and hacking that can compromise the cloud storage system. In an interview on GTV news on 15 May 2023, the Principal of the Agogo Presbyterian Women's College confirmed that, although the institution wanted to deploy a cloud-based records management system, the system has no integration between different AI components. Such fragmentation can result in ineffective records management practices in Ghanaian CoEs.

If these challenges are not addressed, CoE in Ghana risk losing valuable institutional archival records and weakening their organisational memory. Poor archival management may result in delayed decision-making, reduced accountability, compromised compliance with regulatory requirements, and limited support for teaching, research, and accreditation activities (Ngoepe, 2024; Marutha, 2021). Weak digital preservation practices also increase the risk of cyberthreats, technological obsolescence, and permanent loss of archival heritage (Katu, 2023).

However, embedding AI into cloud storage system can ensure upgrading of the digital storage in terms of security, management and access. AI can help strengthen the security of the cloud storage by ensuring authentication to accessing the digital storage, encrypting of digital archival records and intelligent archival access. According to Modiba (2021) the integration of AI in a cloud based ERMS and digital repository can ensure that the system is protected against hacking, duplicate files can be eliminated and authorised access to can be prevented due to the capacity of AI algorithms such as machine learning, deep learning and black box that are automatically capable to prevent the cloud storage to be compromised. Hence this study intends to investigate how AI embedded cloud computing technology can assist in managing archival records effectively and efficiently at CoE.

1.4 Research purpose, objectives and questions

The overall purpose of this study is to investigate the use of AECCT to manage the digital archival records at the colleges of education in Ghana.

1.4.1 Research objectives

According to Al-Riyami (2008), the research objectives of a study are a description of the primary justifications for conducting the research in the first place, arguing that research objectives follow naturally from the purpose of the study. Researchers define the goals of a research project in specific terms, and these goals serve as the foundation for all research because they guide the types of

questions and measurements that should be used for data collection and analysis (Creswell & Creswell 2018).

In order to fulfil the justification of the study, the researcher has set a number of objectives, which are to:

1. Evaluate policies and legislative frameworks for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana.
2. Assess users' perceptions, expectations, and anticipated implications of AECCT in the management of digital archival records in the CoEs of Ghana;
3. Examine the usability of AECCT in the management of digital archival records in the CoEs of Ghana;
4. Identify the AECCT infrastructure for the management of digital archival records in the CoEs of Ghana;
5. Identify the skills required for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana;
6. Propose a framework for the utilisation of AECCT in the management of digital archives in the CoEs of Ghana.

1.4.2 Research questions

Based on the research objectives, the study is guided by the following research questions:

1. Which policies and legislative frameworks can be employed for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana?
2. What is the user perception regarding the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana?
3. What is the usability of the AECCT in the management of digital archival records in the CoEs of Ghana?
4. Which AECCT infrastructure can be employed effectively in the management of digital archival records in the CoEs of Ghana?

5. Which skills are required for the utilisation of AECCT in the management of digital archival records in the CoEs in Ghana?

1.4.3 Research dashboard

Damyanov and Tsankove (2019) define a research dashboard as a visual display of the most relevant information needed to fulfil one or more objectives. The research dashboard is organised on a single screen and can be viewed at a glance. In this study, a research dashboard is presented in a table that summarises the research objectives, research questions, theories, procedures, and data collection methods, as shown in Table 1.1.

Table 1.1: Research dashboard

Research objectives	Research questions	Theories / Models	Methodologies	Data collection methods
1. To evaluate policies and legislative frameworks for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana.	Which policies and legislative frameworks can be employed for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana?	Technology Acceptance Model	Qualitative method	Documents review, semi-structured interviews
2. To explore users' perceptions, expectations and anticipated implications of AECCT in the management of digital archival records	What is the user perception regarding the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana?	Technology Acceptance Model	Quantitative and Qualitative method	Questionnaire (Open and closed ended questions) and Interviews

Research objectives	Research questions	Theories / Models	Methodologies	Data collection methods
3. To examine the usability of AECCT in the management of digital archival records in the CoEs of Ghana	What is the usability of the AECCT in the management of digital archival records in the CoEs of Ghana?	Object Analysis for Embedded System Theory and Technology analysis of cloud computing technology systems and possibility of implementation of those technologies in addressing the problem	Quantitative and Qualitative method	Questionnaire (Open and closed ended questions) and Interviews
4. To identify the AECCT infrastructure for the management of digital archival records in the CoEs of Ghana	Which AECCT infrastructure would be effective in the management of digital archival records in the CoEs of Ghana?	Records lifecycle	Qualitative	Structured Interviews
5. To identify the skills required for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana	Which skills are required for the utilisation of AECCT in the management of digital archival records in the CoEs in Ghana?	Object Analysis for Embedded System Theory	Qualitative method	Questionnaire (Open and closed ended questions) and Interviews

Research objectives	Research questions	Theories / Models	Methodologies	Data collection methods
6. To propose a framework for the utilisation of AECCT in the management of digital archives in the CoEs of Ghana.	What framework can be proposed that can be adopted for the utilisation of AECCT in the management of digital archives in the CoEs of Ghana?			Integrated finding from all instruments

1.5 Justification for the study

This section outlines the anticipated contributions of the study, both to the advancement of scholarly publications and scientific inquiry, and to the enhancement of digital archival records management, institutional policy development and professional practice. The justification of a study encompasses the reason why a study is worth conducting (Creswell & Plano-Clark 2018).

The findings and recommendations of the study are expected to enhance the digital archival management capabilities of Ghanaian CoEs significantly. The utilisation of AECCT in CoEs includes automated classification schemes, maximisation of storage capacity, systematic disposal of obsolete records, and streamlined management of institutional archives. The implementation of AECCT in the CoEs has the potential to address critical operational challenges that currently undermine their efficiency, including data loss, record duplication, insecure document transmission, and system failures leading to crashes or overload. When effectively implemented, the AECCT model proposed in this study can significantly enhance the digital management of archival records in the CoEs by enabling cloud-based storage, facilitating efficient retrieval through integrated database systems, and supporting electronic disposal of records according to established retention schedules.

The study adds to the body of knowledge in archival records management by promoting the growth of knowledge in digital archival records management. The findings of this research are expected to provide valuable insights for policymakers at the Ghanaian CoEs and other relevant stakeholders, thereby supporting evidence-based decision-making and policy implementation that encourage the adoption of AECCT for digital archival records management.

Furthermore, the outcomes of the study have pedagogical implications for Library and Information Studies education in Ghana; particularly in the integration of AECCT applications into the curriculum to prepare future information professionals and practitioners. Such integration will equip graduates with the necessary competencies to deploy and manage AI-driven archival systems across diverse organisational settings.

This study provides a set of recommended guidelines for the utilisation of AECCT in the management of digital archival records. Future researchers in records management can draw upon and apply the proposed framework in their own research.

Given the multidisciplinary nature of this research, spanning digital archival records management, artificial intelligence, computer science and engineering, the mixed-methods research approach is proposed to ensure a comprehensive and rigorous study. Future researchers in this field are, therefore, encouraged to adopt mixed methods research approaches when investigating issues related to records management and AI. Although this study focuses on Ghanaian CoEs, the findings are expected to be beneficial to a wide range of related organisations.

1.6 Originality of the study

The originality of research is associated with generating new data, employing fresh methods or techniques, exploring new research fields, providing additional evidence for existing theories, models or interpretations, challenging or denying

existing theories, models or interpretations, and collecting both existing and new literature to establish a new balance of ideas (Bhattacharjee 2012; Williams, Jones, Jonsson, Harris & Mulvany 2019). This means that the researcher has different ways of demonstrating the originality of a study.

The thesis should also establish its potential to advance understanding of the research topic. Research originality should be grounded in the capacity to generate and contribute to existing intellectual property, advance the body of literature in the field of study, and inform practice and policy (Jayasundara 2009). Williams et al (2019) reiterate that a PhD thesis or research project must make a substantive contribution to the existing knowledge within its subject area.

This research makes a substantive contribution to the body of knowledge on archival records management, with a specific focus on Ghanaian institutions of higher learning. In the context of digital-age records management, the Ghanaian CoEs remain among the most underexplored institutions in the national educational landscape. By addressing this gap, the study provides critical insights into technology-assisted archival management practices in these institutions, thereby advancing both scholarship and practice in the field. As such, this study presents new knowledge on the management of digital archival records in the CoEs of Ghana using AECCT. Additionally, there is no evidence of a previously conducted study with empirical evidence on the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana.

Evidence shows that previous research on the archival management of Ghanaian educational institutions has mainly focused on traditional paper-based systems and low-level digitisation programmes, without adopting AI capabilities and cloud computing solutions. Furthermore, scholarly articles in this context primarily address traditional records management issues rather than technology-based alternatives for archival records management. There are only two similar studies conducted by Modiba (2021) and Modiba and Shekgola (2024).

The first study, which investigated the utilisation of AI for the management of records at the Council for Scientific Industrial Research, addressed the integration of AI into records management but differs from this study in that it focuses on AI, without addressing cloud computing integration and records management in a research institution setting.

The second study conducted by Modiba and Shekgola (2024), which investigated artificial intelligence embedded cloud computing technology for the management of digital archives in the Fifth Industrial Revolution in South Africa, is more closely related to the current study, as it combined AI with cloud computing technology for digital archives management.

However, the study differs from the present study in that it was conducted in a general industry context, focusing on the 5IR, with emphasis on broad digital archive management across sectors, rather than educational institutions. Furthermore, these two studies were conducted in the South African setting, whereas this study focuses on the unique challenges of CoEs within Ghana's education system.

This study is distinguished by its integration of AI technology with cloud computing capabilities in the development of an integrated AECCT framework designed to address multiple archival management challenges simultaneously. This novel synthesis constitutes a significant contribution to the field, substantiating the originality of the present research. More specifically, the study advances archival records management scholarship by proposing a contextually relevant framework for the adoption of AECCT in digital archival records management in Ghanaian CoEs, accounting for both technological innovation and institution-specific constraints.

1.7 Scope and delimitation of the study

According to Akanle, Ademuson and Shittu (2020), the scope of study explicitly identifies what the study includes and excludes, which relates to its outline and research strategy. Hassan (2024) defines the *delimitation* of a study as the purposeful boundaries that the researcher sets to confine the scope of the study into a particular and manageable entity for research purposes.

This study seeks to investigate the application of AECCT in managing the digital archival records in the CoEs of Ghana. Therefore, the scope of the study is limited to the application of AECCT in managing digital archival records in the CoEs in Ghana. Although the researcher acknowledges other, equally important institutions that may face similar archival records management challenges, the scope of this study is limited to digital archival records management in the CoEs. The digital archival records under consideration consist of both academic and non-academic materials, predominantly in text-based formats. The AECCT framework is specifically selected as the technology solution to address the identified archival management challenges. Although similar challenges are experienced by CoEs across West Africa and globally, this research is delimited to Ghanaian CoEs, which are examined in a case study context.

1.8 Definition of key concepts

The key concepts and constructs involved in the study are defined in the subsequent sections.

1.8.1 Artificial intelligence (AI)

Artificial intelligence is defined as an imitation of human intelligence activities by means of machines, particularly computer systems. Although it is a broad discipline that applies different methods and approaches, in essence, AI deals with developing electronic systems that can "think" and "learn" in accordance with human thinking (Russell & Norvig 2010).

Although AI tends to be linked with robotics design, it also has its application in software running on ordinary computers (Andreu-Perez, Deligianni, Ravi & Yang 2018).

AI refers to the development of algorithms and concepts that enable machines to exhibit intelligent behaviour, such as problem-solving, experience-based learning, understanding natural language, and pattern detection. As discussed by Jarrahi (2018), the primary objective of AI is to develop systems capable of performing tasks autonomously, adapting intelligently to changing contexts and improving their performance over time through learning.

1.8.2 Cloud computing technology

According to Miller (2008), cloud computing refers to the on-demand use of computing resources, applications, servers (physical server and virtual server), storage space, development tools, networking capacity, etc., housed in a remote data centre and regulated by an organisation that provides cloud services via the internet. The cloud service provider (CSP) delivers access to these tools for an existing subscription rate or charges per usage. Merging AI technology and cloud computing may help with efficient and effective storage of data (Ahmad, Rasool, Javed, Baker & Jail 2021).

1.8.3 Artificial intelligence embedded cloud computing technology (AECCT)

Said (2024) and Prangon and Wu (2024) assert that AECCT is the integration of AI capabilities, such as machine learning, natural language processing and intelligent automation, into cloud computing infrastructure and services with the aim of enhancing their performance, automation, scalability and efficiency in decision-making. Rana, Mallick, Kaya & Rana (2024) define *AECCT* as a union of AI and cloud platforms that enables smart data processing, real-time analytics and adaptive resource allocation within distributed systems.

According to Shahzaad, Barros and Fidge (2025), AECCT enables the orchestration of microservices and smart workflows within resource-constrained environments and, therefore, it is suitable for archival and educational systems. Through digital archives' management, AECCT encompasses smart systems capable of performing automated digitisation, smart classification, metadata generation, content analysis and prognostic strategies (Modiba 2021; Terras 2022).

For the purpose of this study, *AECCT* is defined as an integrated technology platform that brings together AI features and cloud computing infrastructure to provide automated, smart and scalable digital archival management solutions to CoEs in Ghana. This technology incorporates automatic digitisation procedures, smart classification and indexing technologies, predictive archive preservation analytics, automated metadata generation, smart search and retrieval mechanisms and adaptive cloud-based management of data (Sadam 2024; Modiba & Shekgola 2024).

According to Kumar, Ramachandran and Kumar (2021) and Zhang and Chen (2022), AECCT has the following four inherent characteristics: (i) adaptive learning capabilities to improve system performance over time; (ii) smart automations that limit the need for human intervention; (iii) scalable infrastructure that can evolve with altering workloads; and (iv) analytics embedded within the system that provide insights into archival usage trends and preservation needs.

1.8.4 Digital archive

A digital archive is essentially a well-managed and organised compilation of electronic records meant to be preserved in the long term (Macarios 2022). Digital archives represent a collection of data in the form of numerical, text, videos, images, maps or audio files that are free and can be easily accessed via the internet (Bolick 2006; Carbajal & Caswell 2021).

With its enhanced data extraction capability, more effective data management capabilities and upgraded document processing capabilities, AECCT would be particularly helpful in the maintenance of the archival digital records of the CoEs. AI-driven technology is capable of separating, categorising and extracting structured data from documents, facilitating quick and precise processing of records (Ashri 2019; Baviskar, Ahirrao, Potdar & Kotecha 2021).

1.9 Conceptual framework

A conceptual framework serves as a guiding structure that enables the research to address the research objectives directly (Creswell & Plano Clark 2018). It is often represented as a visual or graphical synthesis of the relevant literature, illustrating how a particular phenomenon can be explained (Regoniel 2015; Van der Waldt 2020). Ngulube (2020) emphasises that a conceptual framework maps the steps to be taken in a study, informed by the researcher's prior engagement with existing scholarship and personal observation of the phenomenon under investigation. Ultimately, a conceptual framework reflects the researcher's perspective on how the key concepts and theories interrelate within the study.

As Babbie (2014) observes, a well-constructed conceptual framework provides essential guidance in shaping the researcher's thinking throughout the data collection, analysis and interpretation. An initial literature review has revealed that AECCT is a converging and complex technology in digital archival management. Therefore, examining the use of AECCT to manage digital archival records in CoEs in Ghana requires a well-designed conceptual framework to guide the research.

A conceptual framework consists of one or more formal theories (complete or partial), and other concepts and empirical literature (Ngulube 2020; Regoniel 2015 & Van der Waldt 2020).

Unlike a theoretical framework, which is largely a pre-existing theory, a conceptual framework is derived from concepts, formal theories or components of the theory and empirical evidence in academic literature.

The conceptual framework applied to this study is founded on the following three concepts: (i) artificial intelligence: perception and usability; (ii) cloud computing technology: skill and infrastructure; and (iii) digital archival records management: policy, legal framework. The relationship between these concepts ensures the adoption and use of AECCT in the administration of digital archival records in the records management systems of educational institutions. The following two theories underpin the conceptual framework: (i) the Task Technology Fit Theory, and (ii) Digital Transformation Theory designed by Hughes, Davis and Imenda (2019). A comprehensive discussion on the conceptual framework is presented in Chapter 2.

1.10 Research methodology

The research methodology comprises the systematic selection and application of techniques, methods and strategies to conduct a particular study and obtain valid answers to research questions (Babbie 2020; Silverman 2013). The methodology framework is essentially based on philosophical paradigms that form the foundation for scholarly inquiry and interpretation.

A research paradigm can be understood as a systematic framework of ideas that guides scientists in a particular field of inquiry in defining their research focus, conducting investigations, and interpreting research findings (Bryman 2012). Research paradigms represent overarching worldviews or belief systems that researchers adopt to shape their methodological choices and to draw meaningful conclusions from their studies (Teddle & Tashakkori 2009; Romm 2018).

Based on Marutha and Modiba's (2022) recommendation of using the mixed methods research (MMR) approach when investigating the application of AI in records management to avoid gaps, this study adopts the mixed methods research approach. As argued by Ngulube (2022), mixed methods research is the most

appropriate method for any study that explores the subject of AI and its incorporation into records management systems.

Drawing on the works of Bryman (2012), Teddlie and Tashakkori (2009) and Ngulube (2015), the research utilises a pragmatist paradigm. Pragmatism offers the flexibility to address both ontological and epistemological considerations in a manner aligned with the practical demands of the research objectives. This paradigm enables the researcher to examine the phenomenon from multiple philosophical perspectives, thereby enhancing the validity and robustness of the study. With a convergent research design, primary data for this study were collected using interviews, questionnaires and observation. The sampling technique for this study is the parallel sampling technique. The research methodology is further discussed in detail in Chapter 3 of this study.

1.11 Outline of chapters

This thesis is structured into the following six chapters:

Chapter 1: Introduction: Setting the Scene

As the first chapter in the thesis, Chapter 1 presents the background on and an overview of the research, as well as the essential research problem, the reason for conducting the research, the research objectives and questions, the originality of the study, the definition of key terms and concepts, and an overview of the research methodology.

Chapter 2: Conceptual Framework and Literature Review

Chapter 2 presents the reviewed literature on the application of AECCT in records management, as well as the conceptual framework underpinning its application.

Chapter 3: Research Methodology and Design

This chapter addresses the study's research methodology, including the research paradigm, research approach and design, the target population and sampling

methods, data collection and analysis techniques, and the ethical considerations involved in the study.

Chapter 4: Presentation of the Research Findings

In this chapter, the researcher presents the research findings based on the primary data collected.

Chapter 5: Interpretation and Discussion of Research Findings

This chapter presents the interpretation of the research findings.

Chapter 6: Summary, Conclusions and Recommendations of the Study

In the final chapter, the researcher summarises and concludes the study and provides recommendations based on the research findings. Finally, the chapter presents the proposed framework for the utilisation of AECCT in the management of archival records in Ghana's CoEs.

1.12 Chapter summary

This chapter presented an overview of the study and explained matters related to the application of AECCT in records management. After an introduction, the research background was presented, followed by an explanation of the research problem.

The research objectives and questions were also identified, along with the research justification and originality. After defining the key terms and concepts, the conceptual framework and research methodology were outlined.

The conceptual framework and the literature review are presented in the next chapter. Guided by the research objectives, the topics that will be covered in the literature review include the state of records management in the Ghanaian CoEs, the legal and policy framework for records management, AI infrastructure available to manage records, user attitudes towards the use of AECCT, and records management tasks that AECCT can handle.

CHAPTER 2: CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1 Introduction

Chapter 1 set the research scene by presenting the introduction to and the background on the study, as well as the problem statement, research objectives and questions. This chapter presents a review of the literature pertaining to the use of AECCT in records management.

Fink (2014) defines a *literature review* as a critical examination and explanation of scholarly works or publications on a given subject. As asserted by Creswell, the evaluation of the literature is pivotal to the execution of an evidence-based study. The literature review has to identify, summarise, evaluate and critically appraise other works and existing research in light of the research.

Furthermore, the literature review outlines the underlying conceptual construct that allows the researcher to navigate the trajectory of the research with coherence and focus. Irrelevant works must be excluded, and peripheral works should be rigorously filtered (Fink 2014). To establish whether or not research is sufficiently pertinent to conduct, researchers can compare their inquiry to similar studies through a literature review. The literature review typically begins with the exploration of broad concepts and progresses towards more specific and targeted topics (Creswell & Creswell 2018).

This chapter critically explores and discusses literature on the prevailing conditions of records management, the current history of management, AI-infrastructure that could be employed to process and manage records, AECCT usability in managing digital archives, records management activities that may be conducted by using AECCT, and users' perceptions towards the use of AECCT in digital archival records.

2.2 Role and purpose of the literature review

The review of scholarly works typically involves the integration, categorisation and assessment of previous contributions of another research on a particular topic (Randolph 2009; Snyder 2019). Literature reviews are most often included as part of a research thesis, but they can be used independently as a critique of published studies on a topic. Analysing related literature in research is a critical part of the scientific research process for every research work (Burget, Bardone & Pedaste 2017).

The literature review offers a critical foundation for the research problem by enabling the researcher to collect background knowledge from prior studies and examine findings that are pertinent to the current inquiry (Paré, Trudel, Jaana & Kitsiou 2015). Through references to scholarly books, articles and other relevant literature of any topic, scope, or theory, the literature review provides a description, an overview and a critique of such writings in relation to the subject of the research under investigation (Rowe 2014). For this study, the essence of the literature lay in providing an overview of the sources that the researcher consulted to examine the subject under investigation and to illustrate how the research could be contextualised within the broader research discourse (Fink 2014).

Although the literature review can generally include an overview of the principal sources, an institutional pattern is usually adopted in the social sciences, which combines synthesis and summary, often within a particular theoretical class (Paré & Kitsiou 2017). “Synthesis” refers to the structuring of the material in a way that is understandable as to how the researcher intends to investigate a research question, whereas a “summary” refers to an account of the major information obtained from the source (Algozzine & Hancock 2017; Hancock, Algozzine & Lim 2021).

Budgen and Breton (2006) and Narayanamurthy and Gurumurthy (2016) identify a number of characteristics that should be found in a literature review, which include that the literature review:

- Offers either a fresh interpretation of antiquated information or a synthesis of both;
- Follows the natural progression of the subject field and includes key conversations;
- Evaluates the sources and directs the reader towards the most pertinent studies; and
- Identifies any gaps in the methods used to explore a topic thus far.

According to Templier and Paré (2015) the aims of a literature review are to:

- Consider the effect of each scholarly resource on the research issue being studied;
- Assign the relationship between each source that is being discussed and the others;
- Categorise fresh perspectives on previous research;
- Reveal any gaps in the existing literature;
- Resolve disagreements between contradictory findings in earlier studies;
- Identify subjects or topics studied previously to prevent repetition;
- Determine how to address the need for future searches; and
- Connect the research findings back to the body of knowledge reflected in existing literature.

2.2.1 Literature review procedure

A literature review illustrates the degree to which a researcher is aware of the body of knowledge in a field of study and ready to connect prior findings to new questions or ideas.

According to Hart (2018), a literature review provides a research paper with a solid foundation and enables the researcher to situate their own inquiry within the broader scholarly debate on a particular issue. A comprehensive literature review also showcases the researcher's credibility.

The following four steps should be considered when reviewing literature:

- Step 1: Search the available literature in your area of research interest
- Step 2: Assess the literature obtained
- Step 3: Develop a theoretical or conceptual map
- Step 4: Begin the writing process for the literature review

Step 1: Search the available literature in your area of research interest

Given the reciprocal relationship between thoroughness and conciseness, researchers aim to develop topics that are both comprehensive and precise (Bell & Waters 2018; Templier & Paré 2015). Aspects of subject matter are interrelated, prompting researchers to frame their topics in a manner that is both detailed and comprehensive. Okoli and Schabram (2015) suggest that, once the researcher has clearly defined the research topic and the problem to be addressed, they can systematically explore the existing body of literature. A well-defined understanding of the research focus is essential for conducting an efficient and targeted literature review.

The primary purpose of research in any field is to establish new knowledge, solve problems and deepen understanding of a particular subject through a systematic literature review (Fink 2014). The most reliable sources of literature are typically scholarly journals and academic books. Consulting these sources can significantly streamline the research process by directing the researcher to relevant prior studies. Key resources include journal indices, journal article abstracts and citation indices. Books, journals and dissertations are now predominantly stored in cloud-based databases and institutional repositories. Researchers can leverage

electronic library resources to develop a well-structured bibliography (Ashikuzzaman, 2025).

Step 2: Assessing the literature obtained

The second step in the literature review involves reading the books and journals identified in the first step to extract and compile general themes relevant to the study (Tracy 2019; Fink 2014). The key concepts derived from the literature should be recorded to ensure they can be referenced later, particularly if a research framework has not been fully developed. The information can be systematically integrated when constructing the preliminary framework (Darlow & Wen 2015).

Step 3: Developing a theoretical or conceptual map

According to Bell and Waters (2018), analysis of literature can be an open-ended process. Therefore, it is essential for researchers to set clear boundaries throughout the literature review process, particularly given the time constraints inherent in completing a research task. All data collected from literature sources have to be systematically organised, with relevant theories and concepts integrated into the emerging framework. Additionally, researchers should define the scope of their literature in alignment with the conceptual framework they have developed, ensuring a structured and focused analysis. This approach provides both a foundation and a blueprint for future research. Consequently, developing a framework prior to conducting a literature search is of critical importance (Compagnucci & Spigarelli 2020).

Step 4: Starting the writing process for the literature review

The researcher begins the assessment by identifying key concepts to be highlighted and, subsequently, proceeds to organising and collecting the concepts to be addressed and reported (Paré and Kitsiou 2017).

In the writing process, the researcher should identify research gaps within the existing body of knowledge and outline relevant theoretical and philosophical approaches applicable to the study.

It is also important to describe the current contribution of the field and recent developments that have been documented (Petersen, Vakkalanka & Kuzniarz 2015). In this study, prevailing trends that were prioritised included: the Fourth Industrial Revolution (4IR), records management and the application of AECCT to records management.

Petersen, Vakkalanka and Kuzniarz (2015) report that, during the literature review, the researcher compares, contrasts and evaluates existing research findings against the following criteria:

- Research hypothesis;
- Theories surrounding the area of study;
- Research design employed;
- Ideas assigned;
- Hypothetical future roles posited by researchers.

2.2.3 Literature review map

Researchers usually adopt a visually graphed literature approach called a literature map, which enhances the practice of scrutinising materials for research gaps and areas of influence (Linebacker, Marrowbone & Singh 2020). For a researcher initiating a research literature review, the most pressing requirement is a structured template for systematically mapping the literature (Randolph 2009; Gray & Malins 2016). The literature review map serves as a tool for systematically organising topics drawn from studies accessible online or through library resources. It allows the researcher to understand the relevance of the literature under review and to demonstrate how it contributes to advancing knowledge within the field of study further (Creswell 2014).

The research objectives of the study are translated into conceptual or idea maps, guiding the structure of the literature review. Therefore, key themes within the literature review are constructed in alignment with the objectives of the study, which themselves are derived from the research problem and overarching conceptual framework.

The literature review map for this study is illustrated in Figure 2.1.

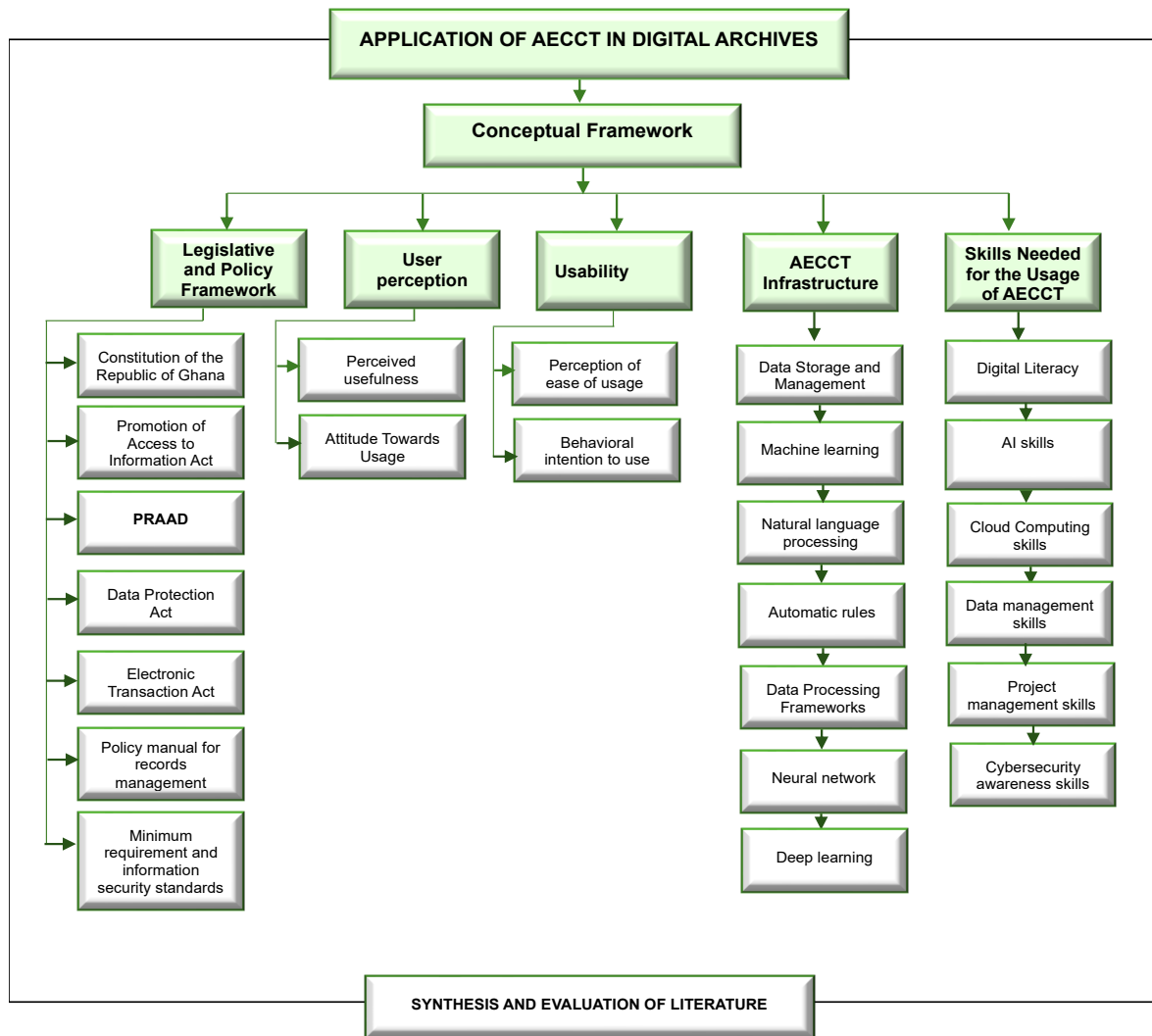


Figure 2.1: Map of the literature review

(Source: Researcher 2025)

2.3 Conceptual framework

A conceptual framework is a set of ideas underpinning the research process, from data collection to data analysis and discussion, with diagrammatic representations normally being used to illustrate the relationships between key concepts (Imenda 2014; Van der Waladt 2020). Concepts borrowed from other ideologies, previous and existing research, or the researcher's personal practice are integrated in the conceptual framework (Nieswiadomy 2012; Ngulube 2020). As defined by Miles, Huberman and Saldana (2014), a conceptual framework is a written or pictorial representation of the relationship between concepts, perceptions, variables, and/or expectations on which the research is based.

As indicated by Miles, Huberman and Saldana (2014), Ravitch and Riggan (2017), Ngulube (2020) and Van der Waladt (2020) and Van der Waladt (2020), a conceptual framework functions as an intellectual roadmap that guides the research process by detailing what needs to be explored. It outlines the key concepts that require investigation and provides direction on how the data is to be collected and analysed.

In this study, the researcher employed the literature review to develop a conceptual framework that supported the utilisation of AECCT for records management. The researcher uncovered key concepts from the reviewed literature that had the potential of being included in the development of an AECCT utilisation framework for managing digital archival records. The conceptual framework for this study is founded on the following two core ideas: (i) the perception, usability and system analysis; (ii) digital archive, which encompasses policy and legal frameworks.

Figure 2.2 illustrates the interconnections across these ideas and concepts, demonstrating how the AEECCT framework can be implemented in the management of digital archival records. Furthermore, Figure 2.2 demonstrates the relationship between the two concepts – archival records management and AI-

cloud computing – and their interaction with other concepts to contribute to the development of a conceptual framework. The research objectives were used as a foundation in the development of the conceptual framework.

The conceptual framework was premised on the following concepts:

- AI embedded cloud computing, comprising the Technology Acceptance Model (TAM): perception and usability;
- Object Analysis for Embedded System (OAES): system analysis and requirement analysis; and
- Digital archive encompassing archival records management.

The research topic and title, the research problem and the research objectives of the study were aligned with the conceptual framework. However, no single hypothesis was found to be most appropriate for our research. To ensure that all the research objectives were addressed in the conceptual framework, the researcher had to accept and include different theories.

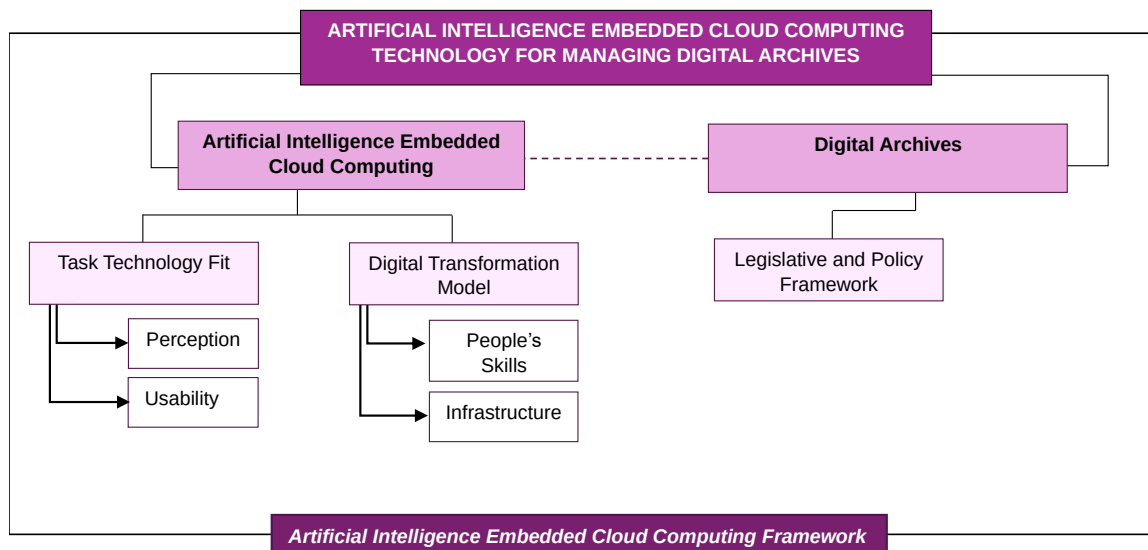


Figure 2.2: Conceptual framework

(Source: Researcher 2025)

This study's conceptual framework was based on the Technology Acceptance Model (TAM), developed by Fred Davis in 1986. The study sought to understand stakeholders' perceptions, preparedness, acceptance, and potential use of Artificial Intelligence Embedded Cloud Computing Technology (AECCT) for the management of digital archival records in Colleges of Education (CoEs) in Ghana, and thus TAM was adopted as the theoretical framework.

The TAM is a theory that aims to describe and predict the acceptance and adoption of new technologies by users. The two main factors of the model (perceived usefulness and perceived ease of use) are found to be significant predictors of the attitude toward technology, behavioural intentions, and acceptance and rejection of the technology. TAM was developed as an adaptation of the Theory of Reasoned Action (TRA) and has proven to be one of the most used theoretical models in research about information systems, artificial intelligence technologies, cloud computing adoption, and digital transformation initiatives.

In terms of acknowledging the adoption and use of various technologies, including robots and AI, the TAM is the most persuasive and well-recognised model (Lai 2017). The TAM can help businesses avoid the danger of adopting and implementing technology that may be underutilised (Gbongile, Xu & Amedjonekou 2017). Therefore, it was critical to adopt the TAM principles in this study.

The choice of TAM was appropriate for this study because the main focus was on respondents' perceptions, technological readiness, training exposure, confidence levels, perceived usability, and expected benefits or challenges of using AECCT. The study aimed to investigate how prospective users in educational environments, who might employ AI tools for archival records management, would respond to the prospect of incorporating AI-powered cloud-based records management solutions into archival workflows.

Perceived usefulness in this study was defined as the extent to which a respondent thought that AECCT would enhance the efficiency, accessibility, security, retrieval,

preservation and management of digital archival records. Perceived ease of use – respondents' perceptions of the complexity, usability, learnability and operational feasibility of AI-powered cloud systems in the institutional context of Colleges of Education in Ghana.

TAM also offered a helpful lens to analyse all the issues associated with institutional readiness, staff acceptance of the new technologies, training requirements, infrastructure limitations, and resistance or receptivity to AI-based archival systems. The model proved useful for analysing respondents' expectations, perceptions, and expected acceptance behaviour in a context of exploration and perception, as the AECCT technologies were not yet widely applied within the institutions studied.

2.3.1 Policies and legislative framework

One fundamental element of records management is the framework involved in legislation and policies. This framework identifies how laws can contribute to the effective and successful use of AECCT in records management. The Public Records and Archives Administration Department (PRAAD), formerly known as the National Archives of Ghana, was established in 1955 to maintain the records and archives of the nation. Among the available records management policies of the Republic of Ghana are a records management document, government agency electronic document maintenance policies and guidelines, and minimum information security standards (see Section 2.4).

2.3.2 Technology Acceptance Model (TAM)

In 1985, Fred Davis coined the term *Technology Acceptance Model (TAM)* in his PhD thesis titled, "A technology acceptance model for empirically testing new end-user information systems: theory and results". The TAM is an information technology (IT) construct that has been applied in different types of studies, including studies of ageing populations, to explain how individuals adopt and utilise emerging technologies in the workplace. As Ratten (2020) and Knox, Gemine,

Rees, Bowen, Groom, Taylor, Bond, Roser and Lewis (2021) explain, the model posits that an individual's perceptions of the usefulness and ease of use of a technology can predict their actual usage behaviour. In the context of AI, adoption may be enhanced by its potential to increase productivity, improve accuracy, and support the completion of complex tasks, thereby strengthening user confidence.

However, concerns regarding job displacement, data security and privacy frequently arise. These perceived risks can be mitigated through honest, transparent communication, robust security controls and the responsible use of AI. Building credibility – through endorsements from trusted sources, the establishment of clear usage protocols and evidence of successful deployment – is essential for fostering trust and confidence. Positive user perception can also be reinforced by designing and presenting AI applications that are beneficial, intuitive and enjoyable and attractive, supported by interactive features and constructive feedback mechanisms. To investigate these dynamics, this study assessed users' attitudes towards the perceived usefulness, perceived ease of use, and overall attitude towards adoption and use.

2.3.2.1 User perception of AI embedded cloud computing technology

Perception is generally defined as the process by which individuals gain awareness and understanding of a phenomenon through sensory data, while involving related concepts such as awareness, knowledge, realisation, sense, perception, origin, impression and vision.

Akhtar and Falk (2017) explain perception as the process of achieving sensory awareness or understanding of a particular phenomenon or subject. The *Essential Collins English Dictionary* (2006) also defines and frames *perception* as a concept that encompasses insight, intuition and worldviews. Raingruber (2014) juxtaposes the concept of perception with related concepts such as position consideration, observation, information, intelligence, mental model and comprehension.

Since perception represents an individual's comprehension of a particular subject or situation, it can be regarded as a reliable motivator for behaviour. Observation of the cosmos can be interpreted through the lens of sociocultural influence, shaped by the processing of sensory data and experience. The senses are not neutral; rather, perception reflects an individual's distinctive way of engaging with ideas, integrating memory and experience with the communication of information to foster understanding (McDonald 2011; Bolas 2017).

As a core construct of the TAM, perceived usefulness is central to understanding acceptance behaviour. "Perceived usefulness" refers to the extent to which individuals believe that using a technological innovation will enhance their performance or efficiency (Kumar, Engle & Tucker 2018; Ratten 2020). For instance, the application of AECCT for records management exemplifies this concept, as its utilisation has the potential to improve efficiency, accuracy and overall service deliver. Consequently, persuading records management professionals and the industry leaders of the benefits of AECCT is essential to fostering its adoption (Davis 1989 Bugembe 2010).

In the context of online shopping, Tong (2010) regards perceived ease-of-use as the consumers' opinion regarding the dependability and easy-to-understand nature of an innovation. Ratten (2020) argues that technology consumers adopting rapidly evolving innovations, such as AECCT, stand to benefit significantly from technological advances.

This premise underpins the TAM, which emphasises the importance of perceived ease of use – the extent to which an individual believes that utilising a particular system will reduce effort while enhancing efficiency. In the context of records management, professionals should recognise that AECCT offers user-friendly functionality, with automated processes that streamline record sorting and generate accurate, efficient outputs (Knox et al. 2021; Yathiraju 2022).

The third dimension, drawn from the TAM, involves the concept of attitude towards use (ATU), which refers to users' overall feelings or disposition towards engaging with a technology. ATU serves as a critical factor in explaining technology adoption. This means that records management professionals should cultivate a positive attitude towards the utilisation of AECCT to enhance the delivery of records management (Lai 2017).

2.3.2.2 The use of AI embedded cloud computing technology (AECCT)

Several decades ago, the term "usability" was coined to replace "user-friendly," which, by the early 1980s had acquired a set of negative, vague and overly subjective connotations (Jordan 2020; Modiba 2022). However, over time, the concept of usability itself has become slightly diluted. Originally, *usability* referred to the extent to which a product could be effectively used, encompassing both its appropriateness and learnability. It also specified the functional suitability of a product for a particular user performing a specific task within a defined context (Jordan 2020).

Usability also refers to ease of use and suitability of a system or product for a defined set of users performing tasks in a specific context, where ease of use dominates both user performance and satisfaction. Acceptability, on the other hand, assesses whether the system will be adopted and how it will be used (Calisir, Altin Gumussoy & Bayram 2009; Knox et al. 2021). While ease of use determines whether an item can be used effectively, acceptability evaluates the likelihood and manner of its actual adoption.

The inherent properties of the system shape its ease of use in a given environment, while measures of user performance and satisfaction serve to evaluate this (Scholtz, Mahmud & Ramayah 2016).

In this study, the objective of the applying the usability concept is to determine if AECCT can be effectively employed in records management. In this context, the researcher also considers the system requirements of OAES, along with the

requirement analysis and system analysis principles to provide a more comprehensive assessment.

2.3.3 Artificial intelligence (AI)

In the context of records management, artificial intelligence involves the effective and efficient digitalisation, management and retrieval of documents by using robotic equipment and computer programs (Subeesh & Mehta 2021; Javaid, Haleem, Singh & Suman 2022). The benefits of AI, as determined by Lee and Yoon (2021), are its applicability in solving complex problems, imitating human decision-making processes, fixing problems, including human errors, and delivering services with greater effectiveness and efficiency. In this research, AECCT was positioned as a solution to challenges such as misplaced, duplicated, altered or lost documents. By ensuring secure and reliable access to records when required, AECCT enhances service delivery and supports the fulfilment of organisational and regulatory requirements.

In their research, Madakam Holmukhe and Jaiswal (2019) established that employing intelligent technologies, such as AECCT, in record automation could be the only way to address the negative impact of fatigue on human capabilities. They argue that AECCT can complement human capabilities in big data environments by collecting, classifying, and organising data with greater speed and efficiency than human effort alone (Madakam Holmukhe & Jaiswal 2019).

Consequently, China and the United States of America (USA) have addressed persistent records management challenges by employing AECCT to enhance the effectiveness and reliability of their record-keeping practices and manage records (Yao, Zhang & Chen 2015; Ripcord 2019).

Lee and Yoon (2021) opine that the use of AECCT in records management can augment human capabilities and effort by integrating different jobs and functions and incorporating other emerging technologies. Workplace record automation enhances productivity and reduces the amount of labour required to obtain

records. Using human creativity, rather than expending effort on repetitive records administration tasks, enhances productivity and the meaningfulness of work (Madakam, Holmukhe, & Jaiswal 2019). In this context, the researcher emphasises the concepts of perception, usability and system analysis, as these form the theoretical foundation for the research objectives of the study.

2.4 Policy and legislative framework for records management

With the aim of ensuring that legislation and relevant policies are reviewed and considered when using AECCT in records administration, this section examines the legislation involved in electronic records management. Where AECCT is used in records management in Ghana, such policies should be formulated, because there is neither law nor policy in Ghana to use in records management.

This study examined the adoption of AECCT in records management under Ghana's current records management legislation. The researcher examined the provisions of the Constitution of the Republic of Ghana to ensure proper and effective records management. Therefore, the Constitution established additional legal frameworks that are crucial to the functioning of public organisations, including the management of electronic data.

In all business fields, including records management and archives, the legal framework is critical to business success (Marutha 2019). All improvements in records administration must be done in acknowledgement of records are being created within an institutional environment and, therefore, national laws and regulatory standards must be followed (Katuu & Van der Walt 2016; Marutha 2019). In this way, the legal system plays a critical role in the way in which records, including records created and stored within networked settings, are maintained and managed (Ngoepe & Saurombe 2016; Mosweu & Rakemane 2020). In addition to the core legislative component, the policy and legal framework also encompasses the political, organisational, administrative, social and economic

conditions that ensure legislation is available, accessible, effective and enforceable (Republic of Ghana 2012b; Modiba 2022).

According to Mojapelo (2020), the overriding legal system that defines records is essential for eliminating ambiguity regarding accountability in national archives and for driving effective archives and records management.

To ensure efficiency, records management units in both public and private organisations require a robust legal framework supported by appropriate policies. The records unit can secure, regulate and grant access to their records in a secure and professional way because of a chain of policies and legal guidelines (Oyaro 2023).

A legal and policy environment facilitates the records division in the maintenance, management and accessibility of records in a secure and professional manner (Oyaro 2023). Sizeable organisations, such as government, schools and companies, also utilise legal frameworks when informing employees of the clearance required to develop new policies, laws that must be followed when developing new policies, the relationship and implementation of new policies, and long-term goals that new policies must strive to sustain (Republic of Ghana 2012b).

A legal framework is only effective if it avoids one of three common pitfalls: (i) comprehensive legislation that exists on paper only, with regulators being powerless, ineffective, and/or under-resourced; (ii) a weak or inactive justice system; and (iii) existing legislation that is largely unknown to, or unacknowledged by, key stakeholders (Rundle 2009).

The Data Protection Act (Act 843) of 2012 and the Constitution of the Republic of Ghana are the statutory and legislative foundations, with the Public Records and Archives Administration Department (PRAAD) being responsible for policy setting for complete records management. Other components of the legislative and regulatory framework of Ghana include:

- State Secrets Act (Act 101) of 1962;
- Right to Information (RTI) Act (Act 989) of 2019;
- Civil Service Act (PNDC Law 327) of 1993;
- Electronic Transactions Act (Act 772) of 2008.

Records management policy, including the maintenance of electronic records in government agencies – comprising policy, principles, regulations and minimum information security requirements – forms part of the broader policy and legal framework. In Ghana, citizens hold a fundamental right to access and preserve records. Guided by the Public Records and Archives Administration Department (PRAAD) Act, (Act 535) of 1997, all institutions, including the colleges of education, are required to maintain and administer their archives and records management systems. The Public Records and Archives Administration Department (PRAAD) is an institution that provides technical guidance on records management to both public and private organisations in Ghana. Importantly, the Constitution of the Republic of Ghana serves as the foundation for all legislation and policies, as it establishes the legal and institutional framework of the country (Republic of Ghana 1992 & 1997).

2.4.1 Constitution of the Republic of Ghana, 1992

The Right to Information (RTI) Act (Act 989) of 2019 and the Constitution of the Republic of Ghana, 1992 state that every individual is entitled to obtain information in possession of the government or another possession, subject to the requirement that procuring the same is necessary for the exercise or defense of a right (as in the case of the Constitution of Ghana). The provisions of the Right to Information Act (Act 989) guarantee the right to information to all citizens of Ghana under Paragraph (f) of Clause (1) of Article 21 of the Republic of Ghana Constitution (Republic of Ghana 1992).

As AECCT facilitates faster access to information, its use ensures that information requesters receive responses promptly and efficiently through robotic processes.

This improved speed of information access further enables requesters to complete their respective tasks within planned timeframes (Tom, Keane, Blaze, Pasquale, Chiang, Lee & Lee 2020).

The Public Records and Archives Administration Department (PRAAD) Act, (Act 535) of 1997 governs the functional matters of private regional legislative competence regarding archives and records management (Republic of Ghana 1997).

Paragraph (f) of Article 21 of the Constitution assigns both national and provincial archives the mandate and responsibility to regulate and maintain records Republic of Ghana 1992). The Constitution requires government agency public archive repositories in Ghana to take responsibility for the management of documents within government agencies like national ministries, provincial departments, municipalities and statutory bodies. This is the result of Jenkinson's contention that the initial work of an archivist or records manager is to preserve the records, and the second is to make documents available to users (Jenkinson 1937).

According to Modiba, Ngoepe and Ngulube (2019), this responsibility imposes a regulatory statutory function on the repositories of the public archive for records management in government institutions and the conservation of documents of lasting significance that would be utilised or accessed by the general public. The Constitution of the Republic of Ghana established a number of accountable mandated laws for administration and record keeping in Ghana, which are discussed in the subsequent sections.

2.4.2 Right to Information (RTI) Act (Act 989) of 2019

As indicated in Section 28: Subsection (f) of the Right to Information (RTI) Act (Act 989) of 2019, the Constitution handles matters involved accessing of electronic records (Republic of Ghana 2019). Once an information officer is issued a notice of access, it becomes his/her duty to find the record and present it to the requester (Republic of Ghana 1997).

The information officer may find and provide the required record to the requester by using AECCT, e.g. robotics and related software. In addition, the requester may obtain information from database records linked to a robotic system, which retrieves the required data and displays the record on the computer screen (Kruhse-Lehtonen & Hofmann 2020). Section 43 of the Right to Information (RTI) Act of 2019 addresses the mandatory protection of third-party research information, as well as the protection of research information by public institutions (Republic of Ghana 2019).

The cloud storage of an organisation must be secured, so that documents cannot be accessed unauthorised individuals. Records kept in their cloud storage would be viewed by the information officer only. Passwords and encrypted security codes must be used to guard the records, ensuring that they cannot be accessed without authorisation. According to Tom et al. (2020), AECCT security solutions would prevent documents from illegal and unauthorised access.

2.4.3 Data Protection Act (Act 843) of 2012

Apart from regulating the processing of personal data originating in Ghana, the Data Protection Act (DPA) (Act 843) of 2012 covers the legal dissemination of personal data and governs the collection, use and disclosure of personal data for the protection of individual privacy and personal data (Dagbanja 2016). The Data Protection Act of 2012 safeguards personal privacy by ensuring that individuals whose personal data is being collected – referred to as the data subjects – are informed of the nature of the data being collected, the purpose for its collection, the intended recipients and the potential consequences of failing to provide such data (Republic of Ghana 2012b).

In addition, the Act governs the data controllers and data processors, demanding that personal data is processed fairly, lawfully and without violating the privacy of the subject of the data (Tikkinen-Piri, Rohunen & Markkula 2018).

The information officer is accountable and answerable for the collection of personal data, the maintenance of accurate and high-quality records, and the protection of processed data (Republic of Ghana 2012b). With the adoption of automation, a greater proportion of records can be fully digitised by machines.

However, the information officer remains the sole individual authorised to provide the robot with digitised data. Consequently, as the person responsible for supplying data to be processed through AECCT, the information officer must ensure that all information is accurately digitised and must assume responsibility for the integrity and security of the data handled through this system (Demaitre 2020).

The adoption and utilisation of AECCT in records management must account for Section 24 of the Data Protection Act of 2012 on the correction of personal information. If personal information is under the control of a party subject to a rule and is wrong, inappropriate, unnecessary, obsolete, incomplete, misleading, or gathered unlawfully, the data subject is entitled, in the prescribed manner, to request the responsible party to amend or erase the information.

Additionally, as per Section 21 of the Data Protection Act of 2012, the concerned party is to delete or destroy any proof of the data subject's personal data that they do not have a right to retain (Republic of Ghana 2012b). Data that was incorrect at the time of automation, must be corrected by the automated machines to be adopted and used for record keeping. For the AECCT to correct data automatically on demand, it must have the capability to modify the data it acquires (Davenport & Kalakota 2019).

2.4.4 Electronic Transaction Act (Act 772) of 2008

The acceptance of a document for electronic filing and issuance is addressed under Section 8(c) of the Electronic Transactions Act (Act 772) of 2008, including robotics, software and databases available to any body of the community that, under any law, accepts the lodgement of documents or the generation and

preservation records (Republic of Ghana 2008). These stipulations in the Act ensure that records are lodged electronically.

Organisations may also provide users with documents upon request by utilising AECCT. Section 26 of the Electronic Transactions Act of 2008 ensures the public agency's duty to design an electronic transactions policy (Republic of Ghana 2008). Public institutions are expected to design and implement policies promoting the inter-operation of 5IR technologies – such as artificial intelligence, robots, cloud computing, big data, blockchain the Internet of Things and the Web of Things – in the public sector (Manda & Dhaou 2019). Such electronic transaction regulations allow institutions like the CoEs of Ghana to access and transact their information immediately by using AECCT.

As stated in Sections 25 and 26 of the Electronic Transactions Act (Act 772) of 2008, it is the responsibility of the National Archivist to evaluate the terms and conditions under which electronic documents are processed (Republic of Ghana 2008). Therefore, the National Archivist is responsible for identifying the records management activities to be managed by AECCT in the course of implementing records management practices.

The Electronic Transactions Act defines an *electronic records system* as any system that utilises computer technology in the creation and storage of information electronically (Republic of Ghana 2008).

Addressing the management and administration of public documents, the Act stipulates that proper administration and care of public documents in the custody of government departments is the responsibility of the National Archivist (Republic of Ghana 2008). Consequently, organisations are required to comply with the provisions of the Electronic Transactions Act of 2008 to ensure effective and efficient records management. Such compliance is a prerequisite for the successful adoption and utilisation of AECCT strengthening records management.

In the context of effective records management, this research examined the Electronic Transactions Act of 2008 To ensure alignment with its provisions. The implementation of AECCT must be consistent with the requirements of this Act and should not violate any of its stipulations. By facilitating easy access to records, enhancing the efficiency of records management, ensuring secure cloud storage, and safeguarding records against loss or misplacement, the use of AECCT could help to ensure that CoEs comply with the stipulations of the Electronic Transactions Act of 2008

2.4.5 National Records Management Policy Manual (2008)

Sections 7, 8 and 9 of the National Records Management Policy Manual address the way institutions are to handle their electronic documents. As stipulated in the Electronic Transactions Act of 2008, electronic records are governed by the same regulations as other documents (Public Records and Archives Administration Department 2008).

As per the National Records Management Policy Manual, the person responsible for the authority to decide the status of documents, if they have been copied electronically, and the regulations for operating the electronic records system is the National Archivist.

Smith, Bayeck and Stewart (2020) opine that the National Archivist should recommend the adoption and utilisation of AECCT in public sector records management, as well as the functions of records management that AECCT would be expected to perform, e.g., preservation, record classification or filing, access, retrieval and disposal.

2.4.6 Policy for managing electronic records in government bodies

As a core component of their records management plan, government agencies require guidance on how to comply with legal requirements for electronic records (Mullon & Ngoepe 2019; Dikopoulou & Mihiotis 2012). Although Ghana currently

lacks a standalone policy solely dedicated to the management of electronic records, the Public Records and Archives Administration Act, 1997 (Act 535) provides the fundamental legal framework for managing records. Sections 8 and 21 of this Act detail the requirements for creating, maintaining, and preserving records, including records in digital formats.

Government organisations must consider the technological infrastructure needed to maintain electronic records efficiently in order to facilitate the shift to digital records management systems. Even though Ghana is yet to adopt a single national standard for electronic records management, it can draw lessons from other countries. In South Africa for instance, the National Archives and Records Management Service details the necessary infrastructural considerations for establishing an integrated document and records management system (IDRMS). These considerations include workstation deficiencies that must be addressed before deployment, server capacities, network perimeters that may affect response time, reused elements for the system, and technology direction determined by the government agency (National Archives and Records Service of South Africa 2006).

The IDRMS would be interfaced to the utilised AECCT, e.g., a robotic system that the public sector uses to process electronic documents effectively and efficiently. When documents are searched through the IDRMS, the AECCT (robotic machine) retrieves them, and the user can see them through a database that is linked with both the AECCT and the IDRMS. Also, the robotic records management machine would come with features such as automatic record classification, automatic filing, cloud storage, and effective record retrieval and access (Ripcord 2019; Demaitre 2020).

2.4.7 Minimal information security standards

As indicated in South Africa's policy on minimum information security standards, the security of documents – particularly those classified as confidential, secret, or

top secret – is required under Chapter 4 of the Minimum Information Security Standards.

Files must be categorised during classification according to their level of sensitivity. The information must be provided or categorised, depending on the level of sensitivity, determining the level of security (Republic of South Africa 1996).

These files must be protected against unauthorised access by individuals or the public. The designated information officer must implement strict security measures to ensure the protection of these files. Accordingly, such information must be safeguarded through encrypted security protocols and robust password systems that prevent unauthorised access, even in cloud storage environments. The head of the organisation or department should grant access to these documents to individuals with the necessary security clearance or authorisation only (Republic of South Africa 1996). The concerned password would also be employed before these individuals can read the materials.

Stringent securities are essential when using AECCT to protect sensitive documents. Access to any records stored on robotic or cloud-based systems should be subject to thorough security screening prior to authorisation (de Montjoye, Farzanehfar, Hendrickx & Rocher 2017).

2.5 User perception on the use of AECCT in the management of archival records

Machine learning can be employed to identify, process and dispose of records that are no longer required or that are duplicates (Woodward 2018). These large-scale, data-optimised systems are capable of handling millions of records across various industries in the USA (Ripcord 2019). Automated systems can efficiently detect, tag and remove duplicate entries. Furthermore, they can distinguish records, based on specific attributes, such as date fields, which are essential for proper record keeping (Desai, Wang, Vaduganathan, Evers & Schneeweiss 2020).

2.5.1 Perception of ease of usage

Ease of use, derived from seven self-report questionnaire items in Davis' (1989) early Technology Acceptance Model, can be defined as the degree to which an individual believes that using a given system would be free from errors. According to Modiba (2022), users are more to adopt an application that is perceived as more adaptable or user-friendly compared to alternatives. Perceived ease of use influences attitudes towards the system, behavioural intention to use it, and actual usage. Malureanu, Panisoara and Lazar (2021) add that perceived ease of use also affects self-reported perceptions of usefulness. Therefore, AECCT to be effectively adopted in records management, it must be designed and described as user-friendly.

One of the applications of AECCT compliance is highlighted by Kim and Kim (2017) and Woodward (2018). Typically, organisations are required to collect all documents essential for an audit within a limited time frame. Although human intervention in this process is often time-consuming and cumbersome, AI systems can be trained to recognise keywords, labels, or patterns that classify documents as relevant according to compliance requirements, enabling rapid extraction of relevant records (Treder 2019; Modiba 2022).

Moreover, Engel, Elshan and Ebel (2021) argue that AECCT can improve data quality, a critical concern for all organisations. Poor data quality may result in replication issues, compromising the organisational ability to obtain an accurate overview of its key information (Mikalef, Framnes, Danielsen, Krogstie & Olsen 2017). Machine learning allows automated systems to detect inconsistencies, such as ZIP encryptions entered into date fields or documents with identical locations but different names. These automated interventions significantly enhance the accuracy, reliability and overall quality of organisational data (Syed, Suriadi, Adams, Bandara, Leemans, Ouyang, & Reijers 2020; Haleem, Javaid, Singh, Rab & Suman 2021).

2.5.2 Attitude towards use

As observed by Almahamid, Tweiqat and Almanaseer (2016), organisations have been trying to implement AECCT in records management for more than 20 years and have largely failed. Time-consuming and labour-intensive approaches to teaching computer algorithms to seek out clear-cut mechanisms and records management professionals' resistance towards the application of AECCT for records management have been identified as two of the major challenges to the use of AECCT in records management (Qhal 2023). The effectiveness and efficiency of AECCT usage would depend on the attitude that records management practitioners hold about records management. Davis (1989) states that the Technology Acceptance Model (TAM) illustrates how a person's attitude to the use of technology predicts their willingness to use a particular technology. The attitude is driven by the perceived ease of use and usefulness of the device or system. Gill (2019) argues that some individuals fear that records management practitioners may lose their jobs following the adoption of AECCT. However, records management professionals are more likely to welcome the automation of routine and tasks, as AECCT would enable them to focus on higher-value and more strategic aspects of their work. Institutions globally should explore potential applications of AECCT in records management, as both AECCT and machine learning have moved beyond the realm of theoretical probability to practical reality (Gill 2019).

2.6 Usability of AI embedded cloud computing technology to manage archival records

According to Ripcord (2019), AECCT has been widely adopted and implemented by numerous organisations in China and the USA. These organisations have collectively invested billions of dollars in initiatives aimed at digitising their records management processes and enhancing the quality of library and records management services. Across various enterprises, information professionals in the Library and Information Science (LIS) sector in both countries have endorsed the

use of AECCT, recognising its value and positive impact on professional practice (Ripcord 2019). Overall, their attitudes towards AECCT adoption have been favourable, viewing the technology as beneficial to the efficiency and effectiveness of records and information management.

2.6.1 Perceived usefulness

Perceived usefulness is one of the independent variables in TAM and was operationalised using seven self-report questionnaire items (Davis 1989; Knox et al. 2021). As a core construct derived from Davis's original TAM model (1989), perceived usefulness is defined as the degree to which an individual believes that using a particular information system will enhance their performance and productivity.

Since AECCT manages records correctly and efficiently, it is viewed as successful and capable of increasing productivity at any institution. According to Khang, Gupta, Rani & Karras (2023), modern electronic records management is increasingly linked to the application of AECCT. Robotic systems are capable of classifying records with a high degree of accuracy and precision, thereby improving the efficiency and reliability of records management processes.

Institutions employing AECCT for digital records management in its early stages faced difficulties with records classification and categorisation (Maderer 2017; Bennett 2017). Because the procedure is progressive, AECCT cannot immediately begin managing the records properly on its own; instead, it has to be taught how to operate properly. To ensure appropriate and successful machine learning for effective and efficient records management, personnel training should also be determined methodically (Jackson 2014; Bennett 2017; Lepak 2019).

Jackson (2014) observes that ensuring proper system configuration often demands a substantial investment of time and expertise. Furthermore, due to changes in technology, algorithms, retention policies and records management, AI

mechanisms must be effectively retrained (McFarlane, Giannikas & Lu 2016). Maderer (2017) asserts that AECCT has been acknowledged to have trouble with isolated cataloguing sites. Automation of the records management system is not feasible with limited knowledge of file elements, such as cataloguing (type or subject) that may aid in searching. According to Jackson (2014), unstructured recordings tend to include a wide range of subjects or classes.

2.6.2 Behavioural intention to use

Dwivedi, Rana, Jeyaraj, Clement and Williams (2019) posit that a person's *behavioural intention* to embrace and utilise new technology can be defined as the extent to which they are purposefully prepared to perform or refrain from performing a particular action.

A recurring theme across several theoretical models is that, in any organisation, users' behavioural intention to use a technology – or to acquire the skills needed for its effective use – is a critical determinant of actual adoption (Fishbein & Ajzen 2005; Knox et al. 2021).

Records management practitioners should embrace and implement new technologies, such as AI and robotic machines, in their workplace, considering the notion of behavioural intention to use, which is part of Davis's Technology Acceptance Model (1989). Additionally, records management practitioners should demonstrate their resolve and desire to implement and utilise AECCT within their particular establishments.

Information professionals have shown their willingness to embrace and implement AECCT for the provision of information services in countries like China and the USA. For instance, records management in the USA was handled by Ripcord, while library services were provided by Xiaotu in China (Yao, Zhang & Chen 2015; Ripcord 2019). According to Yao, Zhang and Chen (2015), AI is useful for providing library services. According to Ripcord (2019), AI is a useful tool for managing

documents in the USA. In South Africa, the University of Pretoria library has embraced the Libby robot to offer information and reference services (Mathibela 2019).

Srivastava, Pant and Agarwal (2020) regard the application of blockchain and AI as a critical component in the management of healthcare records, noting that healthcare-related technology has become more comprehensive, ranging from electronic health records and personal health trackers to population health management tools. The study proposed a blockchain-based integrated AI system for managing medical information, with the objective of providing a platform that leverages blockchain and AI and ensuring that it can (i) safeguard the administration of medical records; (ii) efficiently integrate data; and (iii) conduct reliable computer-assisted analysis (Srivastava, Pant & Agarwal 2020).

To activate the system preconditions, a goal-oriented modelling approach employing a simplified goal model was utilised. The model was validated and refined by using data obtained from a questionnaire administered in a case study conducted in Abu Dhabi, enabling it to account for the number of system operators.

As pointed out by Braud, Fromentoux, Radier and Le Grand (2021), the amount of data being managed is growing significantly. Nevertheless, machine learning offers strategies that show promise for assisting with the challenging task of records classification. The creation of intricate sets of rules based on record information is not necessary for records managers. By using actual documents as training data, records management practitioners can train machine learning algorithms to handle record metadata (Demaitre 2020).

Parmenter (2019) adds that AI is becoming a potent multiplier in the field of records management. It can optimise all stages of the workflow – from data acquisition and storage to information retrieval – by making processes more efficient, intelligent and responsive. Time wastage is being reduced, while collaboration and user

engagement are being enhanced, leading to shorter turnaround times for shared workflows.

2.7 AECCT infrastructure required for the management of digital archival records

As argued by Modiba (2021), AI is gradually influencing a wide range of human activities, including how the archival records and information management sectors are likely to evolve in the coming years. The rapid advancement of AI demonstrates its capacity to move across domains – from consumer applications such as Apple’s Siri to commercial innovations like Amazon Go, and potentially from autonomous vehicles to autonomous weapon systems (Modiba, Ngoepe & Ngulube 2019; Jones 2022).

Through the automation of data organisation and retrieval processes, AECCT significantly improves the efficiency and accuracy of the management of digital archives content. This integration simplifies sophisticated analytics and metadata tagging, thereby enabling faster access to relevant data and better decision-making (Hechler, Oberhofer & Schaeck 2020). Furthermore, the scalability of cloud computing enables archive systems to manage growing volumes of digital documents without a degradation in performance.

Strong security protocols ingrained in AI-powered cloud platforms safeguard archiving content against potential intrusions and unauthorised access. AECCT can also be used to automate archival records management, which includes technological infrastructure as outlined in the subsequent sections.

2.7.1 Data storage and management

According to Iliev and Ignatova (2021), data management services continue to advance their technological capabilities. One notable innovation in this regard is storage technology – an internet-based data access solution capable of retaining information for extended periods at minimal costs. Cloud storage, in particular, has

become a widely adopted method for ensuring that data remains both accessible and secure (Ion, Sachdeva, Araguaya & Čapkun 2011; Sassanian, Correlate, Marquesas, Andre & Sousa 2013). A key advantage of cloud-based archiving systems is their ability to reduce reliance on multiple physical storage devices such as discs, tapes and hard drives, thereby lowering operational costs (Sanchez-Gomez, Diaz, Hernandez-Encinas & Arroyo 2018).

The principal aim of archiving is to achieve cost efficiency by transferring older or less frequently accessed content from primary storage to secondary, less expensive storage. Consequently, less active data requires less frequent backup. Modern technological advances have further enabled the development of archiving systems capable of accommodating diverse data types – including files, databases and unstructured data such as logs – within a unified and easily accessible framework (Osseous, Libellous, Larceny & Belfry 2018).

Siddhartha, Kareem and Gina (2017) opine that stored data is not as readily accessible as primary storage data. However, the latest storage solutions provide direct access by any device, anywhere on the planet. The majority of companies use centralised storage devices and data centres. However, since contemporary storage systems are expected to share data across multiple datacentres, it is preferable to store data on an independent system that can synchronise seamlessly with the main datacentre (Rostov, Cervical & Milosevic 2014). According to Politburo, Ale Pis, Virtuous and Pakistanis (2022), storage continuously protects data and follows retention policies to ensure security. The cloud storage services provide a more comprehensive set of digital archiving capabilities, such as data management and governance, archival planning, archival storage, on-ingestion and access. The decision regarding which content to preserve is a highly critical process in the management of data. To preserve the context of the data to be archived, the users are required to supply descriptive metadata about their archiving strategy.

The cloud archiving market currently provides a variety of solutions. Some of the existing cloud services available in the market are Amazon Web Services, Preservica Cloud Edition and DuraSpace.

2.7.2 Machine learning (ML)

At its core, machine learning involves the application of statistical techniques that enable computers to learn from data (Danger 2017; Alzubi, Naysayer & Kumar 2018). Machine learning is a branch of AI that allows systems to improve automatically through experience without explicit programming (Ra, Saddam, Turnip & Harissa 2022).

The ultimate goal of machine learning is to develop computer programs capable of independently retrieving and analysing data in order to refine their performance over time (L'Heureux, Lingering, Elysian & Pretzel 2017).

The adaptive capabilities of machine learning are particularly relevant to records management, where systems can analyse collaborative editing patterns to identify relationships among users. For example, when records management practitioners edit files jointly, the computer can infer a stronger association between co-authors than with users who have never collaborated (Black & Muddiness 2016). Dunjko and Briegel (2018) argue that, instead of relying solely on explicit programming, machine learning algorithms allow computer systems to learn autonomously from examples, gradually developing their own reasoning and interpretive frameworks. Some scholars even attribute creative capacities to AI, as machine learning algorithms can independently generate innovative solutions for specific problems (Prigg 2017; Fok 2021).

The computer can discover much about work performance and interests if the correlations are plotted across a series of phases and materials, building a pattern that will hold true in future situations (Schwartz, Vassilev, Greene, Perine, Burt & Hall 2022). By identifying the information that should be classified as a file, this pattern can establish relationships between files for records management, thereby

reducing the occurrence of classification errors (Bruno, De Fino & Fatiguso 2018; Meryem & Ouahidi 2020). To enhance productivity and optimise user collaboration, machine learning can assist in clustering related information, such as aggregating all data associated with a specific client from multiple information sources (Bell-Orgaz, Jung & Camacho 2016). It also underpins predictive analytics, enabling organisations to forecast trends and make evidence-based decisions through the analysis of historical data. In electronic records management systems, the integration of machine learning facilitates greater operational efficiency, minimises human error, and improves overall data quality and accessibility.

2.7.3 Natural language processing (NLP)

Artificial intelligence concerned with the interaction between computers and human (natural) language is known as “natural language processing” (Earnhardt & Narayanan; Rains & Krishnamurti 2022). Natural language processing (NLP) includes a range of digitisation functions and focuses on programming computers process large volumes of natural language data through linguistic analysis (Kan, CAI, Tan, Huang & Liu 2020).

While its applications may appear irrelevant to records management, NLP can, in fact, identify concepts and metadata that are intrinsically relevant to a document – similar to a human reader discerning key themes and relationships (Chai & Massing 2016). Percy, Oder and Hokusai (2019) opine that an NLP system can detect relationships among named entities, e.g. it can locate the department associated with a document, even if it is not explicitly mentioned, or extract an individual's name of an individual from the text (Houston 2014).

NLP algorithms underpin widely used search engines like Google and YouTube, which rely heavily on information consumers in the Library and Information Science (LIS) field. As foundational technology supporting subject indexing, bibliometrics and information retrieval systems, NLP plays a key role in information organisation and access (Taskin & Al 2019).

In digital records management, NLP enables the automatic analysis and structuring of unstructured text data, facilitating efficient classification and indexing by extracting valuable information from diverse document types such as emails, reports and notes. This, in turn, enhances searchability and retrieval, allowing users to locate specific documents through natural language queries with ease. Tripartite, Sumatran and Cook (2024) argue that integrating NLP into digital record systems enhances the overall efficiency of record-keeping processes, simplifies workflows, and improves data accuracy.

2.7.4 Automatic rules

Saffady (2021) and Modiba, Ngulube and Marutha (2023) assert that routine and repetitive tasks performed by records management practitioners can be translated into automated digital rules. Similarly, Percy, Oder and Houri (2019) suggest that an automated preservation framework can be established in which a record is conceptualised as a contract. Within such a framework, records management practitioners can automatically determine when specific triggers occur and which rules should be executed through mechanisms such as digital thumbprinting or linguistic analysis embedded in automated rule algorithms (Sheet, Sheet, Pa, Ra, Quandary, Sheet, Napa, Namath & Soundbar 2022).

Automatic rules are important to electronic records management systems, because they ensure the consistent and systematic application of organisational policies and processes across all record types. By automating tasks and processes such as data categorisation, retention, and disposal, these rules uphold compliance with organisational and regulatory requirements, minimise human error, and enable practitioners to focus on more complex and strategic tasks (Anagnoste 2018). Furthermore, automated rules can generate alerts for key actions – e.g., when documents require review or disposal – thereby enhancing the accuracy, reliability and timeliness of record-keeping activities. Overall, the integration of automated rule systems into digital records management systems

improves operational efficiency, preserves data integrity, and strengthen regulatory compliance.

2.7.5 Neural network

Neural networks, which are modelled after the structure and functions of the human (biological) brain (Michel, Eden & Hamill 2019), are used in AI and machine learning, allowing the use of computers in the resolution of a variety of problems (Kasabov 2019; Percy, Oder & Hokusai 2019).

A neural network is an abstracted form of related neurons with a specific structure and connection that can be used to solve computer-based application problems in different fields, such as statistics, technology and economy (Gosh, Collaborator & Law 2018).

Neural networks underpin several applications used in automated categorisation processes, including biometric techniques such as thumbprinting, which facilitate interaction with intelligent classification systems (Jackson 2011; Woodward 2018). Algorithms based on neural network architectures assist records managers in categorising content accurately and applying appropriate preservation strategies, thereby increasing confidence in classification decisions (Liu 2011).

Neural networks have the capacity to automate and optimise data processing tasks, thereby substantially enhancing the organisational capacity to manage records in cloud environments. The advanced algorithms can classify and organise vast volumes of data with high precision, improving the efficiency of record retrieval and processing.

Additionally, neural networks contribute to data security and integrity by detecting anomalies, identifying patterns and flagging irregularities or unauthorised access. These networks also support intelligent search capabilities, enabling users to locate relevant information rapidly through natural language search queries. The integration of neural networks into cloud-based records management systems

enhances overall organisational performance, reduces personnel costs, and improves the accuracy and reliability of data management.

2.7.6 Deep learning

Deep learning is a specialised subset of machine learning, operating through layered neural architectures that categorise content based on hierarchical patterns, similar to a classified file plan (Woodward 2018; Dushanbe, Musk, Ann, Gupta & Panamanian 2022).

Artificial neural networks, computational models inspired by the structure and function of the human brain, rely on enormous datasets to learn autonomously through a process known as “deep learning” (Markham & Singh 2019).

Zhou, Pan, Wang and Vasilakos (2017) opine that deep learning algorithms enable machines to address complex challenges, even within highly heterogeneous, unstructured and interconnected datasets. Viera et al. (2017) further contend that hierarchical models, such as file plan pyramids, can be conceptualised as valid frameworks for information organisation and contractual logic in digital environments.

In cloud-based records management, the adoption of deep learning significantly enhances organisational efficiency. By automating and optimising core processes – such as data classification and retrieval, two fundamental yet vital elements of any cloud records management system – it streamlines workflows and improves system responsiveness. Beyond these standard applications, deep learning also strengthens "anomaly detection," enabling real-time monitoring of potential security threats and ensuring data integrity. Collectively, integrating deep learning into cloud-based records management systems fosters greater operational effectiveness, accuracy and security.

2.7.7 Optical character recognition technology

Outta and Municipal (2022) regard character recognition as a process in document analysis that involves the automated recognition, segmentation and identification of characters in digital images.

Character recognition can also be defined as the identification and differentiation of characters from input images and the conversion of these characters into the American Standard Code for Information Interchange (ASCII) or other machine-editable forms (Si, Ba & Yao 2016; Chandon, Asikuzzaman, Pickering & Gharial 2022).

In most applications, there is a significant need to transfer information from printed, handwritten or photographic sources onto computer storage systems to enable subsequent digital processing.

A common method for achieving this is to scan the physical materials and save them as image files. However, querying or extracting textual and other embedded information from such image files is highly challenging (Dapper 2016).

Therefore, Watermark and Davy (2015) emphasise the need for a method that can automatically extract and store information – specifically textual content – from image files.

Handwritten documents must be converted into machine-readable formats, so that manuscripts and other valuable historical documents are readily accessible and can be presented by efficiently (Vidal, Kareem, Thule, Backhanded, Amaretti & Hyades 2021). Accurate and trustworthy machine pattern recognition is particularly helpful for populating the AECCT of CoEs, encompassing technologies such as automatic optical character recognition, face recognition, fingerprint identification, speech and handwriting recognition for both students and staff.

An organisation can reap many benefits from optical character recognition (OCR) technology, as it relates to cloud record-keeping. The two cloud-based advantages

of OCR are automation and digitisation, which together mean that the physical records of an organisation can be indexed in digital format, enabling the cloud to serve as a safe, stable virtual storage space for those records and making them readily accessible for retrieval.

With a cloud-based OCR solution, it becomes possible to edit the text of a retrieved record directly. By combining cloud services with OCR-processed text, digital records can be interacted with in the same way as their original physical counterparts. This integration represents a significant improvement in both security and accessibility – advantages not achieved by conventional digitised PDFs alone.

2.7.8 Cloud-embedded electronic records management systems

Cloud computing technologies are evolving at a fast pace, similar to the way web services transformed the Internet from a mere file-transfer and file-sharing infrastructure to an advanced stack offering high-level services (Buyya, Srirama, Casale, Calheiros, Simmhan, Varghese, Gerogiannis, Javadi, Vaquero, Kousiouris, Evangelinou, Iosup, Zhao, Rafique, Shi, & Shen 2018). To leverage the capabilities of scalability, on-demand resources and pay-per-use pricing models, functions are migrating to the cloud with growing frequency (El-Seoud, El-Sofany, Abdelfattah & Mohamed 2017). The majority of the cloud-embedded records management systems are at the beginning stage of cloud adoption, with noteworthy exceptions in data storage and user interface. Given the advances in cloud-integrated records management solutions within the field of cloud computing, real-time records management systems can potentially be migrated to the cloud (Mohamed & Pillutla 2014). Today, the primary focus of cloud services is on embedding functionality directly into cloud applications, enabling users to adopt and utilise cloud technologies more seamlessly.

According to Tao, Ora and Dong (2017) and Fang, Romdhani, Jamshidi and Pahl (2016), integrating a data logic layer adds greater semantic meaning to cloud applications. This logical layer is largely underpinned by web service standards,

which are increasingly deployed in cloud systems. Records management systems can range from simple data processing machines to complex distribution systems (Blair 2018), and cloud computing can be integrated into these systems in multiple ways. It can be used for data storage or for the user interface only, or it can support the operation of the entire system within the cloud. Various service models – including Platform as a Service (PaaS), Software as a Service (SaaS) and Infrastructure as a Service (IaaS) – are widely available.

Records management systems are among the processes most closely associated with physical components, such as sensors and actuators, and are therefore treated as exceptions. In contrast, industrial control systems typically consist of four distinct layers that integrate both hardware and software. According to Tomzik (2022), the timing requirements of such applications vary considerably, ranging from milliseconds and microseconds for low-level sensors and actuators located close to the process to seconds or fractions of a second for high-level human-machine interface (HMI) configurations.

Control and protection devices constitute the layer above actuators and sensors, executing all control and protection tasks with either strict or relaxed real-time requirements. The top two layers typically encompass high-level communications (e.g., control and remote-control centre), event handling for historical data storing, data storage for process data, and a user interface for process control and human monitoring. Together, the functions of these four layers form a closed-loop control system. Timing requirements shift across these layers: processes close to sensors and actuators demand low latency and precise timing, whereas user-level operations prioritise throughput and the use of time-stamped data.

With more businesses utilising cloud-based applications, smart data protection has become critical (Yathiraju 2022). IT personnel can employ AI-driven network security tools to proactively monitor and analyse network traffic. According to Madhura and Chaudhary (2022), cloud-embedded records management systems can issue alerts when they detect anomalies, thereby preventing data loss. For

example, Amazon GuardDuty employs a sophisticated threat detection engine that uses AI and machine learning to identify potential threats and security risks in real time.

The scalability, flexibility and accessibility of cloud computing and cloud-based records management systems have the potential to transform the processing and management of documents in organisations. Apart from centralised data storage and management, these systems enable easier access to documents from anywhere with an internet connection.

Cloud-based electronic records management systems (CERMS) enable multiple users to access and modify documents simultaneously, thereby supporting collaboration and ensuring all users have the most up-to-date information. They also offer robust security features, such as encryption and access controls, to protect vital information. Automatic backup and disaster recovery capabilities further ensure data integrity and availability. By implementing CERMS in their records management practice, organisations can achieve regulatory compliance, minimise operational costs, and enhance overall productivity.

2.7.9 Cloud computing tools

Cloud computing represents one of the most efficient approaches to data utilisation and management (Jawed & Sajid 2022). It provides access to a wide range of resources through the internet. Cloud computing applications employ diverse technologies, each governed by distinct procedures and protocols. Most users access cloud computing as an IT-related service offered via the Internet on a pay-per-use basis (Birje, Challagidad, Goudar, & Tapale 2017). Certain processes can be executed across multiple servers simultaneously, rather than locally on a single system. Hadoop, Dryad and other Map-Reduce frameworks are the most widely adopted technologies employed in cloud systems (Alzakholi, Shukur, Zebari, Abas, & Sadeeq 2020). Additionally, specialised technologies such as Cap3, HEP and Cloudburst are utilised to optimise cloud processing and performance.

The widespread adoption of cloud computing technologies as resulted in the extensive utilisation of various cloud services by major providers such as Google, Microsoft, Yahoo, IBM and Amazon (Kannadasan, Prabakaran, Boominathan, Krishnamoorthy, Naresh & Sivashanmugam 2018).

Amazon remains the market leader, distinguished by its advanced architectural design and broad service portfolio. In order to address the evolving operational requirements of both service providers and customers, numerous open-source and proprietary solutions are being developed (Odun-Ayo, Falade & Samuel 2018).

As documented by Nwobodo, Adegbola, and Amajuoyi (2024), these technologies enable integrated access to records, enabling efficient information organisation, retrieval and dissemination across departments and locations. Features such as version control, automated backups and real-time collaboration enhance data availability, consistency and workflow efficiency. To safeguard sensitive data, cloud computing solutions incorporate strong security measures, including encryption and access control (Carroll, Van Der Merwe & Kotze 2011; Alanezi 2021). By using these solutions, organisations can improve their records management practices and processes, ensure regulatory compliance, reduce IT-related costs and improve business efficiency.

2.8 Skills needed to use AECCT in the management of digital archival records

Records management operations encompass the following: creation, storage, classification, retrieval, preservation and disposal of records. In the view of Penn and Pennix (2017), records management refers to a set of operations that an organisation must perform in order to manage its records appropriately.

2.8.1 Cloud computing skills

Cloud computing competencies are essential in digital records management, with an array of technical and conceptual skills necessary to ensure efficient and secure data processing in cloud environments (Okafor & Ile 2024). These skills include the ability to design, configure, implement and manage cloud storage systems for reliable and scalable data management, as well as proficiency in major cloud platforms such as AWS, Azure, or Google Cloud (Kaushik, Rao, Singh, Vashisht & Gupta 2021).

According to Mohammed and Zeebaree (2021), digital preservation experts and archivists should have a comprehensive understanding of cloud computing infrastructures – specifically deployment types (public, private and hybrid) and service models (IaaS, PaaS and SaaS). They should also be able to critically assess the suitability of particular cloud platforms and services for the specific needs of digital archives (Ballon, Glidden, Kranas, Ruston, Menychtas and Van Der Graaf 2011; Ray 2016).

In order to make informed and optimal choices regarding archival requirements, users must understand the distinctions among Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

Furthermore, knowledge of domain name systems (DNS), IP addressing and virtual networks is essential to enable seamless setup, configuration and operation of archival systems in the cloud. Ruest, Fritz, Deschamps, Lin and Milligan (2021) also argue that cloud-based digital archives demand skills in secure data backup, retrieval and storage. Apart from redundancy and version control, cloud storage solutions need to be established, and archivists should be able to ensure the integrity and availability of digital content over time. They should also understand preservation and metadata management methodologies in cloud computing.

In addition to maintaining digital archives, a sound understanding of cloud security principles is essential. In order to secure sensitive archival material, users must

demonstrate proficiency in encryption, identity and access management (IAM), and firewall configuration. Moreover, knowledge of compliance and governance frameworks is essential to ensure that digital archives comply with relevant legal and regulatory standards (Singh, Thakkar, & Warraich, 2023). Automated archival processes and well-designed disaster recovery strategies are equally important, as they protect information from loss or corruption, thereby contributing to the long-term preservation and resilience of digital records.

The implementation of cloud services and the automation of archival processes may lead to increased efficiency and scope (Hostetter, Khanna & Mandell 2018). Archivists must have skills in cloud API integration, scripting, and workflow automation to simplify processes such as file ingestion, metadata extraction, and preservation. They should also demonstrate the capacity to analyse and implement cloud-native technologies and services to enhance digital archive management. The effective administration of ACCT-based digital archives requires advanced data automation and management abilities.

Tools such as Terraform and Ansible can potentially automate large-scale archives, while orchestration platforms like Kubernetes enable more efficient management of extensive archive systems (Gupta, Chowdary, Bussa & Chowdary 2021; Choi & Medina 2023).

When combined with strong problem-solving skills and the ability to remain updated with changing AECCT, these competencies enable practitioners to maintain digital archives effectively within cloud computing environments (Ozyurt, Gurcan, Dalveren & Derawi 2022).

2.8.2 AI skills

Archivists and digital preservation professionals need to be familiar with the principles, functions and limitations of AI (Jaillant & Rees 2023; Jaillant & Caputo 2022). Computer vision, machine learning, natural language processing and other

relevant AI-related techniques, such as knowledge organisation and classification, are examples of this skills category. It is also essential for users to have knowledge of machine learning and data science in order to apply AI in the management of digital archives (Hannon, Rantanen, Sawyer, Ptucha, Hughes, Darveau & Lee 2019). Since supervised and unsupervised learning algorithms can be used to label, structure and classify archival material efficiently, understanding these techniques is critical.

It is essential to be able to evaluate various AECCT and related technologies to determine which are most suitable for specific archival processes, such as digital preservation, content analysis and automated metadata generation (European Commission, High-Level Expert Group on Artificial Intelligence 2020). Practitioners should be able to assess the accuracy, reliability and ethical implications of AI systems.

Digital repositories frequently contain vast volumes of unstructured text data, including reports, emails and historical documents. Competence in NLP enables users to perform sentiment analysis, extract valuable information from such texts, and enhance search functionality (Khan, Durrani, Ali, Inayat, Khalid & Khan 2016; Athanasiou & Maragoudakis 2017).

Tools such as NLTK, SpaCy and BERT are indispensable for entity recognition, topic modelling and text classification tasks. These skills facilitate the creation of more searchable and accessible digital archives, thereby improving user experience and enabling efficient retrieval of relevant information from large datasets.

The seamless integration of AI processes and tools within current archival systems and processes are needed for the successful implementation of AECCT in digital archives (Cameron, Franks & Hamidzadeh 2023). AI-enabled applications require archivists to have the technical competence to install, configure and maintain such

systems, and to train and adapt models to meet the specific requirements of their digital collections.

Schellnack-Kelly and Modiba (2024) opine that digital archive management – particularly when dealing with multimedia materials – requires the deployment of AI-driven image and video analytics capabilities. When applying computer vision techniques to recognising and categorising visual content, practitioners must be familiar with technologies such as object recognition, face recognition and image classification (Leo, Medioni, Trivedi, Kanade & Farinella 2017). Strong libraries, such as PyTorch, TensorFlow and OpenCV, provide excellent tools for extending and refining these capabilities.

Furthermore, the processing of complex visual information is supported by an understanding of deep learning models, such as convolutional neural networks (CNNs) (Krizhevsky, Sutskever & Hinton 2012). Such skills improve the accuracy and efficiency of archival management procedures by automating the retrieval and organisation of multimedia content in digital repositories.

Effective AECCT administration of digital archives also requires a critical awareness of the ethical issues involved AI implementation and use, including accountability, privacy and prejudice (Floridi, Cows, Beltrametti, Chatila, Chazerand, Dignum, & Vayena 2018). To maintain the ethical and open application of AI within their institutions, archivists should be able to establish and enforce institutional policies and procedures that promote the responsible and transparent use of AI. Ensuring that AECCT models remain interpretable, transparent and auditable is essential for sustaining trust and regulatory compliance. In addition, competence in data governance – particularly in developing policies on data quality, access and use – is essential (Khatri & Brown 2010). By integrating an understanding of AI with ethical and governance considerations, users are better positioned to manage digital archives responsibly and ethically and to advance innovative, trustworthy and sustainable archival solutions.

2.8.3 Data management skills

Purcell (2016) argues that the management of digital archives has become increasingly critical in the contemporary information environment. As growing volumes of data and information are stored and accessed digitally, the ability to manage and protect such resources has become essential to organisational sustainability.

Effective management requires that digital data and information are located, organised, interpreted, evaluated and analysed systematically (Chaffey, Edmundson-Bird & Hemphill 2019).

In order to ensure the integrity and long-term availability of digital collections, digital archivists should demonstrate advanced expertise in information retrieval, data curation and digital preservation. AECCT users, in particular, require a broad range of data management competencies to manage digital archives effectively. A sound understanding of data organisation principles and data storage solutions is fundamental to this capacity. Moreover, the robust and scalable management of archives increasingly depends on experience in cloud storage solutions like Google Cloud Storage and Amazon S (Allegra et al. 2011).

The management of digital archives enables institutions of learning to protect and make valuable learning materials, research outcomes and historic records available (Barwick & Thieberger 2018). It also facilitates communication among students, lecturers and researchers, thereby enhancing knowledge sharing and high-quality learning. Data governance and compliance skills are required for successful data management. Users have to institute strong data governance frameworks that provide standards for data quality, access control and lifecycle management (Khatri & Brown, 2010; Zahid, Altaf, Ahmad, Iqbal, Vera, Flores & Ashraf 2023).

One such framework is the application of metadata standards to ensure the consistent recording and description of the archived material, thereby making it

more accessible for preservation and retrieval. To make sure digital archives fall under current data protection policies, it is equally essential to be aware of applicable legal and regulatory provisions such as GDPR or HIPAA (Politou, Alepis, Virvou & Patsakis 2022; Bakare, Adeniyi, Akpuokwe & Eneh 2024). As Miller (2022) argues, metadata plays a key role in the preservation, structure and organisation of digital materials in a digital archive. Archivists require expertise in generating, modifying, and maintaining metadata for the description of the file content and to facilitate searching and retrieval. They index and categorise enormous collections of files with metadata, building taxonomies so that others can locate files easily.

Knowledge of data interoperability and integration is required for the effective handling of digital archives (Maltese 2018). Data integration of heterogeneous data sources, such as external databases, digital archives and legacy systems, has to be supported for end users. Archivists should have the skills to use data integration tools and ETL (Extract, Transform, Load) processes to integrate data into a unified archiving system.

As indicated by Borgman, Scharnhorst and Golshan (2019), users should have a sound understanding of data interoperability standards, such as Dublin Core and OAIS (Open Archive Information System), to ensure that archival data can be shared and retrieved across various systems and platforms.

Digital preservation methods are significant for archivists to conserve paper records, photographs and audio-visual resources from deterioration or loss. As affirmed by Samiei (2020), digital preservation is the process of maintaining and preserving digital materials available in the future. To capture knowledge from earlier data, users must be skilful in data analysis and visualisation, which involves querying and analysing data, viewing trends, and creating reports that guide archive management decisions by using programmes like SQL, Python, or R (Gupta & Rani 2019). Additionally, the production of understandable and informative visualisations of historical data is dependent on competence with data

visualisation software like Tableau and Power BI. Besides supporting the facilitation of data understanding, these competencies also enhance stakeholder communication and decision-making in managing digital repositories.

2.8.4 Digital literacy skills

The main functions of digital archive management include working with virtual stakeholders and producing and disseminating digital information (Schaffhauser-Linzatti, (2009; Vasylenko, Butko, Domitrak, & Alistrenko 2022).

In order to manage and share the digital archive properly, digital archivists are required to be competent in digital media production, online communication and virtual collaboration. The skills that AECCT users must acquire effectively manage digital records include general fields of digital literacy, which include basic competence in computers and the internet. Knowledge of how to utilise different types of technology and software – such as cloud storage devices, digital asset management (DAM) platforms, and content management systems (CM) – is part of the process for digital preservation operations (Lenk, Klems, Nimis Tai & Sandholm 2009; Avram 2014).

An important additional requirement for AECCT users is proficiency in internet browsers and office productivity tools, which facilitates the organisation, searching and sharing of historical documents (Holtzblatt, Damianos & Weiss 2010; Evans 2010). Administering the digital archives effectively also demands competence in online communication to promote efficient collaboration among users, stakeholders and the public (Buchanan, Gruning, Gursoy & Barker 2017).

This includes the ability to use email, instant messaging, video conferencing and collaborative platforms such as Slack and Microsoft Teams (Hicks & Graber 2010).

Furthermore, AECCT users should be proficient in using social media and other outreach platforms to enhance public visibility of the archives, engage with users, and disseminate information about events and holdings. It is vital for AECCT users

to have problem-solving skills and critical thinking abilities when addressing issues and challenges in digital archives management (Chang, Chiu & Huang 2018).

They should be able to analyse complex problems, identify potential solutions, and implement effective strategies for the preservation and monitoring of digital files (Franks 2013). This includes resolving technical issues, automating business processes and adopting new technologies and practices.

Developing such digital literacy ensures effective, secure and sustainable management of digital repositories that preserve valuable digital heritage for future generations (Hunter 2020).

2.8.5 Project management skills

Being able to scope and plan projects efficiently is an essential skill in the management of digital archives. Project management involves a range of skills essential for effective, well-planned and sustainable archiving processes in the management of digital repositories. These project management skills include establishing the project goal, setting the scope of work and creating detailed project schedules with deadlines, milestones and resource allocations (Kerzner 2017).

Archival project management, which can encompass enormous amounts of data and sophisticated operations, is characterised by setting realistic deadlines and achievable goals. Digital project management skills, which are crucial in the current technology-driven work environment, involve project component control and employing computer aids and web resources to ensure that everything goes according to plan. This method enables the digital archivist to take advantage of resources available in the digital environment by combining digital tools and platforms with conventional project management tools and processes.

The digital archivists can lead their projects to successful completion if they have digital project management competencies, such as strong leadership, data literacy,

flexibility, professional and personal stress management, and effective virtual team management. It is mandatory for AECCT users to express project aims, status and setbacks clearly to different stakeholders, including members, organisational leaders and external partners (Project Management Institute 2017). This entails conducting regular meetings, giving updates in reports and presentations, and employing group communication technology.

Strong negotiation and conflict resolution skills are also essential, so as to address and resolve any disagreements and to ensure that all the parties are committed to the project goals of the project.

Risk management is also a necessary skill in digital archive management. Minimising threats like data loss and technology failures or non-compliance requires the identification of potential threats that may affect the project and develop mitigation plans (Hillson & Simon 2020). Adhering to legal and regulatory requirements entails conducting rigorous risk assessments, backing up, exercising security controls and monitoring compliance. AECCT users can prevent disruption and achieve long-term preservation by taking preventive steps to contain hazards and maintain the integrity and accessibility of electronic archives.

Finally, digital archiving projects by applying project management tools and processes. Users can monitor progress, control tasks and collaborate with team members effectively if they are familiar with project management tools like Microsoft Project, Trello, or Asana (Larson & Grey 2017). The users can also benefit if they are instructed and in the use of techniques like Waterfall, Scrum and Agile, which can be helpful when adapting to various needs and situations of projects. By offering a structured approach to project management, these tools and techniques ensure that archive projects are conducted effectively, on schedule and within budget.

2.8.6 Cybersecurity awareness skills

There has been a significant rise in cyberattacks and, therefore, organisations have to remain vigilant and proactive in countering increasingly innovative and sophisticated cybercriminals (Paoli & Visschers, 2017; Arora, Manglani, Bakshi & Choudhary 2022), which, in turn, has resulted in a high demand for cybersecurity specialists.

Strong technical foundations are essential for specialists managing digital repositories, including competencies such as secure coding, network security, vulnerability scanning and incident response (Monson 2017; Hunter 2020). Identifying and mitigating security threats to the AECCT requires at least a fundamental understanding of the complexities of modern technologies and systems. Effective AECCT management also requires a strong cybersecurity awareness to protect valuable and sensitive data from cyberattacks and illegal access.

Establishing and maintaining effective access control mechanisms is a critical cyber security skill for archivists. End users must configure and manage identity and access management (IAM) systems to regulate who has access to specific records and the extent of the access. This involves implementing role-based access control (RBAC) and multi-factor authentication (MFA), as well as conducting regular access audits to ensure compliance with security policies. According to NIST (2014), internal threats may be mitigated by ensuring that only authorised staff members have access to sensitive archival content through controlled permissions and periodic reviews (National Institute of Standards and Technology 2014).

Data in digital archives is protected by encryption, which converts information into a coded format that is accessible only to authorised individuals with the correct decryption key (Van den Eynden, Corti, Woollard, Bishop & Horton 2011; Stallings 2017). Therefore, archivists require a comprehensive understanding of

cybersecurity techniques to safeguard sensitive material from unauthorised access and web attacks. To protect data in transit and storage, users need to be well-versed with encryption methods and available tools, which will ensure safeguarding against data breaches and unauthorised access and viewing (Stallings 2017). To ensure data security during transmission and in storage, AECCT users must understand how to implement encryption and use the appropriate tools. This will help prevent unauthorised access and data breaches. Furthermore, archivists are expected to have competencies in risk analysis, threat assessment, risk prioritisation and mitigation are essential for the effective administration and long-term security of an AECCT (Hubbard & Seiersen 2023).

Apart from the implementation and administration of access controls, which are essential cybersecurity capabilities, strong identity and access management (IAM) systems are required, which stipulate who has authorised access to which information in the archives (Maclean 2017). Ensuring adherence to security policies includes role-based access control (RBAC), multi-factor authentication (MFA) and periodic audits. The risk of insider threats can be minimised by restricting access to sensitive material and regularly reviewing user permissions, thereby ensuring that only authorised individuals can interact with critical archival content (Mather Kumaraswamy & Latif, 2009; Guo, Yuan, Archer & Connelly 2011).

To ensure the integrity of the digital archive, all stakeholders, including users and archivists, must be educated in security awareness (Plazas, Vergara & Aedo 2024). The effective communication of security procedures and the implementation of a security-conscious culture in the organisation require AECCT users to be good communicators and to understand prevalent cyber threats and vulnerabilities in digital archives.

Users must be informed of the latest cybersecurity threats, such as ransomware, malware, and phishing attacks, and understand how these threats affect archival systems (Andress 2019). Trained users, who are equipped with threat detection

and incident response training, are more likely to recognise suspicious behaviour and respond quickly to contain potential damage. Incident response plans must be developed and implemented to specify actions to be taken in the event of a cyber incident, ensuring that digital repositories are promptly and effectively restored to a secure state.

Knowledge of data protection policies and regulatory compliance ensures the cybersecurity of digital repositories (Raul 2021). AECCT users need to be informed about laws like the Health Insurance Portability and Accountability Act (HIPAA) of 1996 in the USA, and the General Data Protection Regulation (GDPR) of the European Union. Knowledge of these laws enables users to apply the required procedures and controls to ensure that electronic archives adhere to the law, thereby avoiding fines and other legal problems. Additionally, being familiar with this legislation ensures that users remain updated with the latest legal conventions and maintain the security and integrity of their digital collections (Solove & Schwartz 2020).

2.9 Chapter summary

This chapter presented a literature review on the use of AECCT in digital records management, which included discussions on records management professionals' perceptions of the use of AECCT for keeping records, the use of AECCT for keeping records, and AECCT infrastructure for keeping records. The necessity and significance of the literature review, its procedure and sources, source citation, research literature mapping, records management policy framework, and the functions of records management were also addressed. In the next chapter, the research methodology employed in the study is described in detail.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The previous chapter presented a review of the literature on records management activities, with the emphasis on the utilisation of AECCT in records management. The chapter also discussed the following: the legislative framework related to records management; the state of records management in the public sector; the suitability of AECCT for records management; and user perceptions of AECCT's use for records management.

This chapter explains the research methodology and design used to collect and analyse the primary data, in order to obtain reliable, meaningful research results and findings. The primary aim of the research methodology is to find suitable solutions to the problem and answers to the research questions posed by the study, in order to meet the research objectives (Babbie & Edger ton 2023).

Research methodology, which essentially involves the method of dealing with the research problem systematically, can be understood as the science of knowing how to carry out systematic research (Pollock & Berg 2018). The researcher examines the different procedures generally followed when conducting research on a particular topic and the reasons for following those particular procedures in the research process (Kellett 2005; Hancock, Algonquin & Lim 2021). In this way, research methodology is viewed as a manner of formally detailing the research topic (Patterton 2016; Pandey & Pandey 2021). Research methodology can also be thought of intuitively as a means of peering into the methodological process of inquiry (Gough, Thomas & Oliver 2012; Newman & Gough 2020).

The research technique emphasises the procedures followed, the instruments used, and the strategies employed in executing a research project. The research design describes the practical planning of the research project and shows how the study was executed (Babbie & Mouton 2001; Fellows & Liu 2021).

This chapter further highlights the standard processes the researcher incorporated in the design of his methodology (Marczyk, DeMatteo & Festinger 2010; Grove, Burns & Gray 2012; Gray & Malins 2016; Richey & Klein 2014; Creswell & Creswell 2018; Ngulube 2020). To cover all elements of the research methodology, the chapter addresses the research paradigm, the research approach and design, the population and sampling technique, the data collection and analysis techniques, the research rigour, as well as the ethical considerations involved in the study.

The study employed the pragmatist research paradigm. Pragmatism was selected as the most suitable research paradigm because it facilitated the adoption of the mixed-methods research approach, which was appropriate for studying the utilisation of AECCT for records management in the CoEs of Ghana. According to Creswell and Creswell (2018) and Ghiara (2020), the pragmatist research paradigm reflects a mixed-methods research perspective, which is associated with the use of both qualitative and quantitative research approaches. The researcher adopted the pragmatist paradigm because the topic and the research problem of the study cut across four disciplines: records management, Artificial Intelligence (AI), and Computer Science. Because pragmatism did not present the restrictions of one-sided philosophical perspectives, such as positivism and interpretivism, it was regarded as the most suitable research paradigm.

The multidisciplinary nature of this research necessitated the effective use of both qualitative and quantitative approaches, allowing the researcher to conduct an exhaustive analysis of the research topic. Because the mixed methods research approach is recommended for the investigation of a complex and wide-ranging issue, it was decided to employ it in this study (O'Cathain, Murphy & Nicholl 2007; Venkatesh, Brown & Sullivan 2016; Creswell & Creswell 2018). Consequently, the study adopted the mixed methods approach, anchored in the pragmatist research paradigm.

In summary, the research methodology aims to map the research plan (Kuada 2012) to obtain relevant primary data that can be analysed to yield reliable research results. The research methodology map of this study is illustrated in Figure 3.1.

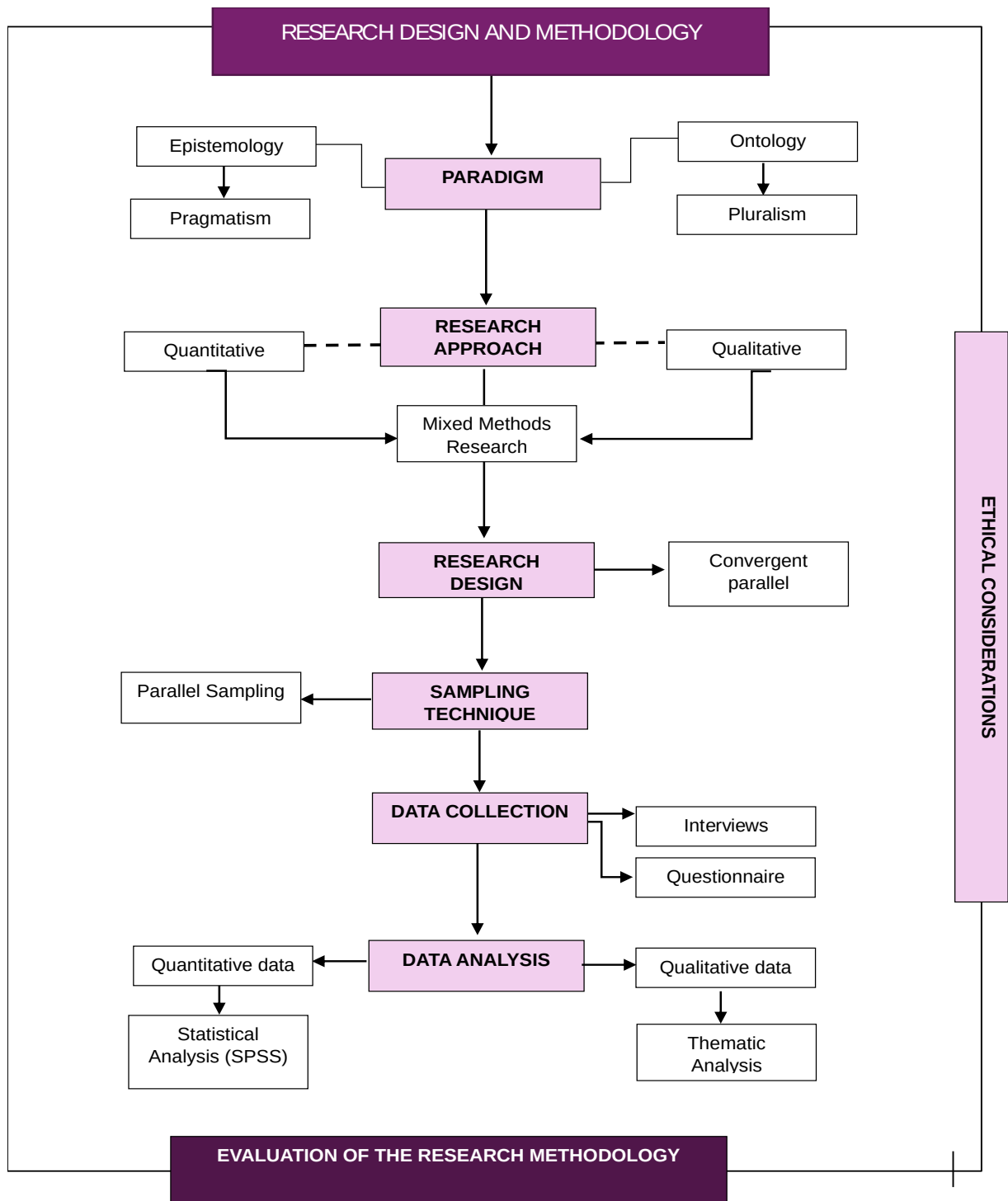


Figure 3.1: Research methodology map

(Source: Researcher 2025)

3.2 Research paradigm

A research paradigm can be regarded as a theoretical worldview, but it is also referred to by other terms, such as "explanatory framework" (Creswell & Creswell 2018; Kenneth 2021), "epistemologies and ontologies, or more broadly conceived as research procedures" (Babbie 2013; Guo, Yang, Cheng, Wu, Li, Lo & Chen 2022). Bryman (2012) and Taylor, Bogdan and DeVault (2016) define *paradigm* as a "set of beliefs and decrees" which, in theory, inform researchers on what to research and how data investigation and analysis techniques may be influenced. A *paradigm* is also defined as "a world view central to the philosophies and procedures of a particular topic, to a given way of seeing a given concept" (Creswell & Plano-Clark 2018; Saliya 2023). Paré and Kitsiou (2017) and Creswell and Plano-Clark (2018) describe a paradigm as a framework of systematic and scholarly ideas, ethics and expectations.

Paré and Kitsiou (2017) assert that a paradigm is a set of beliefs and principles that researchers and/or scholars in a particular field of study follow to determine what is to be investigated, how a study is to be conducted, and how the results are to be interpreted. Conflicting paradigms denote differing perspectives or belief systems that researchers adopt and apply to guide their inquiries and shape their conclusions (Shah & Al-Bargi 2013; Aliyu, Bello, Kasim & Martin 2014).

Creswell (2014) and Jason and Glenwick (2016) opine that there are contradictions and inconsistencies among different philosophers and scholars on the homogeneity or diversity of paradigms, epistemology and ontology, and whether they are connected or not. The three concepts are noted at different levels by Bryman (2012) and Creswell and Creswell (2018), who emphasise that a paradigm provides the researcher with a foundation for their inquiry, based on different epistemologies and ontologies.

The three primary dimensions of the research paradigm are ontology, epistemology and methodology (Terra Blanche, Durrheim & Painter 2006; Saliya 2023). These theoretical processes are at the heart of the research process and the scientist's inclination towards the topic, as they establish social methods and styles of work (Bhattacharjee 2012). The basis of ontology and epistemology is the personal motivations and understanding of the researcher (Aliyu, Singhry, Adamu, & AbuBakar 2015). However, Teddlie and Tashakkori (2009) observe that there are substantial paradigm problems – particularly in mixed methods studies, which include the elements of ontology, epistemology, methodology and axiology. Ngulube (2015) also reports that ontology and epistemology are part of the research paradigms.

In this study, the researcher chose Ngulube's viewpoint (2015) and built his research paradigm based on the dimensions of ontology and epistemology, drawing on the works of Bryman (2012), Teddlie and Tashakkori (2009), among others. After weighing Ngulube (2015) and Al-Ababneh (2020), the researcher decided to adopt the two major philosophical stances: ontology and epistemology.

3.2.1 Ontology

Bittle (2022) and Coffey (2018) describe ontology as the "concept of being". Ontology addresses three main concerns: (i) the nature of the universe under investigation; (ii) the status of its reality; and the structure of that reality. It involves the study of existence and reality – examining the nature of being and various categories of entities – which provides a foundation for researchers as they seek to address their research problems (Fleetwood 2005; Creswell & Plano-Clark 2018).

According to the *SAGE dictionary of social research methods* (Jupp 2006), *ontology* refers to "a phenomenon associated with the existence of, and affiliation between, various features of the community such as social players, cultural standards, and social features".

Uschold and Jasper (1999) and Richards (2003) describe ontology as the perspectives that scientists and researchers develop regarding the nature and principles of reality and the phenomena that ultimately occur within in. Ontology, according to Machado, LMO, Almeida and Souza (2020), is the state of the universe and the extent of knowledge that scientists can acquire. Sice, Bentley and Rauch (2018) define *ontology* as the study of "whether or not there is a social actuality that exists autonomously from human perspectives and clarifications and, carefully connected to this, whether there is a communal social truth or only manifold, context-specific ones." Simply put, ontology is the science of exploring human conceptions of nature and reality, or the social world.

As reported by Sherratt and Leicht (2020), ontological views are those that provide an answer to the question, "What can be considered public knowledge?" or "What is the truth's current status?". Relativism (ruled by subjectivity) and realism (the world of objectivity) are examples of ontological expectations (Cupchik 2001; Chakravartty 2011).

The term *social ontology* was introduced by Bryman (2012), Kember and Corbett (2018) and Baker (2019), who define it as an abstract contemplation concerning the status of social objects, such as whether they are or can be tangible objects or if they are social constructs in and of themselves that are constructed from the perspectives, actions and clarifications of the people in a particular community.

Ngulube (2015) introduced a new ontological presupposition known as *ontology-pluralism*. As an emerging dimension of ontology, pluralism is closely associated with the mixed methods research approach, as demonstrated by Ghiara (2020) and Mack (2010). According to Bryman (2012) and Baškarada and Koronios (2018), pluralism involves the integration of paradigms, data, and analytical techniques to enhance understanding of a study's research objectives and outcomes. It also promotes engagement across different levels of interpretation and encourages deliberation and dialogue among researchers.

In the context of multiplicity, pluralism encompasses a range of beliefs, practices, behaviours and values associated with a particular phenomenon (Baškarada & Koronios 2018). Pluralism emphasises the variety of practical perspectives both within and across techniques, in order to introduce a range of perspectives to the study while minimising the possibility of collected data that would be limited to its denotations (Ngulube 2020). However, Ngulube (2015) assumes that pragmatism and pluralism are the results of an attempt to link the ontological and epistemic divide between constructionist, positivism and realism.

The researcher adopted pluralism as the ontological perspective for this study, since it is widely considered the most effective ontological perspective in mixed methods research (MMR). Pluralism is a theoretical framework that recognises and promotes the coexistence of diverse perspectives, cultures and interests within a society or an institution. Based on the possibility of multiple viewpoints and approaches coexisting, this study adopted pluralism as the ontological perspective to explore the utilisation of AECCT for cloud-based records management. By employing a pluralistic ontological perspective, the study aimed at assessing multiple methodologies and stakeholder perspectives to develop inclusive and effective digital records management techniques.

3.2.2 Epistemology

Examining epistemology helps explain how researchers acquire and justify their knowledge (Hardy 2016). Epistemology concerns how individuals perceive and interpret the world around them (Saunders, Lewis & Thornhill 2019). It encompasses the nature of knowledge itself and reflects specific interpretations of what constitutes valid understanding. Greco (2017) emphasises that epistemology forms the basis and foundation of all knowledge.

According to Huutoniemi (2016) and Greco (2017), epistemology deals with the “status” of knowledge, its prospects (i.e., what knowledge is anticipated to accomplish *versus* what it is not), its scope and its veracity. Similarly, Bryman

(2012) defines *epistemology* as the investigation of what is (or could be) considered sufficient knowledge in research. In essence, epistemology is concerned with an individual's understanding of "the very degree of knowledge, its status and form, how it could be developed, and how it could be interconnected to other individuals" (Hofer 2012; Babbie 2013). All of the aforementioned scholars emphasise how the epistemological assumptions that researchers develop about knowledge influence their approach to the investigation of knowledge of social attitudes.

According to Creswell and Plano-Clark (2018), epistemology concerns how researchers determine the authenticity and transferability of different forms of information and provides the rationale for drawing local conclusions. More broadly, epistemology can be viewed as a theoretical assumption about the nature and status of knowledge (Sandoval 2014) or the extent to which knowledge about the world can be discovered (Snape & Spencer 2003).

Ngulube (2015) and Maarouf (2019) identify the following epistemological stances: pragmatism (used in the mixed methods research approach), positivism (used in the quantitative approach), and interpretivism (used in the qualitative approach). Ngulube (2015) clarifies that pragmatism is an epistemological stance that can be used in mixed-method research.

Based on the assumption of Ngulube (2015) and Allmark and Machaczek (2018) that pragmatism is most suitable in mixed methods research, pragmatism was employed as the epistemological lens through which this research was conducted.

As a theoretical disposition, pragmatism underpins the proposition that an ideology can only be true if it operates in an acceptable manner (Wills & Lake 2020). It also adapts the philosophy that non-viable ideologies should be rejected and that the value of a philosophy can be discovered in the practical implications of adopting it in the world (Creswell 2014). Pragmatism aligns with mixed methods research

because it embodies a worldview distinct from positivism and post-positivism (Teddle & Tashakkori, 2009) and constructivism, focusing instead on the research problem and practical outcomes of the inquiry (Creswell & Plano-Clark 2018; Prayag 2023).

As noted above, the pragmatic approach has emerged as the primary paradigmatic response to the "paradigm wars" debate and the methodological integration of mixed methods and models (Knappertsbusch 2023). It is framed in various ways around rejecting the necessity of choosing exclusively between constructivism and post-positivism (Mayo-Dosa, Madrigal & Dioso 2022). According to Jason and Glenwick (2016), the pragmatic stance provides a logic foundation and the flexibility to investigate a research problem by using appropriate methods, applying the findings in ways that are both practical and aligned with the researcher's values (Alemu, Stevens & Ross 2011; Creswell 2014).

The pragmatic epistemological approach was adopted for this study, because it was particularly well suited to management and social research. It aligns with quantitative, qualitative and mixed-methods designs typically employed in application-oriented research.

3.3 Research approach

Almalki (2016) and Dawadi, Shrestha and Giri (2021) opine that the mixed methods research approach combines qualitative and quantitative approaches in addressing a complex research problem. In this way, a researcher can utilise qualitative and quantitative methods in a single study to collect and analyse primary data, synthesise results and make deductions (Sandelowski, 2000; Haq 2015). Gilbert (2006) and Hesse-Biber (2010) assert that mixed methods research approaches are strategies that include both theoretical knowledge and research methods. The approach includes conceptual views that direct the process of data collection and interpretation, and qualitative and quantitative data integration in a single or categorised research (Yilmaz 2013; Brannen 2017).

According to Almeida (2018), the mixed methods research approach involves the combination of two research approaches – the quantitative and qualitative approaches – in order to understand and validate the research outcomes. In other words, MMR is research approach that involves combining quantitative methods – e.g. surveys, questionnaires and descriptive statistics – and qualitative methods, e.g. interviews, focus groups and observations (Timans, Wouters & Heilbron 2019). The strategy allows the researcher to expand and deepen insight and evade the limits inherent in the use of each individual research approach in isolation (Gobo, Fielding, Rocca & Van der Vaart 2021). The likelihood of triangulation, utilising several methodologies (methods and sources of information) to assess a singular topic, is one of the most valuable advantages of conducting mixed methods research (Molina-Azorin 2012; Shannon-Baker 2016).

Torrance (2012) and Flick (2017) indicate that triangulation remains one of the valid mixed methods research strategies, describing it as a research strategy that validates research findings by comparing different data types and perspectives. Triangulation evaluates similar perspectives by using different techniques (Abdalla, Oliveira, Azevedo & Gonzalez 2018). Following hints from concepts initially collected, the underlying or hidden thought is evaluated (Turner, Cardinal & Burton 2017).

Given that the research problem in this study was relatively broad, cutting across several fields of study – i.e. Computer Science, Artificial Intelligence, and Records Management – the researcher decided to employ the mixed methods research (MMR) approach. As demonstrated in the problem statement, the study explored a complex research question that could not be practically examined using a single research approach. Given the population size, qualitative methods were an option, but the researcher resorted to mixed methods research because of the nature and complexity of the research problem. This method was also adopted to obtain a

holistic picture, since mixed methods research provides supplementary insights into qualitative data by adding more value.

By employing the mixed methods research (MMR) approach, the researcher used both qualitative and quantitative methods in this study to collect primary data on the use of AECCT for records management in the CoEs of Ghana. Mixed methods research was suitable for this study, as it investigated complex research questions that encompassed several aspects and subjects, as well as circumstantial factors that could not be sufficiently addressed by one approach (Morse 2003; Ngulube 2020). The researcher employed the mixed methods research approach in line with the pragmatist philosophy, with which it is closely associated (Babbie 2013; Creswell and Creswell 2018; Dawadi, Shrestha & Giri 2021).

As members of the management team, the College secretaries and Information Technology (IT) Officers were expected to have extensive knowledge of institutional and managerial matters. Therefore, the researcher employed a qualitative approach to obtain in-depth information from them through interviews. Since they were also responsible for generating data related to institutional operations, a quantitative method was employed to collect data from College Secretaries, Technology (IT) Officers and Human Resource Officers.

Mixed methods research also provided room for data triangulation, thereby enhancing the reliability and validity of results through cross-verification from multiple sources. Moreover, the method provided scope for a more in-depth examination of challenging issues through the combination of in-depth qualitative results and robust quantitative findings. Based on these justifications, the mixed methods research approach was employed in this research.

3.4 Research design

According to Collins, Joseph and Bielaczyc (2016), research design describes the underlying design of a study and how it was implemented. In other words, the

research design refers to the researcher's overall method for collecting primary data that may provide possible answers to research questions. The term *research design* refers to the all-encompassing plan or framework that directs a researcher in conducting a particular study.

It may be helpful to think of research design as a series of deliberate choices made by the researcher that, collectively, enable the successful execution of the study. These key choices or components are: (i) defining precisely what the researcher intends to find out; (ii) selecting the methods and strategies for obtaining answers to the research questions; and (iii) selecting the people or materials (the sample) from which the required primary data is to be obtained to answer the research questions and meet the research objectives; and (iv) determining how the collected primary data is to be analysed and how the findings would be presented to allow others to judge the value and worth of the research (Tracy 2019; Zina 2021s).

In this study, the researcher employed the convergent research design – a technique for addressing research problems that entail collecting quantitative and qualitative data concurrently and analysing them separately (Hong, Pluye, Bujold & Wassef 2017; Schoonenboom, & Johnson 2017). This research design was previously referred to as the “concurrent” or “parallel” design, which operationalises the principles of triangulation in mixed methods research (Creswell & Plano-Clark 2018; Ngulube 2020).

Convergence research is motivated by an evident and strong research problem, either by scientific origins or immediate social necessity, and possesses significant overlap between fields (Petersen, Ahmed & Pavlidis 2021). The purpose of the convergent design is to assemble supplementary but disparate information on the research topic. The convergent research design gathers relevant quantitative and qualitative data simultaneously to provide an accurate representation of the phenomena under investigation. This design is essentially characterised by convergence, collaboration and divergence of findings (Ngulube 2020).

However, by employing a convergent design, quantitative and qualitative results can be presented side by side. Kolb (2012) and Yilmaz (2013) suggest that the two data collection samples may refer to the same or different individuals. The convergent design seeks to enhance understanding of a particular phenomenon by collecting complementary yet distinct forms of information on related aspects of the research topic. It aims to integrate the strengths and address the limitations of both qualitative and quantitative methods. This research design is typically employed when a researcher intends to achieve a comprehensive understanding by comparing quantitative data with qualitative findings (Mulisa 2022). However, the objectives of this design are corroboration and validation that display quantitative results with qualitative results or investigate relationships between variables by introducing new variables from altered qualitative data into the relationships (Atluri & Thummisetti 2023).

The process of conducting research in a convergent design occurs in the following four basic steps:

Step 1: Acquiring quantitative and qualitative data

In the first step, the researcher acquires quantitative and qualitative data on the subject in question (Leavy 2023). The two data sets are collected simultaneously, but normally separately, which means that the two datasets are not dependent on each other. They are equally significant in addressing the research questions of the study (Creswell & Creswell 2018).

Step 2: Examining the two datasets independently

In the second step, the researcher uses the quantitative and qualitative approaches to analyse/examine the two datasets independently.

Step 3: Combining the results of the two datasets

The third step involves the researcher creating the interface and combining the results of the two datasets, once the two sets of preliminary results have been completed (Creswell & Creswell 2018; Hameed 2020). The amalgamation could involve contrasting the various results in a discussion, or it could involve modifying the results to enable two types of data for further study.

Step 4: Combining the two sets of results

At the last step, the researcher combines the two sets of results to develop a deeper understanding in response to the ultimate purpose of the study by interpreting how and to what extent they meet or diverge from each other (Hirose & Creswell 2023). In the event of the results differing, the researcher is to provide an explanation by revisiting the findings and obtaining further information (Tsvuura & Ngulube 2020).

In this study, quantitative and qualitative data was collected independently and separately. The data was analysed and presented separately before being integrated during the interpretation stage.

3.5 Population of the study

In the context of research, the population refers to the entire set of elements relevant to a particular study. These elements may consist of living or non-living entities in which the researcher has an interest for a specific purpose (Babbie 2014; Neuman 2014). A population can therefore be defined as the entire set of individuals, objects, or entities that exhibit the characteristics or parameters of interest to the researcher (Singh 2022; Novosel 2023). Viljoen (2021) views the population as the set of individuals, objects or information that is of interest to the researcher. Finally, the population refers to the group to which the researchers generalise their findings (Creswell 2014; Nayak & Sigh 2015).

The population of this study comprised employees of the CoEs in Ghana responsible for the manual handling of archival records, as well as users of the CoEs' records management units. The population for this study comprised College

Secretaries (CS), Human Resource (HR) Officers, and Information Technology (IT) Officers. These staff categories were selected because they are directly and indirectly involved with the management of digital archival records, making them the most relevant group for the study.

3.6 Sampling technique

Sampling can be regarded as the process of selecting a portion or subset of a population to represent the entire group. To select a representative sample from a population and examine its features, researchers use statistical methods known as “sampling techniques”, which can be broadly categorised into two types: probability and non-probability sampling (Lohr 2021). Under probability sampling, every member of a select population has a known chance of being selected, making generalisability easy. On the other hand, for non-probability sampling, individuals are selected based on specific characteristics or predetermined criteria set by the researcher.

The sampling technique, which demonstrates the validity and reliability of the research findings, is employed to select individuals or segments of the population to make measurable deductions and predict the characteristics of the population as a whole (Wang & Cheng 2020).

In this study, the researcher employed the mixed methods approach, using a parallel sampling technique to concurrently collect data (both qualitative and quantitative) from a set of unique but comparable samples. Parallel sampling is a strategy in which qualitative and quantitative data is collected simultaneously from different, but comparable, samples. In other words, parallel sampling is essentially the application of the same logistic structure to conduct multiple surveys simultaneously (Zhan, Aziz & Ukkusuri 2015; Fischer & Ghaffari 2018). Parallel sampling involves the selection of participants from comparable populations but using a unique sample for every component of the study (Creswell & Plano-Clark 2018). It enables concurrent data collection from various sample groups at once in

an efficient manner, while allowing a proper sample size in each sample group (Wang, Zhang, Zhang, Lin & Chen 2016).

There are two phases involved in parallel sampling: the quantitative phase and the qualitative phase (Creswell & Creswell 2018). Researchers utilise two or more analogous quantitative and qualitative strands in their sample design, either simultaneously or with a brief time lag. Marutha and Modiba (2022) argue that, after independent analysis, similar qualitative and quantitative issues are addressed, or parts of the same mixed methods research topic are addressed, and the strand findings are integrated into meta-inferences.

Qualitative questions, data collection and analysis are involved in the first phase, while quantitative questions, data collection and analysis are involved in the second phase. Planning and executing the qualitative and quantitative phases should address various aspects of the central research question.

Researchers make conclusions from the information collected in each step and, in order to draw meta-inferences, they combine their results from the qualitative and quantitative phases (Corrigan & Onwuegbuzie 2020; Onwuegbuzie & Hitchcock 2022).

In this study, the researcher employed the parallel sampling technique to select 39 individuals for the quantitative phase, comprising 13 college secretaries, 13 HR officers, and 13 IT officers. For the qualitative phase, 26 individuals were selected, comprising 13 college secretaries and 13 IT officers. These participants represented staff from the 13 selected Colleges of Education, enabling the researcher to obtain both qualitative and quantitative data from separate samples within the same population. The qualitative phase of the parallel sampling employed purposive sampling, which is a type of non-probability sampling. The quantitative data was collected through surveys distributed among the College Secretaries and College HR Officials, while qualitative data was obtained by conducting interviews with IT Officers. Document analysis also generated qualitative data, which was generated through a system analysis perspective.

3.7 Data collection

Data collection is essentially the method and mode of collecting primary data from sampled research participants (Creswell & Creswell 2018). The data collection method enables the researcher to measure outcomes and respond to the research questions (Peersman 2014; Hepburn & Bolden 2017; Flick 2018). The mixed methods research (MMR) approach employed in this research used different tools for data collection (Creswell & Creswell 2018). In this study, the researcher employed questionnaires, interview guides, document analysis and observations to collect the primary quantitative and qualitative data. These data collection techniques are discussed in more detail in the subsequent sections.

3.7.1 Questionnaire

A questionnaire is a well-structured document containing a list of questions that solicits responses from research participants (Kumar 2014). A questionnaire is a surveying instrument comprising a collection of questions designed to capture data on the research topic from respondents (Dalati & Marx Gómez 2018).

Babbie (2014) observes that questionnaires contain questions and response-type items designed to obtain accurate information for analysis. Questionnaires usually consist of open and/or closed-ended questions. Open-ended questions enable participants to give a comprehensive response to a question on a particular subject, whereas closed-ended questions can only be answered with one response or a short phrase (Hagström 2015; Flick 2017).

In this study, questionnaires were used to obtain respondents' views on and understanding of the utilisation of AECCT for managing digital archival records at the CoE. The questionnaires were used to collect quantitative data from the College Secretaries, IT Officers and HR Officers, who were also acting as the Records Management Administrators at the 13 participating colleges. The questionnaires were sent to the respondents' respective e-mail addresses at the CoEs.

3.7.2 Interviews

There are two general forms of interviews – oral and written – and both can be used to obtain the views of research participants (Babbie 2016). Questions, in either the oral or written form, should be worded clearly so as to enable the participants to provide relevant and meaningful answers (Creswell & Creswell 2018).

An interview that follows a pre-specified set of questions is defined as a *structured interview*. Because questions in structured interviews are pre-designed, all participants are presented with the same set of questions in a consistent manner and sequence (Yeong, Ismail, Ismail & Hamzah 2018). Structured interviews, which typically yield substantial data, may last between 30 minutes and two hours.

The strength of the structured interview lies in the opportunity it provides the interviewer to engage closely with the research participants to collect comprehensive data (Rutakumwa, Mugisha, Bernays, Kabunga, Tumwekwase, Mbonye & Seeley 2020). Based on participants' responses, the interviewer can formulate and pose follow-up questions to elicit deeper, more detailed insights (Leavy 2017).

In this study, 13 IT Officers and College Secretaries, who also served as Record Management Administrators in the participating CoEs, were interviewed using a semi-structured interview guide. The guide was designed to collect information on their management of the electronic archives of the respective institutions. Google Meet was used to conduct the interviews. The interview was used to allow the IT Officers and College Secretaries to provide detailed responses without restricting them.

3.8 Data analysis

Data analysis is the process of transforming collected primary data collected into meaningful information. It involves processing the data by using appropriate analytical tools and systematically outlining the steps taken to interpret the findings (Babbie 2014). According to Creswell and Creswell (2018), data analysis enables researchers use to draw conclusions and make inferences based on their investigations. Babbie (2013) further notes that data analysis also involves synthesising and structuring the data, searching for and identifying recurring patterns and determining what is most significant.

A multi-type mixed analysis was employed to conduct data analysis in this study. The use of this data analysis method was based on the researcher's decision to adopt a mixed-methods research approach. According to Johnson and Christensen (2014), multi-type mixed analysis involves the integration of quantitative and qualitative data by using both types of analytical procedures, including data display techniques.

The quantitative data, collected via the questionnaire, were processed using Version 2020 of the Statistical Package for the Social Sciences (SPSS), and the qualitative data, collected during the interview, were processed using the Atlas.ti software. SPSS was chosen for its extensive range of statistical procedures and user-friendly interface, which enabled the researcher to manage, manipulate and analyse large datasets, perform various statistical tests, create visual representations and draw meaningful conclusions across disciplines. After presenting the quantitative results in output tables, graphs and pie charts, the results were interpreted, enabling the researcher to reach conclusions and answer the research questions.

Atlas.ti was used to analyse qualitative data by identifying and categorising themes and related patterns. The software supports an in-depth understanding of

qualitative research through comprehensive data analysis and interpretation, yielding meaningful findings and recommendations for future studies.

3.9 Validity and reliability

Validity and reliability are critical to establishing the credibility and accuracy of research findings. Babbie (2014) defines validity as the extent to which a study accurately measures what it intends to measure. Reliability, by contrast, concerns the consistency and dependability of research results – specifically, the degree to which measurements yield stable and repeatable outcomes each time they are applied (Babbie 2014). The study adopted a mixed-methods research approach and procedures to ensure alignment with the constructs of validity and reliability and to produce valid and reliable results.

3.9.1 Validity

This study employed a sound methodology to generate reliable results and draw meaningful conclusions. According to Babbie (2014), validity involves measuring precisely what is intended and focusing on the appropriate aspects of inquiry. In this study, validity was achieved by strictly adhering to prescribed procedures for conducting both qualitative and quantitative analyses within the mixed-methods research approach (Creswell & Plano-Clark 2018). In line with this, the study utilised appropriate data collection tools and ensured that only relevant, clearly formulated questions were posed to participants to minimise confusion. In qualitative data collection, participants were given sufficient time to respond, and their feedback was captured promptly. To maintain focus and consistency, the researcher adhered to the defined scope of the study and used a structured questionnaire to collect quantitative data. Furthermore, a checklist guided the document analysis of existing records management policies and frameworks at the time of this study. Collectively, these measures were implemented to ensure that the study's findings were both reliable and valid.

3.9.2 Reliability

Reliability involves the extent to which a study generates consistent results over time, with a focus on the verification of empirical measurements (Creswell & Creswell 2018). In this study, reliability was ensured by employing the mixed methods research approach in a manner that produced findings that were authentic, credible, transferable and dependable. Furthermore, the researcher upheld the confidentiality of participant information and maintained professionalism in the use of all data collection tools.

To further ensure reliability, identical questionnaires were administered to all individual interviewers across the 13 CoEs selected for this study. The concept of complementarity, which emphasises the combination of several techniques and approaches in creative ways (Almeida 2018), was also applied in this study.

3.10 Research rigour

Research rigour is the systematic adherence to rigorous methodological procedures and standards that ensure high-quality, credible, and reliable research findings (Noble & Smith 2015; Cypress 2017). In mixed-methods studies, maintaining research rigour requires careful attention to both the qualitative and quantitative components, as well as their integration (Schoonenboom & Johnson 2017). In this study, several strategies were employed to ensure rigour throughout the research process.

In the quantitative component, rigour was established through statistical conclusion validity by using appropriate sample sizes and SPSS (Version 2020) for statistical analysis. Internal validity was achieved through careful questionnaire design and systematic data collection across the participating institutions. External validity was achieved through representative sampling to enable generalisation to similar educational contexts, and construct validity was achieved by developing

instruments that accurately measured policy frameworks, user perceptions, usability, infrastructure and skill requirements (Shadish, Cook and Campbell 2002).

In the qualitative component, research rigour was ensured through prolonged engagement with participants and member checking of preliminary findings. Transferability was achieved by providing thick descriptions of the research context and employing purposive sampling of information-rich cases. Dependability was maintained by keeping detailed audit trails of all research decisions and analytical processes using the Atlas.ti software.

Confirmability was supported through reflective journaling and transparent documentation of potential research bias. Rigour in the integration of mixed methods was enhanced through the use of a convergent design, which facilitated systematic comparison and validation of findings across the quantitative and qualitative components. Additionally, methodological triangulation – employing multiple methods of data collection, including questionnaires, interviews, document analysis and observation – provided corroborating evidence and minimised the limitations associated with a single method (Creswell & Plano-Clark 2018; Denzin 2017).

3.11 Ethical considerations

Creswell and Creswell (2018) highlight the importance of adhering to ethical guidelines, noting that researchers must identify relevant ethical issues and obtain informed consent from participants. A number of critical ethical considerations were upheld throughout this study, all of which aligned with the *Policy on research ethics* of UNISA (University of South Africa 2024). The study also followed the *Policy for Master's and doctoral degrees* (University of South Africa 2017), the *Policy for copyright infringement and plagiarism* (University of South Africa 2005) and the *UNISA language policy* (University of South Africa 2016).

Honesty and objectivity were maintained throughout the research process to enhance reliability (Leedy & Ormrod 2013). Permission to conduct the study and collect data was obtained from the CoEs through consultation with the University and the researcher's supervisor. Participants were given the freedom to respond to questions voluntarily – a crucial step towards protecting their rights. The purpose of the research was clearly and sincerely communicated to all participants (Babbie 2014), thereby ensuring that they understood the essence of the study and were able to contribute meaningfully to the research.

Prior to data collection, the researcher obtained ethical clearance from UNISA. Data collected was treated with confidentiality to protect participants' rights, enabling them to provide information freely and without any fear. These ethical principles aligned with the research ethics policy of UNISA (University of South Africa 2024).

The participants participated in the study without any form of coercion, inducement or undue influence. Before signing informed consent forms, participants were informed of the following: the research purpose and objectives, information required from participants, voluntary participation, and freedom to withdraw from the research at any point without penalty.

Proper citation and referencing were also used by researchers to ensure that consulted sources were acknowledged appropriately, thereby avoiding plagiarism (University of South Africa 2005).

3.12 Evaluation of research method

Studies following a mixed methods research approach – such as this study on the use of AECCT for records management in the CoEs of Ghana, must be evaluated according to the manner in which the qualitative and quantitative data was collected; the way the two datasets were deliberately combined; the way a particular research design or approach was used to introduce the research; and the explanation of theory and underlying expectations (Ngulube 2020).

The mixed methods research design was rooted in the pluralist ontological and the pragmatic epistemological philosophical stance (McBeath & Bager-Charleson 2020). In an attempt to address the full complexity of the research topic, the study adopted a mixed methods approach. The researcher further used a convergent design in which quantitative and qualitative primary data was collected by using the parallel sampling technique.

Furthermore, the researcher employed the parallel sampling technique to identify and select appropriate respondents from distinct but comparable groups for each phase (qualitative and quantitative) of the study. Document analysis, observation and interviews with record managers were employed to collect qualitative data. Document analysis was conducted by critically examining records management policies and legal frameworks.

3.13 Chapter summary

This chapter discussed the strategies and techniques employed in conducting the research. After clarifying the steps and activities undertaken in the course of the research, the chapter discussed the research paradigm, the research approach and design, the population and sampling method, the data collection and data analysis techniques, as well as the elements of research rigour and ethical considerations. The research findings, derived from the research results obtained through the collection of primary data by means of questionnaires, interviews, observation and document analysis, are presented in the following chapter.

CHAPTER 4: PRESENTATION OF THE RESEARCH RESULTS AND ANALYSIS OF FINDINGS

4.1 Introduction

The preceding chapter introduced the research methodology employed in the study of the adoption of AECCT in managing archives in the Ghana CoEs. The chapter described the research paradigm, research approach, design, methods, target population, sampling techniques, data collection instruments, data analysis instruments, and ethical considerations.

The researcher employed a combination of data collection tools, which included document analysis, semi-structured interviews, questionnaires, and observation. The primary documents were studied, interviews were conducted among the selected participants, and questionnaires were employed to gather adequate information from the population under research. Observation was also made to assess the available archival infrastructure, access mechanisms, legal and regulatory frameworks, and the retrieval and processing time of archived documents.

Data analysis involves establishing the type of data that has been obtained, selecting appropriate data analysis methods, and outlining the processes used to examine qualitative and quantitative data (Neuendorf 2017). The types of data analysis techniques and methods used are subject to the nature of primary data collected in the study (Neuman 2014; Creswell & Creswell 2018; Babbie 2020). For this study, a mixed-methods approach was employed with qualitative and quantitative data collected and analysed concurrently (Creswell & Plano-Clark 2018).

In mixed-methods research (MMR), data analysis involves both statistical and thematic processes to ensure a comprehensive interpretation of the collected data. The quantitative data were analysed using SPSS, and descriptive statistics, tables, bar graphs and pie charts were used to present the analysed data visually.

The qualitative data were analysed using thematic analysis, with verbatim responses from interview participants captured to provide context. These *verbatim* quotations presented participants' views, experiences and opinions regarding the utilisation of AECCT in the administration of archives. The advantage of quoting responses verbatim is that it maintains the originality of participants' words, enabling a deeper understanding of the realities and challenges encountered in the records management at the CoEs. This method captured participants' actual voices, thereby enhancing the reliability and credibility of the study's findings. This enabled the researcher to collect and analyse primary data in two datasets in isolation before combining the results in the interpretation and presentation (Marutha & Modiba 2022; Ngulube 2022).

This chapter presents and interprets the results of the collected primary data in accordance with the first five research objectives of the study. It provides an in-depth explanation of the data analysis process to ensure transparency and credibility in reporting findings.

Data analysis plays a critical role in the research process, as it exposes patterns, generates insights, and advances knowledge, thereby supporting the development of Information Science – particularly in digital archive management in institutions of higher learning (Babbie 2020; Marutha & Modiba 2022).

4.2 Data presentation and analysis strategy

The research findings are presented in descriptive statistics, figures and in *verbatim* quotations. A total of 39 respondents were involved in the collection and analysis of the quantitative data. For the qualitative data, participants sampled from

the records and archives management units of the selected CoEs in Ghana were sequentially numbered as Participants 1–26. The presentation of the research findings follows a sequential structure aligned with the research objectives and guided by the overarching aim of exploring the use of AECCT in institutional records management of digital archival records.

The analysis of the research results is based on the following five research objectives of the study:

1. To evaluate policies and legislative frameworks for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana;
2. To explore users' perceptions, expectations and anticipated implications of AECCT in the management of digital archival records;
3. To examine the usability of AECCT in the management of digital archival records in the CoEs of Ghana;
4. To identify the AECCT infrastructure for the management of digital archival records in the CoEs of Ghana;
5. To identify the skills required for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana;
6. To propose a framework for the utilisation of AECCT in the management of digital archives in the CoEs of Ghana.

As indicated previously, quantitative data was collected through the administration of structured questionnaires, whereas qualitative data was collected through semi-structured interviews. The collected quantitative data was captured and analysed in SPSS and is presented in tables, bar charts and pie charts.

The qualitative data, on the other hand, is presented in text format and by using thematic explanations, descriptive narrations and *verbatim* quotations of participant responses (Marutha & Ngulube 2012).

4.3 Description of research respondents and participants

The respondents for the quantitative data were staff members of various administrative and management departments of the 13 selected CoEs in Ghana who were directly or indirectly involved in archival and records management activities. They were selected based on their occupations, functions, and relevance to the study's research objectives. Their perceptions and experiences were considered vital for determining the existing archival systems and assessing readiness to adopt AECCT for the management of archives in the CoEs.

A total of 39 respondents participated in the quantitative component of the research. The categories of the respondents involved were College Secretaries, Human Resource (HR) Officers and Information Technology (IT) Officers. These roles were primarily related to recordkeeping systems, data management practices, and institutional decision-making for digital infrastructure. These respondents were distributed as follows: one (1) Information Technology (IT) Officer, one (1) College Secretary and one (1) Human Resource Officer, each from the 13 CoEs, totalling thirty-nine (39).

The presence of IT Officers in the sample indicated the growing significance of technology-focused roles in managing archives, particularly in implementing cloud-based AI solutions. The participation of College Secretaries and Human Resource Officers provided a broader view of the institutional structures, administrative processes, and the key challenges associated with records and archives management. Each category of respondents provided a unique contribution to the study.

The College Secretaries provided institutional perspectives and policy information; the IT Officers defined their technical competence and the ICT infrastructure capacity, and the Human Resource Officers provided opinions on staff capacity and training needs. This spectrum of respondents ensured an overall

understanding of the existing archival climate and the potential for AI-integrated cloud computing solutions in the CoEs of Ghana.

The participants who were interviewed for the qualitative data were the College Secretary and IT Officer at each of the 13 CoEs selected for the study. A total of 26 participants were interviewed to obtain the primary qualitative data. The distribution reflected a deliberate choice of officers involved in the different facets of institutional records management, both administrative and technical. IT Officers played critical roles as stakeholders of electronic records management. College Secretaries also provided valuable insights into policy implementation, paper-based records management and the coordination of institutional document processes.

4.3.1 Personal data

This section of the study sought to determine the profession, experience, training and credentials of respondents and participants. This information helped the researcher maintain balance across these categories and representations of the general population, according to their shared differences.

4.3.2 Respondents and participants per section

Questionnaires were administered to assess respondents' knowledge of AECCT utilisation in the management of digital archival records in Ghana's CoEs. The researcher sent out questionnaires to 78 employees involved in archives management at the CoEs. These respondents included three (3) Information Technology (IT) Officers, two (2) College Secretaries and one (1) Human Resource Officer from each of the 13 selected CoEs. Out of the 78 questionnaires emailed to staff involved in archival records management across the 13 selected CoEs, only 39 were completed and returned to the researcher. This represents a 50% response rate. Specifically, one IT officer, one college secretary, and one HR officer from each CoE responded, giving a total of 13 IT officers, 13 college secretaries, and 13 HR officers. The remaining 39 questionnaires were not returned.

For the qualitative strand, 26 participants were interviewed. The College Secretary and Information Technology (IT) Officers at each of the 13 selected CoEs in Ghana were interviewed to assess their knowledge of AECCT's implementation and utilisation in managing digital archival records.

4.3.3 Respondents and participants per job title

The section shows the distribution of respondents by job title to establish their specific roles and duties related to archives and records management across the 13 selected CoEs in Ghana. As shown in Figure 4.1, three (3) CoE staff – IT Officers, College Secretaries and Human Resource Officers – were selected to participate in the quantitative data collection. Out of the 39 respondents, 13 were IT Officers, representing 33.3% of the sample; 13 respondents (33.3%) were College Secretaries; and another 13 respondents (33.3%) were Human Resource (HR) Officers. A breakdown by job titles demonstrated the extent of positions involved in the management of archives in the CoEs.

Various staff categories contributed differently to records management operations. IT Officers shared information on system infrastructure, computer storage capacity and cloud computing capacity. Most of the IT Officers also reported their contributions to the digital transformation agenda, particularly in embracing AI-based cloud computing technologies for the management of institutional archives. College Secretaries provided administrative and policy input and shared their views on handling student-related documents and records.

Human Resource Officers contributed to discussions on staff management and capacity development. This segmentation of the respondents enabled the researcher to examine how different work functions intersect with archival management tasks and to assess how AI-enabled cloud be integrated across different administrative areas in the CoEs.

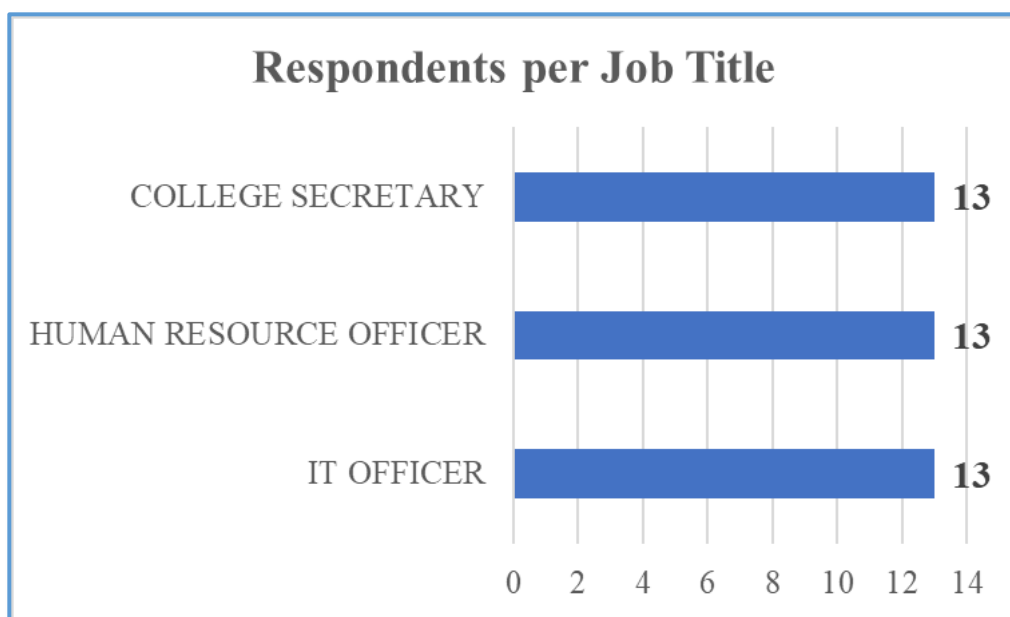


Figure 4.1: Respondents per job title (N = 39)

The occupation titles of the participants involved in the qualitative data collection were the College Secretary and IT Officers at each of the 13 CoEs selected for the study. A total number of 26 participants were interviewed to collect qualitative primary data.

The distribution reflected a deliberate choice of chief officers involved in various aspects of institutional records management, both administrative and technical in nature. IT Officers played critical roles as stakeholders of electronic records management. College Secretaries provided valuable information on policy implementation, paper-based records management and the coordination of institutional document processes.

The multifaceted combination of job titles among interview participants was particularly significant, in that such a multidisciplinary perspective ensured a strong assessment of the effectiveness, challenges and policy enforcement of records management systems.

4.3.4 Respondents and participants by years of experience

The researcher employed the questionnaire to collect data on respondents' experience in archives and records management within the CoEs of Ghana. This analysis sought to establish the level of institutional knowledge and professional experience among staff in archives and records-related activities, as these factors could influence their perception of embracing AECCT in the management of records.

Figure 4.2 shows the distribution of respondents according to their years of work experience in their respective jobs. Out of the 39 respondents, nine (9) respondents (23.1%) had 0–5 years of work experience in archives and records management; ten (10) respondents (25.64%) had 6–10 years of experience; and the majority of 20 respondents (51.28%) had 11–20 years of experience.

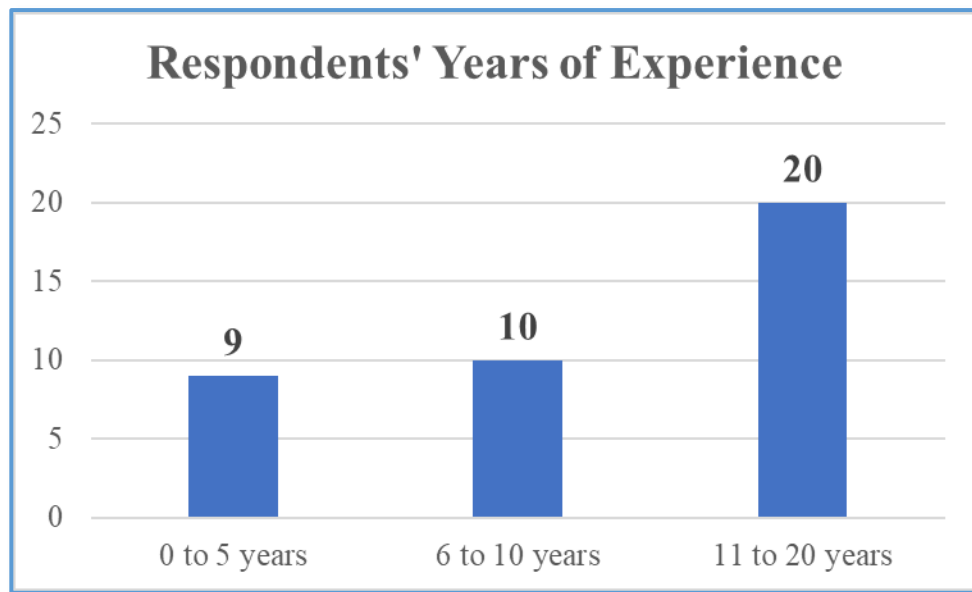


Figure 4.2: Respondents' work experience (N = 39)

The years of experience of the interview participants also indicated varying levels of experience, with close to half of the participants (42%) indicating having 11–20 years of experience; 35% of participants reported their years of experience as ranging from 0–5 years; and 23% of participants stated their years of experience ranged from 6–10 years. The diversity of work experience among the participants provided rich insights into how records were created, managed and archived within the organisations.

4.3.5 Training of respondents and participants

The data collected on respondents' training and educational levels revealed an uneven distribution of expertise. Respondents were asked to indicate their perceived level of training and competence. The categorisation into basic, intermediate, and advanced is based solely on self-reported perceptions. A total of 15 respondents reported having no formal training; nine (9) respondents indicated having received some basic training; 12 respondents reported having an intermediate level of training; and only three (3) respondents indicated having had an advanced level of training. The categories indicated here are self-reported descriptions of respondents' exposure and participation in training. The categories are defined as follows;

- No formal training: refers to individuals who indicated that they have had no form of structured or professional training in relation to AI and related technologies and their application to digital archival management.
- Basic training: refers to individuals with some exposure to foundational seminars or workshops on AI and related technologies, and minimal hands-on experience.
- Intermediate training: refers to individuals who indicate moderate exposure to AI and related technologies gained through formal coursework or professional development programmes with some practical engagement with relevant digital systems.

- Advanced training: refers to individuals with substantial educational or professional exposure, specialised training or extensive hands-on experience with AI and related technologies.

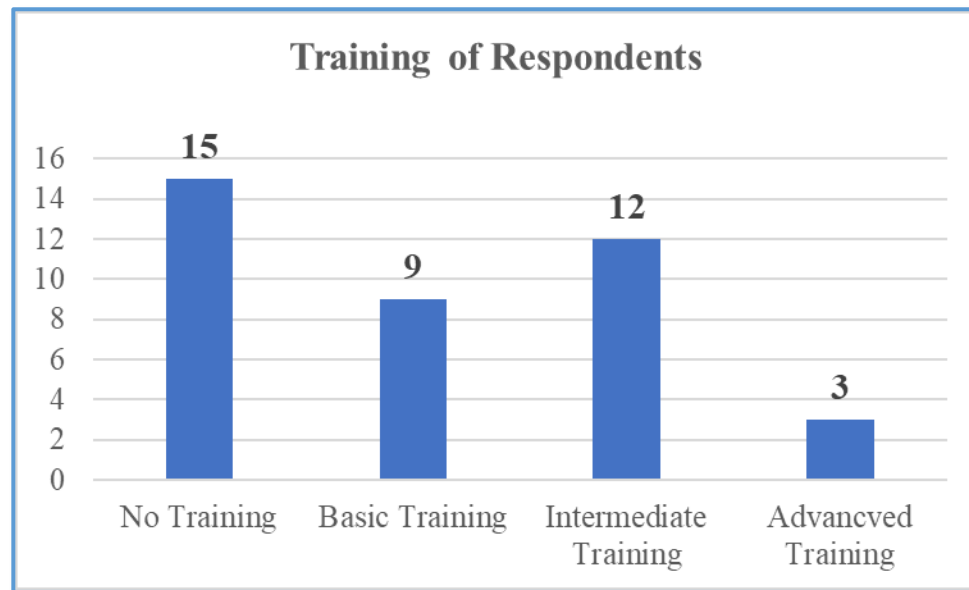


Figure 4.3: Training of respondents (N = 39)

The participants also provided information on their levels of training. Ten (10) participants reported having no formal training; five (5) participants indicated that they had received basic training; seven (7) participants described their level of training as intermediate; and only four (4) participants reported having had an advanced level of training.

4.3.6 Respondents' and participants' educational qualifications

Being aware of the level of education of respondents and participants was an integral component of this study, since qualifications would influence their capacity to adopt and utilise technological innovations such as AECCT solutions in archives and records management. This section presents the respondents' qualifications to indicate whether their level of education was adequate for the digitisation of archival systems in the CoEs of Ghana. Respondents were asked to provide their highest level of education in the standardised questionnaire.

The responses were categorised into four general categories: Master's Degree, Bachelor's Degree, Diploma and None. Of the 39 respondents, 24 (61.54%) held a Master's degree, indicating that the majority of staff involved in archives management in the CoEs had advanced academic qualifications. Ten (10) respondents (25.64%) reported having a Bachelor's degree, conventionally regarded as the foundational educational qualification for professional teaching and administrative careers. Only five (5) respondents (12.82%) held a qualification at diploma level.

Figure 4.4 reflects the qualifications of the respondents.

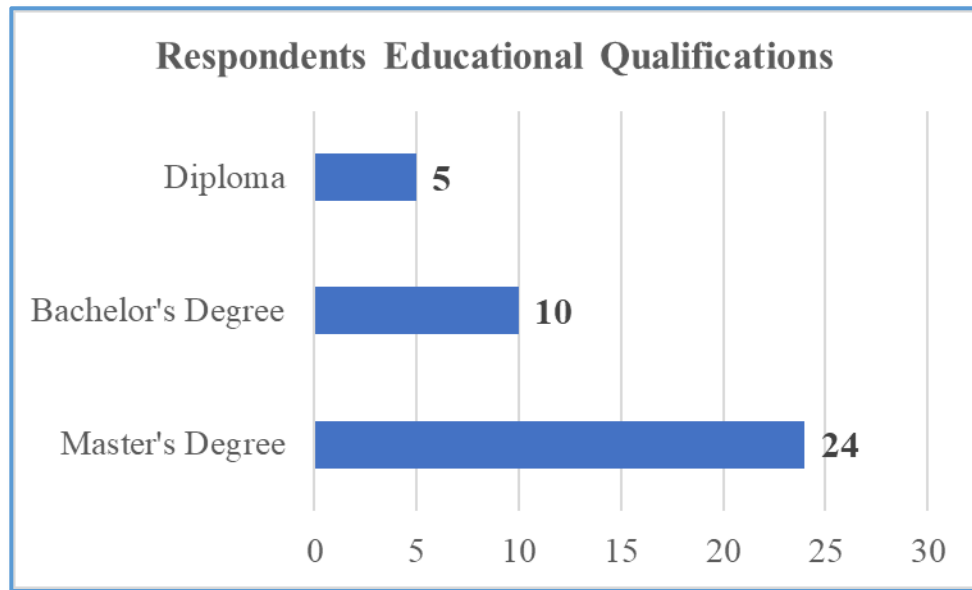


Figure 4.4: Respondents' educational qualifications (N = 39)

A total of 68% of the interview participants had at least a Bachelor's degree, while 32% indicated that they had a diploma certificate.

In the subsequent sections, the results of the collected primary data will be presented according to the research objectives and research questions that guided the study.

4.4 Policy and legislative frameworks to utilise AECCT to manage digital archival records in the CoEs of Ghana

The initial analysis was based on the research first objective and research question. A variety of questions were posed to respondents and participants through survey questionnaires and interviews to elicit responses that attempted to address this research objective and the corresponding research question.

Research Objective 1: To evaluate policies and legislative frameworks for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana.

Research Question 1: Which policies and legislative frameworks can be employed for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana?

4.4.1 Availability of an officially sanctioned policy for archival records services

The survey posed closed-ended questions to respondents regarding whether there was an officially approved policy for the archival records services. In the results, 15 respondents confirmed that there was an officially approved policy for archival records services. Ten (10) respondents disagreed with this statement, and 14 respondents were unsure whether such a policy existed. Figure 4.5 shows the quantitative analysis of the officially approved policy for archival records services.

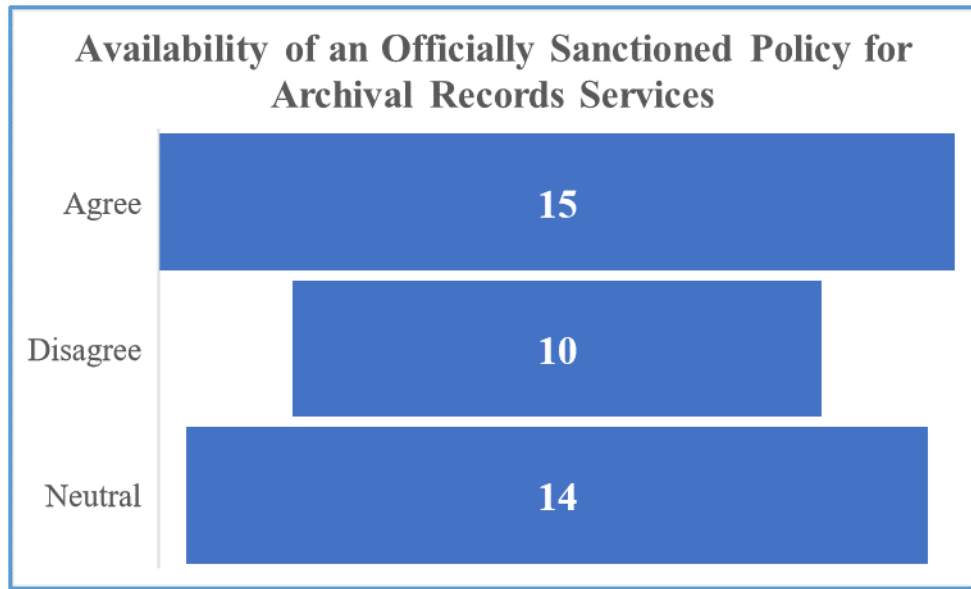


Figure 4.5: Availability of an officially sanctioned policy for archival records services (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe how the presence or absence of an officially sanctioned policy for archival records had influenced the management and accessibility of archival records in their organisation. Ten (10) respondents revealed that having an official policy ensured that archival and records management staff follow clear guidelines, while 15 responded that, without a policy, everyone did things differently, and records got lost. Fourteen (14) respondents also reported piloting an automated system but paused due to the absence of an official policy. The following responses were captured:

Respondents 1–10	<i>Having an official policy ensures archival record staff follow clear guidelines, reducing duplication and data misplacement.</i>
Respondents 11–25	<i>Without a policy, everyone does things differently. Records get lost, and using AI cloud tools becomes difficult.</i>
Respondents 26–39	<i>We piloted an AI-based system but paused because there was no official policy.</i>

In the interviews, participants were asked whether an officially sanctioned policy was available for archival records services. Participants were also asked to elaborate on the availability of an officially sanctioned policy for archival records services. Their responses were coded thematically into five (5) categories to determine the key insights regarding awareness, accessibility and utilisation. Their responses were as follows:

Participants 1–2	<i>Yes, there is an officially sanctioned policy for archival records services. The major challenge however, is that the policy is not effectively implemented. Most staff members have limited knowledge about the provisions in the document, even though it exists. Lack of proper sensitisation and enforcement makes the policy ineffective in practice.</i>
Participants 3–10	<i>From my experience, I am not aware of any officially approved policy for archival records services. Most of our operations are guided by informal procedures and departmental traditions rather than a clearly defined policy document. If such a policy exists, it has not been communicated effectively to staff. This lack of clarity affects consistency in recordkeeping practices across departments.</i>
Participants 11–15	<i>I am not sure if there is an officially sanctioned policy guiding archival records services. From my experience, I have not seen any formal documents or guidelines that detail how archival records should be managed. Although we perform basic records management duties, there seems to be a lack of clear direction on procedures and responsibilities.</i>
Participants 16–17	<i>The institution has an existing policy; however, it is largely outdated and does not reflect the current realities of records management, especially in the current digital age. The policy is heavily skewed towards manual recordkeeping and offers limited guidance on managing electronic archival records. Because of this, most staff find it difficult to apply the policy to modern recordkeeping tasks, undermining its usefulness.</i>

Participants 18–26	<i>As far as I know, there is no well-communicated or accessible policy for archival records services. Although there are occasional references to certain guidelines by management, these are not standardised or compiled in a formal policy document. This lack of a comprehensive and enforceable policy results in varied practices across units and makes coordination difficult.</i>

4.4.2 Existence of an officially approved policy for records management

The respondents were asked closed-ended questions in the questionnaire about whether there was an officially approved policy for managing records. The survey results showed that 11 respondents agreed that there was an officially approved policy for the management of records. A total of 12 respondents disagreed with the statement, and 16 respondents did not know whether such a policy existed. Figure 4.6 presents the quantitative analysis of the existence of an officially approved policy for archival records services.

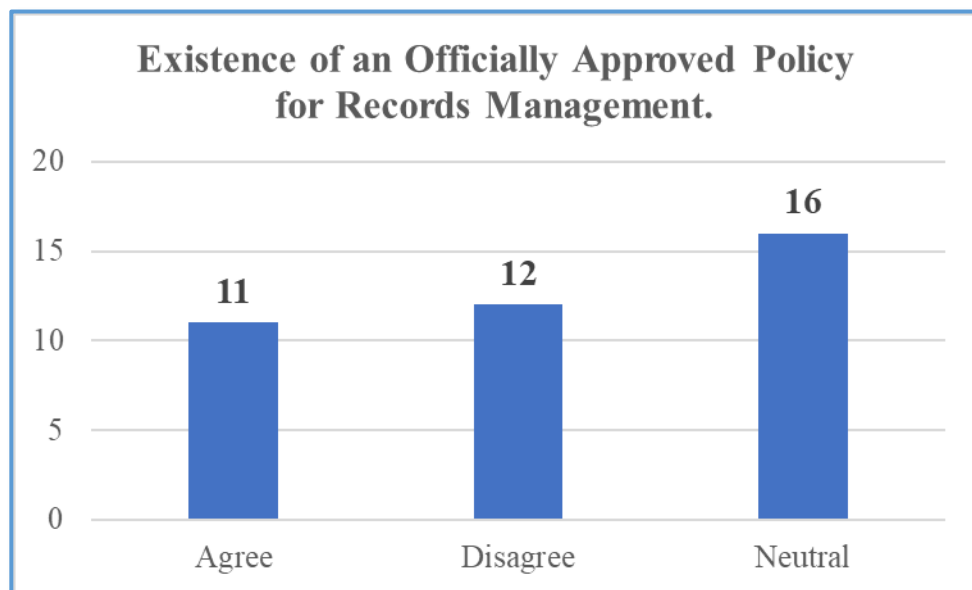


Figure 4.6: Existence of an officially approved policy for the management of records (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe how the existence or absence of an officially approved policy for archival records had impacted the way their organisation handled and stored archival records. A total of 20 respondents revealed that having an official policy ensured that archival records staff followed clear procedures in handling records, while 15 responded that the absence of an official policy would result in unstandardised procedures that can lead to confusion, mishandling of records, and difficulty in ensuring proper storage and access to archival records. Three (3) respondents stated that the lack of a formal policy currently hampers every effort targeted at making records management an efficient and seamless process.

The following responses were provided:

Respondents 1–20	<i>Having an approved policy for archival records brings clarity and structure to records management. It ensures that the processes are standardised, improving efficiency in how archival records are handled, stored and accessed.</i>
Respondents 21–35	<i>The lack of standardised procedures leads to confusion, misplaced records, and difficulty in ensuring proper storage and access to archival records.</i>
Respondents 36–39	<i>The lack of formal policy currently hampers records management, but we hope that once it has been implemented, it will improve how records are handled and ensure better compliance.</i>

Regarding the presence and utilisation of an officially approved records management policy, some participants expressed mixed perceptions in the interviews. Their responses were coded thematically into five (5) distinct categories to determine the key insights concerning awareness, accessibility and utilisation of the policy. Most of the participants confirmed the existence of an officially approved records management policy. However, a significant gap was evident in staff awareness and understanding of the content of the document. The following interview responses were captured:

Participants 1–6	<i>Yes, there is an officially approved records management policy in place. However, not all staff members are well informed about its contents or implications. The policy documents are not widely circulated, and as such, implementation is inconsistent across departments.</i>
Participants 7–14	<i>I agree there's a policy, but it's mostly seen as a formal document rather than a practical working guide. The records management policy exists on paper, but it is not actively enforced. Staff members go about their tasks using their own methods, and in most cases, there's no monitoring mechanism to ensure adherence to the policy directives.</i>
Participants 15–20	<i>In my department, we have never seen or been briefed on any official records management policy. The absence of sensitisation makes it difficult to claim that a policy truly exists, even though some senior staff say it does. Some staff members might not even be aware that a policy exists if it is not properly communicated, making implementation ineffective, even if a policy does exist.</i>
Participants 21–23	<i>Yes, a records management policy exists, and I've read through it. It specifies procedures for creation, classification, storage and retrieval of records. There is a challenge, however, with compliance. While some units try to follow the procedures, others do not due to a lack of supervision or training.</i>
Participants 24–26	<i>I'm not certain whether we have an officially approved policy. There are no clear guidelines communicated to staff. Everyone does things differently depending on what they've learned on the job. If there's any policy, then it is not effectively implemented or made accessible to staff across the institution. These sentiments indicate a communication gap that weakens policy implementation and standardisation of records management procedures.</i>

4.4.3 Formal procedure established for managing archival records

The survey posed closed-ended questions to respondents regarding the existence of a formal procedure for managing archival records. In the results, ten (10) respondents confirmed that there was an officially approved procedure for handling archival records. A total of 14 respondents disagreed with this statement, and 15 respondents were unsure whether such a procedure existed. Figure 4.7 shows the quantitative analysis of the establishment of a formal procedure for managing archival records.

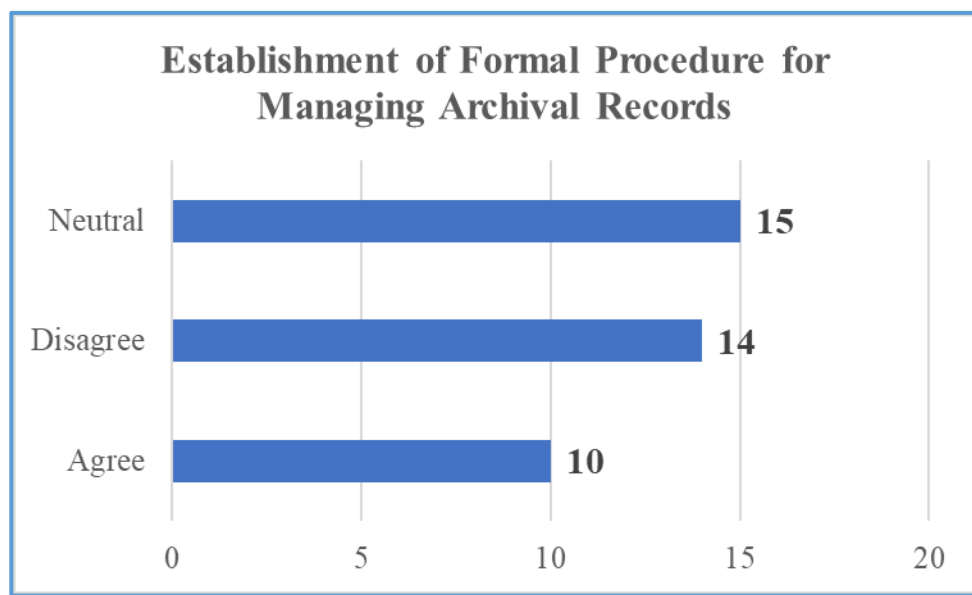


Figure 4.7: Establishment of formal procedure for managing archival records (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe the impact of establishing a formal procedure on the long-term preservation and access to archival records.

A total of 21 respondents reported that having an official procedure ensured that records were properly labelled, stored, and maintained over time, while 15 reported that, without an established procedure, everyone did things differently, records got lost, and using AI-based cloud tools became difficult and ineffective. Three (3)

respondents reported that having formally established procedures enhanced the preservation of archival records.

The following responses were captured:

Respondents 1–21	<i>Having an approved procedure for archival records ensures that records are properly labelled, stored and maintained over time. This makes it easier to retrieve older documents when needed and protects them from loss or damage.</i>
Respondents 22–36	<i>Without an established formal procedure, records often go missing, get mixed up, or deteriorate. It becomes harder to track older files and important documents.</i>
Respondents 37–39	<i>Having formally established procedures enhances preservation of archival records.</i>

This segment also examined the opinion and experience of interview subjects on the existence of formal procedures for the handling of archival documents in the CoEs. Their responses were coded thematically into five (5) categories to determine the key insights concerning awareness, accessibility and utilisation. They explained that there were certain procedures for moving inactive records, arranging archival documents and maintaining their long-term preservation and retrieval. The participants gave the following answers:

Participants 1–10	<i>Yes, the College has a clear process for managing archival records. Once records are no longer active, they are transferred to a designated storage facility. We follow guidelines on how these records are labelled, stored and retrieved when needed.</i>
Participants 11–16	<i>There is a formal structure for archival records. We maintain a register for all archived files and use a classification system to make it easy to trace documents. It's not digitised yet, but the manual process works well.</i>

Participants 17–20	<i>There's no clearly defined procedure for archival records. Sometimes, old files are simply kept in storerooms without any proper categorisation or inventory. It's difficult to retrieve documents once they are archived.</i>
Participants 21–25	<i>In theory, we are supposed to manage archival records, but in practice, the system is informal. There's no standard process across departments, and documents often get misplaced or lost over time.</i>
Participant 26	<i>I'm not sure if we have an official procedure for managing archival records. I've never seen a written document or policy on it. We just keep records we don't use often in a different cabinet.</i>

4.5 Users' perception of using AECCT in the management of digital archival records at the CoEs in Ghana

A series of questions were posed to respondents and participants through survey questionnaires and interviews to elicit responses to address the second research objective and answer the second research question.

Research Objective 2: To explore users' perceptions, expectations and anticipated implications of AECCT in the management of digital archival records.

Research Question 2: What is the user perception regarding the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana?

4.5.1 Utilising AECCT to improve productivity

The survey posed closed-ended questions to respondents regarding their perceptions of utilising AECCT to improve productivity in managing digital archival records in the CoEs of Ghana.

A total of 20 respondents confirmed that utilising AECCT could improve productivity in the management of digital archival records in the CoEs in Ghana. A total of 13 respondents disagreed with this statement, and six (6) respondents were unsure

whether utilising AECCT could improve productivity in managing digital archival records in the CoEs in Ghana. The quantitative data obtained from the questionnaire is illustrated in the bar chart in Figure 4.8.

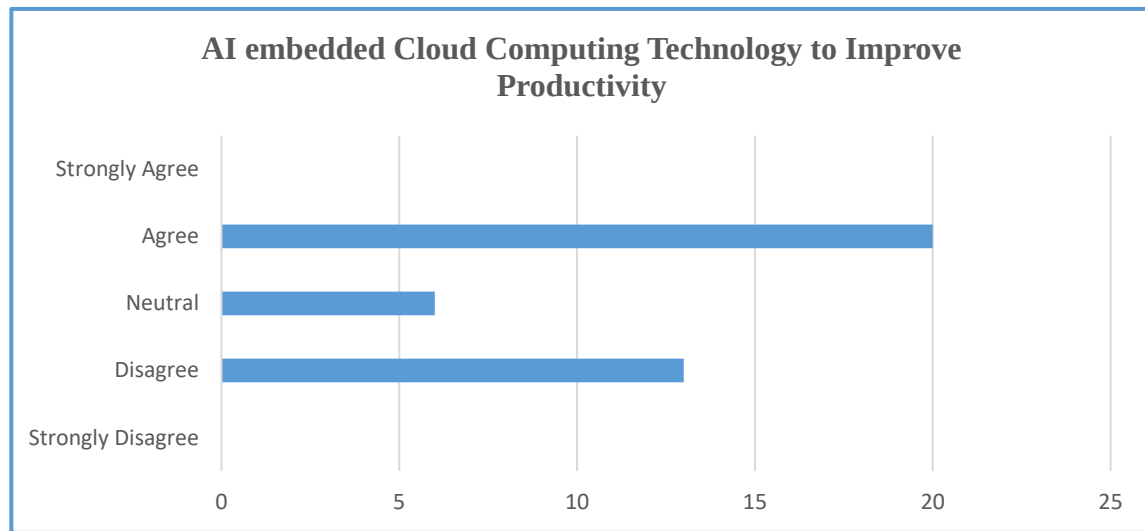


Figure 4.8: AECCT to improve productivity (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe how the integration of AI and cloud computing technology could enhance the way archives were managed in CoEs in Ghana.

One (1) respondent reported that integrating AECCT could significantly reduce the time they spent searching for old records, while 20 respondents indicated that it would bring a level of order and accessibility that their existing systems lacked. Ten (10) respondents stated AI and cloud computing would automate the indexing of documents, allow instant access from any location, and provide real-time backups. Eight (8) respondents remarked that, with AI and cloud systems, they could access files and projects from their phones or laptops.

The following responses were given:

Respondent 1	<i>The integration can significantly reduce the time we spend searching for old records. With AI, we can easily retrieve documents using simple search terms, and the cloud ensures that we don't lose data due to physical damage or poor filing systems. It would also make audits and reporting far more efficient.</i>
Respondents 2–20	<i>I think it would bring a level of order and accessibility that our current systems lack. With AI analysing trends in stored documents, we could even predict what files are accessed most often and optimise storage. Also, students and staff can access files remotely, which is a huge productivity boost.</i>
Respondents 21–30	<i>Currently, our archives are mostly manual, and retrieving even one file can take hours. AI and cloud computing would automate the indexing of documents, allow instant access from any location, and provide real-time backups. The technology would reduce human error and enhance security.</i>
Respondents 31–39	<i>Sometimes we need past projects or lecture notes, but they are locked in cabinets that no one wants to open. With AECCT, we can easily access records from our phones or laptops. This will save time and make research easier and also encourage us to use archived materials more often.</i>

From the interviews, five key responses were drawn from the participants, which reflected different perspectives and levels of understanding regarding this approach to emerging technologies.

The following interview responses were captured:

Participants 1–7	<i>AI-integrated systems will make our work easier and more accurate. This system can help us increase productivity and allow us the time to concentrate on other important things. Rather than wasting time searching for documents manually, the AECCT can organise and retrieve them for us instantly.</i>
Participants 8–15	<i>Yes, I believe it will be beneficial. But many staff members are not familiar with such technologies, so there must be training and gradual implementation. If done well, it will reduce delays and improve efficiency in managing digital records.</i>
Participants 16–20	<i>AI and cloud computing sound great, but what about electricity, internet, and the computers we need to run them? These are some of the real challenges we face every day. Before thinking about AI, we need to figure out some of these basic things.</i>
Participants 21–26	<i>I am not against new technology, but I'm not sure it will work here. We still have trouble managing paper files properly. Maybe we need to fix those issues before jumping into something like AI.</i>

4.5.2 Utilising AECCT will phase out archival records workers

The survey posed closed-ended questions to respondents regarding their perceptions that the utilisation of AECCT would render archival records staff redundant in Ghanaian CoEs.

The results showed that 15 respondents agreed with the statement, confirming that the use of AECCT would render archival records staff redundant in Ghana's CoEs. A total of 13 respondents disagreed with this statement, and eight (8) respondents were unsure whether the use of AECCT would render archival records staff redundant in the CoEs. Only one (1) respondent indicated strong agreement with the statement, and one (1) respondent strongly disagreed. The quantitative data obtained from this question is reflected in the pie chart in Figure 4.9.

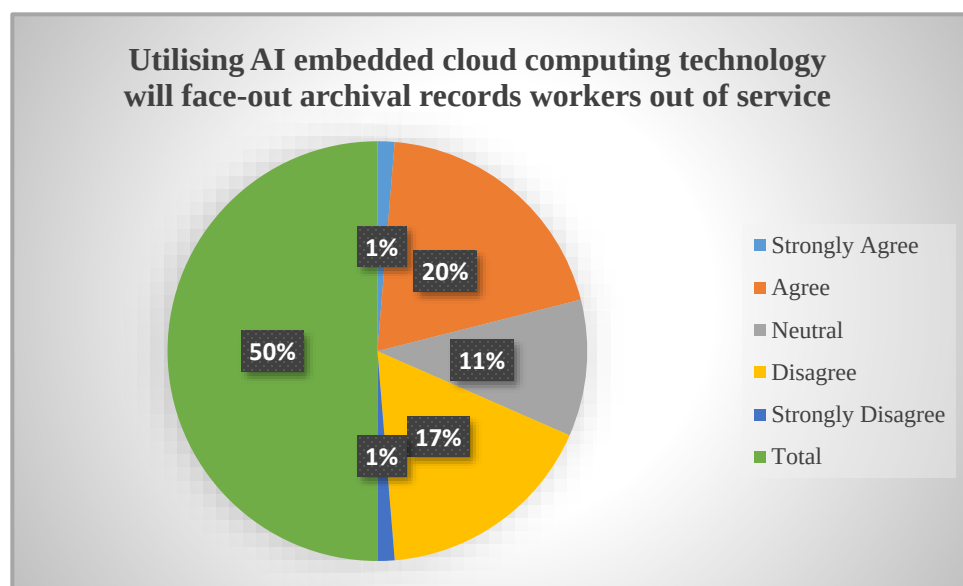


Figure 4.9: Utilising AECCT will phase out archival records workers (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe their thoughts on the idea that using AECCT might lead to archival records workers losing their jobs in CoEs.

Ten (10) respondents revealed that the role of archival staff would evolve. Three (3) respondents opined that some roles might become redundant, particularly those involving basic filing, but new roles would emerge, such as data analysts, digital records officers and system monitors. A total of 22 respondents stated that if the system were brought in without training the existing staff, they could be left behind. Finally, four (4) respondents were of the view that there was a risk involved, particularly if the change was rushed, indicating that AI should be seen as a tool – not a replacement.

The respondents answered as follows:

Respondents 1–10	<i>It's a valid concern, but I don't think it should be seen as a total replacement. Rather, the role of archival staff will evolve. We may not do as much manual filing, but there'll be a need for</i>

	<i>people who understand how to manage and oversee these digital systems. Training will be key.</i>
Respondents 11–13	<i>Some roles may become redundant, especially for those who only do basic filing, but new roles will emerge too, like data analysts, digital records officers, and system monitors. The technology can't run itself without human supervision, so it's more about upgrading skills than losing jobs.</i>
Respondents 14–35	<i>I honestly think if the system is brought in without training the current staff, they could be left behind. But if management invests in upskilling them, they'll still be relevant. This AECCT can help us handle repetitive tasks, but we will still need people to make certain decisions and to handle certain sensitive information.</i>
Respondents 36–39	<i>There's a risk, yes, especially if the change is rushed. But AI should be seen as a tool, not a replacement. Archive workers should be part of the digital transformation process. They know the records well, and with the right training, they can guide the system rather than be pushed out by it.</i>

In the interviews, participants' opinions were sought on whether the use of AECCT would lead to the displacement or redundancy of archival records personnel in CoEs in Ghana. Participants' reactions varied from deep concern to total disagreement with the statement.

The participants gave the following responses:

Participants 1–9	<i>AI systems will eventually take over our jobs. Once everything becomes automated, there won't be much need for people to manually manage records. I'm afraid we might be phased out sooner than expected.</i>
Participants 10–12	<i>Yes, it's possible that some roles will be affected, especially repetitive tasks. But I think those who learn to work with the new</i>

	<i>technology will still have a place. It's more about redefining our roles, not losing them completely.</i>
Participants 13–19	<i>I'm not quite sure. AI can be a helpful tool, but I don't know if it is going to replace us entirely or not. Maybe it will just change the way we work. It's too early to tell exactly how things will go.</i>
Participants 20–23	<i>No, AI can't replace us. It can assist us, yes, but managing records requires more than just technology. We still need people to make decisions, verify documents, and manage sensitive information.</i>
Participants 24–26	<i>There's no way AI can fully take our place. Technology will always need humans behind it. It might make our work easier, but it won't eliminate the need for us.</i>

4.5.3 Utilising AECCT to optimise the archival operations of CoEs

The survey posed closed-ended questions to respondents regarding their perceptions of how the utilisation of AI-embedded computing technology could optimise the archival operations at CoEs in Ghana through automated predictive maintenance, enhanced efficiency and fraud detection of archival records management systems. The findings revealed varied perceptions and expectations, ranging from strong belief in AI's capabilities to cautious neutrality about its actual effects.

A total of 17 respondents agreed that utilising AECCT could optimise CoEs' archival operations through automated predictive maintenance, enhanced efficiency, and fraud detection. Five (5) respondents also indicated a strong agreement with the statement, but six (6) respondents disagreed with this statement, and one (1) respondent strongly disagreed. Ten (10) respondents were unsure as to whether the CoEs could optimise their archival operations through automated predictive maintenance, enhanced efficiency and fraud detection. Figure 4.10 presents the quantitative data collected.

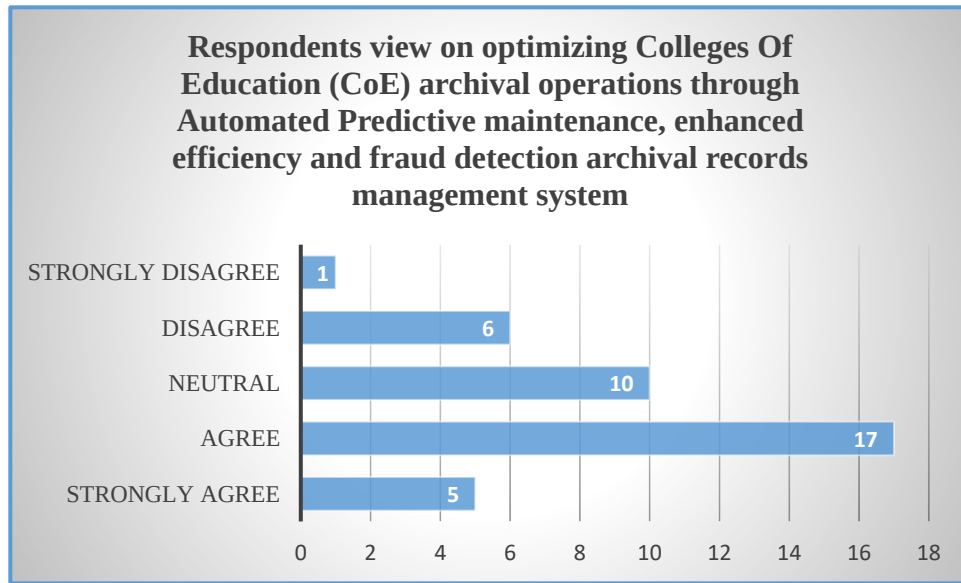


Figure 4.10: Respondents' views on optimising the archival operations of CoEs (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe how they thought AECCT could enhance archival operations in the CoEs, particularly in areas such as system maintenance, efficiency, and fraud-prevention procedures that influence record-keeping and access.

Twenty (20) respondents indicated that AECCT could help by detecting problems in the system before they occurred; 14 respondents indicated that an AECCT could track access logs, detect unusual patterns and alert them immediately. Two (2) respondents were of the view that implementing AECCT in the management of archived records could make it easier to back up and retrieve records, stating that adding AI meant that the system could auto-organise files, schedule updates and even optimise storage space. Lastly, two (2) respondents stated that incorporating AI would make the system more reliable. The responses were as follows:

Respondents 1–20	<i>Using AI can help us detect problems in the system before they even happen. For example, if a file is frequently accessed or tampered with, the AI can flag it. That kind of predictive maintenance would save us from sudden system breakdowns and help protect sensitive records from manipulation.</i>

Respondents 21–34	<i>In terms of fraud detection, AI would be a game changer. It can track access logs, detect unusual patterns, and alert us immediately. Sometimes people manipulate student records or financial documents. With AI, such actions can be traced faster and more accurately.</i>
Respondents 35–36	<i>Cloud computing makes it easier to back up and retrieve records, but adding AI to it means the system can auto-organise files, schedule updates, and even optimise storage space. It reduces downtime and makes the entire archival operation more efficient, especially in large colleges.</i>
Respondents 37–39	<i>I think AI would make the system more reliable. It can help make sure records don't go missing, and if someone tries to change anything in the archives, it will show. That makes the whole system more trustworthy and saves time too when we need to get old files or transcripts.</i>

In the interviews, participants were requested to provide their opinions on whether the use of AECCT could simplify archival operations at the CoE through automated predictive maintenance, enhanced efficiency and fraud detection. Their responses were coded thematically into six (6) categories to determine the key insights concerning awareness, accessibility, and utilisation. The following responses were captured:

Participants 1–4	<i>AI will transform the way records are managed. It will help predict and prevent system failures, improve the speed of operations and detect irregularities. This will bring better control and transparency into archival processes.</i>
Participants 5–10	<i>The efficiency that AI brings cannot be overstated. Tasks that used to take hours can now be done within minutes with fewer errors. It will surely improve productivity and reduce stress on the records management workforce.</i>

Participants 11–15	<i>AI can track activities in the system and flag suspicious actions, which is key for fraud prevention. Also, its ability to keep data clean and organised is a great plus for CoEs record systems.</i>
Participants 16–20	<i>AI can help us work faster and smarter. If a file is misfiled or altered, the system can alert us instantly. That's a big deal for productivity and service delivery.</i>
Participants 21–24	<i>Honestly, I see the potential, but we're not there yet. AI can do great things, but we need the infrastructure and training. Until then, it's just a good idea on paper.</i>
Participant 25–26	<i>These technologies sound promising, but their impact depends on execution. If not tailored to our institutional needs, we might not fully benefit from them.</i>

4.5.4 Archival records practitioners would lose their jobs if AECCT is implemented in the CoEs of Ghana

The survey posed closed-ended questions regarding respondents' perceptions of the possibility of archivists and records managers practitioners losing their jobs if AECCT were integrated into CoEs archival records system. The findings reported in this section capture the perceptions and expectations of respondents and participants, varying from faith in AI being a powerful machine to doubt over its actual use.

The results indicated that 17 respondents believed that the introduction of an AECCT could potentially result in archivists and records managers practitioners losing their jobs, if the system was integrated into the archival records operations of the CoEs. Six (6) respondents strongly disagreed with this statement, while three (3) disagreed. Thirteen (13) respondents were unsure whether the implementation of an AECCT might lead to job losses among archivists and records management practitioners, if AECCT were integrated into the CoEs archival records system.

The bar chart in Figure 4.11 illustrates the quantitative findings.

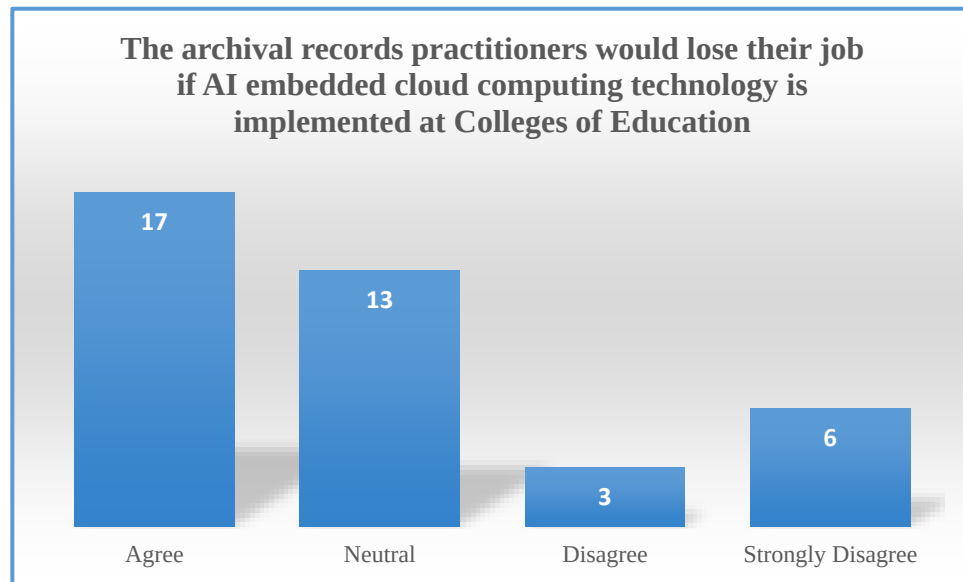


Figure 4.11: Respondents' perception of AECCT implementation resulting in job losses of archival records practitioners (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe their concerns about archival records practitioners potentially losing their jobs if AECCT was introduced in CoEs. One (1) respondent noted that it was a valid fear, "... especially for those of us who have been doing this job manually for years". A total of 17 respondents stated that the goal of adopting AI should not be to render people jobless, but to increase efficiency. Twelve (12) respondents expressed doubts that people would be replaced immediately, noting that some roles would become less important over time. Nine (9) respondents believed the technology would improve access, although they were concerned about the human side and how it could affect people's jobs.

The responses were as follows:

Respondent 1	<i>I think it's a valid fear, especially for those of us who have been doing this job manually for years. But I also believe that instead of losing our jobs, we should be trained to work alongside the</i>

	<i>technology. We already know the content and structure of the archives; AI just makes the work faster and more accurate.</i>
Respondents 2–18	<i>The goal of adopting AI should not be to render people jobless but to increase efficiency. Roles will shift, yes, but we will always need humans to manage, audit, and interpret data. If we plan the implementation properly, we can upskill our current staff to remain relevant in the new system.</i>
Respondents 19–30	<i>I don't think the fear is that people will be immediately replaced, but that some roles will become less important over time. However, this also creates opportunities. For instance, someone who was just filing papers could now be trained as a digital records analyst. It depends on how the transition is handled.</i>
Respondents 31–39	<i>I think the technology will improve access, but I also worry about the human side. The people working in archives have families to feed. Maybe the system can be introduced gradually so workers can adapt and get trained instead of just being replaced.</i>

The responses of the participants reflect a broad spectrum of views regarding the impact of AECCT on job security among practitioners of archival records in the CoEs. Their responses were coded thematically into seven (7) categories to determine the key insights about awareness, accessibility and utilisation. The views reflected different levels of concern, neutrality and reassurance regarding the future of human involvement in archival management systems.

Responses from participants were summarised as follows:

Participants 1–7	<i>The more we digitise and use AI, the fewer hands will be needed to do the work. Most of what we do now can be automated, and that worries me about job losses.</i>

Participants 8–10	<i>Yes, it could affect jobs, but not entirely. Some positions may become obsolete, but others will evolve. Practitioners must be willing to adapt to new technologies</i>
Participants 11–15	<i>It could go either way. AI might take over some tasks, but there will still be roles for humans to play especially where human judgement and supervision are needed.</i>
Participants 16–20	<i>Maybe some roles will disappear, but others could be created. The real question is whether workers will be ready to learn the new skills needed to stay relevant.</i>
Participants 21–22	<i>AI is just a tool. People will still be needed to interpret data, manage systems, and handle exceptions that machines can't deal with</i>
Participants 23–25	<i>I don't see AI as a threat. It should help us do our work better, not eliminate our roles. Practitioners are still key to decision-making and quality control.</i>
Participant 26	<i>Human input will always be essential. AI can assist but not fully replace the expertise and discretion of archival professionals.</i>

4.6 Usability of AECCT in the management of digital archival records in the CoEs of Ghana

The analysis regarding the usability of AECCT in the management of digital archival records in the CoEs in Ghana was premised on the third research objective and research question:

Research Objective 3: Examine the usability of AECCT in the management of digital archival records in the CoEs of Ghana.

Research question 3: What is the usability of AECCT in the management of digital archival records in the CoEs of Ghana?

An array of questions was posed to respondents and research participants via administered questionnaires and interviews to collect answers to address this research objective and answer the research question.

4.6.1 Proficiency level in AI skills

The survey posed both closed and open-ended questions that aimed at measuring the self-reported competence and confidence of the respondents in using AI-related skills and capabilities in digital archival management situations. AI proficiency was defined by respondents' self-reported exposure to AI concepts, involvement in AI training or courses, familiarity with AI-enabled digital systems, previous experience with automated or intelligent systems, and confidence in using AI systems. The study did not use formal skills testing or professional certification methods, and the skill levels reported should be interpreted as perception-based self-assessments, not technical skills testing.

For the purposes of clarity, proficiency levels were categorised as follows;

- No proficiency: referring to individuals with little or no exposure, awareness or hands-on and practical interaction with AI-related technologies.
- Basic proficiency: referring to individuals with general digital literacy and surface-level understanding of AI concepts or rudimentary exposure to AI-enabled systems, but without substantial practical experience.
- Intermediate proficiency: referring to individuals who had participated in some foundational training or course in AI and related fields, showing conceptual awareness but limited hands-on engagement with AI tools.
- Advanced proficiency: referring to individuals with strong familiarity and advanced exposure to AI tools and applications, such as data analytics, automation, with express confidence in applying such technologies in a professional setting.

Based on these categories, a total of 16 respondents had a basic proficiency level in AI skills; five (5) respondents had an intermediate proficiency level in AI skills; three (3) respondents had advanced proficiency levels; and eleven (11) respondents had no proficiency in AI skills. Four (4) respondents possessed expert proficiency in AI skills. Figure 4.12 illustrates the quantitative data obtained.

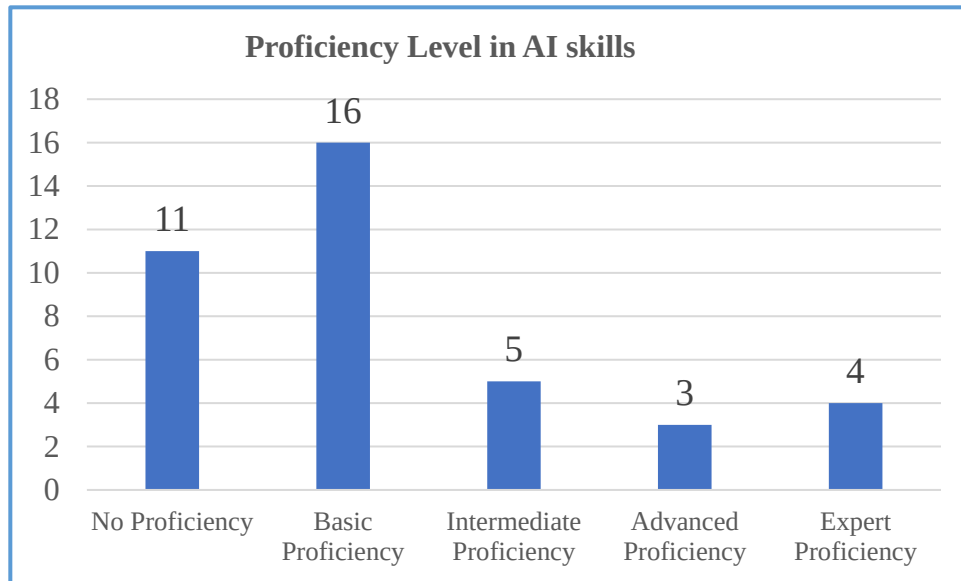


Figure 4.12: AI Proficiency (N = 39)

Through open-ended questions in the questionnaire, respondents were asked to describe their current level of proficiency in AI-related skills, and how confident they were about using AI-based systems in their work. Ten (10) respondents had taken online courses on machine learning (ML) and AI in education, which meant that they understand the concepts and could work with some tools, while 20 respondents responded that they had little to no experience with AI. Nine (9) respondents stated that they were at the elementary level and, although they were generally comfortable using technology, AI-specific systems were still unfamiliar to them. The responses were as follows:

Respondents 1–10	<i>I would say my proficiency is intermediate. I enrolled for a few online courses on machine learning and AI in education, so I do understand the concepts and can work with some tools. However, the whole idea of applying AI to specifically manage archival records is still new to me. I'm sure I'll need some practical training to feel fully confident.</i>
Respondents 11–30	<i>To be honest, I have little to no experience with AI. I've heard of it, but I've never used any AI tool before. My work has always been paper-based, and while I'm open to learning, I'd need a</i>

	<i>structured training program to even get started with basic AI skills.</i>
Respondents 31–39	<i>I'd say I'm at a beginner level. I'm generally comfortable with using technology, but I'm unfamiliar with using AI system. I am however confident that I could learn quickly if given the opportunity. I already have experience with Google Drive and SharePoint.</i>

In the interview, participants also shared their views on their level of proficiency in AI-related skills. Their responses portrayed varying levels of familiarity and proficiency with AI-based systems, with the implications having significant effects on the ease of use and appropriateness in digital archive management.

The following are examples of the qualitative responses given by five participants:

Participant 1–5	<i>I am very confident when it comes to using AI-based tools. I've taken personal training in data analytics and AI, and this has made it easier for me to navigate such platforms. I believe AECCT will greatly enhance our records management if more staff are trained.</i>
Participant 6–15	<i>I have a fair level of knowledge in AI tools, particularly those integrated into cloud platforms. While I may not be an expert, I can confidently operate most systems and adapt quickly to new technologies. I think usability challenges are more about exposure and training than the technology itself.</i>
Participant 16–20	<i>I'm comfortable with using cloud systems, though I still need guidance with some AI functionalities. I think most of us are willing to learn, and once training is provided, we'll be able to fully utilise these tools for efficient records management.</i>
Participant 21–24	<i>Honestly, I've not had much hands-on experience with AI tools. I mostly rely on traditional record systems. Though I'm open to learning, I would require thorough training before I can confidently say AI systems are usable for my work.</i>

Participant 25–26	<i>My knowledge of AI is limited. I often find it difficult to understand the functionalities of such systems. For now, I prefer manual systems, unless consistent training and technical support are provided. Otherwise, these technologies might not be fully usable for people like me.</i>

4.6.2 Frequency of application of AI skills in existing role

The survey posed closed-ended questions to respondents regarding their insights into the common use of AI abilities in their current job activities. The accounts presupposed different perceptions and assumptions, from strong confidence in AI capabilities to guarded neutrality about its real influence.

A total of 13 respondents used their AI skills only occasionally in their existing roles; 14 respondents reported rarely using AI skills in their existing roles; 9 respondents reported never using AI skills in their existing roles; and 3 respondents reported often using AI skills in their existing roles or positions. The pie chart in Figure 4.13 illustrates these quantitative findings.

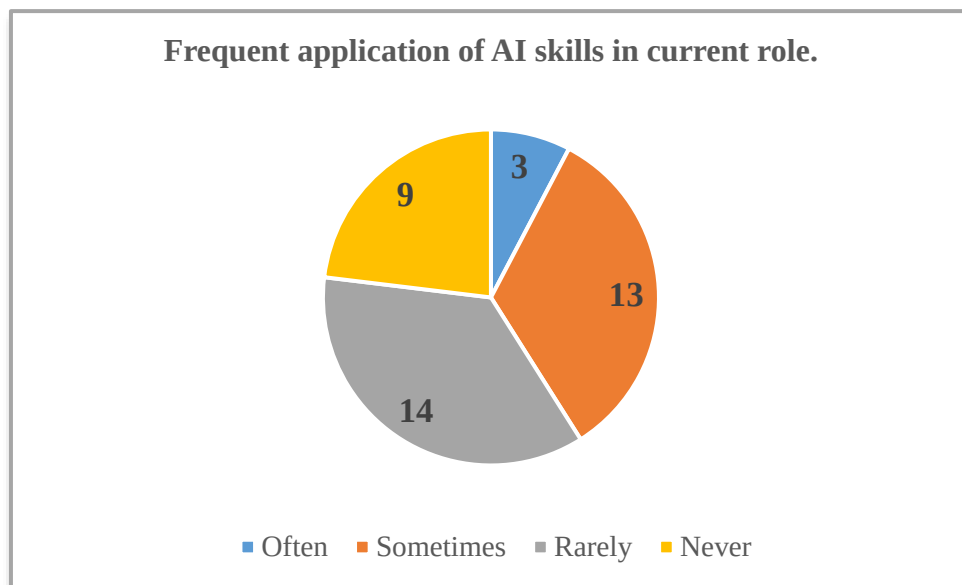


Figure 4.13: Frequency of application of AI skills in current role (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe how often they applied AI-related skills in their existing roles, and in what ways (if any) these skills supported their daily tasks. Two (2) respondents revealed that they used AI-related skills quite frequently, particularly in troubleshooting and managing digital learning platforms. A total of 18 respondents indicated that they were not currently applying AI-related skills, as most of their tasks were performed manually. Ten (10) respondents stated that they rarely used AI tools directly, and nine (9) respondents indicated they did not actively use AI tools in their existing roles: “Our HR records are not yet digitised enough to allow AI use, but I’ve seen how chatbots and predictive software could help with employee queries and performance tracking if implemented”.

The following responses were given:

Respondents 1–2	<i>I use AI-related skills quite frequently, especially in troubleshooting and managing digital learning platforms. I also use automated systems for data backup and security alerts. These skills save time and help me respond faster to technical issues that staff and students report.</i>
Respondents 3–20	<i>At the moment, I don’t really apply any AI skills in my role. Most of our work is still done manually. I do believe AI could help with sorting, searching, and preserving documents more efficiently, but we haven’t received the training or systems to do that yet.</i>
Respondents 21–30	<i>I rarely use AI tools directly. However, I occasionally interact with automated systems that organise files or send reminders for document updates. Most of my work is still done manually or with basic digital tools like Microsoft Word and Excel.</i>
Respondents 31–39	<i>Honestly, I don’t actively use AI tools in my role. Our HR records are not yet digitised enough to allow AI use. But I’ve seen how chatbots and predictive software could help with employee queries and performance tracking if implemented.</i>

The effective use of AECCT is strongly influenced by the frequency with which staff engage with AI-related skills in their current roles. Participants' perceptions varied according to their level of interaction with AI in their daily work. The following are summarised qualitative responses representing the main data categories established in the interview responses:

Participant 1	<i>In my daily activities, I frequently use AI enhanced systems, especially for document classification and sorting. These tools save time and reduce manual errors. Applying AI has become routine in my work, and I believe others can also benefit if given the opportunity.</i>
Participant 2–10	<i>I occasionally apply AI tools in tasks like data analysis or automating certain documentation processes. Although not all duties require AI, I have integrated it into some aspects of my role, which has improved speed and accuracy.</i>
Participant 11–15	<i>I rarely get to use AI in my current role. Most of the systems we use are still manual or semi-digital. Although I understand AI tools exist, I don't get the chance to use them often in practice.</i>
Participant 16–20	<i>My tasks don't really demand the use of AI tools, so I've not had the opportunity to apply them regularly. I think if our institution incorporated AI systems more broadly, then my usage would naturally increase.</i>
Participant 20–26	<i>I hardly use AI tools at all. Most of our work is paper-based or done through simple digital systems without AI functionalities. The lack of infrastructure and training limits our application of AI in practice.</i>

4.7 AECCT infrastructure to manage the digital archival records in the CoEs of Ghana

AECCT infrastructure in the management of digital archival records was assessed, in order to address Research Objective 4 and to answer Research Question 4:

Research Objective 4: To identify the AECCT infrastructure for the management of digital archival records in the CoEs of Ghana.

Research question 4: Which AECCT infrastructure would be effective in the management of digital archival records in the CoEs of Ghana?

An array of questions was posed to respondents and research participants via administered questionnaires and interviews to obtain primary data to address this research objective.

4.7.1 AECCT infrastructure experience in machine learning (ML)

The survey posed closed-ended questions to respondents to provide insights into their exposure to, familiarity with, and practical experiences with machine learning technologies in the context of AECCT infrastructure. The responses obtained largely reflect personal-level experimentation and exposure or professional curiosity with machine learning technologies rather than formalised institutional adoption or deployment within the CoEs. The narratives reflected a variety of expectations and levels of understanding, ranging from high confidence in the capabilities of AI to experience in machine learning regarding its actual impact. A total of 12 respondents had moderate experience in machine learning with regard to AECCT infrastructure; 15 respondents had a basic experience in machine learning with regard to AECCT infrastructure; 11 respondents had no experience in machine learning with regard to AECCT infrastructure; and one (1) respondent had advanced experience in machine learning with regard to AI-embedded cloud computing technology infrastructure. Figure 4.14 illustrates these quantitative findings.

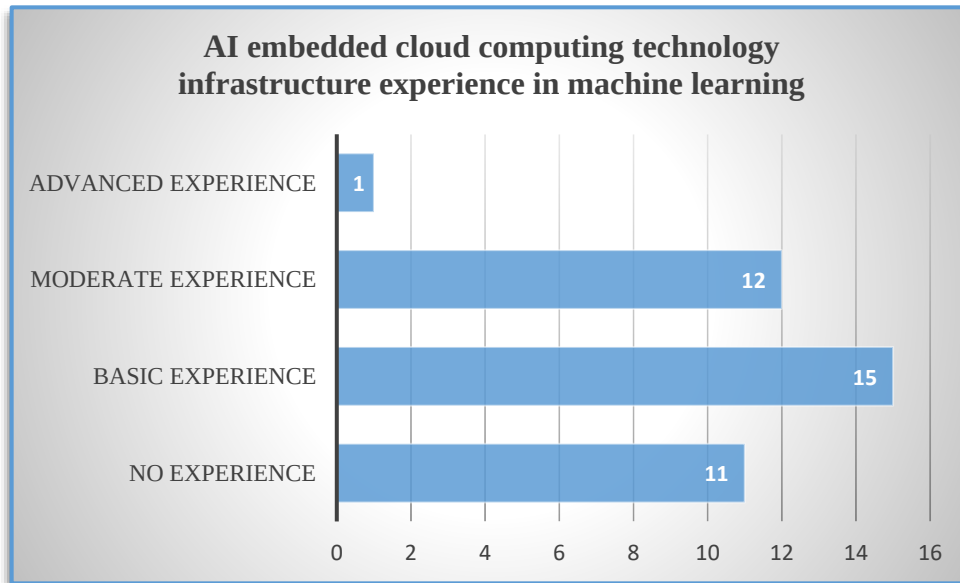


Figure 4.14: AECCT infrastructure experience in machine learning (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe their experience or exposure to machine learning infrastructure within the AECCT used at their college.

A total of 20 respondents reported having hands-on experience with machine learning using Google Cloud tools; ten (10) respondents had limited experience, although they had read about machine learning in the context of cloud computing; and five (5) respondents stated that they had not had direct interaction with machine learning systems but had attended a webinar that demonstrated how machine learning could help with recruitment and performance tracking. Finally, four (4) respondents stated that they had set up cloud-based servers before, but integrating ML models into them was something they were exploring. The following responses were given:

Respondents 1–20	<i>I have some hands-on experience with machine learning through Google Cloud's AI tools. I experimented with automated document classification for our digital archives, where the system suggested tags for student records. But we</i>

	<i>haven't officially adopted any ML infrastructure college-wide yet.</i>
Respondents 21–30	<i>To be honest, my experience is quite limited. I've read about machine learning in the context of cloud computing, but we don't have any tools or infrastructure that we actively use in our office. We mostly use basic cloud storage like Google Drive for documentation.</i>
Respondents 31–35	<i>I haven't had direct interaction with machine learning systems, but I've attended a webinar that demonstrated how machine learning can help in recruitment and performance tracking. It opened my eyes to the possibilities, but our college doesn't have the infrastructure yet.</i>
Respondents 36–39	<i>I've set up cloud-based servers before but integrating ML models into them is still something I'm exploring. We did a pilot test with a simple model that predicts frequent file access patterns to optimise our archive retrieval system, but it was just for trial.</i>

Interview participants provided varying insights regarding the AECCT infrastructure experience in machine learning. The following are synthesised qualitative responses representing the primary categories identified in the data:

Participant 1	<i>I honestly don't have any prior experience working with machine learning systems. I have heard about AI and its applications, but I haven't had the opportunity to interact with machine learning tools within my work environment. Everything I know is theoretical, and I believe there is a significant gap in training and exposure at the institutional level.</i>
Participants 2–15	<i>I've had some basic exposure to machine learning, mainly through online seminars and reading materials. I can understand the concept and see how it can benefit archival record systems, especially in automating repetitive tasks. However, practical implementation is still limited here at the College, and we need infrastructure and training to take it further.</i>

Participants 16–20	<i>I've worked on a few small-scale projects where machine learning tools were introduced for predictive analytics and file classification. From that experience, I understand how valuable it can be in streamlining archival processes, particularly in indexing and record retrieval. The challenge is the lack of institutional infrastructure to scale these ideas up.</i>
Participants 21–24	<i>My background in IT has allowed me to explore machine learning in depth. I've been involved in applying machine learning algorithms for document clustering and pattern detection. In my opinion, if CoEs could integrate such AI tools into cloud systems, it would greatly transform the speed, accuracy, and security of archival records management.</i>
Participants 25–26	<i>While I'm not an expert, I've experimented with AI tools that utilise machine learning capabilities such as automated tagging and content recognition. It's fascinating to see how such technologies could reduce the workload in records management. However, our current systems are far from supporting such innovations on a large scale.</i>

4.7.2 AECCT infrastructure experience in natural language processing (NLP)

The survey posed closed-ended questions to respondents to provide insights into their AECCT infrastructure experience in natural language processing. The narratives reflected different levels of understanding and diverse expectations, ranging from high confidence in AI's capabilities to experience with natural language processing regarding its actual impact.

A total of 19 respondents had moderate experience in natural language processing with regard to AECCT infrastructure; six (6) respondents had basic experience in natural language processing with regard to AECCT infrastructure; 13 respondents had no experience in natural language processing with regard to AECCT infrastructure; and one (1) respondent had advanced experience in natural

language processing with regard to AECCT infrastructure. Figure 4.15 illustrates these quantitative findings.

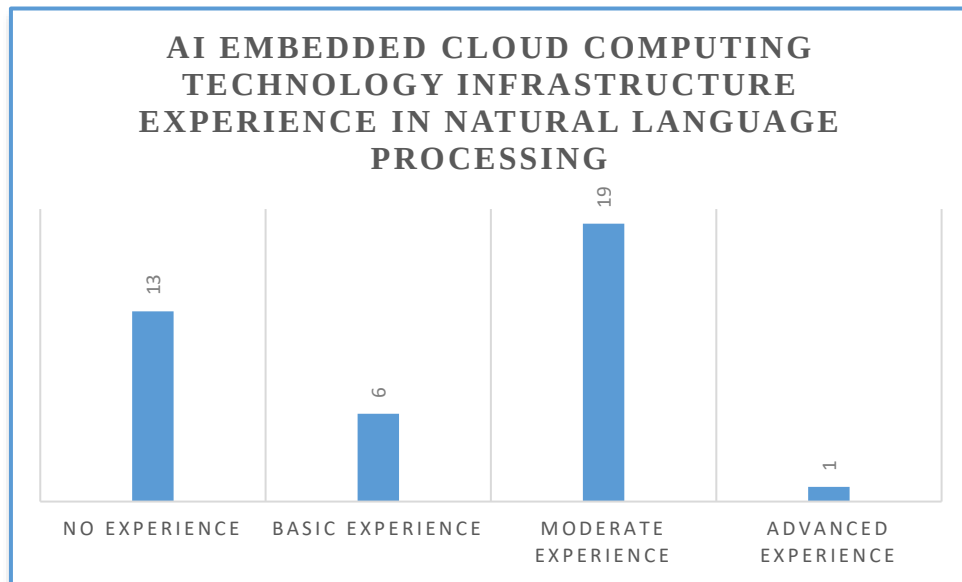


Figure 4.15: AECCT infrastructure experience in NLP (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe their experience in or exposure to natural language processing (NLP) features or tools within any AI-based cloud systems at CoE.

A total of 20 respondents reported exploring NLP features as part of a pilot document automation project, and 14 respondents indicated they had not received direct training in NLP but had noticed that the cloud email system they used often suggested responses based on message content. Two (2) respondents stated that they had not officially deployed NLP tools, but had once used a free online AI tool to help paraphrase and correct the grammar of an internal memorandum. Finally, three (3) respondents stated that their team integrated a beta chatbot for internal use in the previous semester, mainly to answer their frequently asked questions (FAQs).

The responses were as follows:

Respondents 1–20	<i>Yes, I've explored NLP features as part of a pilot document automation project. We used a tool that could extract keywords and summarise handwritten scanned notes into digital records. It really helped reduce the time we spent manually categorising the archived documents.</i>
Respondents 21–34	<i>I have not had direct training on NLP, but I noticed that the cloud email system we use often suggests responses based on the message content. These smart replies make my communication faster. I suppose that's NLP in action, though I haven't used it for archiving tasks yet.</i>
Respondents 35–36	<i>We haven't officially deployed NLP tools, but I once used a free online AI tool to help paraphrase and correct the grammar of an internal memo. It understood my writing well and improved it. I think if we had a full NLP system, it could help with writing official reports and screening staff documents.</i>
Respondents 37–39	<i>Our team integrated a beta chatbot last semester for internal use, mainly to answer IT FAQs. It used NLP to interpret natural questions and respond accordingly. Though it wasn't perfect, it showed how NLP could assist in reducing staff workload by automating routine information delivery.</i>

Interview participants provided varying insights based on their AECCT infrastructure experience in natural language processing. The following are synthesised qualitative responses representing the major data categories.

Participants 1–10	<i>I really don't have any practical experience with natural language processing. I've read about its use in digital systems, but I haven't used any tools or platforms that apply NLP. I have no practical experience with it at our college, there has not been any opportunity or training that exposes us to how this technology can be used to manage archival records.</i>

Participants 11–18	<i>I have a basic understanding of NLP and how it functions, particularly in translating text or recognising keywords in large datasets. My experience comes mainly from watching demonstration videos and attending webinars. Though I've not used it extensively, I believe it can be beneficial in improving how we search and retrieve records in our digital archive systems.</i>
Participants 19–22	<i>I've worked with a few tools that utilise NLP, especially in document classification and extracting key phrases from digital records. From my experience, NLP can improve the searchability of records and even assist in summarising large text files. These features could revolutionise archival management if we integrate them effectively with AI-cloud systems.</i>

Participants 23–24	<i>I have advanced experience with NLP tools. I've used platforms that apply NLP algorithms to sort, index, and even interpret large volumes of text data automatically. If such tools are incorporated into our cloud archival systems, it would significantly enhance data accessibility, reduce manual sorting, and even improve decision-making by drawing meaningful insights from text data.</i>
Participants 25–26	<i>My moderate experience with NLP comes from my involvement in research-based digital projects. I've seen how NLP can be used for sentiment analysis, document classification, and language translation. If the CoEs can adopt this technology, it will make archival data more interactive, efficient, and easier to manage.</i>

4.7.3 AECCT infrastructure experience in automatic rules

The survey posed closed-ended questions to respondents to provide insights into their AECCT infrastructure experience with automatic rules. The narratives

reflected various understandings and expectations, ranging from high confidence in AI's capabilities to experience with automated rules regarding its actual impact.

Nineteen (19) respondents had moderate experience in automatic rules with regards to AECCT infrastructure; eight (8) respondents had a basic experience with automatic rules with regards to AI-embedded cloud computing technology infrastructure; ten (10) respondents had no experience in automatic rules with regards to AI-embedded cloud computing technology infrastructure; and two (2) respondents had advanced experience in automatic rules with regards to AI-embedded cloud computing technology infrastructure. The bar chart in Figure 4.16 illustrates the quantitative findings collected.

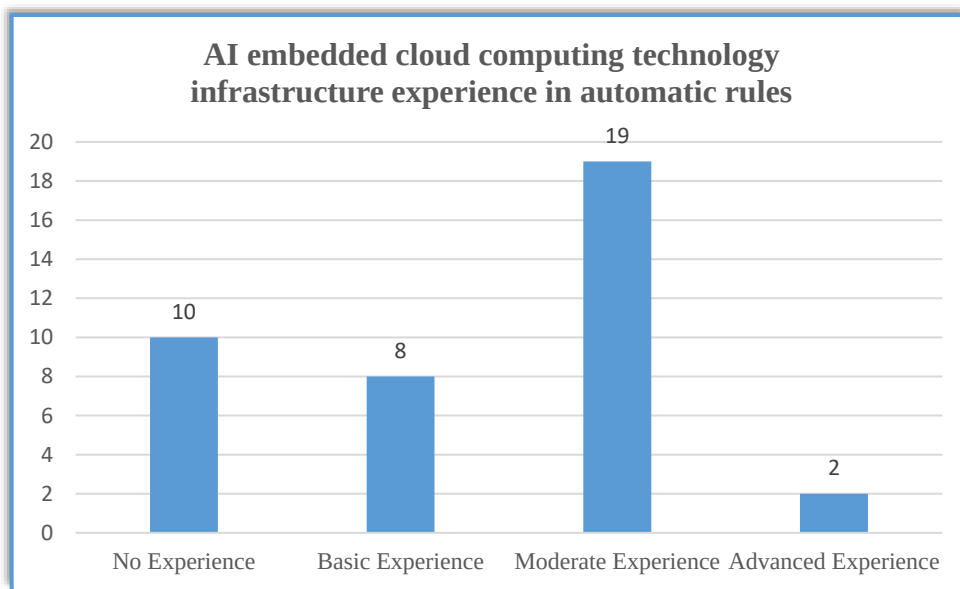


Figure 4.16: AECCT infrastructure experience in automatic rules (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe their experience with AI-embedded cloud systems that use automated rules (such as auto-sorting, auto-backup or predictive alerts) for managing archival records or data. If they had no experience, they were asked what they thought such features could support in their work.

One (1) respondent indicated that he had limited experience with the auto-backup settings in Microsoft Azure and with Google Workspace rules that auto-organise shared folders. Nine (9) respondents indicated that they had not used such features directly but had observed automated sorting in email and basic cloud drives. Ten (10) respondents stated that they had not used such features directly but had seen how automated sorting works in email and basic cloud drives. Nine (9) respondents indicated that they experimented with auto-sorting scripts for internal file servers, but nothing deeply integrated with AI yet.

The responses were as follows:

Respondents 1–8	<i>Yes, I've had limited experience using Microsoft Azure's auto-backup settings and Google Workspace rules that auto-organise shared folders. They're quite effective in reducing manual work. If we could extend these to archive systems, tasks like sorting student files or flagging duplicate entries would become faster and less prone to human error.</i>
Respondents 8–15	<i>I have not used such features directly, but I've seen how automated sorting works in email and basic cloud drives. If similar systems were applied to our archives, it would save a lot of time and reduce our dependence on paper-based systems. I believe these technologies can really enhance our document management if we get the right support.</i>
Respondents 19–30	<i>I've not worked with any AI system that uses automatic rules, but I think it would help a lot. For example, auto-reminders for expiring contracts or auto-tagging of HR documents would make our work more organised. We still do most things manually, so introducing those tools would be a game changer.</i>
Respondents 31–39	<i>I've experimented with auto-sorting scripts for internal file servers, but nothing deeply integrated with AI yet. The idea of predictive alerts for server overload and missing backups is exciting. These features can help prevent data loss and reduce downtime, especially in a college setting where it is critical.</i>

Interview participants provided varying insights based on their AECCT infrastructure experience in automatic rules. Below are synthesised qualitative responses representing the major data categories in the interview responses.

Participants 1–8	<i>I have not had any hands-on experience with automatic rules in AI systems. The concept sounds interesting, but I've not worked in any environment where such systems are used. In our current records management practices, everything is done manually, and automation is still far from implementation</i>
Participants 8–15	<i>I've had some basic exposure to automatic rules, mostly from online training modules and reading. I understand it as the ability of AI systems to perform tasks based on predefined conditions. Though I haven't practised this extensively, I believe it can reduce routine tasks in archival management</i>
Participant 16–23	<i>With moderate experience in using automatic rules, I have seen how they can streamline operations. In one of my previous training sessions, I learned how automatic categorisation and indexing of records can help reduce human error and improve workflow. This technology can be a game-changer if introduced into the records systems of our CoE.</i>
Participants 24–25	<i>I've worked with AI tools that rely heavily on automatic rules. For example, rules that automatically archive inactive records or trigger reminders for review dates. These tools can drastically enhance the efficiency of managing digital archival records. If well implemented in the CoEs, it will not only reduce workload but also ensure consistency in records handling.</i>
Participant 26	<i>Although I'm not deeply experienced, I've explored basic features of automatic rule settings in cloud platforms. These include rule-based access controls and automated responses to data changes. Even such basic applications can improve productivity in our archival operations by eliminating repetitive tasks and ensuring accuracy.</i>

4.7.4 AECCT infrastructure experience in neural networks

The survey posed closed-ended questions to respondents to provide insights into their experiences with neural networks in AECCT infrastructure. The narratives reflected varying levels of understanding and diverse expectations, ranging from high confidence in AI's capabilities to experiences with neural networks and their actual impact.

Nine (9) respondents had moderate experience with neural networks for AECCT infrastructure; 13 respondents had basic experience with neural networks for AECCT infrastructure; 15 respondents had no experience with neural networks for AECCT infrastructure; and two (2) respondents had advanced experience with neural networks for AECCT infrastructure. Figure 4.17 summarises the quantitative findings on experience with neural networks for AECCT infrastructure.

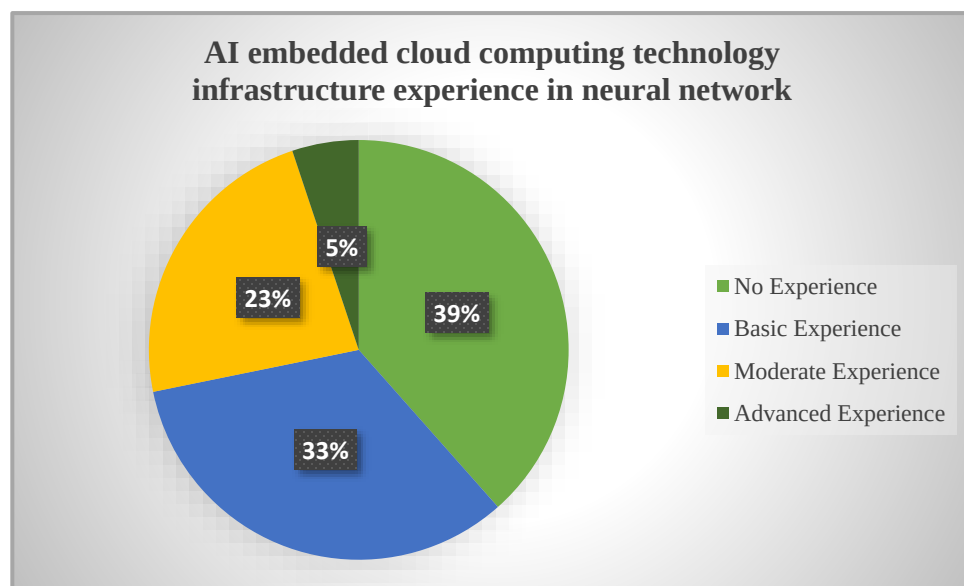


Figure 4.17: AECCT An experience in neural networks (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe their exposure to or experience with neural network systems (such as pattern recognition, predictive modelling, or intelligent automation) at their institution using AECCT.

A total of 15 respondents reported having read about and taken online courses on neural networks, particularly their use in pattern recognition. However, they indicated that they had not yet implemented any system using neural networks at their institutions. Fifteen (15) respondents reported that they did not have any hands-on experience with neural networks. The concept was still quite technical for most of them in administrative roles. Five (5) respondents stated that they had not used neural networks before and that the term was new to them. Finally, four (4) respondents stated that they had not personally deployed any neural network tools, but had seen demonstrations of their use in advanced data processing.

The responses were as follows:

Respondents 1–15	<i>I've read and taken a few online courses on neural networks, particularly their use in pattern recognition. But at the institutional level, we haven't implemented any system using neural networks yet. I believe they can be very useful in predicting document retrieval trends, automatically organising files, or even detecting irregularities in student records.</i>
Respondents 16–30	<i>I don't have any hands-on experience with neural networks. The concept is still quite technical for most of us in admin roles. But if it can learn from our filing patterns and make smart suggestions or even automate parts of our archiving, then I think it would be a great innovation for our records management system.</i>
Respondents 31–35	<i>No, I haven't used neural networks before, and honestly, the term is new to me. But if it can help in identifying staff record gaps, automate evaluation processes, or alert us to compliance issues, then I think it would be helpful. However, staff would need training to understand and trust such a system.</i>
Respondents 36–39	<i>I haven't deployed any neural network tools personally, but I've seen demos of how they're used in advanced data processing.</i>

	<i>If integrated into our cloud system, they could intelligently classify and index archive documents. It's a step beyond rule-based automation and could significantly reduce workload if done right.</i>

The interview narratives reflected participants' varying levels of familiarity with and engagement in neural network applications for digital archival records management within the CoEs of Ghana. Participants provided insights based on their experience with AECCT infrastructure for neural networks. The following synthesised qualitative responses represent the major data categories obtained from the interviews.

Participants 1–9	<i>I have heard about neural networks in ongoing discussions around AI, but I do not have any direct experience with their use. In our institution, such advanced technologies are not yet part of our operational systems. I believe more sensitisation and training are needed before such tools can be adopted for archival records management</i>
Participants 10–19	<i>My experience with neural networks is very basic. I've encountered the concept during an online course and understand that they mimic human brain functions to make predictions or classifications. While I haven't used them practically, I see the potential for such technology to help in organising and analysing archival records more intelligently.</i>
Participants 20–24	<i>I've had moderate exposure to neural networks through workshops and digital systems training. These networks can identify patterns in large datasets, which can help in streamlining digital records. For example, a neural network could be used to detect duplicates or misfiled records in a large archive. Though not widely used at my college, I see immense potential in applying this to improve our archival systems</i>

Participant 25	<i>I've worked on a project where neural networks were used for document classification and predictive modelling. This level of automation could greatly enhance the management of archival records at CoEs. Neural networks could assist in automatically tagging and organising records based on content analysis, making retrieval more efficient and accurate.</i>
Participant 26	<i>Although I've only interacted with neural networks at a fundamental level, I appreciate their application in identifying trends and relationships in data. In digital archives, this could mean better forecasting of record usage patterns and proactive management of archival materials. It's a technology we should begin considering for institutional improvement.</i>

4.7.5 AECCT infrastructure experience in cloud-embedded electronic records management systems

The survey posed closed-ended questions to respondents to provide insight into their experience of AECCT infrastructure within cloud-embedded electronic records management systems. The narratives reflect varying levels of understanding and a diversity of expectations, ranging from high confidence in the capabilities of AI to experiences of its actual impact.

The results showed that ten (10) respondents had moderate experience with cloud-embedded electronic records management systems in relation to AECCT infrastructure.

A total of 14 respondents indicated having basic experience with cloud-embedded electronic records management systems related to AECCT infrastructure, and ten (10) respondents indicated having no experience with cloud-embedded electronic records management systems using AECCT infrastructure. Five (5) respondents indicated that they had advanced experience with cloud-embedded electronic records management systems using AECCT infrastructure. Figure 4.18 reflects these quantitative findings.

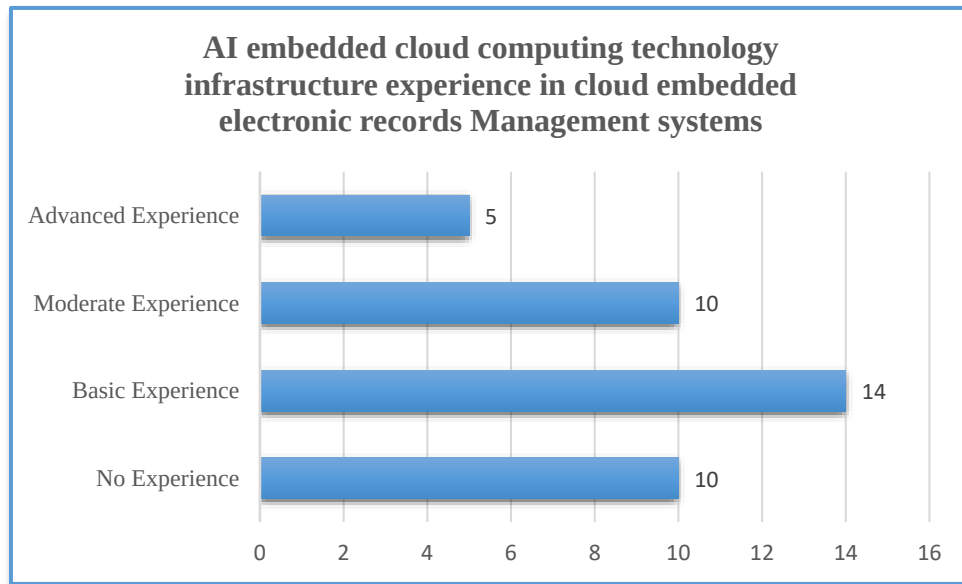


Figure 4.18: AECCT experience in cloud-embedded electronic records management systems (N = 39)

Through open-ended questions in the questionnaire, respondents were asked to describe their experience with any cloud-based electronic records management systems (ERMS) incorporating AI features.

Five (5) respondents reported working with an open-source ERMS with basic AI features, such as smart search and automatic classification of uploaded documents, while 15 reported that they had not used such a system directly but had seen demonstrations during a workshop.

They described the observed ERMS's performance as impressive, citing its ability to retrieve files instantly, sort them by relevance, and restrict access based on assigned roles. Ten (10) respondents stated that, although they had no personal experience of using such systems, they strongly supported their introduction. Finally, nine (9) respondents reported having tested Google Workspace integration and also supported a pilot with M-Files, a cloud ERMS with AI-driven tagging. The responses were as follows:

Respondents 1–5	<i>Yes, I've worked with an open-source ERMS that had basic AI features like smart search and automatic classification of uploaded documents. It wasn't fully optimised, but it showed how powerful such systems can be in reducing human workload and improving file accessibility. I believe a more robust version could transform how records are managed in our colleges.</i>
Respondents 6–20	<i>I haven't used one directly, but I've seen demonstrations during a workshop. Its ability to retrieve records instantly and sort files by relevance is impressive. Its implementation could save us a lot of time and reduce the risk of losing important documents.</i>
Respondents 21–30	<i>I haven't had any personal experience using such systems, but I strongly support their introduction. Filing and retrieving documents is time-consuming. An AI-embedded cloud ERMS could make it easier to manage staff records and improve data security. What we need is a system that is user-friendly and doesn't require heavy technical skills.</i>
Respondents 31–39	<i>Yes, I've tested Google Workspace integration and also supported a pilot with M-Files, a cloud ERMS that had AI-driven tagging. The system suggested categories and grouped documents automatically. It made archiving smoother and reduced duplication. If rolled out across the college, it would boost efficiency and accountability.</i>

The participants' interview responses reflected varying levels of experience and perspectives on using this infrastructure to manage digital archival records. The following synthesised qualitative responses represent the major data categories in the interview responses.

Participants 1–7	<i>I haven't had any hands-on experience with cloud-embedded electronic records systems. Most of our records are still stored manually or using basic digital formats. There hasn't been any</i>

	<i>official training or introduction to such technologies in our institution yet. I believe it's something we might adopt in the future, but we are not there yet.</i>
Participants 8–15	<i>I've had some basic experience with cloud-based electronic records systems. At my institution we've started using a few tools to store and manage files online even though it is not fully structured at the moment. This for me is a great step towards centralising records for improved collaboration and easy retrieval, especially for archival records that will need long-term storage.</i>
Participants 16–24	<i>My experience with cloud-embedded records systems is moderate. I've worked with a few platforms that allow real-time access, backup, and classification of documents. The system has helped reduce physical clutter and made records more accessible. Integrating AI features into these systems, like smart search and predictive analytics, would further enhance their usefulness.</i>
Participant 25	<i>I've had the opportunity to work on implementing a full cloud-based records management system in a previous role. These systems offer scalability, automation, and better security for archival records. When embedded with AI, they can intelligently classify, detect anomalies, and recommend actions. This infrastructure is essential for the future of digital archival records management at CoEs.</i>
Participant 26	<i>I'm familiar with the basics of cloud storage and records management systems. While our college hasn't fully adopted it yet, I can see its relevance. A cloud-based system will prevent data loss and enable quick access to archived records from anywhere. With AI integration, this could become a game-changer for how we manage records.</i>

4.7.6 AECCT infrastructure experience in cloud computing tools

The survey posed closed-end questions, requesting respondents' insights into their technology infrastructure experience with cloud computing tools. The responses reflected various levels of understanding and expectations.

A total of 12 respondents indicated having moderate experience with technology infrastructure in cloud computing tools; 15 respondents reported that they had basic experience in technology infrastructure; nine respondents indicated that they had no experience in technology infrastructure; and three (3) respondents had advanced experience in technology infrastructure with regard to cloud computing tools.

The bar chart in Figure 4.19 illustrates these quantitative findings.

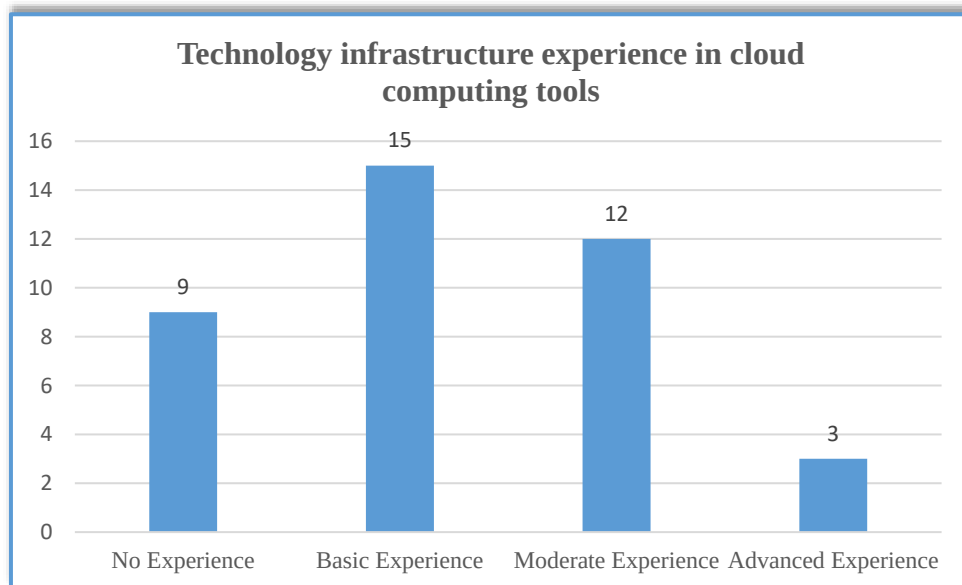


Figure 4.19: AECCT in cloud computing tools (N = 39)

Through open-ended questions in the questionnaire, respondents were asked whether they had been exposed to any cloud-based electronic records management systems (ERMS) incorporating AI features. If their response was "yes", they were asked to describe their experience. If not, they were asked how such systems could benefit archival records management at their institution.

One (1) respondent indicated they had worked with an open-source ERMS that had basic AI features, such as smart search and automatic classification of uploaded documents. 14 respondents stated that they had not used an ERMS with AI features directly but had seen demonstrations of such a system during a workshop, particularly the ability to retrieve records instantly and to sort files by relevance. Five (5) respondents reported no personal experience with such systems and indicated they strongly supported their introduction. Finally, nineteen (19) respondents stated that they had tested Google Workspace integrations and also supported a pilot with M-Files, a cloud ERMS with AI-driven tagging.

The following responses were captured:

Respondent 1	<i>Yes, I've worked with an open-source ERMS that had basic AI features like smart search and automatic classification of uploaded documents. It wasn't fully optimised, but it showed how powerful such systems can be in reducing human workload and improving file accessibility. I believe a more robust version could transform how records are managed in our colleges.</i>
Respondents 2–15	<i>I haven't used one directly, but I've seen demonstrations during a workshop. The software's ability to sort files automatically based on relevance and retrieve records instantly was impressive. Such a software, if implemented here, could save us a lot of time and reduce the risk of losing documents.</i>
Respondents 15–19	<i>I haven't had any personal experience using such systems, but I strongly support their introduction. Filing and retrieving documents is time-consuming. An AI-embedded cloud ERMS could make it easier to manage staff records and improve data security. What we need is a system that is user-friendly and doesn't require heavy technical skills.</i>
Respondents 20–39	<i>Yes, I've tested Google Workspace integrations and also supported a pilot with M-Files, a cloud ERMS that had AI-</i>

	<i>driven tagging. The system suggested categories and grouped documents automatically. It made archiving smoother and reduced duplication. If rolled out across the college, it would boost efficiency and accountability.</i>

Interview participants provided varying insights based on their exposure to cloud-based electronic records management systems (ERMS) that incorporate AI features. The following are synthesised qualitative responses representing the major data categories in the interview responses.

Participants 1–7	<i>I haven't used any cloud computing tools before. My work still depends on traditional software and physical records. While I've heard of cloud computing, I've never had formal training or the chance to apply it in my role</i>
Participants 8–15	<i>I've had some exposure to cloud computing tools like Google Drive and Dropbox. These tools make file storage and sharing easier. However, my usage is limited to basic uploading and downloading of files. I haven't explored their full potential, especially in terms of AI integration</i>
Participants 16–18	<i>I'm fairly comfortable with using cloud tools such as OneDrive and Google Workspace. I use them regularly for collaborative work and document management. While I've not directly used AI-enabled features, I can imagine how automation and intelligent sorting could help us manage archival records more effectively.</i>
Participants 19–20	<i>I've used advanced cloud computing tools including platforms like Microsoft Azure and Google Cloud Platform for managing institutional data. These tools offer integrated AI features like real-time analytics and smart classification. If implemented in the CoEs, they can greatly optimise archival recordkeeping systems</i>
Participants 21–26	<i>I have a moderate level of familiarity with cloud computing tools. I mostly use them for data backup and file access from multiple devices. I'm eager to explore how AI can enhance these</i>

	<i>platforms further, especially for records management, automated tagging, and predictive organisation of data.</i>

4.7.7 Technical readiness to implement AECCT in the COEs of Ghana

The survey posed closed-ended questions, asking respondents to provide insights into the technical readiness and capacity to engage with AECCT and contribute to its utilisation within the context of Ghanaian CoEs. The results showed that five (5) respondents reported that they were completely ready to engage with and utilise AECCT systems in managing digital archival records in their institutions; 17 respondents reported that they were generally ready in terms of fundamental technical knowledge and digital skills; ten (10) respondents were neutral; and two (2) reported not being ready. Whilst the majority expressed some degree of readiness, perceptions of technical readiness for implementing AECCT remained low. The pie chart in Figure 4.20 reflects these quantitative findings.

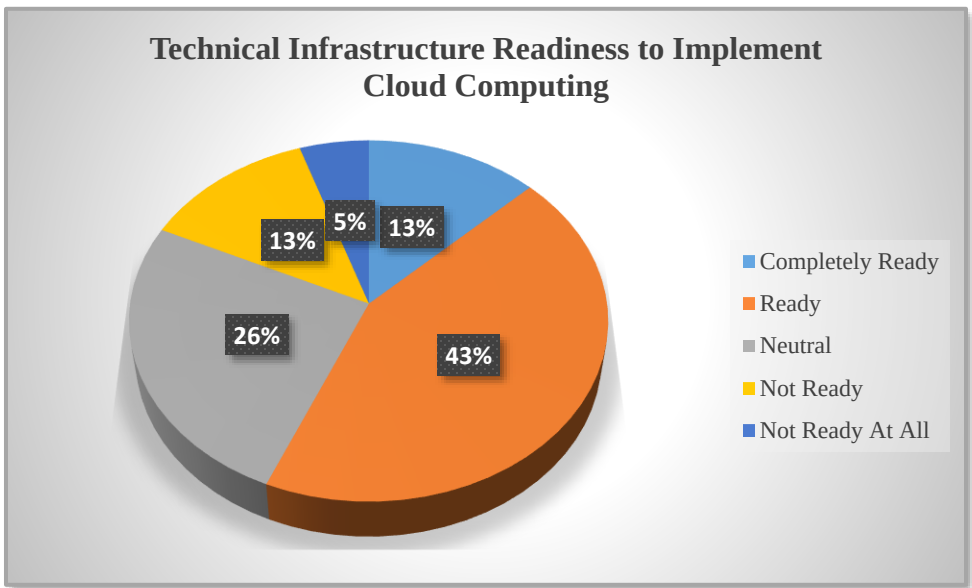


Figure 4.20: Technical infrastructure readiness to implement AECCT in the CoEs (N = 39)

Using open-ended questions in the questionnaire, respondents were also asked to describe how they would assess their own technical readiness and ability to support the implementation and utilisation of AECCT for archives management.

A total of 17 respondents reported making some progress with digitisation, noting that they had participated in digitisation-related programmes within their institutions; however, they still consider themselves to be in the early stages of AI readiness. Eight (8) respondents indicated that they were comfortable working with basic archiving technologies and conventional systems but lacked practical experience with advanced AI-enabled technologies. Five (5) respondents described themselves as partially ready, noting that they possessed general computer literacy but would still require supplementary training to confidently engage with AI-enabled systems, whereas nine (9) respondents reported having moderate experience with digitised records systems and cloud-based systems. This experience, they believe, can serve as a foundational skill in engaging and utilising AECCT for managing digital archival records

The following responses were captured:

Respondents 1–17	<i>Our college has made some progress with digitisation, but the infrastructure is still in its early stages when it comes to AI-readiness. We have basic internet connection and local servers, but limited cloud integration. To fully implement AI embedded cloud systems, we need more reliable internet bandwidth, increased storage capacity, and updated hardware that can support AI applications.</i>
Respondents 18–25	<i>From my point of view, our systems are functional for basic archiving but not equipped for advanced technologies like AI. Most of our documents are still managed manually or with simple software. We need systems that can communicate with each other, faster internet, and trained personnel to manage</i>

	<i>cloud-based platforms. Without this, implementing AI would be a challenge.</i>
Respondents 26–30	<i>I would say our infrastructure is partially ready. We have computers and some networked systems, but they are not fully optimised for cloud or AI use. Also, many staff members, including myself, would require training in how to use such systems. The interest is there, but the infrastructure and digital literacy need improvement.</i>
Respondents 36–39	<i>We have laid the foundation with digitised records and moderate cloud use through platforms like Google Workspace. However, the infrastructure is not robust enough for full AI integration. We need investment in secure cloud environments, AI-ready servers, and tools that can support automation. If these are addressed, implementation can move faster.</i>

Interview participants provided varying insights into the technical infrastructure readiness to implement the AECCT infrastructure. The following are synthesised qualitative responses representing the major data categories in the interview responses.

Participant 1–10	<i>In our institution, we have the needed infrastructure which is fully equipped with high-speed internet and an updated computing hardware. We are more than ready to integrate AI-embedded cloud technologies into our archival records management</i>
Participant 11–15	<i>I believe we are quite prepared in terms of the basic infrastructure. We have decent computers, internet connectivity and some cloud-based platforms already in use. What we need is more training and integration support to maximise AI capabilities.</i>
Participant 16–18	<i>In my view, our infrastructure is somewhat ready, but not completely. While we have computers and internet access, our systems are not robust enough to support full AI integration.</i>

	<i>We need to upgrade our software systems and network capacities first.</i>
Participant 19–21	<i>We are far from being ready to implement such advanced technologies. Our current infrastructure lacks consistency in terms of internet access and even basic digital tools. Implementing AI-based cloud systems will require a significant investment in upgrading our facilities.</i>
Participant 22–26	<i>There is no technical foundation yet. Most of our archival processes are still manual, and our IT infrastructure is outdated. Without a major overhaul and budget allocation, it will be impossible to implement AI-embedded cloud computing in our institution.</i>

4.7.8 Institutional technical infrastructure readiness for AECCT adoption

The survey posed closed-ended questions to elicit respondents' insights into the technical infrastructure readiness of their institutions for implementing AECCT.

Four (4) respondents reported that their colleges were fully prepared, in terms of technical infrastructure, to adopt the AECCT; 12 respondents stated that their colleges were prepared to use the AECCT; 18 respondents remained neutral; two (2) respondents indicated that their institutions were not ready at all to implement the AECCT in terms of technical infrastructure; and three (3) respondents indicated that their institutions were not ready to implement the AECCT in terms of technical infrastructure. The bar chart in Figure 4.21 illustrates these quantitative findings.

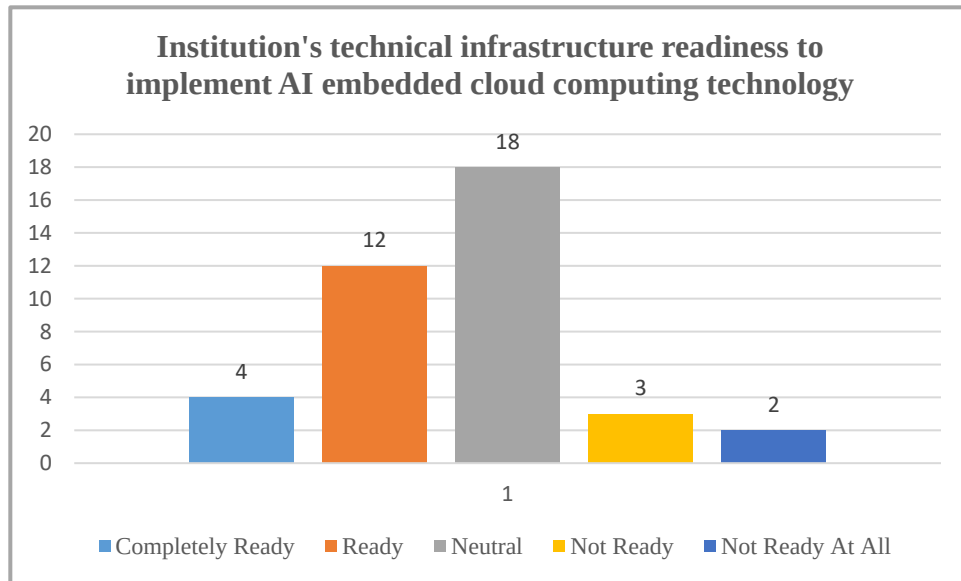


Figure 4.21: Institutional technical infrastructure readiness level for AI-embedded cloud computing implementation (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe the existing technical infrastructure at their institutions in terms of readiness to implement AECCT for managing archival records.

Ten (10) respondents reported having cloud backup systems and an internal server for staff files, but in terms of readiness for AI integration, they were only halfway there. A total of 20 respondents indicated that they had some digital filing systems, but these were limited to basic storage and retrieval functions. Five (5) respondents stated that they did not yet have the cloud-based tools required to manage large volumes of staff records with AI. Four (4) respondents reported having a functional network system and adequate hardware, but they needed to upgrade their bandwidth and adopt scalable cloud solutions to run AI-embedded applications. The following responses were captured:

Respondents 1–10	<i>Our college has made some progress with digitisation. We have cloud backup systems in place and an internal server for staff files. But in terms of readiness for AI integration, I'd say we are</i>

	<i>halfway there. We still lack consistent internet speed and advanced AI platforms that can handle real-time predictive archiving task.</i>
Respondents 11–30	<i>From an administrative point of view, we are still largely paper-based. We do have some digital filing systems, but they are limited to basic storage and retrieval functions. The infrastructure needs to be upgraded, especially in terms of secure cloud access and automation tools before AI can be fully implemented for records management.</i>
Respondents 31–35	<i>Currently, our infrastructure supports basic digital communication tools like email and internal HR systems. However, we don't yet have the cloud-based tools needed to manage large volumes of staff records with AI. We would need training, stronger servers, and more secure data systems to be ready for that shift.</i>
Respondents 36–39	<i>Technically, the potential is there. We have a functioning network system and decent hardware. But to run AI embedded applications, we'd need to upgrade our bandwidth and adopt scalable cloud solutions. Our readiness is promising, but without policy direction and financial investment, it'll remain theoretical.</i>

In the interviews, the researcher also obtained qualitative insights based on participants' self-reported technical infrastructure readiness to implement AI-embedded cloud computing. The following are synthesised qualitative responses from the participants representing the major data categories.

Participants 1–10	<i>Our institution is fully equipped and prepared to implement AI-embedded cloud computing systems. We've invested heavily in upgrading our IT infrastructure to new servers, cloud-based storage systems, and reliable internet connectivity across departments. The IT support team has also undergone specialised training in AI and cloud operations. Frankly, we're</i>

	<i>not just ready, we're eager to take off with this technology and integrate it into our digital archives and beyond.</i>
Participants 11–15	<i>I would say we are generally ready. The basic infrastructure is already in place with good connectivity, secure networks and moderate computing power. Even though we don't have everything in its most advanced form, the current setup provides a strong foundation for us to implement the AECCT. What we need now is consistent technical maintenance and some improvements in capacity building for staff.</i>
Participants 16–21	<i>Honestly, I'm not sure if our institution is fully ready. We have some basic infrastructure like internet and a few cloud tools, but I'm not convinced it's enough to support AI functionalities. It feels like we are somewhere in between, neither advanced nor totally unprepared. Without a proper audit of our systems, it's hard to tell where we really stand.</i>
Participants 21–25	<i>From what I see, our institution still has a long way to go. Some of our systems are outdated, internet service is unreliable, and we lack dedicated IT personnel who understand AI-integrated systems. There's potential, but without a serious upgrade in infrastructure and funding, implementing AI-cloud systems would be challenging.</i>
Participant 22–26	<i>I believe we're ready, but not without limitations. The infrastructure is fair; we've started digitising records and using some cloud-based tools. However, when we talk about AI-powered cloud systems, that requires more advanced resources and smarter servers. So, we're ready in terms of mindset and basic tools, but not yet in terms of full technical capacity.</i>

4.8 Skills needed to use AECCT in the management of digital archival records in the CoEs of Ghana

A variety of questions were posed to respondents and participants through survey questionnaires and interviews to elicit responses that attempt to address Research Objective 5 and the corresponding research question.

Research Objective 5: To identify the skills required for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana.

Research question 5: Which skills are required for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana?

4.8.1 Cloud computing skills proficiency

In the survey questionnaire, the researcher posed closed-ended questions to respondents regarding their cloud computing skills proficiency. The narratives reflected various levels of understanding and diverse expectations, ranging from high skills proficiency levels in cloud computing and its actual impact.

A total of 20 respondents had a basic skills proficiency level in cloud computing; six (6) respondents had an intermediate skills proficiency level in cloud computing; five (5) respondents had advanced skills proficiency levels; seven (7) respondents had no skills proficiency in cloud computing; and one (1) respondent had expert skills proficiency in cloud computing.

The bar chart in Figure 4.22 shows these quantitative results.

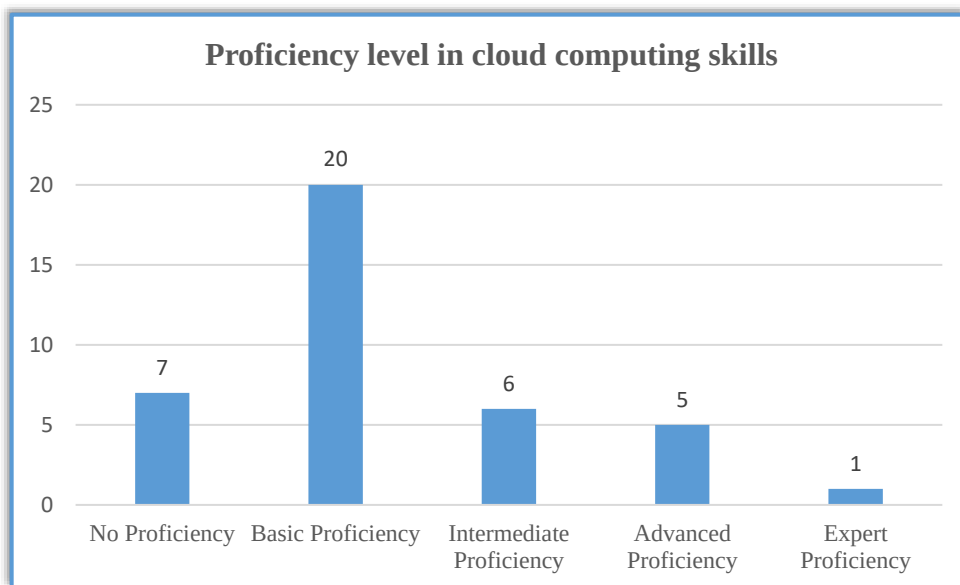


Figure 4.22: Proficiency level in cloud computing skills among archival staff (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe their existing level of skills proficiency in cloud computing, and how it affected their ability to manage or interact with institutional archives. Six (6) respondents indicated that they had an intermediate level of skills proficiency in cloud computing; nine (9) respondents reported having limited experience in cloud computing; 15 respondents stated that they had basic knowledge of cloud platforms; and nine (9) respondents reported having fairly advanced skills proficiency in cloud computing. The following responses were captured:

Respondents 1–6	<i>I would say that my proficiency level in cloud computing is intermediate. I'm quite comfortable with setting up cloud storage, managing user access and integrating basic tools like Google Drive or Microsoft OneDrive. However, I still need more training in AI integration and advanced data security protocols.</i>
Respondents 7–15	<i>My experience with cloud computing is quite limited. I mostly use shared folders and email platforms, but I don't have the skills to configure cloud systems or use more advanced features. This makes it difficult when I need to collaborate on shared records or retrieve documents from centralised storage systems quickly.</i>

Respondents 16–30	<i>I have basic knowledge of cloud platforms. I am familiar with uploading, downloading and sharing documents using platforms like Google Drive. However, when it comes to using cloud-based systems to manage data and backups, or AI functionalities, I struggle. This limits how efficiently I can work with digital personnel files.</i>
Respondents 31–39	<i>I consider myself fairly advanced in cloud computing. I've worked with both private and public cloud environments and can handle tasks like system backup, user management, and automation workflows. This skill level enables me to support other departments and ensure their records are safely stored and easy to access remotely.</i>

To explore the level of cloud computing skills proficiency among archival staff at the CoEs, participants were interviewed on their self-assessed capabilities. Their insights reflected varying levels of preparedness in adopting AECCT for digital archival records management. Below are synthesised qualitative responses representing the major data categories obtained in the interviews.

Participants 1–15	<i>I can handle basic cloud computing tasks, such as Google Drive for file sharing, and using cloud-based apps like Microsoft OneDrive. However, I still need more training in advanced system administration and data security within cloud platforms.</i>
Participant 16–21	<i>Honestly, I've never worked with any cloud computing system beyond basic email or uploading documents. I find it quite technical and intimidating. If AI cloud systems are introduced, I will definitely require intensive training</i>
Participants 22–23	<i>I have some exposure to cloud systems. I've used cloud-hosted platforms and understand concepts like remote access and storage. But my knowledge is not deep enough to manage AI-driven systems or perform system maintenance tasks. I'm willing to learn more if the opportunity arises.</i>

Participants 24–25	<i>I am confident in handling cloud computing tools and even integrating them into work processes. I've previously used collaborative tools like Google Workspace and Azure-based systems. With little orientation, I can easily adapt to AI-embedded technologies</i>
Participant 26	<i>My experience is limited to uploading and accessing records on cloud platforms. I understand the concept but need support with troubleshooting and managing system functionalities. We need hands-on training workshops to bridge the skill gap</i>

4.8.2 Artificial intelligence (AI) skills proficiency

The survey posed closed-ended questions to respondents regarding their proficiency levels in AI. The narratives reflected various levels of understanding and diverse expectations, ranging from high levels of AI proficiency to the actual impact of AI.

A total of 22 respondents reported having a basic skills proficiency level in AI; five (5) respondents had an intermediate skills proficiency level in AI; four (4) respondents had advanced skills proficiency; five (5) respondents had no AI skills proficiency; and three (3) respondents had expert AI skills proficiency.

The quantitative data obtained is reflected in the pie chart in Figure 4.23.

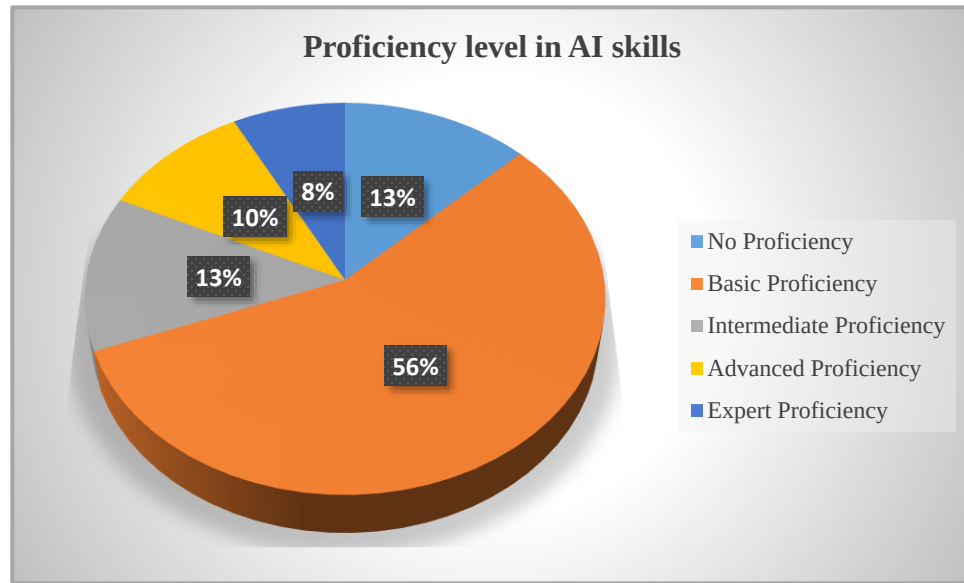


Figure 4.23: Proficiency level in AI skills (N = 39)

Through the open-ended questions posed in the survey, respondents indicated their current level of AI skills proficiency and how it influenced their ability to manage or interact with digital archives at their institutions.

A total of 15 respondents reported having a basic understanding of AI concepts such as machine learning, automation, and data prediction, although they did not have the opportunity to apply these skills in their college settings. Five (5) respondents stated that they had very limited knowledge of AI; ten (10) respondents stated that their skills were quite basic; and four (4) respondents indicated that they had taken online courses on AI and had experimented with basic AI tools like chatbots and automation scripts.

The responses were as follows:

Respondents 1–15	<i>I have a basic understanding of AI concepts like machine learning, automation and data prediction. I haven't had the chance to apply this knowledge practically. I believe with more training and access to AI tools; I could be more effective in its use.</i>

Respondents 15–30	<i>Honestly, I have very limited knowledge of AI. Most of my work is manual or done through simple digital platforms. I know that AI could make records management faster and smarter; however, without formal training or exposure to AI tools, I may not be able to fully explore its benefits to my role.</i>
Respondents 31–35	<i>I have quite basic AI skills. I've read about the use of AI in HR systems and how it can be used to track staff performance and aid recruitment. However, I haven't used it directly. I imagine that AI could help with organising staff files or identifying outdated documents in digital archives, but I would need more training to be able to use those features confidently.</i>
Respondents 36–39	<i>I've taken some AI courses online and also experimented with some basic AI tools like chatbots and automation scripts. While I am not an expert, I appreciate how AI can enhance records management, especially in the area of sorting large volumes of data or detecting patterns in archived files.</i>

As part of understanding the skills needed to use AECCT effectively in the management of digital archival records at CoEs, participants shared their self-assessed AI skills proficiency levels.

The following are synthesised qualitative responses representing the major categories in the data.

Participants 1–10	<i>I know the fundamentals of AI and am familiar with concepts like chatbots and automation tools, but I've never applied this knowledge in a real-world setting. I believe AI can be a useful tool for records management but there will be a need for some guidance and training for me to make the most of it.</i>
Participants 11–15	<i>AI is a completely new area for me. I have heard the term a few times, but I don't really understand how it works or how it</i>

	<i>applies to archival records. I would need introductory training to catch up.</i>
Participants 16–22	<i>I've used some AI applications like predictive text and voice-to-text systems, and I understand how machine learning supports automated systems. However, I don't have practical experience in applying AI in professional archival work</i>
Participants 23–24	<i>I'm quite confident with AI use. I have previously taken training and also experimented with an AI-based document classification tool. I am sure that with the right infrastructure, I can assist the team in adopting and successfully implementing the AECCT.</i>
Participants 25–26	<i>While I haven't used AI tools at length, I understand that they can help streamline archival records management operations. I believe that organising workshops and training on how these tools work and how they can be used will help boost the confidence of staff on its use.</i>

4.8.3 Data management skills proficiency

The survey posed closed-ended questions to respondents regarding their skills proficiency levels in data management. The narratives reflected various levels of understanding and a diversity of expectations, ranging from high levels of data management proficiency to the actual impact.

A total of 20 respondents had a basic skills proficiency level in data management; five (5) respondents had an intermediate skills proficiency level in data management; four (4) respondents had advanced skills proficiency in data management; seven (7) respondents had no skills proficiency in data management; and three (3) respondents had expert level skills proficiency in data management. Figure 4.24 illustrates the quantitative results of data management skills proficiency levels.

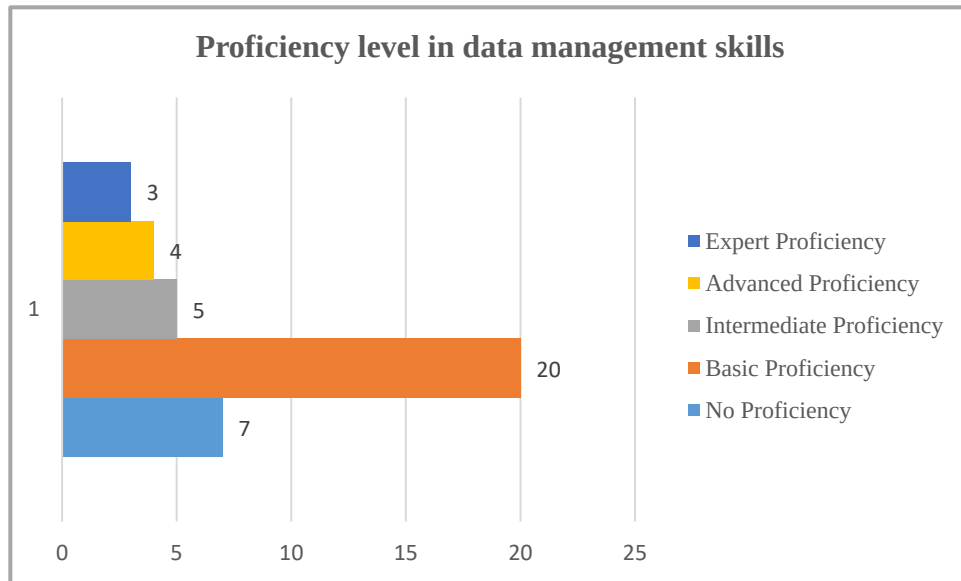


Figure 4.24: Proficiency level in data management skills (N = 39)

Through open-ended questions in the questionnaire, respondents were also asked to describe their existing level of skills proficiency in data management and how it affected their ability to manage or interact with institutional archives.

Twenty (20) respondents reported having high levels of skills proficiency in data management; five (5) respondents indicated that their data management skills proficiency levels were moderate; ten (10) respondents stated that their skills proficiency level in data management was basic, mostly limited to the use of Excel to track staff records and store documents in folders on shared drives.

Finally, four (4) respondents stated that they were highly proficient in data management. The responses are as follows:

Respondents 1–20	<i>I'll describe my level of proficiency in data management as good. I'm quite familiar with data organisation, backup procedures, access control and data validation. These skills will enable me to support the structuring of digital archives at my institution, ensuring that data is securely stored and retrieved with ease when needed.</i>

Respondents 21–25	<i>I would say my data management skills are moderate. I know how to organise files, maintain records, and use spreadsheets and basic database systems. However, when it comes to applying more advanced data management tools, I sometimes struggle. I believe improving these skills would make me more efficient and effective in my role.</i>
Respondents 26–35	<i>My proficiency in data management is basic. I mostly use Excel to track staff records and store documents in folders on shared drives. I don't have formal training in data handling, so sometimes retrieving specific records can be challenging, especially when naming or organising isn't consistent.</i>
Respondents 36–39	<i>I'm highly proficient in data management. I use database management systems and understand data security, redundancy protocols, and metadata tagging. This allows me to ensure that our archival system is not only well-organised but also compliant with data privacy and institutional policies. My skills make a big difference in keeping our digital archives up-to-date and reliable.</i>

To ensure effective implementation of AECCT in managing digital archival records, participants were asked to reflect on their skills proficiency levels in data management – a key requirement in the digital records ecosystem.

The following are synthesised qualitative responses representing the major data categories as reflected in the interview responses.

Participants 1–9	<i>I am capable of handling basic to moderate data organisation, cleaning and sorting tasks. I've had experience working with Excel spreadsheets and simple databases. Though I am not an expert, I'm fairly confident in managing structured data and I can quickly adapt to cloud-based systems.</i>
Participants 9–15	<i>I know how to label and store files appropriately and sometimes use folders and tags to manage digital records. But I've not had</i>

	<i>any training in advanced data management tools. I think basic data practices are important, but I need more guidance.</i>
Participants 15–20	<i>Honestly, I do not have any real knowledge in data management. My focus has always been on paper-based records. Transitioning to digital or cloud data management is something I would need training for.</i>
Participants 20–24	<i>My role involves tracking and retrieving digital documents, so I'm fairly comfortable managing data. I've also attended a workshop on metadata and digital preservation. With a little more exposure, I believe I can handle advanced systems effectively.</i>
Participants 25–26	<i>I'm well-versed in data management concepts. I can work with databases, apply metadata standards, and even understand data security protocols. I think I can mentor others if we move to AI-embedded digital record systems.</i>

4.8.4 Project management skills proficiency

The survey posed closed-ended questions to respondents regarding their skills proficiency levels in project management. The narratives reflected various understandings and expectations, ranging from a high proficiency level in project management skills to its actual impact.

A total of 15 respondents had a basic skills proficiency level in project management; five (5) respondents had an intermediate skills proficiency level in project management; four (4) respondents had advanced skills proficiency; 12 respondents had no skills proficiency in project management; and three (3) respondents reported having expert skills proficiency in project management.

Figure 4.25 illustrates these quantitative results.

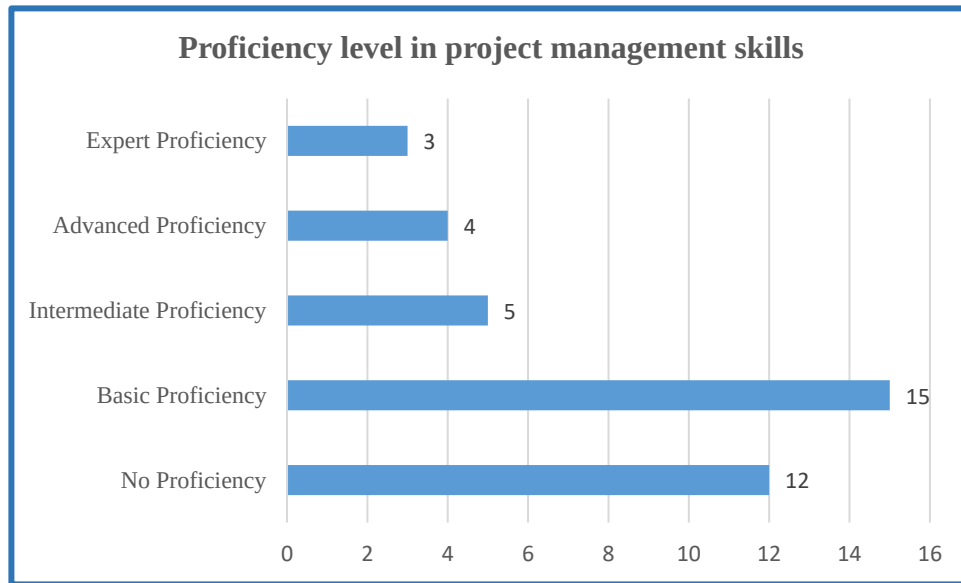


Figure 4.25: Proficiency level in project management skills (N = 39)

Through open-ended questions in the questionnaire, respondents were asked to describe their existing level of skills proficiency in project management, and how it affected their ability to manage or interact with institutional archives. Ten (10) respondents revealed they had a fairly strong background in project management, particularly in coordinating IT-related projects like setting up digital filing systems and implementing software updates. Ten (10) respondents indicated that they had moderate project management skills; ten (10) stated that their project management experience was mostly informal, organising staff training sessions, coordinating recruitment processes and managing staff files; and nine (9) respondents stated that they had formal training in project management and had applied it in technical and administrative roles.

The responses were as follows:

Respondents 1–10	<i>I have quite a strong background in project management, especially in the areas of coordinating IT-related projects like setting up digital filing systems and implementing software updates. With these skills, I can plan, delegate and follow up on tasks, ensuring timelines and goals are effectively met.</i>

Respondents 11–20	<i>I would describe my project management skills as being moderate. I'm good at coordinating meetings, setting timelines for filing and record reviews and ensuring that documentation processes are followed. These skills help me maintain consistency and ensure that records are organised and handled properly.</i>
Respondents 21–30	<i>My experience with project management is mostly informal. I used to organise staff training sessions, coordinate recruitment processes and manage staff files. I don't have any formal training in project management, but I believe my ability to organise and follow up plays a crucial role in ensuring records are up to date.</i>
Respondents 31–39	<i>I've taken some formal training in project management, and I apply it in my current role at the CoE. I draft implementation plans and ensure that projects run smoothly and meet institutional needs.</i>

Project management skills are essential in the successful implementation of AECCT in archival record systems. Participants were interviewed to assess their self-reported proficiency levels in managing and coordinating digital transformation projects within their institutions.

The following are synthesised qualitative responses representing the major data categories regarding project management skills proficiency.

Participants 1–9	<i>I've been involved in small team coordination tasks such as arranging meetings and ensuring we meet deadlines. However, I haven't had formal training in project management tools or methodologies. I would benefit from capacity building in this area.</i>
Participants 10–15	<i>To be honest, I have no experience with project management. I mostly follow instructions and support others in</i>

	<i>implementation, but I haven't led a project or tracked timelines, deliverables, or budgets before.</i>
Participants 15–20	<i>I've coordinated a few internal records management initiatives and supervised timelines. I'm familiar with basic planning and stakeholder engagement. I believe I'm ready to handle moderately complex projects with some support</i>
Participants 21–24	<i>I have led several digitisation and system transition projects. I'm comfortable using tools like Gantt charts and basic project management software. I understand risk assessment, progress tracking, and team delegation quite well.</i>
Participants 25–26	<i>While I'm not a certified project manager, I've worked under supervision on projects. I understand the importance of planning, documentation, and ensuring tasks are completed, but I still rely heavily on others for execution strategies.</i>

4.8.5 Cybersecurity awareness skills proficiency

The survey posed closed-ended questions to respondents regarding their proficiency levels in cybersecurity awareness. The narratives reflected various levels of understanding and varying expectations, ranging from a high skills proficiency level in cybersecurity awareness to its actual impact.

The results showed 16 respondents having a basic skills proficiency level in cybersecurity awareness; five (5) respondents having an intermediate skills proficiency level in cybersecurity awareness; three (3) respondents having an advanced skills proficiency level; 11 respondents having no skills proficiency in cybersecurity awareness; and four (4) respondents having expert skills proficiency in cybersecurity awareness. Figure 4.26 presents the quantitative data obtained on cybersecurity awareness skills proficiency.

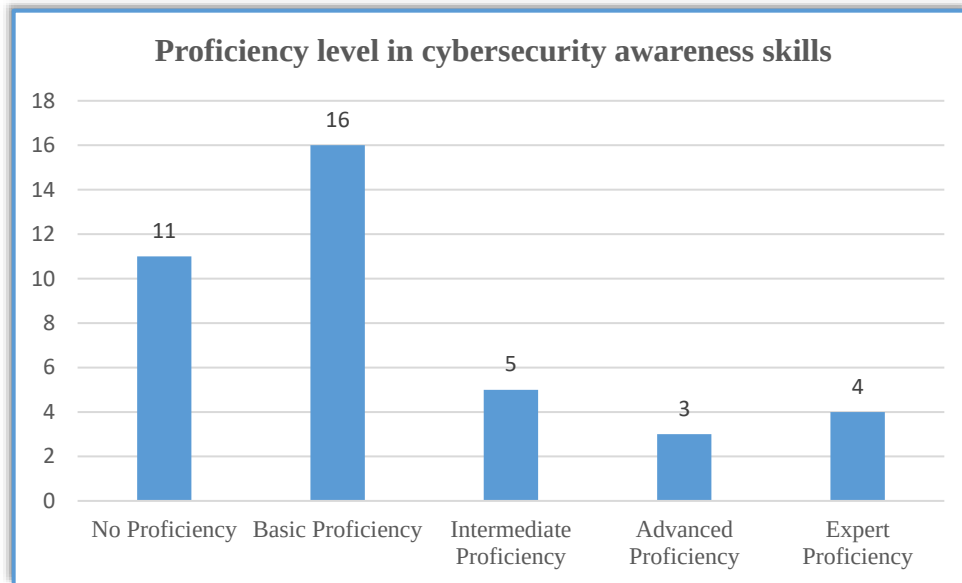


Figure 4.26: Proficiency level in cybersecurity awareness Skills (N = 39)

Open-ended questions in the questionnaire were used to elicit respondents' views on their level of proficiency in cybersecurity awareness and how it affected their ability to manage or interact with archives within their institutions. The results showed that 15 respondents had a solid understanding of cybersecurity principles, including data encryption, the use of secure passwords and recognising phishing attempts; another 15 respondents reported a basic understanding and awareness of cybersecurity issues; and five (5) respondents cited themes such as information confidentiality and data privacy, indicating some awareness but not a particularly clear understanding of the concept.

Finally, four (4) respondents indicated having a high level of awareness and appreciation for cybersecurity and related skills. The responses as follows:

Respondents 1–15	<i>I have a great understanding of cybersecurity principles, including data encryption, secure password management and detecting phishing attempts. In my current role, I ensure that archival systems are protected with firewalls and secure access controls. I also occasionally assist colleagues with identifying and resolving threats to protect sensitive information.</i>

Respondents 16–30	<i>I possess a basic understanding of cybersecurity. I know how to avoid suspicious links and the essence of using strong passwords. I'm not familiar with how to deal with advanced cybersecurity threats and how to use advanced data protection strategies. I am very cautious when handling data because I fear making any mistake that would lead to data loss and a breach.</i>
Respondents 31–35	<i>I have some awareness of cybersecurity issues, especially around staff confidentiality and data privacy. I try to be careful with how I store and share personnel records. However, I would benefit from more training, especially on how to recognise online threats or ensure safe file-sharing practices within the college network.</i>
Respondents 36–39	<i>High proficiency and awareness in cybersecurity. I regularly update my antivirus software. I'm constantly monitoring for vulnerabilities, and I regularly educate my colleagues on secure file handling.</i>

Cybersecurity awareness is a critical skill for managing AECCT in archival record systems. This section presents qualitative insights drawn from participants' self-reported cybersecurity proficiency levels.

Below are synthesised qualitative responses representing the major data categories.

Participants 1–7	<i>I don't have any formal knowledge of cybersecurity. I am solely dependent on the IT personnel in my institution to ensure that the systems are safe and secure. I'm very sure that some form of training on cybersecurity will be very useful to some of us.</i>
Participants 8–13	<i>I understand the importance of strong passwords and avoiding suspicious emails, but I'm not familiar with advanced security threats like phishing, malware, or data encryption.</i>
Participants 14–20	<i>I have some knowledge of cybersecurity principles, such as access control and data protection. I can identify potential</i>

	<i>security risks, but I still need guidance in implementing security protocols effectively.</i>
Participants 21–25	<i>I have a strong grasp of cybersecurity best practices. I understand network security, encryption techniques, and data protection laws. I often educate colleagues on secure digital practices to prevent breaches.</i>
Participants 25–26	<i>I can identify and respond to basic security threats, but I'm not fully confident in managing more sophisticated cyber risks like hacking attempts or ransomware attacks.</i>

4.9 Chapter summary

The research findings, obtained using two key data collection methods – questionnaires and interviews – were presented in this chapter. Charts and graphs were used to illustrate the findings from the quantitative analysis, and verbatim quotations from interviewees were presented and analysed in this chapter. The results and outcomes of the study presented in this chapter were premised on the first five research objectives, which centred on the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana. The next chapter presents an interpretation and discussion of the research findings.

CHAPTER 5: INTERPRETATION AND DISCUSSION OF RESEARCH FINDINGS

5.1 Introduction

On the premise of the data collected from the sampled respondents and participants, the results of this research were presented in the preceding chapter. This chapter interprets and discusses the analysed research findings, based on the analyses of the research results presented in Chapter 4 (Creswell & Creswell 2018; Babbie 2020). The discussions and interpretations presented in this chapter are rooted in the research objectives of the study, specified as follows:

1. To evaluate policies and legislative frameworks for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana;
2. To explore users' perceptions, expectations and anticipated implications of AECCT in the management of digital archival records;
3. To examine the usability of AECCT in the management of digital archival records in the CoEs of Ghana;
4. To identify the AECCT infrastructure for the management of digital archival records in the CoEs of Ghana;
5. To identify the skills required for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana;
6. To propose a framework for the utilisation of AECCT in the management of digital archives in the CoEs of Ghana.

5.2 Policies and legislative frameworks to utilise AECCT in the management of digital archival records in the CoEs of Ghana

The findings interpreted and discussed in this section are based on Research Objective 1: To evaluate policies and legislative frameworks for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana.

Implementing AI-driven cloud computing technology for the management of digital archival records in Ghanaian CoEs must be grounded in strong policy and legislative frameworks. However, most analyses focus exclusively on AI policy on the national and international level, overlooking existing institutional governance structures and legislative frameworks for the utilisation of AECCT. (Liebig et al 2024). This observation is supported by the assertion made by Ngoepe and Saurombe (2016) that the legal system of any nation profoundly affects the way records are maintained, particularly those created in networked environments.

The findings from both the quantitative and qualitative components of this study provide important insights into the state of these foundations across different institutions and the implications for the successful adoption of digital archival technologies. The research reveals a complex interrelation among the prevalence of policy documentation, staff awareness, procedural adoption, and organisational preparedness for technological change. A basic finding in the quantitative component is the widespread uncertainty regarding whether formally endorsed policies for archival records services are in place. While up to 23.1% of interviewees affirmed the existence of such policies, a significant 34.6% disagreed, and an even larger majority, 42.3%, were undecided.

This aligns with the findings of a study conducted by Segbenya, Bervell, Frimpong-Manso, Otoo, Andzie and Achina (2023), who argue that the utilisation of AECCT in the management of digital archival records has been a contemporary issue attracting varied perspectives, since there are no endorsed policies. The uncertainty mirrors what Dikopoulou and Mihiotis (2012) identify as a critical gap in records management policies, particularly in transitioning institutions. This uncertainty suggests a lack of transparency and ineffective communication of policy provisions within the institutions.

The ambiguity may also indicate the non-existence of overarching archival records policies or, at best, the presence of outdated and poorly communicated documents that are not of much assistance in the current digital era. These concerns echo what Katuur and Van der Walt (2016) describe as the challenge of policy frameworks that fail to keep pace with technological advancements in records management.

The qualitative findings from interviews with institutional stakeholders support these matters. Although some participants acknowledged the existence of policy documents, they also highlighted significant weaknesses in policy implementation and enforcement. For example, several participants suggested that, even when policies were in place, they were often outdated or insufficiently aligned with digital records management practices. Others pointed to the absence of a formalised policy framework, with departments relying on informal traditions or *ad hoc* processes to manage archival records. This finding reflects what Marutha (2019) terms the “policy-practice gap” in records management, where formal policies exist but are not operationalised in daily records management tasks. This discrepancy between existence and operationalisation of policies emphasises a basic gap in policy effectiveness.

The situation appears slightly better regarding the existence of general records management policies. The results of the quantitative responses show that the majority of respondents (57%) were positive that a records management policy exists in their institutions. However, 38% of respondents disagreed that a records management policy exists, and 3.8% were uncertain about its existence.

As Mojapelo (2020) indicates, effective archives and records administration is driven by a comprehensive legal framework that clarifies responsibilities and scope. The mere existence of a records management policy is no assurance of uniform knowledge or implementation across all departments and personnel.

In support of Mojapelo (2022), Mullon and Ngoepe (2019) indicate that a common challenge in records management is that policies do exist on paper, but are not effectively disseminated or implemented within the organisation.

5.2.1 Availability of an officially sanctioned policy for archival records services

The majority of respondents – 15 of 39 respondents – confirmed that there was an officially approved policy for archival records services in their institution. This could be because these respondents were aware of a documented policy due to their roles in, or exposure to, administrative procedures involving records management. Due to the nature of their work, staff in administrative or IT-related roles may be more conversant with such policies.

This finding is supported by the study conducted by Shepherd and Yeo (2003), who mention that institutional awareness of information policies is often highest among staff who are directly involved in the creation, storage and retrieval of records. Furthermore, Asogwa (2012) emphasises the essence of having archival policies, stating that these policies are needed to ensure structured and standardised records management practices to promote accountability and effectiveness.

According to Ngulube (2004), poor dissemination of archival policies and inadequate training often result in limited awareness and frequent misunderstandings among staff – even when such policies do exist. Ten (10) of 39 respondents, representing the minority, disagreed with the statement that there was an officially approved policy for archival records services. The reason for this may be that this minority group was not directly involved in records management activities, or they lacked access to relevant policy documents.

This finding may also result from a lack of clear communication or training on institutional policies governing the management of archival records. As Kemoni (2008) asserts, several educational institutions in sub-Saharan Africa suffer from gaps in policy communication, creating a knowledge divide between administrative staff and other personnel.

This disparity was reflected in participants' responses, with some reporting no awareness and others completely denying the existence of any sanctioned policy. This may be because sanctioned policies – if they exist – are not properly documented for archival workers. This observation aligns with Broglund and Oberg's (2007) argument that effective records management policies must be adaptable to both paper-based and electronic records.

However, a minority of participants reported that there was an officially approved policy for archival records services in their institution – probably because the policy was formally documented and communicated to staff, they knew their responsibilities. This assertion is supported by De Ming and Carrillo-i-Martinez (2018), who note that effective records management requires clear assignment of responsibilities and seamless communication between policymakers and implementers. This observation is also supported by Fang et al. (2016), who observe that structured data environments are essential for effective cloud computing integration – a perspective that aligns with that of Chachage and Ngulube (2006), in that effective records management policies are foundational to successful technological integration in archives.

5.2.2 Existence of an officially approved policy for records management

The majority of respondents – 16 of 39 respondents– reported being uncertain about the existence of an officially approved records management policy. This uncertainty reflects potential underlying issues of poor communication, training gaps and limited stakeholder involvement in policy formulation.

Such a lack of clarity may also imply that policies exist only in name, without integration into daily practice. In this way, policies exist on paper only and are neither actively enforced nor referenced in daily operations.

According to Ngulube (2004), a major challenge in records management in African educational institutions is the lack of staff awareness of and access to policies. When records management policies are not communicated effectively or are not part of institutional culture, staff tend to operate informally, often unaware of standardised procedures. As noted by Kemoni (2007), the success of archival and records management policies rests on sensitisation, accessibility and continuous professional development. The lack of these elements leads to a disconnect between policy documentation and actual practice, resulting in widespread uncertainty, as observed in the current data.

Responses that fell within the minority views were split into two groups: 11 respondents confirmed the existence of an approved policy by agreeing with the statement that there was an officially approved policy, while 12 respondents disagreed with this statement. Those who affirmed the existence of a formal policy were likely to be engaged in administrative or procedural roles. Conversely, those who opposed the statement might be equating the absence of standardised systems and poor visibility of policy enforcement with the non-existence of formal policies.

Shepherd and Yeo (2003) emphasise that staff who are more involved in operational or administrative functions are better positioned to understand and acknowledge records management policies. On the other hand, Asogwa (2012) observes that, even when policies are in place, ineffective enforcement and lack of visibility may lead to perceptions of non-existence. This aligns with the disagreement of some respondents, who might not have seen practical evidence of policy-driven recordkeeping systems.

The majority of participants reported that their institution had an officially approved policy for archival records services, likely because the policy was documented and communicated to staff, so they knew their responsibilities. This assertion is supported by De Ming and Carrillo-i-Martinez (2018), who indicate that effective records management requires clear assignment of responsibilities and seamless communication between policymakers and implementers. In support of this argument, Fang et al. (2016) observe that structured data environments are essential for effective cloud computing integration – a perspective that aligns with the claim of Chachage and Ngulube (2006) that effective records management policies are foundational to successful technological integration in archives.

A minority of participants reported being aware of an officially approved policy governing archival records services in their institution. This may be due to inadequate documentation or poor communication of such policies to archival staff. This observation aligns with the argument of Broglund and Oberg (2007) that effective records management policies must be properly communicated to both policymakers and implementers.

5.2.3 Formal procedure established for managing archival records

The majority of respondents (15 of 39) expressed uncertainty about whether formal procedures for managing archival records exist in their institutions. This widespread ambiguity highlighted potential issues, including inadequate communication about institutional procedures, limited training, and low staff engagement. In many cases, procedural frameworks may be available, but they are either poorly documented or poorly enforced, or not properly applied to everyday institutional operations. Such uncertainty suggests a gap between the existence of policy and operational awareness.

Ngulube (2004) identifies institutional unawareness and inadequate dissemination of information as major barriers to effective records management in African academic environments. When formal procedures are not consistently enforced or

supported by staff orientation and capacity building, most personnel remain unsure of their existence or nature. Kemoni (2008) also argues that a lack of awareness of formal processes may hinder accountability and compromise the reliability of institutional records, particularly in settings where digital transformation has not been fully embraced.

A minority of ten (10) respondents confirmed the existence of a formal procedure for managing archival records. Those who confirmed the presence of such a procedure were likely to be working in administrative units such as the registry, human resources office, or ICT departments. Their roles may provide firsthand exposure to these procedures or involvement in their implementation. Shepherd and Yeo (2003) observe that procedural knowledge is often confined to personnel with direct roles in records and information governance. In contrast, general staff may not perceive procedural frameworks as existing if they are not part of routine operations.

Asogwa (2012) emphasises that, without structured implementation and digital support, formal record-keeping procedures often go unnoticed or are perceived as non-existent, particularly in institutions where modern technologies such as AI and cloud computing have not been adopted or adequately explained.

The majority of participants reported being aware of the officially approved procedure for archival records management in their institution. This may be because the policy was formally documented and communicated to staff, so they knew their responsibilities. This observation aligns with the argument of Broglund and Oberg (2007) that effective records management policies must be communicated between policymakers and implementers.

However, a minority of participants reported that there was no officially approved procedure for archival records services in their institution, possibly due to a lack of seamless communication between policymakers and archival workers. This

assertion is supported by De Ming and Carrillo-i-Martinez (2018), who note that effective records management requires clear assignment of responsibilities and seamless communication between policymakers and implementers. In support of this, Fang et al. (2016) observe that structured data environments are essential for effective cloud computing integration. This perspective aligns with the claim of Chachage and Ngulube (2006) that effective records management policies are foundational to successful technological integration in archives.

5.3 Users' perception of the utilisation of AECCT in the management of digital archival records

The findings interpreted and discussed in this section are based on Research Objective 2: To explore users' perceptions, expectations and anticipated implications of AECCT in the management of digital archival records.

The study sought to explore users' perceptions of the utilisation of AECCT as a strategy for managing digital archival records in Ghana's CoEs. Both quantitative and qualitative results revealed a four-dimensional perspective among users – characterised by optimism, caution, recognition of practical realities and consideration of future implications for archival records management. The quantitative responses indicated a positive inclination towards adopting AI-integrated cloud computing technology, particularly for productivity improvements, streamlining business processes, and enhancing the performance of digital records management systems. The majority of the interviewees agreed that AI would improve productivity through the automation of routine archival tasks, effective access and retrieval systems and minimising human errors.

The following five themes emerged from the qualitative (interview) findings: (i) optimism about greater productivity; (ii) the need for user training and a phased rollout; (iii) infrastructural constraints; (iv) incredulity about preparedness; and (v) fear of job displacement. The majority of participants regarded AI as an innovative technology that would transform archival operations through features such as

predictive maintenance, fraud detection, real-time alerts, and optimal data management – an outlook consistent with the findings of the study conducted by Georgieff and Hyee (2022). These participants anticipated greater efficiency and reduced delays, ultimately leading to improved service delivery and enhanced institutional effectiveness.

However, a significant number of respondents emphasised the need for certain prerequisite conditions to ensure successful implementation. These included adequate digital infrastructure, stable internet connectivity, reliable power supply and comprehensive staff training to build the competencies required to engage with the new technology systems. Without these support systems, AI advantages may remain theoretical rather than practical. Interview participants were also sceptical about the preparedness of the CoEs in Ghana for such technological advancements.

Overall, participants' attitudes towards adopting AI-integrated cloud computing technology for archival records management were generally optimistic, though tempered by some reservations. The majority valued its perceived benefits, such as productivity gains, streamlined operations and greater transparency, but there were also concerns about infrastructural readiness, staff capability and job displacement. Successful deployment of such technology would, therefore, require a phased approach, beginning with infrastructure development, capacity-building programmes and sensitisation of archival staff. The suggestions emphasised the need to align technological advancement with institutional preparedness and workforce adaptation to maximise the potential of AI in the management of archival records in the CoEs of Ghana.

5.3.1 Utilising AECCT to improve productivity

The majority of respondents (20 of 39) agreed that the use of AECCT will enhance productivity in the management of digital archival records in the CoEs in Ghana. This positive response may be attributed to greater exposure to digital archives

management and emerging technologies within CoEs in Ghana. These respondents would likely view the benefits of automation, faster information retrieval, enhanced precision, and centralised storage, all facilitated by AI and cloud computing systems. Improvements in processes – particularly in data organisation – might have convinced them of the productivity potential of AI and cloud computing systems. This view is supported by Czarnitzki, Fernández and Rammer (2023), who observe that greater exposure to digital archives records management in AECCT makes employees' work more efficient by cutting repetitive work. According to Thaker, Raval and Khengar (2025), the use of AI in document management supports decision-making, eliminates redundancy, and improves efficiency, particularly in environments with high exposure to digital archives and records management.

A minority of six of 39 respondents were unaware of the potential and impact of AI technologies, which could be attributed to a lack of exposure to the technology itself or to working in environments where AI-embedded cloud computing tools had not been deployed. Others might have had unfavourable experiences due to infrastructural failures (e.g. unstable internet connections or inadequate training).

Those who were undecided were likely to have a limited understanding of how such systems operate or to have had no direct involvement in their application within archival activities. This aligns with the research conducted by Georgieff and Hyee (2022), who argue that recognising the impact of AI technologies on archival systems has been undermined because most archival services workers have not been exposed to its benefits and to how it increases productivity. This argument is supported by the findings of Boavida and Candeias (2021), who established that technological adoption in developing countries often faces a productivity paradox due to situational constraints such as low digital literacy, underfunding, and institutional lags.

The majority of the interviewees (Participants 1–15) were hopeful that AI-embedded cloud systems would improve productivity in archival records management. This might be because they were grounded in the realities of day-to-day operations in a resource-constrained environment for archival records management services. Their viewpoint resonates with the view of Igna and Venturini (2023), who opine that workers who frequently use AI-embedded cloud computing tools are more likely to recognise their benefits than those who do not use these tools and technologies as much.

A minority of participants cited infrastructural issues, including an unstable power supply, unreliable internet connectivity, and inferior computers, as major hindrances. These participants were likely grounded in the realities of day-to-day operations in resource-constrained environments and viewed digital transformation as a long-term strategy, believing that the underlying issues must be addressed first. In other words, their hesitation was driven by practical considerations rather than technological resistance.

The literature review highlighted that technical solutions in AI-embedded cloud computing, in most cases, fail in the CoEs of Ghana, not because of ineffective tools, but rather because of environment-related issues such as infrastructure, finance and human resource capabilities. AI adoption without addressing these underlying issues may lead to implementation failure, which likely explains the cautious responses among participants (Czarnitzki, Fernández & Rammer 2023). In their research, Robbins and Van Wynsberghe (2022) established that the effective implementation of AECCT in archival records management mainly relies on stakeholder preparedness and capacity building, which explains the cautious optimism.

5.3.2 AECCT implementation may face out archival records workers

The majority of the respondents (15 of 39 respondents) revealed that adopting AECCT would render archival records staff obsolete in the CoEs of Ghana. This majority viewpoint was likely due to a growing fear that the computerisation of

traditional record-keeping and retrieval procedures would reduce the demand for jobs involving manual labour. As the quality of AI software improves, enabling it to handle tasks such as data classification, storage and retrieval, some archival staff may become concerned about potential job losses. This concern is supported by Acemoglu and Restrepo (2020), who assert that the advancement in AI and automation has led to the replacement of repetitive human labour, particularly in administrative and clerical work.

Similarly, Chudayeva and Dmitruk (2022) opine that automation would replace a significant number of routine-based occupations, including those entailing information management. These findings affirm the concern that the use of AI in the management of archival records may ultimately render some human jobs obsolete.

A minority of respondents disagreed with the assertion. This may be because even if AECCT assists with repetitive tasks, it may not replace the sound judgment, oversight, and decision-making required in archival records management. AI should be seen as a complementary tool rather than a replacement. Respondents who were unsure about potential job losses likely needed more exposure to or information about the impact of AI on the job market to form an absolute opinion. This is supported by Puerta-Beldarrain, Gomez-Carmona, Sanchez-Corcuera, Casado-Mansilla, Lopez-de-Ipina and Chen (2025), who argue that rather than replacing human labour, intelligent systems will instead increase their capacity, envisioning a future in which humans and machines collaborate (Arslan, Cooper, Khan, Golgeci & Ali 2022). They also maintain that the human role in information system management remains central, due to ethical, contextual and interpretive factors that AI cannot handle. These arguments align with the school of thought that AI will not fully replace archival staff.

Insights from interview participants further underscored these contrasting views. Of the 12 participants, Participants 1–9 feared that jobs would be automated,

resulting in them losing their jobs, while Participants 10–12 adopted a more positive outlook, acknowledging changes but suggesting that staff might retain their jobs by adapting to emerging technologies. This finding reflected growing concerns that routine functions, such as document indexing, searching, categorisation and filing, would increasingly be delegated to automated systems. However, there is a parallel belief that upskilling and adapting to technological advancements may reshape or redefine careers rather than entirely erase jobs.

As noted by Arslan et al (2022), structured, routine and predictable tasks are the most vulnerable to automation by AI. Du, Jiang, Xu and Zhou (2025) further explain that, while some roles may be fully replaced or outsourced to automation systems, new roles will emerge for individuals who develop the skills to work collaboratively with intelligent systems. This aligns with the views of participants, who perceived a shift in roles rather than complete displacement by AI systems.

A minority of participants believed that AI could not entirely replace humans, reasoning that records management entails responsibilities beyond the capabilities of current technologies. These participants would likely view AI as a tool – not a substitute, believing that although AI may process information, it lacks the human common sense required for document verification, ethical decision-making, or handling confidential information. Their own experience could show that human oversight remains necessary, even in technology-enhanced environments. Their assertion is supported by Ngoepe et al. (2022), who note that although machines and intelligent systems can perform and replicate several tasks, there will always be a place for professional judgement, ethical reasoning and decision-making, which are fundamentally human capabilities. These arguments provide additional support for the minority opinion that AI will not fully render archival staff redundant.

5.3.3 Utilising AECCT may optimise archival operations at CoEs

The majority of the respondents – 22 of 39 respondents – supported the proposition that the application of AECCT could potentially optimise the archival

operations of the CoEs through automatic predictive maintenance, enhanced efficiency and fraud detection of the archival records management systems. This could be because the ability of AI to perform complex data analysis, monitor systems and automate routine tasks makes it ideal for improving operational efficiency in archival records management. The promise of fraud detection and predictive maintenance resonates with their desire for reliability, accuracy and accountability in record keeping.

As argued by Ngoepe et al. (2024), AECCT is most appropriate for anomaly detection and workflow optimisation, and, therefore, it is highly capable of making data-driven processes easier. Similarly, Broekhuizen, Dekker, De Faria, Firk, Nguyen & Sofka (2023)

argue that AI has the potential to enhance operational effectiveness and reduce system downtime through predictive maintenance. All these scholars agree that, if properly employed, AI technology has the potential to improve archival operations significantly.

The minority – i.e., 7 of 30 respondents – disagreed with the view that AI could potentially improve archival operations, which could be attributed to substandard digital infrastructure, inadequate staff training and the incompatibility of high-end technologies with existing institutional work processes. Others could also contest the feasibility or sustainability of AI adoption without first addressing basic operational gaps. According to Mungai and Bayat (2018). The implementation of AECCT in the CoEs primarily fails because of inadequate infrastructure, lack of experience and resistance to change. Dikmen and Burns (2022) assert that technology must be anchored in local institutional imperatives if it is to be successfully adopted. These remarks support the hesitation of some respondents regarding the actual impact of AI on archival work in the CoEs of Ghana.

The majority of the participants (Participants 1–20) expressed strong optimism about the benefits of AI, opining that it would transform archival operations through faster processing, fraud detection and improved productivity. This might be

because they were most likely aware of the potential of automation and data intelligence to eradicate current inefficiencies. They were assured, because they saw AI as a tool that not only accelerated processes but also increased transparency and offered system reliability.

Participants' high expectations of AI are supported by Ngoepe et al. (2022), who point out that AI is most valuable in predictive analytics and pattern recognition, which are very important in fraud detection and system optimisation. Furthermore, Ali et al. (2023) point out that the use of AI in information systems can greatly reduce errors and improve decision-making.

Participants 21–26 were reserved or pessimistic, feeling that the benefits of AI could not be utilised to maximum levels without necessary infrastructure and education, while Participants 25–26 pointed out that the success of implementation depended on how well AI solutions were tailored to the specific institutional needs.

These interviewees could have had first-hand experiences with previous system implementations that failed due to poor planning or poor support. Their responses showed that optimism was not enough, and that actual institutional readiness, capacity building and context-sensitive adaptation were required for AI to function.

The caution expressed by the minority of participants regarding infrastructure, training and customisation is supported by Broekhuizen et al. (2023), who opine that technology must be made to fit local institutions – particularly in the developing world – in order to avoid failure. Similarly, Dikmen and Burns (2022) caution that, unless infrastructure and user training are properly addressed, even the most advanced systems will fail to deliver impact.

5.3.4 Archival records practitioners may lose their jobs if AECCT is implemented at CoEs

The majority – i.e., 17 of 39 respondents – agreed that the use of AI-embedded cloud computing technology could render archivists and records managers in CoEs obsolete. This suggested that the majority of respondents viewed AI as a disruptive technology that could automate fundamental archival processes currently undertaken by experts.

Their concern might stem from the increasing automation of repetitive tasks such as indexing, retrieval and data sorting, which are central to records management. As AI capabilities continue to improve and become more cost-effective, employees may fear that their roles could be reduced or eliminated entirely. According to Acemoglu and Restrepo (2020), occupations involving repetitive and predictable tasks are particularly vulnerable to automation. Archivists and records managers whose responsibilities typically include repetitive document processing and system maintenance are, therefore, at risk of job displacement. Bhargava, Bester and Bolton (2021) also, argue that AI adoption may result in workforce restructuring, particularly within administrative functions.

A minority of six (6) of the 39 respondents strongly disagreed that AI could entirely replace humans. These respondents could potentially think that, although AI could perform repetitive tasks, it could not entirely replace human oversight, judgment, and ethical decision-making. Prentice and Nguyen (2020) are of the opinion that AI will increase current work, rather than replace it, reconstructing the profession of experts without replacing them. Similarly, Susskind and Susskind (2016) suggest that the application of AI leads to job changes in which workers will master new competencies, rather than being replaced. These reflections align with the perspective of the minority of respondents.

The majority of the interviewees (Participants 1–10) were concerned that increased automation by AI could reduce the number of staff members needed to manage records, thereby resulting in job losses. However, several participants in

this group also concurred that, while some jobs could be rendered obsolete, others could potentially adapt with appropriate skill upgradation. This category of participants likely held the opinion, because of the direct relationship between automation and minimising manual jobs. Their concern originated from the belief that CoEs would not implement reskilling strategies proportionate to the deployment rate of AI.

Santhosh, Unnikrishnan, Shibu, Meenakshi and Joseph (2023) contend that, as machines become more powerful, professional work will increasingly be separated between tasks that machines can perform better and those that require human expertise. This is consistent with the conservative approach of most participants regarding the threat of job displacement.

The minority of interviewees (Participants 11–19) expressed a positive view, noting that while AI would affect some jobs, it would also create new ones, particularly for those willing to adapt to emerging technologies and new systems. Most of these participants believed that human oversight, judgement, and decision-making remained critical elements of archival work. This might be because they trusted human-centred functions such as policy enforcement, verification and moral decision-making, which could not be fully automated. According to Bhargava, Bester and Bolton (2021), anxieties about mass job displacement through automation are more about hyperbole than about realistic expectations. Most jobs consist of a variety of tasks, of which only some can be automated. Human-AI collaboration is, therefore, the more practical future – a view supported by the positions of Participants 11–19.

5.4 Usability of AECCT in the management of digital archival records in the CoEs of Ghana

The interpretation and discussion presented in this section rest on Research Objective 3: to examine the usability of AECCT for managing digital archival records in the CoEs of Ghana.

The third research objective of the study was to assess the usability of AECCT in handling digital archival records in the CoEs of Ghana. This aim was most significant in determining the practical usability and the readiness of archival staff to embrace and use such technologies.

The findings, drawing on quantitative and qualitative data, provided rich insights into employees' AI competence levels, the rate of application of AI-related competencies, and the broader implications for usability. Firstly, the findings in Section 4.7.1 showed the varying levels of proficiency among staff in the archives with regard to AI skills. It could be seen that, while some participants were well-trained and confident in AI applications and cloud-based systems, the remaining participants had less exposure to and no technical experience with such technology.

Highly skilled participants expressed strong interest in adopting AECCT, emphasising that these systems would enhance productivity, reduce manual intervention, and improve efficiency in archival processes. Usability was not a problem for them, as they were assured, they could manage the features and adopt new digital processes.

On the other hand, individuals with less experience of or exposure to AI tools were apprehensive about the ease of use of such technologies. They found AI systems difficult to understand and expressed a strong need for systematic training and ongoing technical support. Their responses suggested that, while AI-embedded cloud systems could be highly useful, their usability relied heavily on the user's digital competence and experience with such systems. This viewpoint emphasises the critical importance of building human capacity for technology deployment. For AI solutions to be implemented in real-world archival settings, there needs to be conscious investment in employee training and digital reskilling at all levels in the institution. The study highlights that the successful implementation of AECCT in

records administration in CoEs depends not only on the availability of technology but also on the skills, confidence, and daily engagement of end-users.

The suitability of AECCT in the administration of digital archival records in Ghanaian CoEs rests on staff capacity, usage levels and organisational support systems. In spite of widespread optimism regarding the revolutionary potential of such technologies, the study emphasises the need for formal training programmes, continuous technical support and a phased integration approach to bridge the digital literacy gap. If these prerequisites are met, AI-based cloud computing technology should be functional and effective in revolutionising archival records management in the education system of Ghana.

5.4.1 Artificial intelligence (AI) skills proficiency

The majority – 16 of 39 respondents – indicated that they had basic competence in AI skills. This may reflect archival records service workers who had worked with AI applications or received basic training. Although they were familiar with basic applications, they were unsure about advanced levels of AI because of limited training, assistance or support. According to Celik (2023), archival workers generally have an elementary familiarity with AI, but often lack the deeper skills needed for the full utilisation of its potential, leading to underutilisation of the technology unless upskilling is prioritised. Park and Ryoo (2013) similarly observe that AI literacy is still at an elementary level in most organisations worldwide, despite rising demands for greater competence.

A minority of three (3) respondents mentioned an advanced level. Those with higher proficiency most likely acquired their skills through formal training, online courses or vocational education. Morandini, Fraboni, De Angelis, Puzzo, Giusino & Pietrantonio (2023) argue that digital skills disparities in schools are common, particularly when institutional policy does not incorporate formal training. Molenaar (2022) also argues that without strategic investment in workforce AI literacy, skills disparities will persist, limiting the adoption of AI technologies.

The majority of participants (participants 6-15) also indicated that they had a fair or moderate level of knowledge in AI, particularly in cloud-based systems. They argued that, although they were not experts, they could easily manage systems, believing they could expand their knowledge and skill sets through relevant training. This disposition suggested that these participants opined that AI literacy was attainable through structured training and hands-on exposure. Their responses reflected a favourable, general openness to technological change, demonstrating a proactive mindset towards acquiring new skills despite existing constraints.

Passalacqua, Pellerin, Magnani, Doyon-Poulin, Del-Aguila, Boasen & Léger (2024) assert that user confidence in AI increases with exposure and practice, and organisations that emphasise practice increase staff confidence considerably. Similarly, Passalacqua et al. (2024) find attitude and adaptability as the prime enablers for successful AI skills uptake.

The minority group of participants (Participants 21–24) demonstrated low or no proficiency, indicating that AI was largely out of their reach without professional training. This might be because the skilled group likely had better training or greater personal interest in AI, whereas the less skilled group lacked institutional incentives or prior experience with AI tools. Their conservatism reflected a need for usable systems and structured training programmes.

Based on the findings of their study, Passalacqua et al. (2024) observe that existing ICT literacy and self-directed learning are strong indicators of the adoption of AI. However, Morandini et al. (2023) warn that users without orientation or support will be prone to resist new technologies, regardless of their benefits.

5.4.2 Frequency of the application of AI skills in existing role

A majority of 14 of 39 respondents reported limited exposure to AI, which might be due to their sporadic use of AI technologies or because they were working in roles

where certain processes, such as reporting or documentation, had only been partially automated using AI functionalities.

Institutional limitations might not enable regular or full integration of such technologies. As suggested by Antonopoulos, Robu, Couraud, Kirli, Norbu, Kiprakis, Flynn, Elizondo-Gonzalez & Wattam (2020), AI is gradually being embraced by employees at most educational institutions, resulting in inconsistent usage patterns. Similarly, Chinyemba and Ngulube (2005) also discovered that average AI usage tends to indicate transitional states in digitisation and infrastructure development.

A minority of three (3) respondents affirmed that they frequently use AI tools in their work. This might be those who regularly use AI embedded cloud computing to work in more technologically equipped departments or have sought training in the usage of AI-assisting systems.

Brynjolfsson and McAfee (2014) point out that, within organisations, the digital divide is likely to create significant disparities in the adoption of AI. Similarly, Chittipaka, Kumar, Sivarajah, Bowden and Baral (2023) learn that the absence of a clear AI implementation plan hinders the general practice, while there is a negligible portion of those who actually make active efforts among early adopters.

The majority of participants (Participants 2–10) reported that they sometimes employed AI in their work, indicating that the use of AI for a specific activity, such as data processing or document automation, had increased productivity, although it was not yet a core part of their processes. These users likely had access to some AI platforms or tools. Their responses reflected growing familiarity with and appreciation for AI, although its use was situational and not systemic.

Chinyemba and Ngulube (2005) emphasise that, if AI software is easy to operate and introduced gradually, employees adopt AI technologies at a comfortable pace.

The scholars further highlight the importance of gradual exposure as a strategy to facilitate acceptance and effective use (Chinyemba & Ngulube 2005).

However, a minority group of participants (Participants 11–15) reported that they rarely or never used AI, citing a lack of infrastructure, minimal relevance of AI to their work, or insufficient training. The heavy users were generally employed in roles with greater digital engagement, whereas others operated in under-resourced or analogue-rich environments.

These participant accounts highlighted institutional gaps in AI adoption, indicating that even when staff were willing, using such tools was challenging. Chittipaka et al. (2023) argue that AI adoption should be accompanied by systemic transformation and training to prevent uneven uptake. Similarly, Chinyemba and Ngulube (2005) found that infrastructure limitations, rather than employee unwillingness, are the key impediments to AI use in education systems.

5.5 AECCT infrastructure for the management of digital archival records in the CoEs of Ghana

The interpretation and discussion of the findings presented in this section are based on Research Objective 4: Identify the AECCT infrastructure for the management of digital archival records in the CoEs of Ghana.

Responses from respondents and participants under Research Objective 4 revealed varying levels of experience and readiness for the adoption of AECCT in the CoEs of Ghana. The findings indicated that, although some institutions had begun adopting digital tools and cloud-based technologies, the implementation of advanced AI technologies – such as neural networks, natural language processing and intelligent automation – remained limited or in its early stages.

Across the different dimensions explored, such as the use of cloud computing tools, experience with neural networks and overall infrastructure readiness, there was a consistent theme of asymmetrical exposure and readiness. A few

participants demonstrated moderate to good experience and awareness of such technologies, referencing potential benefits for efficient archival records management. However, the majority demonstrated elementary or poor knowledge with significant gaps in digital infrastructure, training and institutional support systems. Furthermore, the evidence identified technical infrastructure preparedness as a significant inhibitor to complete adoption.

The majority of institutions still operated with manual systems, outdated hardware and irregular or unstable internet connectivity. Even if the infrastructure existed, there was a pressing need for capacity-building initiatives, finance and strategic planning to harness the full potential of AECCT in records management. In summary, the research objective underscores the pressing need for a holistic approach that combines infrastructure investment, staff training and policy support to enable the effective adoption and utilisation of AI technologies in archival management in the CoEs of Ghana.

5.5.1 AECCT infrastructure experience in machine learning (ML)

The majority of the respondents – i.e., 15 of 39 respondents – reported that they had basic experience with machine learning in AI-embedded cloud computing technology infrastructure. This could be attributed to exposure to digital technologies and institutional efforts to introduce foundational AI tools in educational environments. In spite of their usage not being advanced, these respondents were likely to know about the potential use of machine learning in automating routine tasks, handling digital documents and facilitating decision-making through data analysis.

According to Tan, Lee and Lee (2022), the implementation of AI and machine learning in higher education is generally met with enthusiasm when workers are introduced to its basic applications, such as automated classification and processing of data. Similarly, Sharma, Sharma and Jindal (2021) assert that basic awareness of machine learning among education personnel is enhanced when

institutions offer digital training or give exposure to AI tools through administrative activities.

Only one (1) participant reported having advanced experience, which can be attributed to a technical background and pursuing specialised education. Tan, Lee and Lee (2022) opine that the gap in digital competence still exists in schools due to limited training, low digital competence level, and the confusion of institutions regarding AI applications. Similarly, West and Allen (2019) observe that, even if AI technologies do exist, employees require specialised education and training to enhance their understanding of the technologies.

Most of the interviewees – specifically Participants 2–15 – indicated basic or medium-level experience in utilising machine learning in archival records management by using AI-supported cloud computing environments. This could be attributed to workshop exposure and self-learning, which gave them a general overview of the way machine learning supported data classification and retrieval.

Although they had not explored the full potential of the technology, Participants 8–15 reported using machine-learning features in file-labelling systems and predictive text features embedded in their digital systems. Weinert, Müller, Svensson, and Heinze (2022) observe that initial training and exposure to AI systems generate fundamental familiarity among scholars and all users of AI, even without deep technical understanding. Similarly, Aldoseri, Al-Khalifa and Hamouda (2024) note that even limited exposure to machine learning can increase awareness and drive interest in more sophisticated applications, particularly in information management.

Only one participant representing the minority reported that they understood the theory but had no hands-on exposure to machine learning. Such participant ratings could be owing to the likelihood that the participants were located at colleges that lacked effective digital facilities, or at colleges where the incorporation of machine

learning tools was still pending. Their lack of hands-on exposure resulted from inadequate training and/or supporting measures, or from the relevant policy directives to utilise AI tools for the purposes of archival records management.

In spite of the promising potential of AI application in African learning environments, issues with adoption – including lack of finance, poor infrastructure and lack of capacity typically prevent actual adoption (Chinyemba & Ngulube 2005). Aldoseri, Al-Khalifa and Hamouda (2024) also noted that successful digitisation depends on an enabling environment that does not only include technological facilities, but also human resources to use them appropriately.

5.5.2 AECCT infrastructure experience natural language processing (NLP)

Most respondents – 19 of 39 respondents – reported that they possessed moderate experience with automatic rules in AI-integrated cloud computing technology infrastructure. This was because these respondents were expected to have some experience in automatic rule-based systems in digital environments, such as auto-tagging, archival triggers, or content classification. Their mid-level experience could also be due to institutional workshops, administrative interfaces, or research work involving the use or observation of rule-based automation.

As indicated by AlQudah, Al-Emran and Shaalan (2021), automatic rules in AI systems, such as if-then logic, are increasingly being utilised in digital record systems for enhancing operational efficiency. Similarly, Forradellas and Gallastegui (2021) observe that employees' moderate acquaintance with automation regulations stems from eased digital transformation projects, whereby AI systems undertake repetitive archival operations based on defined conditions.

Two (2) respondents indicated advanced experience with automatic rules, which may be due to their positions or backgrounds involving integration with AI systems, enabling them to experiment with rule-based automation at deeper levels.

Timotheou, Miliou, Dimitriadis, Sobrino, Giannoutsou, Cachia, Monés and Ioannou (2022) note that digital inequalities often leave employees with no hope of working with automation tools, particularly in underfunded academic environments.

Most of the interviewees – in particular Participants 8, 23 and Participant 26 – reported having rudimentary or moderate experience with automatic rules in AI-embedded cloud computing systems. This may reflect some exposure to rule-based systems in digital environments, such as auto-tagging, archival triggers, or content classification. Khurana, Koli, Khatter and Singh (2023) note that exposure to rule-based systems is increasing as institutions adopt digital platforms with conditional logic to improve archiving. Additionally, Rebolledo Font de la Vall and González Araya (2023) observe that moderate engagement occurs when workers are allowed to experiment with automation features, which helps them appreciate their role in process improvement.

The minority of respondents showed extensive awareness of automatic rules, possibly because they were involved in digital transformation projects or in settings with embedded AI, which exposed them to practical experience with advanced rule-based archival systems that automate tasks and enhance consistency.

Timotheou et al. (2022) argued that limitations in digital investment continue to hinder the adoption of AI-based tools by the majority of African educational institutions. In contrast, Brunetti, Matt, Bonfanti, De Longhi, Pedrini and Orzes (2020) indicate that extensive exposure to automation tools typically stems from participation in organisational digital programmes or external professional courses in intelligent technologies.

5.5.3 AECCT infrastructure experience in automatic rules

The majority of respondents – 19 of 39 – indicated they had moderate experience with automatic rules in AECCT infrastructure, possibly because they had prior experience with automatic rule-based systems in digital environments such as

auto-tagging, archival triggers, or content classification. Their intermediate level of experience might result from institutional training sessions, administrative mechanisms, or research involvement in applying or observing rule-based automation. Two (2) respondents, on the other hand, reported advanced experience with automatic rules, possibly because they worked with AI systems that allowed them to explore rule-based automation at advanced levels.

As Liu (2025) opines, such systems are increasingly integrated into archival records management to support intelligent classification. Similarly, Alaoui (2024) observes that structured training and institutional support for professionals in archival management are crucial to enhance familiarity with automation tools. Familiarity with automation rules among employees is fostered through guided digital transformation programmes, in which AI systems automate repetitive tasks in archives based on formal conditions (Colavizza, Blanke, Jeurgens & Noordegraaf, 2021).

Most interview participants indicated having a basic or moderate degree of experience with automatic rules in AI-based cloud computing systems. This was possibly because these respondents had some degree of exposure to automatic rule-based systems in computer environments, such as auto-tagging, archive triggers, or content categorisation. Liu (2025) explains that interaction with automated rule systems is increasing as institutions introduce digital platforms based on conditional logic to support archiving. Moderate interaction occurs when employees are allowed to experiment with automation features, which creates appreciation for their role in process optimisation.

A minority of participants reported having high-level familiarity with automatic rules, which could be because they were engaged in digital transformation projects or AI-facilitated ecosystems, which gave them hands-on experience in operating high-end rule-based archival systems that automate processes and enhance consistency. Timotheou et al. (2022) opine that a lack of adequate digital

investment continues to hinder adoption of AI-facilitated tools in the majority of African institutions of learning.

5.5.4 AECCT infrastructure experience in neural networks

The majority of the respondents – 13 out of 39 – reported only basic experience with neural networks within AECCT infrastructure, possibly because their engagement was largely theoretical, focusing on conceptual applications such as pattern recognition and classification, with minimal hands-on practice or institutional implementation. As claimed by Rodriguez-Conde, Campos and Fdez-Riverola (2023), neural networks form the core of modern AI applications, although institutional use critically relies on information literacy. A study conducted by Chen, Xie, Zou, Cheng, Tao and Wang (2025) indicates that administrative staff are increasingly familiar with AI concepts due to the availability of MOOCs and webinars, but their application in practice remains low.

Two (2) respondents reported having advanced experience. These two respondents may have had advanced experience and professional or academic involvement in AI projects, giving them greater knowledge and practical exposure to neural networks. As Rodriguez-Conde, Campos and Fdez-Riverola (2023) point out, moderate exposure is often the outcome of structured training, filling theoretical-practical gaps in AI system understanding. Simultaneously, the digital divide concerns addressed by Chen et al. (2025) limit AI exposure for the majority of professionals in resource-poor regions. By contrast, high-level users stem from technology-innovative organisations or research initiatives funded by external sources.

The majority of the participants, specifically Participants 1–19, indicated that they had no knowledge of or experience in neural networks as used in AI embedded systems. The basic knowledge is mainly acquired through online tutorials or theoretical classes – not from practice, which implies an awareness-practice gap in education. Rodriguez-Conde, Campos and Fdez-Riverola (2023) specifically

point out that AI adoption is frequently hindered by deficiencies in digital infrastructure and support. As reported by Modiba (2023), although neural network exposure is on the rise in classrooms, it generally only achieves introductory levels, unless there is specific professional development.

A small number of participants (participants 25 and 26) demonstrated high or near-high conceptual understanding of and practical experience with neural networks, likely due to their direct involvement in projects implementing neural networks for tasks such as classification, prediction, or data analysis within archival systems. Such experiences would equip them with a deeper understanding of the way neural networks can refine institutional data handling. According to Chen et al. (2025), the actual application of neural networks typically relies on technical capabilities and interdisciplinary collaboration, which are commonly found in leading institutions or research projects. Additionally, Chen et al. (2025) found that staff engaging in actual AI projects are likely to adopt neural networks, particularly in data-intensive industries such as education and archives.

5.5.5 AECCT infrastructure experience in cloud-embedded electronic records management systems

Fourteen (14) of the 39 respondents had general experience with cloud-embedded electronic records management systems in the context of AECCT infrastructure. This might be because most of the respondents were based in institutions that were beginning to make the transition from manual or traditional systems to digital record-keeping mechanisms, likely via such platforms as Google Drive or Microsoft OneDrive. Because these early-stage digital products have little AI incorporation, the experience is categorised as basic.

The majority of public institutions across developing countries are gradually integrating electronic records management systems, where most users still have to proceed beyond the pilot or familiarisation stages (Rajasekaran & Duraipandian 2023). Ren et al. (2023) also, outline the way cloud migration typically starts with

basic storage, after which it proceeds to incorporate AI-powered records management systems.

Five (5) of the respondents indicated that they had advanced experience, possibly due to their roles involving strategic digital transformation or their experience in applying cloud-based records systems with AI features, such as auto-tagging, outlier detection, or predictive document retrieval. Alotaibi et al. (2025) argue that the effective use of electronic record systems depends on organisational readiness and digital literacy, but these conditions remain largely aspirational. Advanced users are found in organisations that have made significant investments in digital transformation. AI incorporation into such platforms has been found to enhance performance and accuracy in classification, access and conformity (Chandrasekhar & Burgundian 2023).

The majority of participants (Participants 1–15) reported having no experience, whereas a minority reported little exposure. This could be because, although some institutions attempted to apply AECCT, implementation had not been fully developed or AI-enhanced, limiting their experience to basic functions such as storage and retrieval. According to Ngoepe et al. (2023) the majority of the educational institutions in sub-Saharan Africa – including colleges of education – remain without the necessary digital infrastructure for records management. Familiarity at a basic level typically results from casual exposure and not formal training or system adoption. Additionally, Jeilani and Abubakar (2025) argue that adoption is highly contingent on institutional vision and support.

A minority of two (2) participants reported having had some exposure to advanced knowledge or hands-on experience with AI. These participants indicated that they had comprehensive knowledge of cloud-based software and its operation with AI, indicative of advanced expertise. However, one (1) participant reported that although he lacked comprehensive knowledge and experience, he had a strong

conceptual understanding of the potential and usability of such systems for future institutional planning.

This finding might result from participants having first-hand experience with cloud-embedded electronic records management systems. The studies conducted by Elsayy (2024) affirm that such systems significantly lower archival burden and enhance data integrity, particularly when embedded in smart technologies.

5.5.6 Technology infrastructure experience in cloud computing tools

A total of 15 respondents reported that they had basic experience with cloud computing tools as part of their technology infrastructure, which was probably because they were trained to work with traditionally used tools like Google Drive and Dropbox. Nevertheless, their abilities were limited to simple file uploading and sharing, and they were yet to take advantage of AI-driven features like auto-categorisation, smart search and predictive storage. While public institutions increasingly utilise cloud computing tools, their use is superficial and not optimised (Tsabedze 2020). Easy access to inexpensive or free tools facilitates basic application, but inadequate training and limited institutional support hinder deeper exploration of AI-supported functionalities.

Three (3) participants reported advanced experience, possible because they were accustomed to cloud platforms like Microsoft Azure or Google Cloud, with integrated AI features like real-time analytics, automation and intelligent grouping.

As contended by Elsayy (2024), organisations at higher levels of digital maturity use enterprise-grade cloud platforms, which support AI integration for records and data management. Therefore, it is possible that experienced users are better positioned to make the most of what the entire suite of cloud computing has to offer, including smart archival workflows.

The majority of participants (Participants 1–15) belonged to the category of no or elementary experience, possibly using basic platforms such as Google Drive and Dropbox for file storage, but not for any advanced-level or AI-driven capability. Their institutions had not offered formal training in the effective use of these tools. As stipulated by Tsabedze (2020), one of the main impediments to the uptake of cloud in developing environments is the lack of capacity-building programmes, resulting in users being able to use the tools but not their wider applications.

The minority of participants reported high-level experience, possibly because they had worked directly on high-level cloud services (e.g. Azure and GCP) with functions such as AI-enabled auto-classification and analysis. Ren et al. (2023) emphasise the importance of cloud services as central to institutional digital transformation. These platforms facilitate integration with AI, automation and intelligent data processing – features that are highly desirable for modern archival administration.

5.5.7 Technical infrastructure readiness to implement AI-embedded cloud computing in CoEs in Ghana

A total of 22 respondents indicated they were ready to embrace AECCT from a technical infrastructure point of view, possibly because they likely had access to secure internet connectivity, functional computing systems and initial cloud-based environments. Their CoEs had achieved a moderate level of digital adoption, providing a reasonable foundation for hosting AI technologies, although not yet at an advanced level.

Gyamfi, Dayie and Asiedu (2022). point out that numerous schools in Ghana are gradually establishing the technical groundwork for the implementation of AI. Before progressing towards AI-scaffolding systems, preparedness typically starts with infrastructural computers, the internet and digital processes.

Two (2) respondents were not prepared whatsoever, possibly because they lacked an infrastructural foundation or had outdated systems, making AI implementation

highly unlikely, unless substantial upgrades are implemented. According to UNESCO, AI readiness depends on the integration of three key pillars: human capacity, infrastructure and digital policy (United Nations Educational, Scientific and Cultural Organisation 2020). Institutions lacking any of these pillars – particularly robust infrastructure – cannot be considered ready for AI-embedded systems. In this way, budgetary restrictions and the absence of ICT policy and leadership result in most African institutions still using manual or semi-digital systems.

The majority of the participants (Participants 1–15) indicated that they were ready to utilise AECCT. This could be because they had an existing functional infrastructure, such as computers, high-speed internet and cloud storage systems, although they required training and support to get the best out of these tools in terms of incorporating AI. Evidence from the research of Gantz and Reinsel (2019) confirms this argument, indicating that preparedness is not merely a matter of physical infrastructure, but also digital competence and institutional willingness. Institutions that integrate infrastructure with capacity-building measures are more ready for AI adoption.

A few participants reported that they were not yet prepared, likely due to inadequate infrastructure, unstable internet connectivity, limited digital equipment and a lack of essential IT infrastructure and systems. These institutions still operated primarily through manual processes, making AI integration essentially unfeasible.

Jeilani and Abubakar (2025) emphasise that digital transformation is unevenly distributed, particularly across the public school system. Institutions lacking fundamental digital architecture or policy support simply cannot implement AI-driven cloud systems without external finance and structured reforms.

5.5.8 Institutional technical infrastructure readiness for AECCT implementation

The majority indicated neutrality regarding their institutional technical infrastructure readiness for AECCT implementation. This likely reflected that, while their institutions had a basic technological foundation, they were unsure whether it could support AI functionality without further investment in infrastructure and system audits. Institutions are not aware of the benefits of AECCT application in archival record services, which hinders the decision on AI adoption. Five (5) respondents, representing the minority, stated that they were not ready, possibly because they were hesitant to deal with challenges like ageing systems, unpredictable internet connectivity and a lack of AI knowledge. Such organisations require enormous upscaling to support AI integration. AI implementation requires careful infrastructure assessment, hardware and human capability. Organisations and companies that lack stable IT support and whose systems are outdated may face challenges in installing advanced technologies like AI embedded cloud computing.

The majority of participants believed that they were adequately equipped and ready to install AI-embedded cloud computing systems – possibly because they had made significant investments in modernising their IT infrastructure, including new servers, cloud systems and high-level AI training for IT support staff. Their readiness resulted from a mature platform and a readiness to embrace AI in their activities.

As stated by Rajasekaran and Duraipandian (2023), organisations that have built mature infrastructures, such as cloud storage, broadband internet and skilled personnel, are prepared to integrate AI technologies. These organisations focus on building technical capacity and developing employees' skills while moving towards AI adoption.

Four (4) participants, representing the minority, reported that their institutions were not ready for AECCT implementation, possibly because of outdated systems, unreliable or unstable internet and insufficient IT personnel with AI expertise.

Alternatively, they might have indicated that they were not ready because of the difficulties they were experiencing with outdated systems, unstable internet connectivity and limited AI experience. Therefore, they were not yet in a position to implement AI without significant infrastructure overhauls. As asserted by Rajasekaran and Duraipandian (2023), institutions at this level can be mandated to prioritise the development of digital software and technical literacy among workers in a bid to realise successful AI adoption.

5.6 Skills required to use AECCT in the management of digital archival records in the CoEs of Ghana

The interpretation and discussion presented in this section are based on Research Objective 5: Identify the skills required for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana.

The overall finding from the analysis of the primary data indicated that staff at the CoEs in Ghana predominantly possessed basic to moderate skills in key technical skill areas, including cloud computing, artificial intelligence, data management, project management and cybersecurity awareness, with only a few having advanced skills in some of the areas. This uneven skill profile highlighted a significant capacity gap that could hinder the successful deployment and sustainability of AI-powered cloud computing platforms in digital archival records management.

As reflected in bar charts and histograms (see Figure 4.22), the quantitative data consistently showed that the majority of the staff rated their ability in the management of digital archival records either at a beginner or intermediate level, with a small minority identifying themselves as advanced users.

These self-assessments aligned with the qualitative descriptions, which also indicated varying degrees of familiarity and competence in the skill areas. In terms of cloud computing, some respondents and participants could deal with cloud storage and perform basic tasks, but most lacked in-depth knowledge of cloud

infrastructure, virtualisation or deployment models. Similarly, in terms of AI competencies, the participants and respondents manifested limited knowledge, with a majority associating AI with basic automation and a few demonstrating knowledge of machine learning or AI applications in digital records.

Data management competencies appeared relatively strong among the participants, with some possessing knowledge of metadata, data security and digital record organisation. However, a high percentage lacked training in database systems and structured data management, all of which are essential components of effective digital archival systems.

Although most respondents and participants had some background in coordinating functions and basic planning in project management skill sets, they were not knowledgeable about the formal methodologies, digital tools and implementation frameworks required to guide transformation efforts. The absence of such skills would compromise the successful administration of digital projects in archival contexts.

Although identified as significant, cybersecurity awareness was relatively low among respondents. In spite of some respondents showing high security protocol awareness and threat mitigation, the majority had low awareness levels, with many leaving it to IT departments to secure systems. This represented a high exposure risk for digital archival records in the face of growing cyber threats.

Cumulatively, the findings indicated a dire need for comprehensive and systematic capacity-building programmes for upskilling staff in these five competencies. Capacity development in digital literacy, AI integration, cloud-based systems, secure data management and project management software should be a top priority at institutions to enable a smooth transition from traditional to technologically advanced archival records management systems.

5.6.1 Cloud computing skills proficiency

A total of 20 of 30 respondents, representing the majority, reported having a basic proficiency in cloud computing skills. This assertion by respondents stems from their being familiar with the basics of cloud computing, which involves file sharing, accessing and successfully using cloud-based software such as Google Drive and OneDrive. While these respondents indicated being comfortable with basic level functions, many acknowledged that they would need further training to increase their competence and confidence in advanced areas. The willingness to upskill demonstrates a positive disposition and suggests readiness to support initiatives aimed at bridging the skills gap. As observed Elsayy (2024), most archival workers have a basic understanding of cloud computing, primarily focusing on file storage and collaboration tools. However, as technology continues to evolve, there is an increasing need for specialised training, particularly for roles that demand advanced skills such as data security and system management.

A minority of seven (7) respondents reported no proficiency in cloud computing skills. Although the respondents at intermediate proficiency level had more exposure to cloud computing systems, they still found some tasks to be technical or beyond their current skill set (e.g. system maintenance and AI-based systems). Advanced proficiency respondents could handle complex cloud computing applications and even integrate them into their workflow. They understood software like Google Workspace.

It is not unusual for organisations to have varying degrees of competence in cloud computing (Tambe 2025). While numerous employees are accustomed to basic cloud operations, specialised knowledge in advanced areas, such as cloud management and AI integration, is typically less common. As cloud computing becomes increasingly integrated into business processes, employees need specialised training to harness its full potential.

The majority of participants reported that their proficiency in cloud computing skills ranged from beginner to intermediate – a level of competency that reflected the possibility of these participants having had prior engagements with some of the basic tasks under cloud computing, such as file sharing and navigating related platforms such as Google Drive and OneDrive. Other participants specifically expressed confidence and comfort with the basic functions of cloud computing, but admitted the need for additional training in more complex and advanced operations, including system administration, cloud security and other AI-embedded tools. These findings aligned with the literature on cloud computing competency.

According to a study conducted by Park and Ryoo (2013), individuals who are familiar with the rudimentary features of cloud computing often struggle with more complex aspects, such as system management and security, when they lack relevant training. This view supports the need for tailored professional development programmes to enhance cloud computing competency in organisations.

A minority of two (2) participants were more self-assured, stating that they could integrate cloud tools like Google Workspace and Azure into work activities with little assistance. Participants 24 and 25 not only felt confident using cloud computing tools but were also experienced in integrating them into workflows, possibly because they could adapt comfortably to AI-supported systems, demonstrating their above-average competence in cloud computing.

As suggested by Rahman and Chowder (2020), users with greater experience in cloud platforms are more flexible in transitioning to more advanced or AI-enabled cloud applications. However, even experienced users require ongoing training and support to deal with emerging cloud technologies.

5.6.2 Artificial intelligence (AI) skills proficiency

A majority of 22 of 39 respondents indicated basic competence in AI skills, which might be because these workers possessed general knowledge about AI phenomena, such as automation tools and chatbots, but were not practically aware of the application of AI in their professional activities or archival responsibilities. They valued the potential of AI but felt that they needed more training to apply it in practice. As observed by Park and Ryoo (2013), a significant portion of the workers are aware of the potential of AI, but lack hands-on experience working with it. This group is usually familiar with the basics, but without exposure or relevant training, their ability to apply AI in workplaces remains limited.

Five (5) respondents stated that they had no knowledge or experience with AI tools, possibly because they had no practical knowledge of AI, as they did not apply it in their jobs. In this way, the absence of AI-related tasks in their current institutions might have contributed to their lack of knowledge. This group should receive foundational training and exposure to develop an understanding of AI capabilities. In their research, Park and Ryoo (2013) found that AI competency varies widely across organisations and, although most employees recognise its potential, they lack the real-world experience required for effective implementation. Higher levels of AI literacy require formal education complemented by hands-on experience.

The majority of the interviewees (Participants 1–22) stated that they possessed basic to intermediate knowledge of AI skills. Although familiar with fundamental concepts such as automation tools and chatbots, these participants had limited practical experience in real-world settings. They mentioned the need for further guidance and training.

A study conducted by Valko, Goncharenko, Kushnir and Osadchy (2022) highlights that AI literacy is basic or intermediate for most employees, noting that,

while many employees engage with AI in personal or work settings, they often lack the required depth of skill for professional application.

Only two (2) participants indicated having a high or advanced AI proficiency. These participants cited their ability to use AI classification tools as a result of their participation in targeted training programmes. These participants appeared confident in their ability to support their institutions should they decide to adopt AECCT to enhance archival records management. The responses from these participants indicated that they saw the promise of AI in streamlining operations, but recognised the need for workshops to make AI more accessible and simplified for the rest of the staff.

Valko et al. (2022) opine that employee with more experience and training in AI technologies are more inclined to use these tools in their work processes. Additionally, the provision of a support setting with workshops and training sessions can make all staff feel confident and competent to use AI in their work.

5.6.3 Data management skills proficiency

The majority of the respondents – 20 of 39 respondents – reported that they had basic competency in data management skills. This could be because they were familiar with tools like MS Excel spreadsheets and simple databases in archival record services and were capable of handling structured data, although they required additional training to be competent in more advanced systems, such as cloud-based or AI-driven platforms. According to Nabizadeh Rafsanjani and Nabizadeh (2023), a large segment of the workforce has basic data management skills but lacks the expertise required for more complex data handling.

Three (3) participants indicated they had expert proficiency in data management skills, possibly because they were highly experienced in working with databases, applying metadata standards and were familiar with data security protocols. They were confident in guiding others, particularly if the organisation transitioned to more advanced, AI-integrated systems.

According to Pendy (2023), majority of organisations suffer from data management skills gaps, particularly as they transition from analogue to digital systems. Individuals with intermediate or advanced skills can use basic systems but may need additional specialised training in complex tools and digital platforms. Those who are not proficient typically need basic training to move forward from paper-based systems.

Interview Participants 1–20 reported novice to intermediate proficiency in data management, which could be because they frequently utilised AECCT in their archival record services. This concurs with a study conducted by Pendy (2023) in which numerous data management practitioners claim to be familiar with basic tasks, but indicated that they require further training to handle more complex data systems. The variation in proficiency levels points to ongoing professional development in data management practices.

Two participants indicated having expert-level competence in data management – a proficiency that could be attributed to their in-depth familiarity with data management principles and operational protocols, enabling them to guide others in the use of sophisticated systems.

This finding corroborates with Tuli, Casale and Jennings (2023), who note that professionals in data management tend to demonstrate a high level of awareness of advanced systems and complex tools. These professionals are usually at the forefront of the adoption of emerging technologies such as the AECCT.

5.6.4 Project management skills proficiency

A total of 15 out of 39 respondents – the largest group in the survey – indicated that they possessed basic project management skills. This might be because these respondents had experience in tasks such as coordinating small teams, planning meetings and adhering to deadlines. However, they might lack formal training in project management tools or methodologies and feel that they would benefit from

capacity development in this area. Niederman (2021) confirms this by stating that individuals with basic competency in project management are typically involved in administrative or support roles, but lack formal training in the tools and methodologies required to manage larger, more complex projects. Training is required to advance to intermediate or advanced levels of competency.

Three (3) respondents had expert proficiency, possibly because they had led digitisation and system transformation projects, employing tools like Gantt charts and project management software. Having experience in working on projects under supervision and understanding the importance of planning and documentation while still relying on others for execution plans, these respondents were comfortable with risk assessment, monitoring progress and delegating tasks to a team. The study conducted by Niederman (2021) highlights that, while individuals often begin in support roles with low competency in project management, the transition to higher competency levels requires real-world experience in handling more complex activities like budgeting, resource allocation and risk management. Formal education and certification are generally necessary at intermediate and expert competency levels.

A majority of interview participants – specifically Participants 1–15 – indicated basic skills in project management. This might be because they primarily took instructions and assisted others in implementation, believing they would require formal training and exposure to be able to manage a project on their own.

As discussed by Nabizadeh Rafsanjani and Nabizadeh (2023), individuals with basic project management skills are typically employed in support functions but lack the training needed to take on projects independently. These individuals are typically looking for a chance to build capacity and master the necessary skills for higher-level project management functions.

Only two (2) participants reported that they had conducted projects under supervision, possibly because they primarily took instructions and assisted others in implementation, believing they would require formal training and exposure to manage a project on their own. As discussed by Niederman (2021) individuals with basic project management skills are typically employed in support functions, but they lack the training required to take on projects independently.

5.6.5 Cybersecurity awareness skills proficiency

The quantitative and qualitative analysis of the data showed that the proficiency level of cybersecurity awareness skills among archival staff in the CoEs in Ghana was generally low to moderate. The combined analysis of the quantitative and qualitative data revealed low to moderate proficiency in cybersecurity awareness skills among archival staff in the Ghanaian CoEs. Figure 4.22 of the quantitative responses indicates that most of the respondents rated themselves at beginner and intermediate levels, with only a few demonstrating advanced competency in cybersecurity awareness.

The majority of 16 of 39 respondents, the largest group in the survey, indicated that they possessed basic skills in cybersecurity awareness, possibly due to their experience working in password management, cautious email handling, threat detection and secure data protocols, but might lack formal training in cybersecurity awareness tools or methodologies, feeling that they would benefit from capacity development in this area.

Grover, Roll and Babby (2023) assert that individuals with basic competency in cybersecurity awareness are typically involved in administrative or support roles, but they lack formal training in the tools and methodologies required to manage larger, more complex cybersecurity projects. Training is required to advance to intermediate or advanced levels of competency.

Four (4) respondents had expert proficiency in cybersecurity awareness, likely because they had previously led digitisation and system transformation initiatives that involved the use of cybersecurity awareness software. They were comfortable with risk assessment, progress monitoring and team delegation, and had experience working on projects under supervision, with a sound understanding of planning and documentation processes. However, they still relied on others for the execution of detailed cybersecurity implementation plans.

In their study, Nitaj and Rachidi (2023) observe that individuals often start in supporting roles with low competency in cybersecurity awareness, but the transition to higher competency levels requires real-world experience in handling more complex activities like budgeting, resource allocation and risk management. Formal education and certification are generally required at intermediate and expert competency levels.

A majority of interview participants, specifically Participants 1–15, indicated basic skills in cybersecurity awareness, possibly because they primarily took instructions and assisted others in implementation, believing that they required formal training and exposure to manage cybersecurity on their own.

As discussed by Nabizadeh Rafsanjani and Nabizadeh (2023), individuals with basic cybersecurity awareness skills are typically employed in support functions, but they lack the training required to take on cybersecurity. These individuals are typically looking for a chance to build capacity and learn the necessary skills for higher-level cybersecurity awareness functions.

Only a small group of participants (Participants 21–25) reported that they had conducted cybersecurity operations, which could be because they primarily took instructions and assisted others in implementation, believing they would require formal training and exposure to manage cybersecurity software on their own. Robles and Allison (2023) opine that individuals with basic cybersecurity

awareness skills are typically employed in support functions, but they lack the training required to take on projects independently (Niederman 2021).

5.7 Chapter summary

This chapter presented the interpretation and discussions of the research findings, based on the research results presented in Chapter 4, so as to reveal the meaning of the collected primary data. As part of the research objectives of the study, the data discussed entailed the utilisation of artificial intelligence embedded cloud computing technology (AECCT) to manage the archives at the CoEs in Ghana. Additionally, the study explored policy and legislative frameworks for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana; assessed user perception regarding the use of AECCT in the management of digital archival records in the CoEs of Ghana; examined the usability of AECCT in the management of digital archival records at the CoEs in Ghana; identified the AECCT infrastructure for the management of digital archival records in the CoEs of Ghana; identified the skills needed to use AECCT in the management of digital archival records in the CoEs of Ghana.

The last research objective of the study was to propose a framework for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana. This framework will be proposed and discussed in the next chapter, which also concludes the study by presenting the summary, conclusions and recommendations of the study.

CHAPTER 6: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The interpretation of the research findings and corresponding discussions were presented in the preceding chapter. As the final chapter of the thesis, this chapter summarises the study, presents conclusions, offers recommendations based on the study's outcomes, and suggests future research. This chapter also proposes a framework for implementing AECCT in the management of digital archival records in Ghana's CoEs. This proposed framework is based on the sixth and final research objective of this study: To propose a framework for the utilisation of AECCT in the management of digital archives in the CoEs of Ghana

6.2 Summary of the research findings

This section provides a summary of the research findings, emphasising the key points rather than stating the precise outcomes (Babbie 2013). The summary of findings presented in this section is based on the research objectives of this research as captured in Chapter 1 (Section 1.4.1 and Table 1.1: Research dashboard).

6.2.1 Policies and legislative frameworks for the utilisation of AECCT in the management of the digital archival records

The first research objective of the study was to evaluate policies and legislative frameworks for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana.

The findings relating to the first research objective can be summarised as follows:

- AECCT adoption is hindered by a lack of clarity on officially sanctioned policies for archival records services.

- AECCT adoption is affected by inadequate institutional communication and policy diffusion.
- AECCT adoption is constrained by outdated policy documents not aligned with digital practices.
- AECCT adoption is limited by reliance on informal or *ad hoc* procedures instead of formal policy frameworks.
- AECCT adoption is influenced by existing overarching records management policies, although awareness and application vary.
- AECCT adoption is challenged by poor implementation and communication of existing policies.
- AECCT adoption requires effective and well-communicated policies to guide archival records management.

6.2.2 Users' perception regarding the utilisation of AECCT in the management of digital archival records

The second research objective of the study was to explore users' perceptions, expectations and anticipated implications of AECCT in the management of digital archival records. The findings relating to the second research objective can be summarised as follows:

- AECCT can be used to manage archival records.
- AECCT can be used to automate routine archival tasks and minimise human error.
- AECCT can be used to streamline records retrieval and improve institutional performance.
- AECCT requires adequate digital infrastructure and a reliable, stable power supply for effective use.
- AECCT requires staff preparedness and training for effective interaction.
- AECCT may lead to job losses and resistance from traditional records management staff.
- AECCT presents both positive anticipation and concerns about infrastructural and human capacity limitations.

6.2.3 Usability of AECCT in the management of digital archival records

The third research objective of the study was to examine the usability of AECCT in the management of digital archival records in the CoEs of Ghana. The findings relating to the third research objective can be summarised as follows:

- AI technologies can be used to automate various functions in archival records management.
- AI technologies can be used to enhance retrieval speed, reduce misfiling, and improve data organisation.
- AI technologies can be used to sort and categorise documents, and to generate metadata.
- With proper staff training and a user-friendly interface design, AI technologies can be used effectively in archival records management.
- A phased approach can be followed to ensure seamless integration in the implementation of AI technologies.
- AI technologies can be supported by real-time user support systems to improve usability.
- During deployment, AI technologies can be assessed through usability tests and feedback surveys.

6.2.4 AECCT infrastructure for the management of digital archival records

The fourth research objective of the study was to identify AECCT infrastructure for the management of digital archival records in the CoEs of Ghana.

The findings relating to the fourth research objective can be summarised as follows:

- In most institutions, AI and cloud computing cannot be supported due to inadequate technological infrastructure.

- Adopting and utilising AECCT will face infrastructural challenges, including poor internet connectivity, a lack of dedicated servers, and inefficient data storage systems.
- Adopting and utilising AECCT will be hindered by the limited availability of document digitisation devices, such as intelligent scanners and OCR software.
- Adopting and utilising AECCT will be constrained by the absence of cloud storage systems for managing digital archives.
- Adopting and utilising AECCT will require improved access to cybersecurity facilities and backup systems to ensure data integrity and security.
- AECCT can be integrated into existing ICT facilities and developed incrementally.
- Adopting and utilising AECCT should be preceded by infrastructure auditing and proper budgeting.

6.2.5 Skills required for the utilisation of AECCT in the management of digital archival records

The fifth objective of the study was to identify the skills required for the utilisation of AECCT in managing digital archival records in Ghana's CoEs. The findings relating to the fifth research objective can be summarised as follows:

- The adoption of AI systems is hindered by broad skill gaps among archival staff, particularly in digital and AI competencies.
- The adoption of AI systems is affected by low computer literacy among staff.
- Adoption of AI systems requires training in scanning technology, metadata tagging, and the use of AI programs.
- AI systems adoption depends on continuous professional development and modular training courses.
- In some institutions, AI systems adoption is challenged by the absence of plans for employee training in digital records management.
- AI systems adoption requires interdisciplinary skills in records management, ICT and data analysis.

- AI systems adoption can be supported through partnerships with ICT training institutions and universities to build workforce capacity.

6.3 Conclusions based on the research findings

This section presents the study's conclusion in relation to the research objectives. Babbie (2020) emphasises that a study should conclude with a statement outlining the researcher's key findings in relation to the research topic, as well as suggestions for future research focus areas.

In this study, the researcher established that archival records at the CoEs in Ghana are predominantly managed by using outdated or manual systems, with little or no integration of modern technologies. These systems lack effective structural frameworks and are largely unsuitable for modern institutional demands. Archival records are still predominantly stored physically with inadequate digital backup or automation, resulting in inefficient archival procedures – including storage, retrieval and conservation – and increasing the risk of data loss.

This challenge is compounded by the absence of comprehensive policies or legislative frameworks to guide the integration of intelligent systems and tools into archival records management within CoEs. The absence of such policies has created a gap that contributes to fragmented and inconsistent records management practices and standards across CoEs.

Moreover, the technological infrastructure required to support the digitisation of archival records through AECCT remains critically underdeveloped. Basic infrastructure, such as internet connectivity, storage capacity and access to ICT tools, is largely insufficient and, in some contexts, unavailable. Additionally, staff members at these CoEs generally lack the technical skills required to operate advanced technologies such as AECCT, and there is also little to no evidence of existing structured training or capacity-building initiatives aimed at bridging the skills gap.

These challenges notwithstanding, the study revealed notable optimism among stakeholders, who expressed great enthusiasm for AECCT's potential to revolutionise archival records management in the CoEs. The research respondents and participants identified some merits of AECCT integration, including automation, enhanced accessibility, faster retrieval and data-driven decision-making. However, in most CoEs, this optimism is undermined by the lack of a clearly defined roadmap or structure for transitioning to digitised archival records management through AECCT.

Therefore, this study concludes that the current state of archival records management in Ghana's CoEs is markedly deficient. It fails to meet the required standards for effective storage, preservation, retrieval and usability of archival records. To address these challenges and build digital resilience capable of delivering future-proof archival records management services, the CoEs must adopt a comprehensive, multifaceted strategy encompassing policy reforms, infrastructure upgrades, staff training programmes, stakeholder engagement, and the cultivation of an organisational culture that supports innovation.

6.3.1 Policies and legislative frameworks for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana

This section presents the conclusion regarding the policy and legislative framework supporting archival records management at the CoEs in Ghana. The study's findings revealed that the policy and legislative structure of these institutions is largely undeveloped, particularly in relation to the integration of AECCT. Most CoEs lack formally adopted policies to guide archival services, and where such frameworks exist, they are based on outdated models that fail to align with contemporary digital transformation objectives. Furthermore, there is a high level of uncertainty among institutional staff about the existence or content of archival management policies. This not only points to inadequate policy formulation but

also to a lack of effective dissemination and implementation strategies. As a result, archival practices are inconsistent and inefficient, with institutions failing to adhere to standardised procedures.

The study also established that none of the institutions has specific policies addressing the use of AI or cloud computing in records management. This policy vacuum creates a critical disconnect between institutional practices and current technological advancements, thereby hindering institutions from accessing external support or funding opportunities that may require structured digital policies as a prerequisite.

Therefore, the study concludes that the policy and legislative support for archival records management in the CoEs of Ghana is critically deficient. The effectiveness of records management is essentially undermined by the absence of coherent, adaptive, dynamic and legally binding policy frameworks, which ultimately hampers efforts at adopting technologies such as AECCT.

6.3.2 Users' perception regarding the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana

This section presents the conclusion about user perceptions regarding the adoption of AECCT for archival records management in the CoEs of Ghana. The findings of this study indicated that respondents and participants generally hold positive perceptions about the utilisation of AECCT to enhance archival records management at the CoEs. They associate this technology with major operational benefits such as enhanced productivity, improved accuracy in data retrieval, reduced human error and overall greater efficiency in handling archival records.

However, it should be pointed out that this optimistic outlook is tempered by concerns over institutional preparedness and readiness, particularly regarding the underdeveloped infrastructure. Other notable concerns involve limited digital resources and limited skilled personnel. While respondents acknowledged the

revolutionary potential of AI, they also expressed reservations regarding workforce displacements and potential disruptions in traditional work processes. This resulted in conflicting opinions among respondents and participants who simultaneously appreciate the benefits of AI and dread its implications. If not adequately addressed, this tension could result in resistance to change, reduced adoption rates, or the underutilisation of AI-driven systems.

Therefore, the study concludes that stakeholder acceptance is influenced not only by the functionality of the technology but also by the perceived readiness of institutions, the availability of training opportunities, and the assurance of human-AI collaboration rather than substitution. Effective change management that centres on people, clear communication and skills development is essential to facilitate the smooth integration of AI technologies. Without this, stakeholder support may wane, and the full potential of AECCT in archival records management may not be realised.

6.3.3 Usability of AECCT in the management of digital archival records in the CoEs of Ghana

This section presents the conclusion about the usability of AI technologies in the management of archival records in the CoEs of Ghana. The study confirms that AI technologies are highly usable for archival records management. Respondents and participants largely acknowledged the effectiveness of AI in performing core archival records management tasks, such as document classification, metadata creation, secure file storage and seamless file retrieval. These findings reflect the potential of AI systems to reduce manual workload and enable intelligent automation across the archival records lifecycle.

The usability of technologies such as the AECCT hinges upon several crucial factors. As revealed by the research respondents and participants, successful implementation of AECCT to enhance the management of digital archives depends on the following factors: an intuitive user interface design, user adaptability, ease

of access to technical support, and seamless integration into existing workflows at the CoEs. The study also found that, in most CoEs, formal, structured usability testing procedures and feedback mechanisms are absent, limiting their ability to design iterative system improvements through user-centred design refinements.

Hence, this study concludes that, although AI technologies such as AECCT offer a promising prospect for enhancing digital archival records management, their performance is contingent on user-centred implementation strategies. The CoEs must prioritise comprehensive orientation programmes for archival records staff, complemented by locally adapted user interface designs that incorporate feedback mechanisms to promote sustained engagement and optimal performance.

6.3.4 AECCT infrastructure for the management of digital archival records in the CoEs of Ghana

This section presents the conclusion about infrastructural readiness for the adoption of AECCT in archival records management at the CoEs of Ghana. The study concludes that infrastructural deficiencies are the primary barrier to the effective implementation of digital technologies for records management. Most institutions lack essential digital infrastructure, including stable internet connectivity, cloud servers, digital storage systems, smart scanners and data backup facilities – gaps that severely compromise the functionality and long-term viability of any prospective digital innovation. Similarly, the security, integrity and accessibility of digital archival records are greatly undermined by the absence of cybersecurity frameworks and data recovery plans. These gaps render digital archival records susceptible to breaches, data loss and service interruptions.

The research also found that the majority of CoEs have yet to develop strategic infrastructural development plans or seek investment opportunities that support digital readiness. Consequently, this research concludes that the adoption of AI systems such as the AECCT will remain primarily idealistic, rather than actionable, unless these basic infrastructural deficiencies are resolved.

6.3.5 Skills required for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana

This section presents the conclusion about human resource capacity in relation to AI and digital records management in the CoEs of Ghana. The study concludes that there is a significant skills gap across the workforce, particularly concerning AI technologies and digital archival practices.

This research found that there is a major capacity and skill deficit among respondents and participants. This capacity deficit was reflected in the limited exposure of staff to technical skills relevant to the successful implementation of AECCT. Other skills gaps are characterised by the lack of sufficient ICT training and the lack of access to tailored professional development programmes. These skill deficits pose a critical challenge to the effective implementation of AECCT at the CoEs.

Additionally, the low AI skills proficiency and the lack of digital literacy among the surveyed and interviewed staff also impair the usability of AI systems and reduce the return on technological investments, stifling opportunities for institutional innovation. The study emphasises that, without a well-educated and digitally competent workforce, even the most advanced infrastructure cannot yield successful outcomes in archival records management. Therefore, the study concludes that human capital development must be prioritised as the foundation for AI adoption.

6.4 Recommendations

Against the background of this study's research findings, general recommendations are put forward to guide the effective application and integration of AI-powered cloud computing technology in the records management of the CoEs in Ghana. These proposals serve as a strategic blueprint for institutional

leaders, policymakers, professionals and other stakeholders to promote the digitisation of archival records management systems.

Firstly, CoEs urgently need to develop and establish comprehensive records management policies that conform to both digital transformation and AI integration strategies. These policies should specify operational protocols, ethical standards and technology specifications, with predefined roles for responsible staff.

Equally important is the need to encourage stakeholder awareness and understanding by cultivating a receptive disposition towards adopting new technologies. To promote cultural and institutional acceptance, targeted training programmes such as workshops and seminars should be initiated to clarify and address concerns about AI and its implementation to allay the fears of staff members surrounding job displacement and use complexity. Appointing digital champions (agents or ambassadors) from departments can further promote the adoption of a culture of change and innovation.

In terms of usability, institutions must ensure that AI systems are simple to use and tailored to the specific needs and workflows of the CoEs. Usability testing, system demonstration and user feedback mechanisms must be institutionalised to improve system design and user satisfaction. Infrastructure readiness requires strategic investments in basic technologies, as well as systems such as stable internet connectivity, intelligent scanning machines, cloud storage infrastructure, backup centres and security infrastructure. These updates should be phased and adequately financed to ensure consistent progress and sustainable implementation.

Principally, the successful transformation of archival records management through the implementation of AECCT rests on an integrated approach founded on policy development, usability of systems, stakeholder engagement, infrastructural adjustments and progressive capacity building. By implementing these measures,

CoEs in Ghana can reposition their institutions to be digitally efficient archival record service providers.

6.4.1 Recommendations for policies and legislative frameworks for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana

This section presents recommendations regarding policies and legislative frameworks for the successful utilisation of AECCT in the management of digital archival records at the CoEs in Ghana. Based on the research findings, CoEs are recommended to form robust institutional policies, clearly demarcating the frameworks of archiving records management and the application of AECCT. Such policies must be comprehensive, forward-looking and in agreement with international norms and national law. Institutions must give the highest priority to revising and updating existing archival policies to adapt to modern digital realities.

Moreover, the Ministry of Education should lead collective efforts to develop a national policy directive aimed at harmonising digital records management practices across all CoEs. Policies not only have to be formulated, but also effectively communicated to all employees through orientation workshops, digital media and printed manuals. Policy monitoring and evaluation frameworks must also be established to ensure that policies not only exist, but are effectively directing operations. Institutionalisation of the frameworks will enable the creation of a legal and procedural foundation for viable digital transformation.

6.4.2 Recommendations regarding users' perception of the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana

This section presents recommendations on user perceptions regarding the utilisation of AECCT in the management of digital archival records at the CoEs in Ghana. Because user perception drives the adoption of new technology, CoEs are

recommended to implement certain interventions to enhance stakeholders' awareness and acceptance of AECCT.

Regular seminars, sensitisation workshops and user demonstrations should be conducted to mitigate myths and create interest in AI adoption. By including human-AI collaboration topics in institutional communication, institutions must also reassure workers that AI is intended to augment – not replace – their tasks. To develop constructive attitudes, colleges must choose early adopters among staff and hire them as champions of digital transformation. These individuals will serve as role models and agents of change, encouraging their colleagues to embrace the benefits of AI. Moreover, leadership of the CoEs needs to foster a participatory implementation process that actively involves relevant stakeholders and staff in the design, piloting and deployment phases. Such participatory engagement promotes a sense of ownership and deepens institutional commitment. The communication of schedules for implementation, support systems and the long-term vision for digital transformation will increase user readiness and confidence.

6.4.3 Recommendations regarding the usability of AECCT in the management of digital archival records in the CoEs of Ghana

In this section, recommendations are presented on the usability of the AECCT in the management of digital archival records at the CoEs in Ghana. To promote the effective usability of the AECCT, CoEs must prioritise the procurement of systems that are intuitively designed, adaptable and specifically designed to meet their operational needs.

It is important that these technologies conform to the existing workflows in the CoEs, in order to curb potential workflow disruptions and to support the seamless integration of the AECCT. Furthermore, it is essential that the CoEs conduct usability tests and evaluations before full-scale implementation to gather feedback on functionality, interface design and general user experiences. Regular training programmes must be conducted to enable staff to operate the systems with ease, with user guides, FAQs, and interactive tutorials available for independent learning.

Creating an internal support desk or technical assistance group will also be important, in order to provide real-time support and troubleshooting aid. To ensure long-term use and employee satisfaction, organisations also need to test and refine AI systems continuously, based on user feedback, system performance metrics and evolving operational needs.

6.4.4 Recommendations for the AECCT infrastructure for the management of digital archival records in the CoEs of Ghana

This section makes recommendations on AECCT infrastructure for the management of digital archival records at the CoEs in Ghana. AECCT integration into archival records management largely depends on the availability of appropriate technological infrastructure. The CoEs are therefore encouraged to conduct detailed infrastructure needs assessments to identify infrastructural deficiencies and priority areas requiring immediate investment. The CoEs should set aside dedicated budget allocations to procure essential digital resources, such as secure cloud storage facilities, advanced scanning machines, power backup systems and high-speed internet connectivity. Collaboration with government entities, ICT service providers and development partners should be explored to secure funding and technical support for infrastructure investment.

Cybersecurity systems and disaster recovery procedures should also be integrated into digital infrastructures to ensure data security and system resilience. A phased rollout strategy must be employed, starting with pilot departments, to allow learning and phased integration. Infrastructure maintenance policies – including periodic upgrades, system health checks and contingency planning to ensure operating reliability – must be implemented by institutions.

6.4.5 Recommendations regarding the skills required for the utilisation of AECCT in the management of digital archival records in the CoEs of Ghana

This section gives recommendations on the skills needed to use AECCT in the management of digital archival records at the CoEs in Ghana. Closing the digital competency gap among archival personnel is an urgent priority for CoEs in Ghana to leverage AI-based archival management skills. The study recommends the development and implementation of professional training programmes in AI, cloud computing and digital records management.

To ensure a skilled workforce capable of effectively deploying and sustaining the implemented AECCT, training programmes must be tailored to accommodate different levels of technical expertise – from basic computer skills to advanced AI systems administration and application. The CoEs can collaborate with ICT training centres, universities and other relevant organisations to provide tailored courses with recognised certifications in digital archiving for their staff. Other forms of training, such as in-service training and peer mentoring, can also be explored and adopted to enhance the skills and capacity of staff. Institutional digital learning centres will create a continuous learning environment and availability of resources to staff.

Apart from this, technical and digital literacy and AI expertise have to be built into recruitment, performance evaluation and promotion criteria, so that technical excellence becomes instilled. These efforts will not only enhance the employees' capability and competence, but also create a permanent human resource base that is capable of facilitating and maintaining the digitisation of archival records management systems.

6.5 Recommended framework for the utilisation of AECCT in the management of digital archives in the CoEs of Ghana

The final research objective of this study aimed at proposing a comprehensive framework that facilitates the utilisation of AECCT in managing digital archival records at the CoEs in Ghana. The proposed framework integrates cloud computing infrastructure with AI to address key challenges, including limited accessibility, poor classification systems, inadequate security and the lack of sustainable long-term digital storage. Once the framework has been successfully implemented, the CoEs will have an AI embedded archival records management system that allows for seamless storage and access to archived records. Furthermore, the CoEs will have a well-founded digital records management structure that facilitates the effective management of archival records.

This framework was designed based on the concepts presented in the conceptual framework of the study (Chapter 2) and is illustrated in Figure 6.1: Framework for the utilisation of AECCT in the management of digital archives.



Figure 6.1: Framework for the utilisation of AECCT in the management of digital archives

(Source: Researcher 2025)

As illustrated in Figure 6.1, the framework for the utilisation of AECCT in the management of digital archives comprises components arranged across hierarchical levels. These components are outlined in the subsequent sections.

Component 1: Receiving paper-based archival documents

The proposed framework begins with CoEs receiving paper-based archival documents from various academic and administrative departments, including student records, academic transcripts, staff files, financial documents and institutional correspondence.

Component 2: Conducting pre-assessments

Archival staff conduct pre-assessments to determine the integrity of received documents for archival purposes and to determine if they comply with institutional record-keeping standards.

Component 3: Registering and cataloguing

Once archival documents have been received and their compliance has been confirmed through pre-assessment, they are sent for registration and cataloguing. Upon registration, archival records are created by assigning unique reference numbers and classification codes in accordance with the established filing system.

Component 4: Scanning and digitising

After registration, all paper-based archival records are forwarded to the digitisation unit, where they are scanned by using high-resolution scanning equipment. At this stage, high-quality images of the paper records are captured and processed by using OCR software. As an optical character recognition software, OCR is designed to recognise and extract textual content from scanned images. The ability of the OCR to extract text from scanned images ensures the conversion of static image files into editable and searchable digital records.

The OCR also aids full-text searchability, which promotes automated metadata extraction and further enhances document categorisation and retrieval. The digitisation process generates both image files and searchable text, which are processed through software components that manage file formats, compression and quality, ensuring that digitised archival records maintain their authenticity and readability while optimising storage and retrieval speed.

Component 5: Processing digitised records

After successful digitisation of all archival records using OCR, the records should be processed through the AI-embedded cloud storage system, which serves as the central hub for intelligent records management. In this context, “intelligent records management” refers to the application of AI and machine learning algorithms to automate traditional manual archival processes, including classification, indexing, retrieval and preservation.

The adoption of AI enables the appropriate classification of digital archival records by using an auto-classification algorithm and machine learning algorithms integrated into the cloud computing infrastructure. The AI system automatically categorises the digital archival records based on document type, subject, academic year, department, etc. The automated classification algorithms enhance the organisation and retrieval of digital archival records by the CoEs, making access to archived digital records more efficient.

Component 6: Storing and securing digital archival records

Digital archival records should be stored in a hybrid cloud and on-premises server storage facilities powered by AI to ensure easy access by authorised users from both cloud-based and on-premises servers. These storage systems incorporate encryption and verification protocols to protect archived digital records and data uploaded to the servers.

Comprehensive security measures, including multi-factor authentication, role-based access control and end-to-end encryption, should be implemented to protect data at rest and in transit. Encrypted passwords, biometric verification and security codes will ensure that only authorised individuals have access to the archived digital records, based on their designated roles and responsibilities within the college.

Component 7: Retrieving digital archival records

To retrieve digital archival records, the framework incorporates a user interface that supports voice, picture-based and text-based interactions. The user interface should be designed in a way that satisfies diverse user preferences and accessibility requirements. The interface should also allow for the searching of digital archived records by using natural language queries, reference numbers, identification codes or keywords. The text-based interaction provides traditional search functionality with advanced filtering options, Boolean operators and metadata-based queries.

Incorporating a voice interaction capacity will enable users to perform hands-free searches and navigate the system easily. This feature will be particularly beneficial to users with visual impairments or those in working environments where manual input is challenging. The picture-based visual tagging feature will also ensure that documents that have been tagged with a specific picture, which serves as a chapter, can be searched easily. This feature will allow a search engine with advanced query functions to pinpoint and navigate directly to specific document sections that contain that information.

Component 8: Automated system updating

The AI embedded cloud storage system should be programmed with an automated system update mechanism to ensure technological currency and to prevent system obsolescence.

This should involve establishing automated deployment pipelines that test updates in staging environments before production deployment, maintaining version control systems that enable rollback capabilities and scheduling update windows that minimise disruptions to user operations. The update system must maintain format-migration capabilities to convert documents to newer formats as standards evolve and establish vendor relationship management processes to ensure continued support for critical components.

Component 9: Accessing and retrieving digital archival records

Digital archival records should be easily accessible and retrievable through data analytical tools integrated into the AI embedded cloud system. These tools collect and analyse usage patterns, document access frequencies, retrieval success rates and system performance metrics to provide insights into archival system utilisation. The analytics components track most frequently accessed document types, peak usage periods, user behaviour patterns and search query effectiveness. This information enables administrators to optimise system configuration, plan capacity upgrades and identify training needs for users experiencing difficulties with the system.

Component 10: Backing up data

The AI embedded cloud system should further be equipped with an automated data backup system that facilitates automatic data backup procedures and protects against data loss.

A secondary and geographically unique cloud environment should be constructed to mirror and replicate the primary cloud storage content using automated backup mechanisms. This cloud-to-cloud backup structure serves as a safeguard, should there be any adverse event that causes regional outages and service interruptions. This backup system will ensure that the original datasets are constantly synchronised within scheduled time intervals.

To further strengthen data redundancy, a parallel backup stream should mirror the archive to a local encrypted storage infrastructure to provide an offline safeguard against network failures or cloud-related latency.

The implementation of the proposed framework will enable the CoEs in Ghana to adopt AECCT for the effective and efficient management of archival records. The use of digital records will allow institutions to receive, process, store, search and retrieve archived records while maintaining security. Finally, the framework will ensure that documents are digitised quickly and effectively; those records are not duplicated; those records do not go missing; that records are not given to unauthorised users or recipients; and that system overload and crashes do not occur.

6.6 Implications of the research for theory, policy and practice

The study identified several key areas that are crucial for the use of AECCT in the management of the archives at the CoEs in Ghana.

6.6.1 Implications for theory

By providing empirical evidence of AI and cloud computing adoption in colleges in developing countries, this research contributes to the growing body of literature on the digital transformation of records management and archives. The study confirms existing theoretical frameworks, such as the Digital Transformation Model and the Records Continuum Model, by demonstrating their effective application in AI-based records management. The study also adds to the theoretical literature by proposing a conceptual framework that integrates governance, infrastructure, human capacity, system usability and stakeholder participation as the pillars of effective digital transformation. The study, therefore, adds to theoretical insight into how socio-technical systems interact in institutional environments to ensure innovation and service effectiveness.

6.6.2 Implications for policy

The study highlights significant gaps in national and institutional policy frameworks that inform archival records management in Ghana's CoEs. The findings emphasise the urgent need for more comprehensive and up-to-date policies that explicitly address the incorporation of AI and cloud computing technologies. Institutionally, the study calls for policies that prescribe digital records management standards, provide guidelines for implementation, and establish oversight mechanisms. At a national level, the Ministry of Education is urged to develop a generic digital archives policy that can be adopted by all higher education institutions.

The study emphasises the importance of aligning archival policies with data protection laws, digital ethics regulations and national digitalisation blueprints to ensure integrated and compliant implementation. The study also encourages policy instruments that enable ongoing capacity building and infrastructure development.

6.6.3 Implications for practice

From a practical point of view, the study presents institutional administrators, ICT professionals and records managers with a roadmap for the adoption of AI-enhanced cloud computing technology, identifying stakeholder engagement, infrastructure spending and human capital enhancement as essential factors in ensuring successful adoption. Practitioners are advised to prioritise usability when selecting and implementing systems, ensuring that technology tools align with organisational workflows and users' existing skills.

In addition, the proposed framework offers a practical template that institutions can adapt to, adopt and apply in their own contexts. The research also highlights the importance of built-in training, internal knowledge-sharing sessions and cultivating a digital organisational culture in internalising transformation.

In summary, this research enables institutions to move beyond pilot projects and embed AI-facilitated archival work that streamlines work, secures data and enhances service delivery.

6.7 Suggestions for further research

This study addressed six research objectives, all of which were empirically investigated. The research findings and the recommendations on the following topics contributed towards achieving these research objectives scientifically:

1. The policy and legislative frameworks for the utilisation of AECCT in the management of the digital archival records in the CoEs of Ghana were evaluated.
2. The perceptions of the users regarding the utilisation of AECCT in the management of the digital archival records in the CoEs of Ghana were assessed.
3. The usability of AECCT in the management of the digital archival records in the CoEs of Ghana was examined.
4. The AECCT infrastructure for the management of the digital archival records in the CoEs of Ghana was identified.
5. The skills needed to use AECCT in the management of the digital archival records in the CoEs of Ghana were identified.
6. A framework for the adoption and utilisation of AECCT in the management of the digital archival records in the CoEs of Ghana was proposed.

However, there are several areas in which further research is required, in order to deepen understanding and provide practical solutions to ensure the effective AI integration in archival records management at CoEs in Ghana. Therefore, the researcher recommends further research to explore the adoption of AI embedded technology for records management across different types of tertiary institutions in Ghana, including public universities and polytechnics, and to develop comprehensive frameworks adaptable to diverse institutional contexts.

6.8 Final conclusion

This study sought to explore the utilisation of artificial intelligence embedded cloud computing technology (AECCT) in the management of archives at the CoEs in Ghana. The findings of the study revealed an enormous potential for colleges to transform their records management systems through the adoption of modern technological tools. However, the study also revealed a series of institutional, infrastructural and human resource challenges that must be addressed in order to realise this transformation.

The research found that archival records in the CoEs are currently managed in fragmented systems, often without consistent policies or working strategies. The research participants and respondents demonstrated optimism about the integration of AI, recognising the ability of such systems to enhance efficiency, accuracy and accessibility of digital archival records. The path to successful implementation, however, is complicated and requires an integrated approach that ensures the necessary infrastructure, alongside a clear and enforceable policy framework, well-equipped personnel and visionary leadership.

The AI integration framework proposed in this study provides a structured pathway for institutions to take in their digital transformation journey. It has the necessary components, such as governance, infrastructure, human capacity, usability, stakeholder engagement and monitoring mechanisms, providing a complete model that can be customised to fit different institutional contexts.

In conclusion, the study verifies that AECCT has revolutionary potential for archival records management in the CoEs of Ghana. In order to optimise the implementation of AECCTs, the CoEs should follow a strategic and holistic approach that harmonises stakeholder involvement, staff training and policy reforms.

Overall, the adoption of AI technologies in archival systems not merely signifies a technological transformation, but a pathway to institutional excellence, operational agility and improved service delivery and teaching. The conclusions, findings and recommendations of the study provide a practical guideline for policymakers, administrators and educational practitioners that is consistent with both international and national educational objectives.

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ANNEXURES

Annexure A: Letter to request permission to conduct research at the CoEs in Ghana

PERMISSION LETTER REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT THE COLLEGES OF EDUCATION IN GHANA

Title: Utilising artificial intelligence embedded cloud computing technology (AECCT) to manage the archives at the CoEs(CoE) in Ghana

Patrick Dogli (19675356)

UNISA

P. O. Box 392

South Africa

22/05/2024

The Principal,

Agogo Presbyterian Women's College of Education,

Agogo Asante Akim

National Conference of Principals of CoEs(PRINCOF)

Accra, Ghana

Dear Sir/Madam

I, Patrick Cudjo Dogli, am doing research with Dr M Modiba, senior lecturer as my supervisor, in the Department of Information Studies towards a Doctor of Philosophy and Literature at the University of South Africa (UNISA). We are inviting College secretaries, human resource officers and Information Technology Officers in thirteen colleges (13) CoE in Bono, Bone East, Ashanti and Ahafo regions, Ghana to participate in a study entitled "Utilising artificial intelligence embedded cloud computing technology (AECCT) to manage the archives at the CoEs(CoE) in Ghana".

The purpose of the study is to examine the utilisation of artificial intelligence embedded cloud computing technology (AECCT) to manage the archives at the CoEs(CoE) in Ghana. The college secretaries, human resource officers and I.T. officers have been selected

because of their crucial role it play in managing the archives at the Colleges. The study will be in two phases. The qualitative phase will begin with an interview with the substantive I.T. officers of various colleges; the interviews will be based on their knowledge of utilising artificial intelligence embedded cloud computing technology (AECCT) to manage the archives at the Colleges of education. Finally, college secretaries and human resource officers will be served with questionnaires to be completed for the quantitative and interviews College Secretaries and IT Officers for the qualitative phase of the study, respectively.

This will help the records management practitioners of CoE manage records more effectively and efficiently, supporting the organisation's core missions of research and knowledge development. The information gathered and its outcome recommendations will be very helpful to the CoE in terms of issue resolution and management decision-making. Administrative staff who are impacted by the CoE's records management practices, whether directly or indirectly, would also greatly benefit from the study's findings.

No potential risks have been identified by the researcher. The feedback procedure will entail the publication of the results of the study in journals as well as at conferences.

Yours faithfully



Patrick Cudjo Dogli

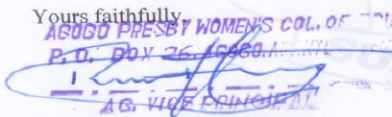
PhD Student

Cc:

1. The Principal - Atebubu College of Education
2. The Principal - Al-Faruq College of Education
3. The Principal - Akrokerri College of Education
4. The Principal - Dambai College of Education
5. The Principal - Offinso College of Education
6. The Principal - Mampong Technical College of Education
7. The Principal - Agona SDA College of Education
8. The Principal - St. Ambrose College of Education, Dormaa Akwamu

9. The Principal - St. Joseph College of Education, Bechem
10. The Principal - St. Monica's College of Education
11. The Principal - St. Louis College of Education
12. The Principal - Wesley College of Education
13. The Principal - Berecum College of Education

Annexure B: Letter of approval to conduct the research at the CoEs in Ghana

AGOGO PRESBYTERIAN WOMEN'S COLLEGE OF EDUCATION	
Our Ref... APWCE/CS/001/06-24 Email: info@apwce.edu.gh	 P. O. Box 26 Agogo, Asante Akyem North Tel: 0595822400 / 0509540435 Date: 3 RD JUNE, 2024
PATRICK DOGLI (19675356) UNIVERSITY OF SOUTH AFRICA DEPARTMENT OF INFORMATION SCIENCE P. O. BOX 392 SOUTH AFRICA EMAIL: 19675356@mylife.unisa.ac.za Dear Sir, <u>RE: REQUEST TO CONDUCT A STUDY AT THE COLLEGES OF EDUCATION</u> I appreciate your request to conduct the study on "Utilizing artificial intelligence embedded cloud computing technology (AECCT) to manage the archives at the Colleges of Education (CoE) in Ghana." at our institution. The management is duly acknowledging your letter. I herewith grant permission for the study to proceed as per the UNISA approval with the provision that provides the CoE with progress reports throughout the study as well as a final report on completion of the research. We wish you all of the best with your research project. Yours faithfully,  Richard Akwasi Frimpong The Vice Principal Email: richardakwasifrimpong20@gmail.com Tel: 0244754406	
 apwce.edu.gh;  0595822400;  @apwce;  apwce;  YouTube apwce	

Annexure C: Ethical clearance

	
College of Human Sciences_CREC	
Date: 03/06/2025	NHREC Registration # : (Rec-240816-052) Ref #: 3347 Name: Mr Patrick Dogli Student #: 19675356
Dear: Mr Patrick Dogli	
Decision: Ethics Approval from 03 June 2025 to 02 June 2026	
Researcher:	Mr Patrick Dogli
	Agogo Presbyterian Women's College of Education P. O. Box 26
	Agogo Asante Akim
	19675356@mylife.unisa.ac.za +233242153825
Supervisor:	Dr Mashilo Modiba modibmt@unisa.ac.za
UTILISING ARTIFICIAL INTELLIGENCE-EMBEDDED CLOUD COMPUTING TECHNOLOGY TO MANAGE THE ARCHIVES AT THE COLLEGES OF EDUCATION IN GHANA	
Qualification: Ph.D. Information Science	
Thank you for the application for research ethics clearance by the College of Human Sciences_CREC for the above-mentioned research study. Ethics approval is granted for one year.	
The low-risk application was reviewed by the College of Human Sciences_CREC on 03 June 2025 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment. The proposed research may now commence with the provisions that: 1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics. 2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the College of Human Sciences_CREC. 3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application. 4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.	

5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date (**02 June 2026**). Submission of a completed research ethics progress report will constitute an application for renewal, for Ethics Research Committee approval.

Additional Conditions

1. Disclosure of data to third parties is prohibited without explicit consent from Unisa.
2. De-identified data must be safely stored on password protected PCs.
3. Care should be taken by the researcher when publishing the results to protect the confidentiality and privacy of the university.
4. Adherence to the National Statement on Ethical Research and Publication practices, principle 7 referring to Social awareness, must be ensured: "Researchers and institutions must be sensitive to the potential impact of their research on society, marginal groups or individuals, and must consider these when weighing the benefits of the research against any harmful effects, with a view to minimising or avoiding the latter where possible." Unisa will not be liable for any failure to comply with this principle.
5. Kindly note that the College of Human Sciences_CREC requires the submission of regular progress reports to be submitted {**annually**}. In line with section 7.2 of the Unisa Policy on Research Ethics (2024).

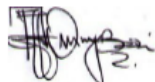
Note

The reference number 3347 should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.

Kind regards,



Prof K J Malesa
Chair of College of Human Sciences_CREC
E-mail: maleskj@unisa.ac.za



Professor Omwoyo Bosire Onyancha
Executive Dean / By delegation from the Executive Dean of College of Human Sciences_CREC
E-mail: onyanob@unisa.ac.za

Annexure D: Informed consent

UTILISING ARTIFICIAL INTELLIGENCE-EMBEDDED CLOUD COMPUTING TECHNOLOGY TO MANAGE THE ARCHIVES AT THE COE IN GHANA

I am Patrick Dogli, a PhD (Doctoral) student at the University of South Africa (UNISA) pursuing Information Science. I am conducting a research study on *Utilising artificial intelligence embedded cloud computing technology (AECCT) to manage the archives at the CoEs(CoE) in Ghana*. The study aims to investigate the utilisation of AECCT for the management archives at CoE in Ghana. The information obtained and the result recommendations could assist CoE in effectively and efficiently managing records. Participation in this study is voluntary.

The information in this questionnaire will not be used for any other purpose than for this study. You are not required to provide your name and will therefore remain anonymous. The questionnaire aims to evaluate your opinion, perceptions, and feelings about the utilisation of AECCT in the management of archives at CoE. The study's results will be used to help answer unanswered questions regarding the application of AECCT for the management of archives. Other possible benefits of participating in this study are the opportunity to share your experiences and contribute to knowledge and records management improvement programmes.

On this basis, the researcher is requesting you as the study participant to consent through this form for your participation in the study. Should you have any questions or seek any clarity, feel free to ask the researcher at any time of your participation at 19675356@mylife.unisa.ac.za or 0242153825 or the supervisor, Dr M T Modiba at 072 633 8044 or modibmt@unisa.ac.za

Thank you for considering participating in this study.

As a participant, I consent to participate in this study.

Participant signature: Date:

Annexure E: Survey questionnaire

UTILISING ARTIFICIAL INTELLIGENCE-EMBEDDED CLOUD COMPUTING TECHNOLOGY TO MANAGE THE ARCHIVES AT THE COE IN GHANA (PLEASE ANSWER SURVEY QUESTIONNAIRE BELOW) 1. To answer the questions, mark the correct answer with a cross (x) and provide an explanation if needed. 2. Please sign the consent form provided before completing the questionnaire.			
SECTION 1: CONTEXTUAL INFORMATION			
JOB TITLE			
College Secretary			
Human Resource Officer			
IT Officer			
SECTION 2: POLICY FRAMEWORK FOR UTILISING ARTIFICIAL INTELLIGENCE- EMBEDDED CLOUD COMPUTING TECHNOLOGY TO MANAGE THE ARCHIVES AT THE COE IN GHANA Please put a cross (X) in the column that describes your response using the following scale: 1 = Agree; 2 = Disagree; 3 = Unsure.			
POLICY FRAMEWORK	Agree	Disagree	Unsure

2.1 Is there an officially sanctioned policy in place for archival records services?			
2.2 Is there an officially approved policy for management records at the Colleges of education?			
2.3 Has a formal procedure been established for managing archival records?			
2.4 Has the CoE established a formal procedure for managing records?			
If the answer to # 2.3 is yes . Have you been trained on it?			
If the answer to # 2.3 is no . Do you follow any policy?			

SECTION 3: THE PERCEPTION OF THE USERS TOWARDS THE UTILISATION OF AI EMBEDDED CLOUD COMPUTING TECHNOLOGY TO MANAGE THE ARCHIVAL RECORDS AT THE COE IN GHANA.

3.1 Which archival records management activities do you think can be performed using AI embedded cloud computing technology to manage the archival records management system? (Tick all that are applicable)	
AI embedded cloud computing technology will improve productivity	
AI embedded cloud computing technology will phase out archival records workers out of service.	
AI embedded cloud computing technology is user-friendly.	

Is the CoE have planning to adopt cloud-based technologies with AI capabilities for records management?			
3.2 Rate the user's perception of AI embedded cloud computing technology for the management of the archival records system at CoE. Please put a cross (X) in the column that describes your response using the following scale: 1 = Agree; 2 = Disagree; 3 = Unsure.			
RECORDS MANAGEMENT ACTIVITY	Agree	Disagree	Unsure
AI embedded cloud computing technology can optimise CoE archival operations through automated predictive maintenance, enhanced efficiency and fraud detection of CoE archival records management system			
AI embedded cloud computing technology combines AI capabilities with cloud-based technology data management to enhance its functionality.			
If implemented successfully, would adoption of the AI embedded cloud computing technology for archival record-keeping and management purposes at the CoE be successful?			
Are you acquainted with the use of AI-embedded cloud technology for record-keeping and management purposes?			
Would the archival records practitioners lose their jobs if AI-embedded cloud technology is implemented at CoE?			

3.3 Please rate how beneficial you think AI-embedded cloud computing would be for each of the following aspects: (1 = Not at all beneficial, 2 = Slightly beneficial, 3 = Moderately beneficial, 4 = Very beneficial, 5 = Extremely beneficial)	
Cost efficiency	
Time savings	
Data security	
Work efficiency	

SECTION 4: USABILITY OF AI-EMBEDDED CLOUD COMPUTING TECHNOLOGY FOR MANAGING ARCHIVAL RECORDS AT CoE	
4.1 For each records management activity below, please rate how suitable you think AI embedded cloud computing technology would be: (1 = Not at all suitable, 2 = Slightly suitable, 3 = Moderately suitable, 4 = Very suitable, 5 = Extremely suitable)	
Creating students and staff archival records at CoE.	
Storing of students and administrative archival records	
Securing and monitoring administrative and students' archival records at CoE.	
Records retention management	
Records disposal management	
4.2 Please rate your institution's readiness to implement AI embedded cloud computing: (1 = Not at all ready, 2 = Slightly ready, 3 = Moderately ready, 4 = Very ready, 5 = Completely ready)	
Technical infrastructure readiness	
Staff expertise readiness	
Financial readiness	

Policy framework readiness			
4.3 Rate CoE's current archival records management activities in terms of the following items of filing, storage, access and security, retention and disposal. Please put a cross (X) in the column that describes your response using the following scale: 1 = Agree; 2 = Disagree; 3 = Unsure.			
ARCHIVAL RECORDS MANAGEMENT ACTIVITY	Agree	Disagree	Unsure
Are the CoE's archival records organised and filed in accordance with the established file plan?			
Are the CoE's archival records centrally stored and overseen by the records manager?			
Are the CoE's claims records readily accessible, secure and well-maintained?			

SECTION:5 AI EMBEDDED CLOUD COMPUTING TECHNOLOGY INFRASTRUCTURE REQUIRED TO MANAGE ARCHIVAL RECORDS AT THE CoE.		
5.1 Are you familiar with any AI embedded cloud computing technology infrastructure used to manage records?	YES	NO
5.2 AI-EMBEDDED CLOUD COMPUTING TECHNOLOGY INFRASTRUCTURE If you answered yes above, Please rate your level of experience with each of the following AECCT: (1 = No experience, 2 = Basic experience, 3 = Moderate experience, 4 = Advanced experience, 5 = Expert level experience)		

Data Storage and Management	
Machine learning	
Natural language processing	
Automatic rules	
Neural network	
Natural language processing	
Deep learning	
Optical Character Recognition Technology	
Cloud-embedded Electronic Records Management Systems	
Cloud computing tools	
5.3 How important do you consider each technology for effective records management? (1 = Not important, 2 = Slightly important, 3 = Moderately important, 4 = Very important, 5 = Extremely important)	
Data Storage and Management	
Machine learning	
Natural language processing	
Automatic rules	
Neural network	
Natural language processing	
Deep learning	
Optical Character Recognition Technology	
Cloud-embedded Electronic Records Management Systems	
Cloud computing tools	

SECTION 6: THE AI EMBEDDED CLOUD COMPUTING TECHNOLOGY SKILLS REQUIRED TO MANAGE ARCHIVAL RECORDS AT THE COE.
6.1 EXPERIENCE How many years of experience do you have in records management?

0 to 5 years	
6 to 10 years	
11 to 20 years	
20 years and above	
6.2 TRAINING	
Please indicate your level of training in each of the following areas: (1 = No training, 2 = Basic training, 3 = Intermediate training, 4 = Advanced training, 5 = Expert level training)	
Workshop in Basic Archives and Records Management (BARM)	
Workshop in Intermediate Archives and Records Management (IARM)	
Workshop in Advanced Archives and Records Management (AARM)	
Programme in Archival Studies	
National Archives: Records Management	
All of the above	
None of the above	
6.3 QUALIFICATIONS	
What is your highest qualification in Records Management or related field?	
Diploma	
Bachelor's degree	
Master's degree	
Doctoral Degree	
None of the above	
6.4 SKILLS	
Please rate your proficiency level in each of the following skills: (1 = No proficiency, 2 = Basic proficiency, 3 = Intermediate proficiency, 4 = Advanced proficiency, 5 = Expert proficiency)	
Cloud Computing skills	
AI skills	
Data Management Skills	
Digital Literacy Skills	

Project management skills	
Cybersecurity awareness skills	
6.5 How frequently do you apply these skills in your current role? (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Very Often)	
Cloud Computing skills	
AI skills	
Data Management Skills	
Digital Literacy Skills	
Project management skills	
Cybersecurity awareness skills	

Annexure F: Interview schedule

UTILISING ARTIFICIAL INTELLIGENCE-EMBEDDED CLOUD COMPUTING TECHNOLOGY TO MANAGE THE ARCHIVES AT THE COE IN GHANA			
SECTION 1: INTERVIEW DETAILS			
1.1 Interviewer:			
1.2 Date:			
1.3 Time:			
1.4 Mode of interview:			
SECTION 2: JOB TITLE			
College Secretary		IT Officer	
SECTION 2: POLICY AND LEGISLATIVE FRAMEWORK FOR USING AI EMBEDDED CLOUD COMPUTING TECHNOLOGY TO MANAGE ARCHIVAL RECORDS IN COE'S RECORDS MANAGEMENT SYSTEM			
2.1 Is there an approved policy for managing Correspondence and Documents Management Services?			
2.2 Has the CoE established an approved records management policy?			
2.3 Does Correspondence and Documents Management Services have a documented Standard Operating Procedure?			
2.4 Does CoE have a standardised procedure for managing records?			

SECTION 3: USER PERCEPTION ON ARTIFICIAL INTELLIGENCE-EMBEDDED CLOUD TECHNOLOGY AT CoE	
3.1	What are your thoughts on using artificial intelligence-embedded cloud computing technology for records management at CoE? Give a brief explanation.
3.2	How do you understand the application of artificial intelligence-embedded cloud computing technology in managing records at CoE?
3.3	Do you believe AI embedded cloud computing technology can be successful at CoE if implemented properly?
3.4	Which benefits do you think improvement do you think AI-embedded cloud computing technology can bring to CoE if properly implemented?
3.5	What are you overall views on AI-embedded cloud computing technology for records management at CoE?
SECTION 4: ACTIVITIES THAT CAN BE PERFORMED WITH THE USE OF AI- EMBEDDED CLOUD COMPUTING TECHNOLOGY FOR CoE ARCHIVAL RECORDS MANAGEMENT SYSTEM	
4.1	What records management tasks can be performed with the use of AI-embedded cloud computing technology for archival records management?
	Filing of the CoE's administrative and students' archival records
	Storage of the CoE's administrative and students' archival records
	Access and security of the CoE's administrative and students' archival records
	Retention and disposal of the CoE's administrative and students' archival records
4.2	How would you rate CoE's current records management activities regarding filing, storage, access and security, retention and disposal?

Are the CoE's administrative and students' archival records organized according to the approved file plan?

Are the CoE's administrative and students' archival records centrally stored and managed by the Records Manager?

Are the CoE's administrative and students' archival records easily accessible, secure and well maintained?

Are the CoE's administrative and students' archival records properly retained and disposed of when no longer needed?

SECTION 6
AI EMBEDDED CLOUD COMPUTING TECHNOLOGY INFRASTRUCTURE
REQUIRED TO MANAGE ARCHIVAL RECORDS AT THE CoE.

5.1 Are you familiar with any AI embedded cloud computing technology infrastructure that can be used to manage the archival records management system?	Agree	Disagree
5.2 AI EMBEDDED CLOUD COMPUTING TECHNOLOGY INFRASTRUCTURE If you answered yes above, In your opinion, how important are the following AI and cloud computing technologies for managing archival records in the College of Education? (Please rate each technology on a scale of 1-5. NB 1 = Not at all important 2 = Slightly important 3 = Moderately important 4 = Very important 5 = Extremely important)		
Data Storage and Management		
Machine learning		
Natural language processing		
Automatic rules		
Neural network		
Deep learning		
Optical Character Recognition Technology		
Cloud-embedded Electronic Records Management Systems		
Cloud computing tools		

Which of these technologies do you currently use in your work? (Select all that apply)		
Data Storage and Management		
Machine learning		
Natural language processing		
Automatic rules		
Neural network		
Deep learning		
Optical Character Recognition Technology		
Cloud-embedded Electronic Records Management Systems		
Cloud computing tools		
SECTION 6: THE AI EMBEDDED CLOUD COMPUTING TECHNOLOGY SKILLS REQUIRED TO MANAGE ARCHIVAL RECORDS AT THE CoE.		
6.1 EXPERIENCE		
1 to 5 years		
6 to 10 years		
11 to 20 years		
20 to 25 years		
6.2 TRAINING		
Workshop in Basic Archives and Records Management (BARM)		
Workshop in Intermediate Archives and Records Management (IARM)		
Workshop in Advanced Archives and Records Management (AARM)		
Programme in Archival Studies		
National Archives: Records Management		
All of the above		
None of the above		

6.3 QUALIFICATIONS	
Higher Certificate in Archives and Records Management	
Diploma	
Bachelor's degree	
Master's degree	
Doctoral Degree	
Other, please specify	
None of the above	

Annexure G: Records management system checklist

UTILISING ARTIFICIAL INTELLIGENCE-EMBEDDED CLOUD COMPUTING TECHNOLOGY TO MANAGE THE ARCHIVES AT THE COE IN GHANA RECORDS MANAGEMENT SYSTEM CHECKLIST			
System Reviewer:	Review Date:		
	Agree	Disagree	Comments
Is the Co's records management system effective?			
Does the archival records management system fully support the overall records management system at CoE?			
Is the records management system fully integrated to support the end-to-end records processing at CoE?			
Does the system enable efficient sharing of electronic records across different CoE business units?			
Can various users access and retrieve records from a central location at CoE?			
Does the system enable effective archiving at CoE?			
Is the records management system adequately backed up at the CoE?			

Annexure H: Editing certificate

Lucia Geyer Writer ~ Courseware Developer ~ Copy-Editor ~ Proofreader Master's in Library & Information Science
CERTIFICATE OF EDITING I hereby certify that I, E.M. (Lucia) Geyer, have edited the following doctoral thesis: PhD Candidate/Researcher Mr. Patrick Cudjo Docgli Title of Thesis <i>Utilising Artificial Intelligence Embedded Cloud Computing Technology to Manage the Archives at the Colleges of Education in Ghana</i> The editing exercise includes: • Formatting • Structuring • Language editing and correcting • Proofreading; and • Bibliographic control: checking of text references and bibliographic entries in the reference list. This thesis has been edited to the best of my professional ability, drawing on my expertise in the English language, my extensive academic experience and my work as an academic editor. I cannot accept responsibility for any editorial suggestions and/or recommendations that the student has chosen not to incorporate, nor for modifications made to the manuscript after submission.  16 September 2025 EM (Lucia) Geyer Email: lgeyer@gmail.com