AN ASSESSMENT OF ECO-FRIENDLY DIGITAL RECORDS MANAGEMENT PRACTICES FOR PROMOTING ENVIRONMENTAL SUSTAINABILITY: A CASE STUDY OF THE MARSABIT COUNTY TEACHING AND REFERRAL HOSPITAL

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A Research Thesis Submitted to the School of Computing and Informatics in Partial Fulfilment of the Requirements for the Conferment of Master of Science in Information Science of Kenya Methodist University

OCTOBER, 2025

DECLARATION AND RECOMMENDATION

Declaration

I declare that this research is my original work and has not been presented earlier for the award of degree or any other award to any other Institution.

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Recommendation

We confirm that the candidate carried out the work reported in this proposal under our close supervision.

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DEDICATION

I dedicate this work to my family for their constant support, encouragement, and belief in me which was instrumental throughout my life.

ACKNOWLEDGMENT

I'm grateful to the Almighty God for His love and blessings throughout my life. I would like to extend my heartfelt appreciation to my supervisors, Prof. Paul Maku and Madam Edith, for their constant guidance and support throughout the writing of this thesis. I also wish to thank the entire teaching staff of the School of Information Science at Kenya Methodist University for the knowledge and skills I gain through this course. I extend my heartfelt gratitude to the management and the staff at the Marsabit County Teaching and Referral Hospital for their cooperation during data collections, to my colleague students for their constant encouragement even when the going got tough and equally to my wife, Galmo and my younger brother Barako for their constant encouragement too in this journey of academic and above all, for pushing me to complete this study for them too to enrol for their masters. I am equally grateful to my children, Challa, Biftu and my foster son Galm Wario Kosi for their patience and understanding throughout my research period. To my entire families, I salute you all and May the Almighty God bless you abundantly.

ABSTRACT

Environmental sustainability is a growing global concern, driving institutions to adopt eco-friendly practices in their daily operations. This study examined how paperless communication, digital archiving, cloud storage, and e-waste management contribute to sustainability at Marsabit County Teaching & Referral Hospital (MCTRH). Anchored on the Green Information Technology (Green IT) theory, a descriptive survey design was applied. Data were collected from 117 staff members through structured questionnaires and from three top managers via key informant interviews. Random sampling was used for staff, while key informants were purposively selected. Quantitative data were analyzed using descriptive statistics, and qualitative insights were thematically analyzed. Instrument validity was ensured through expert review and pre-testing, and reliability confirmed with Cronbach's Alpha values above 0.7. The study achieved a 97% response rate. Results indicated that paperless communication is moderately adopted, cutting paper use and costs while supporting sustainability. Digital archiving improved accessibility and reduced physical storage needs, though adoption was inconsistent. Cloud storage enhanced collaboration and accessibility, offering strong sustainability benefits despite infrastructural challenges. E-waste management practices were partial, signaling the need for structured recycling and safe disposal. Other initiatives, including solar energy, green campaigns, and electronic medical records, were evident though unevenly adopted. The study concludes that eco-friendly digital records management significantly fosters environmental sustainability among healthcare. It recommends stronger policies to institutionalize paperless communication, investment in reliable archiving and cloud systems, and robust e-waste management frameworks. These findings contribute to the growing body of knowledge on sustainable healthcare management while offering practical implications for policymakers and administrators aiming to integrate green technologies into health information systems.

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LIST OF ABBREVIATIONS

EMR – Electronic Medical Records

ICT4D – Information Communication Technology for Development

IPCC - Intergovernmental Panel on Climate Change

KNADS - Kenya National Archives and Documentation Service

MCTRH – Marsabit County Teaching & Referral Hospital

PPP - Public-Private Partnership

SDG - Sustainable Development Goals

UNEP – United Nations Environment Programme

UTAUT - Use of Technology and the Unified Theory of Acceptance

CHAPTER ONE

INTRODUCTION

This chapter explored the background to the study, statement of the problem, purpose, research objectives, research questions, and justification, significance of the study, scope, limitations, assumptions and operational definition of terms.

1.1 Background of the Study

Environmental sustainability is becoming a subject of a great concern that needs the attention of the world. Most of the ideal institutions both the public and private are now trying their best to align their daily routines in order to embrace a culture that is responsible for promotion of environmental sustainability. The adoption of the vast paced technologies has triggered a breath of new life into how institutions are governed and managed. Record management too which is a crucial institution function has no alternatives other than to incorporate some of these technologies so as to contribute to environmental sustainability. This study therefore was timely since it aimed at exploring eco-friendly digital records management practices at the Marsabit County Teaching & Referral Hospital promoting environmental sustainability. By picking on this topic, the researcher was optimistic about this study generating new insights and knowledge that will not only be useful to Marsabit County Teaching & Referral Hospital but also to wider information science experts especially when it comes to discussion revolving around the intersection of record management and environmental sustainability.

1.1.1 Environmental Sustainability

Ruggerio (2021) explained environmental sustainability as a process where natural resources are conserved for future generations, while the current generation's needs are met without jeopardizing the capacity of the next. Environmental protection is a topic of growing importance around the globe. Ozone depletion, the greenhouse effect, global climate change, and global warming are just some of the pressing environmental problems. The growing demand for environmental consciousness has led to a multitude of "Go Green" campaigns and movements, as well as solutions and calls to people, businesses, and governments to become more proactive in their greening endeavours at all levels.

Environmental sustainability encompasses a number of measurable features, with key ones including resource conservation, ecological balance, and social equity. Environmental sustainability is often measured by carbon footprint, level of biodiversity, and use of renewable energy (Cui et al., 2021). For instance, a reduction in carbon emissions, quantifiable through greenhouse gas inventories, serves as a primary indicator of environmental sustainability (Intergovernmental Panel on Climate Change [IPCC], 2021). Similarly, monitoring biodiversity can involve metrics such as species population counts and habitat preservation rates, providing concrete data on ecosystem health (United Nations Environment Programme [UNEP], 2022). Social equity may be assessed through parameters such as access to resources, quality-of-life indices, and community engagement in sustainability practices (Müller et al., 2021).

In the context of eco-friendly digital records management, measurable features may revolve around paper reduction, energy consumption, and data safety. Indicators for determining these practices may range from the volume of paper saved via digitization, volume of power consumed, and the degree of technology adoption (Gupta et al., 2021). For instance, comparing the energy consumed per transaction or per document stored can highlight efficiencies achieved using digital methods (International Energy Agency [IEA], 2022). Additionally, the decrease in carbon emissions associated with reduced paper consumption can be accessed via lifecycle analysis, which clearly expresses the relationship between digital transformation and environmental footprint (Böhringer et al., 2021). Collectively, these indices show the feasibility and scalability of digital records management in reducing environmental impacts.

1.1.2 Global perspectives toward Environmental Sustainability and Eco – Friendly Digital Record Management.

The exploration of the interdependence of environmental, ecological practices, and economic sustainability is also crucial, as seen among U.S. citizens, specifically with emphasis on the definitive roles played by effective environmental practices in generating sustainable economic benefits such as reduced resource consumption, reduced waste, and reduced contamination (Ukpoju et al., 2024). Similarly, filtering an environmentally sustainable food-consuming behavior and its diffusion among French residents has shown that socio-cultural context is one of the main aspects to grasp how such sustainable behavior evolves (Innocent et al., 2023). Public sensitization on the need to understand the effects of climate change, which has given rise to environmental challenges, was also seen as a matter worth attention in Switzerland. Even health professionals were noted to lack confidence in integrating discussions on environmental issues into their patient

consultation processes. Although they understood the necessity of counseling their clients about lifestyle changes and preventative measures, they were often worried about time limitations and their insufficient knowledge of environmental issues. This demonstrates an existing disparity between their desire to act and their ability to execute those actions (André et al., 2022).

Records management initiatives in isolation do not specifically target climate action per se, but the implementation of digital technologies and efficient processes results in paper reduction and energy savings, which lower carbon footprint while promoting environmental sustainability. A study on records management and archival functions toward climate action in Canada demonstrated that environmental benefits can emerge from proper and effective records management even when sustainability is not the main goal (Evans, 2021). The global trends in sustainable management of digital transformation toward environmental sustainability are also gaining momentum, especially in recent years. There exists an urgent need for sustainable management strategies to ameliorate the effects of changes introduced by new technologies, as demonstrated by a study among Canadian higher education institutions (Abad-Segura et al., 2020). Hence, it is of paramount importance to conclude, based on these studies, that there is a need to implement eco-friendly digital record management activities among institutions, such as Marsabit County Teaching & Referral Hospital, in accordance with global sustainability goals.

1.1.3 Environmental Sustainability Efforts & Eco – Friendly Digital Record Management Practices in Africa

Several studies have underscored the critical role of modern technologies in governance toward achieving environmental sustainability across Africa. The diffusion of digital technologies, such as mobile phones and the internet, correlates with reduced CO_2 emissions. There is a need to

emphasize the necessity of robust institutional frameworks to support renewable energy adoption and environmental protection (Traoré et al., 2023). Similarly, Nathaniel et al. (2021) highlighted the environmental pressures stemming from rising carbon emissions and energy consumption in rapidly urbanizing African regions, calling for urgent "greenism" to mitigate these effects. These studies provide a broader continental context, relevant to the Marsabit County Teaching & Referral Hospital, demonstrating the potential of digital technologies to drive sustainable development.

In addition to the above, electronic waste (e-waste) management is a crucial aspect of environmental sustainability, particularly in the face of growing adoption of digital technology. The increasing challenges associated with e-waste and its ecological expenses call for environmentally sound disposal and recycling practices (Bimir, 2020). This study also underscores the need for institutions such as the Marsabit County Teaching & Referral Hospital to adopt eco-friendly digital record management practices, not only to leverage the benefits of digital technologies but also to address the associated environmental challenges, such as e-waste, in the spirit of minimizing environmental problems.

1.1.4 **Environmental Sustainability Efforts & Eco – Friendly Digital Record Management Practices in Kenya**

The high rate of population growth in Kenya has resulted in rapid urbanization, which is significantly impacting its natural environment, with infrastructure development notably fueling carbon emissions and environmental degradation. This demonstrates the importance of urban green spaces in fostering sustainable environments (Mwanzu et al., 2023). Similarly, Maina et al. (2024) investigated Kenyan university libraries' contributions to the Green Library Initiative, with emphasis on digital record management to minimize paper consumption. Though challenges such

as infrastructure limitations and resistance to change were noted as hindrances to its full implementation, both studies collectively underscore the urgent need for sustainable practices among institutions.

Several studies on e-governance in Kenya often focus on the impact of e-government initiatives on service delivery, citizen engagement, transparency, and the challenges related to infrastructure, the digital divide, and policy implementation. However, there still exists the need for improved internet access, robust cybersecurity measures, and targeted capacity building within government institutions to fully realize the potential of e-governance in the country (Esther et al., 2023). There are also several energy-saving and recycling initiatives employed by different organizations toward the attainment of environmental sustainability (Mwanzu et al., 2023). However, the digitalization of record management in achieving the same remains not fully utilized, thus restricting its environmental benefits. Therefore, investigating the practical implementation of digital record management practices at the Marsabit County Teaching & Referral Hospital was essential in assessing their affordability and contribution to overall environmental sustainability goals.

The Marsabit County Teaching & Referral Hospital, like many other public institutions, is grappling with the challenge of managing vast amounts of paper-based records. The traditional approach to records management not only contributes to environmental degradation but also results in significant operational costs, wasted resources, and inefficient use of physical storage space (Survey Report, 2025).

In an era where environmental sustainability has turned into a pressing global concern, it is important for institutions to adopt eco-friendly practices that minimize their ecological footprint.

Digital transformation, backed up by advanced technologies, presents unique opportunities for the Marsabit County Teaching & Referral Hospital to transition toward eco-friendly digital records management practices, which can not only reduce its environmental impact but also enhance operational efficiency, reduce costs, and promote transparency and accountability (Wong et al., 2021). This study, therefore, examined the opportunities for adoption of eco-friendly digital records management practices at the Marsabit County Teaching & Referral Hospital, with a view of promoting environmental sustainability and enhancing the institution's overall performance.

1.2 Statement of the Problem

In an era where technology has become a catalyst for change, most institutions worldwide are increasingly aligning themselves to benefit from these innovations, including governments, some of which are already implementing e-government initiatives to enhance productivity, service delivery, and reduce costs (Shonhe et al., 2020). While embracing these technologies for change, environmental concerns are at the top of organizational agendas, where aligning environmental sustainability with digital information management has become a critical consideration for forward-thinking organizations (Bora et al., 2024).

Since the inception of devolution in 2013, the Marsabit County Teaching & Referral Hospital has received or generated too many records, resulting in challenges of space and storage. Besides, most of these records were in their physical format, further raising concerns over accessibility, sharing, preservation for the future, and their long-term effects on the environment. It is worth noting that the hospital majorly operates with physical records that are decentralized among its departments. These records have accumulated over the years, and in some cases, they are simply being dumped in an old store regardless of their initial value or environmental impact.

The study by Farahat (2021) revealed that environmental sustainability has become a pressing global agenda, requiring innovative approaches to mitigate the impacts of human activities on the planet. However, Isotilia et al. (2023) emphasized that digital transformation can also have unintended environmental consequences. For instance, it blurs the boundaries across organizations, thus interfering with competitiveness. Therefore, it is crucial to adopt a responsible approach to digitalization that minimizes its environmental footprint. This study, therefore, explored the potential of eco-friendly digital records management practices as a key strategy for promoting environmental sustainability within the context of the Marsabit County Teaching & Referral Hospital. By examining the implementation and effectiveness of these practices, this study aimed to contribute to a more sustainable and environmentally conscious approach to digital transformation.

1.3 Purpose of the Study

The study sought to assess Eco - Friendly Digital Records Management practices for promoting environmental sustainability at the Marsabit County Teaching & Referral Hospital in order to recommend best strategies in addressing the challenges identified.

1.4 Research Objectives

i. To assess how the adoption of paperless communication promotes environmental sustainability at the Marsabit County Teaching & Referral Hospital.
ii. To assess how digital archiving in digital records management promotes environmental sustainability at the Marsabit County Teaching & Referral Hospital.
iii. To determine how the adoption of cloud storage solutions in digital records management promote environmental sustainability at Marsabit County Teaching & Referral Hospital.

iv. To examine the existence of e-waste disposal strategies that promotes environmental sustainability at the Marsabit County Teaching & Referral Hospital.

1.5 Research Questions

i. To what extent can paperless communication contribute to environmental sustainability at the Marsabit County Teaching & Referral Hospital?
ii. Can digital archiving be effectively implemented in order to promote environmental sustainability at the Marsabit County Teaching & Referral Hospital?
iii. In what ways can cloud storage solutions be leveraged to promote environmental sustainability at the Marsabit County Teaching & Referral Hospital?
iv. How do you manage e-waste generated from digital records management at the Marsabit County Teaching & Referral Hospital?

1.6 **Justification of the Study**

This study was necessary because of the growing adoption of electronic records management and online services across public institutions in Kenya, coupled with the urgent global demand for environmental sustainability. At Marsabit County Teaching & Referral Hospital, managing vast volumes of records using traditional paper-based systems has led to inefficiencies, increased costs, and negative environmental impacts such as deforestation and poor waste management. With rising patient numbers and expanding institutional responsibilities, these challenges have intensified, highlighting the urgent need for eco-friendly and efficient alternatives.

The study was also justified by the limited empirical research in Kenya linking digital records management practices with environmental sustainability, especially in the healthcare sector. While many institutions are embracing digitization, little is known about how such practices directly

contribute to reducing ecological footprints. This knowledge gap made it critical to assess eco-friendly digital records management practices at MCTRH as a case study to generate evidence-based insights.

1.7 Significance of the Study

The findings of this study are significant for several groups of stakeholders. For the leadership and staff of MCTRH, the study offers practical guidance on how adopting paperless communication, digital archiving, cloud storage, and e-waste management can enhance efficiency while reducing environmental impacts. Records managers and other information professionals will also benefit from insights on aligning their practices with sustainability goals.

For scholars and future researchers, this study enriches the academic discourse on the intersection of records management and environmental sustainability, offering a foundation for further studies. Policymakers and government agencies can use the findings to inform strategies and policies that promote eco-friendly practices in public institutions, contributing to Kenya's broader sustainable development agenda. Finally, the community at large benefits indirectly through improved healthcare service delivery and reduced environmental degradation.

1.8. Scope of the Study

This study was conducted at the Marsabit County Teaching & Referral Hospital comprising several departments from which the respondents were drawn. The study focused on four independent variables which included: - cloud storage solutions, digital archiving, paperless communication and E-waste disposal strategies. The dependent variable for the study was Eco-Friendly digital record management practices that promote environmental sustainability. This study was conducted

between June 2024 and August 2025. The study targeted hospital top management and other selected staff only. Aspects such as staff remuneration, daily routines and staff motivations wasn't covered.

1.9 Limitations of the Study

Recognizing the fact that this study was conducted at the Marsabit County Teaching & Referral Hospital which was one of the sensitive devolved functions to the county, the researcher felt the possibility of political interpretation of this study, however to minimize any chances of such misinterpretation, the researcher clearly spelled out the objectives of the study to all target respondents in earnest and further elaborated to them the fact that this study was purely academic research which has nothing to do with the politics of the area or that of the institution. Besides, the researcher carried out this study in a professional way and above all, assured the respondents that the information collected from them will be held in high confidentiality and use only for academic purposes.

1.10 Assumptions

The study was premised on the assumption that records at the Marsabit County Teaching & Referral Hospital exist in both physical and digital formats, and that these records are created, accessed, managed, and stored in ways relevant to environmental sustainability.

It was further assumed that the selected respondents would generally be available and willing to participate, although some degree of reluctance or non-responsiveness was anticipated, as is common in organizational research. The study also assumed that the main variables under

investigation would remain stable during the research period, allowing meaningful measurement and interpretation.

In addition, it was assumed that while not all respondents would provide exhaustive details, the majority would share their views openly and without deliberate bias. Finally, the research instruments were assumed to be appropriate, valid, and practical for collecting both quantitative and qualitative data within the hospital setting.

1.11 Operational Definitions of Terms

 Paperless Communication: Refers to the use of digital platforms and tools such as emails, instant messaging, electronic memos, and online collaboration systems to replace traditional paper-based communication.

 Digital Archiving: The systematic storage, organization, and preservation of records in electronic formats for long-term accessibility and retrieval.

 Cloud Storage Solutions: Internet-based platforms that allow data and records to be stored, accessed, and shared remotely via servers rather than relying on local storage devices.

 E-Waste Management: The systematic handling, recycling, and safe disposal of electronic waste, such as outdated computers, servers, printers, and mobile devices.

 Eco-Friendly Practices: Broadly defined as organizational initiatives aimed at reducing environmental impact, such as use of renewable energy (e.g., solar power), energy-efficient devices, digitization of records, and reduction of paper consumption.

 Environmental Sustainability: The responsible use of resources and adoption of practices that minimize harm to the natural environment, ensuring that current needs are met without compromising the ability of future generations to meet theirs. In the context of this study, it focuses on how digital records management practices reduce carbon footprint, paper use, and electronic waste.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In modern governance, digital record management has become a crucial subject of concern. Its further alignment with environmental sustainability has been noted as one way of minimizing energy consumption, reducing paper usage and promoting efficient governance of information resources. The adoption and integration of technologies and other green ICT approaches have further fuelled opportunities to uplift institutional operational efficiency at the same time helping in attainment of global sustainability goals. Therefore, any innovation that scales adoption of Eco-friendly digital records management practices is instrumental in promoting environmental sustainability among public institutions.

While Marsabit County Teaching & Referral Hospital may consider adoption and implementation of such Eco-friendly record management practices, this chapter synthesizes existing literature that provided more insights into existing opportunities and prevailing challenges. This literature review therefore explored the past studies touching on Environmental Sustainability Practices. The chapter also critically examined the potential for adoption of Eco-Friendly Digital Records Management practices with special focuses on four key variables under this study: adoption of paperless communication, digital archiving, adoption of cloud storage solutions and E-waste disposal strategies. Lastly, the chapter concluded by correlating the above variables to the appropriate theoretical and conceptual frameworks which is ideal for this study.

2.2 Environmental sustainability Practices and Records in Government Departments

Ruggerio (2023) defined environmental sustainability as a process where natural resources are conserved for generations to come, while current generations' needs are met without jeopardizing the capacity of the next generations. Eco-friendly digital records management encompasses the adoption of digital archiving and paperless communication initiatives that can impact environmental sustainability in a greater way with the fundamental aim of lowering the reliance on paper materials, thus leading to mitigation of deforestation and minimizing waste (Yousufi, 2023). Further, digital archiving can facilitate permanent data preservation with potential of reducing environmental footprint if compared to the old way of traditional paper methods (Peluaga et al., 2022). The advancement of ICT has driven the shift to digital platforms, thus leading to improvement in resource efficiency and reduction in carbon emission (Wen et al., 2021). Furthermore, the wider concept of environmental sustainability in relation to digital records management calls for holistic strategies that bridge technological advancement and sustainable development principles, with more emphasis on the need for responsible digital practices that can minimize ecological impact (Tennakoon et al., 2024).

Cloud storage solutions integration into eco-friendly digital records management has triggered a comprehensive understanding of its environmental impact, particularly based on energy consumption and resource utilization. Therefore, implementation of sustainable practices requires tactful transition toward green cloud with focus on optimization of energy efficiency and reduction in the carbon footprint of data centres (Chugh et al., 2023). Cloud storage solutions also entail strategies that reduce unnecessary data storage, such as redundant photos, so as to decrease energy consumption (Hyun et al., 2024). Simultaneously, proper e-waste management is imperative, as

the disposal of outdated digital components of electronics contributes significantly to environmental degradation (Ahirwar et al., 2021). The mitigation of hazardous materials associated with e-waste and the proper recycling processes is very crucial in promoting environmental sustainability. These double approaches of responsible e-waste handling and the adoption of cloud storage efficiency are fundamental in realization of sustainable digital records management systems (Nath et al., 2024).

Pavli et al. (2023) conducted a qualitative study in Australia to investigate environmentally sustainable practice among residents and found that although some fraction of people are well versed with the role played by sustainable management, the translation of this understanding into actions was often hindered by insufficient knowledge among health practitioners themselves and by lack of clear direction. In particular, the research concluded that most practitioners implemented some environmentally sustainable changes following the enthusiasm of individual practitioners, but not because of government support, leading to fragmented approaches and challenges for spreading and scaling up the activities (Pavli et al., 2023). As a remedy, the study highlighted the need for broader organizational and policy interventions that facilitate widespread adoption of sustainable practices within primary healthcare settings.

Another study in China investigating the role of internet changes in green total factor energy efficiency by Wu et al. (2021) reported a positive correlation between internet growth and energy efficiency. The results of this study indicate that higher internet penetration and use may help develop more sustainable energy use. Finally, it pointed out the possibility of digital technologies to enhance environmental sustainability, which is of direct application to the present study on eco-friendly digital record management practices at County Referral Hospital, Marsabit. Through

adoption and implementation of these practices, the hospital may be able to capitalize on the advantages of digital technologies to further environmental sustainability initiatives, all in service of a larger trend towards using digital innovation for sustainable development.

The role of financial technology as a driver to move toward a green economy in African countries is increasingly becoming of concern. Tamasiga et al. (2022) investigated this in multiple African countries to establish the linkage between green economic growth and FinTech by performing a systematic and bibliometric analysis of related literature. Results revealed how the attention given to green financial technology is reflected in the pursuit of green economic growth, climate change, and environmental regulation. This study also provides a valuable starting point to study the role of digital technology in environmental safety and sustainability, especially in developing countries like Kenya, where the Marsabit County Teaching & Referral Hospital is currently situated.

Nathaniel (2019) explored the interplay between urbanization, trade, economic growth, and energy demand and their consolidated environmental implications for Nigeria. One of the main results showed that a tremendous amount of stress is coming from the increasing energy demand fueled by urbanization and economic development impacting environmental resources. The research further claimed that sustainable development requires change towards more environmentally friendly improvements in nearly every industry, such as the use of energy-saving technologies as well as resource optimization strategies. All this is consistent with the need for environmentally responsible behavior within public institutions, for instance, Marsabit County Teaching & Referral Hospital, where digital record management can contribute significantly to reducing environmental footprint. Shifting from this old-fashioned paper-based record management to electronic platforms can provide these institutions with the opportunity to drastically reduce paper production, high

energy demand for data storage and retrieval and, as a consequence, make a positive contribution to environmental sustainability.

2.3 Adoption of Paperless Communication as Eco-Friendly Practices for Promoting Environmental Sustainability

Paperless communication is simply defined as transitions to electronic methods of information exchange from the traditional paper-based record management. It encompasses a broader spectrum of practices such as the use of digital signatures, electronic documents, automated workflows and online collaboration tools. As posited by Prasetyo et al. (2020), the transition toward paperless system is one critical component of the broader movement towards society 5.0, with emphasis of the integration of technology to enhance sustainability and efficiency. Paperless communication key measurable features entails: - the speed of information transfers, the reduction in paper consumption, the efficiency of digital workflows and the accessibility of digital documents. Furthermore, Pandey et al. (2023) placed premium on the importance of identifying success factors for adoption of paperless communication, alluding to the fact that reduced operational costs, increased productivity and improved environmental impact are some of the measurable metrics of successful implementation of paperless ecosystem.

Successful implementation of paperless communication should be built on the adoption of various digital tools and systems designs that will support the replacement of paper-based processes. This may involve the use of cloud-based storage, document management systems and digital communication platforms (Yousufi, 2023). The study further underpinned the numerous environmental benefits of transition to paperless system, key among them being reduction of carbon footprint. In the context of libraries, Enakrire et al. (2024) demonstrated the trends in

shifting toward paperless libraries as one of the necessities toward the 5th industrial revolution. The role of paperless office systems toward supporting office automation with key components such as electronic forms, digital signature and online collaboration tools as essential features was well highlighted, alongside the need for considering the potential challenges in implementation of the paperless communication (Hardiyanti et al., 2023).

Many have embraced the transition to paperless communication as one way of promoting environmental sustainability. Prasetyo et al. (2020), in the study of the challenges of paperless system, highlighted the difficulty associated with digital solutions adoptions, pointing out the need for society to be ready to embrace it and the provision of technological infrastructure. The study that primarily addressed societal paperless adoption concepts, have underscored that the transition is not just a technological but socio technical transformation. Similarly, Tatlı et al. (2024), study among universities in Turkey, which adopted the Use of Technology and the Unified Theory of Acceptance (UTAUT) to assess the adoption of the paperless technologies have reveal that factors such as performance expectancy, social influence, effort expectancy and the facilitating conditions all have impacts on the acceptance and the adoption of paperless communication systems among academic institutions. Both the above studies indicate that the implementation of effective paperless communication requires not only technologies availability but also user's acceptance beside supportive organizational structures.

On the benefits and implications of shift to paperless library in Nepal, the study by Adhikari (2023) pointed out the advantages such as reduction in paper usage, Accessibility Improvement and information retrieval enhancement, not forgetting also challenges such as infrastructure limitations and digital literacy. Moreover, the coverage of paperless communication goes beyond the societal and high learning institutional settings. Thimbleby (2019) advice on the use of the three laws for

paperless with emphasis on the significance of the design and the usability of digital system so as to achieve paper reductions goals. The study advocate for well-crafted digital interface that will easily replace the traditional paper-based systems. This move is important for the digital solutions to effectively contribute to sustainability goals rather than just shifting the environmental burden. Unluturk et al. (2021) demonstrated the fact that digital communication tools used among healthcare settings streamlined the processes and led to reduction in paper wastage, this is after they explored paperless communication technologies adopted among hospitals. The study further, enumerated the potential of the adoption of paperless communication toward promotion of environmental sustainability. The insights from all these studies underpin the different application of the paperless communication and the need for tailor-made approaches in addressing sector specific challenges.

The need for efficiency and sustainability has driven the shift to paperless communication, thus gaining momentum across wider sectors. Several studies have demonstrated this transition in varied contexts. To begin with, study by Sayegh et al. (2022) evaluated the use of instant messaging among the hospitals in Germany with the findings that the adoption of digital tools having revolutionized physician communication and streamlined information exchange thus resulting to paper reductions among healthcare. Similarly, Unluturk and Utku (2021) also examined the adoption of paperless communication technologies again among hospital setting, with more or less same findings that this shift to paperless communication system having given rise to digital solutions. Both studies have underscored the need for practical and reliable communication which can be achieved by adoption of paperless technologies toward promotion of environmental sustainability. Furthermore, Wang et al. (2021) conducted a comparative study in China and Japan, with focus on emotions work by use of digital visual communication, clearly

showing that digital tools can be used to support complex communication that goes beyond simple information exchange. These studies too concluded that paperless communication is already being adopted among various sectors, and that they are very significant for many communication needs.

The user acceptance and technological infrastructures are the cornerstones for successful implementation of paperless communication. Kustov and Silanteva (2020) have scrutinized the technological components of trust among cross-border paperless exchange, with emphasis on the need for secure and reliable systems that will facilitate international digital communication. The study affirmed that security and reliability are critical for establishing confidence in paperless transactions and for data sharing. On the same wavelength, but from educational perspective, Tatlı et al. (2024) examined the adoption of the paperless technologies among universities in Turkey by applying the United Theory of Acceptance and the Use of Technology model (UTAUT). The study gave insights into the factors responsible for the adoption of digital communication tools by faculty and students, it pointed out that the perceived usefulness and the Ease of Use are among the key factors. The study brought about the nexus between the acceptance of the technologies and it subsequent use by clearly spelling out the fact that the acceptance of these technologies squarely depends on the willingness of the people to use them. From the above we can confidently say that effective adoption of paperless communication depends on both the availability of the technology and the willingness of the people who will use them.

The transitions toward paperless communication should also be anchored on the policy considerations and sustainability goals. Kim (2019) carried out a study on e-commerce in South Korea, with focus on policy priorities and potential incompatibilities. The study posits the need for coherent policy frameworks that will support the growth of E-commerce which in turn will lower

the reliance on paper-based transactions. Therefore, it is needless to say that by promoting digital trade, governments can stand to achieve two goals in one, contributing to environmental sustainability while at the same time fostering economic growth. In a nutshell, it is true also to deduce the fact that the adoption of paperless communication is not just a technological or operational shift but also a strategic move with positive implications for both the national and international institutions. The studies suggest that the adoption of paperless communication should be supported by policy, and that if well adopted and implemented, it has the potential of contributing to a more sustainable future.

In African context, the adoption of the paperless communication is linked to digital transformation endeavors. Several studies have highlighted the potential of technologies adoptions and e-government in creating paperless environment. A study among Nigerian public Universities conducted by Kayode et al. (2020) has identified that though e-government holds a lot of promises, there exist number of challenges such as limited digital literacy and inadequate ICT infrastructure that has hindered the full implementation. Similarly, Mncwango (2024) has put a lot of significance on the role of ICTs in e-governance among Africa Nations, pointing out the fact that the success of digital communication is contingent upon looking at and correcting issues of digital accessibility and inclusion. The challenges and opportunities revolving around digital diplomacy in Africa were further emphasized by Birhan et al. (2024). The study draw a clear line on how these challenges directly relates to paperless communication in governance and in international relations. From all these studies, one can again easily deduce the fact that even though the transition to paperless communication is a desirable goal toward achieving environmental sustainability, it realization call for concerted efforts in order to overcome infrastructural and capacity related

barriers which will ensure equitable access to digital resources and technologies across diverse populations.

The impacts of digital technologies, and to larger extent, paperless communication practices, vary from one sector to another. Erlangga et al. (2023) carried out a study on the impact and challenges associated with mobile phone usage on agricultural practices in Africa. The study indicated transformative power of digital technologies especially in dissemination of information and it contribution in enhancement of efficiencies. The sector specific study clearly demonstrated that the adoption of mobile technology if well harnessed has the potential to shift digital communication, thereby reducing paper consumption even among traditionally paper-intensive sectors like this one of agriculture. This study finding can be extrapolated to other sectors such as education and public administration where information dissemination is crucial. However, it is worth noting the fact that effectiveness of these digital tools is hinges on user proficiency and reliable connectivity, as understood in the contexts of the study on agriculture. This success story of digital communication in agriculture sector above can serve as a reliable case study for the adoption of paperless communication among other sectors.

The adoption of digital communication tools and modern technologies also plays a significant role in fostering sustainability and enhancing efficiency within project management. The study by Kwofie et al. (2019) conducted in Ghana and South Africa on communication performance challenges among Public-Private Partnership (PPP), revealed the danger of ineffective communication which normally results into resource waste and significant delays. The shift to paperless communication can reduce paper consumption, streamline information flows and enhanced overall project efficiency. To achieve more sustainable and efficient work environment,

this study suggests the implementation of digital management systems further backed up by online collaboration tools. Again, this resonates perfectly well with the broader environmental sustainability goals in which reduced paper consumption and improvement of efficiency in communication plays crucial roles in saving and proper utilization of organizational resources. By harnessing modern technologies in communication, organization can without a doubt minimize their environmental footprints while at the same time optimizing its operational performance in more ways than one.

The adoption of modern technologies and ICT related digital tools in Kenya has gain momentum in the recent past, thus undoubtedly impacting several sectors such as education, health and government services. Several studies have shed light on the crucial roles played by ICT in enhancing information management and achieving effective communication. For example, there is need for proper framework for e-record management that will support e-government initiatives (Ambira et al 2019). This study put emphasize on the importance of having a robust digital system that will enhance efficient service delivery. Similarly, there exist a potential of digital technologies that can reduce reliance on paper-based processes and enhance public service delivery (Okemwa & Nambiro 2020). This study explored Information Communication Technology for Development (ICT4D) and E-government in Kenya. Furtherance to the above, Nkanata and Ocholla (2023) also undertook a study to contextualize the E-government initiative run across the 47 Counties at Huduma Centre in Kenya, applauding the efforts of the government to digitize public service in their pursuit to bring service delivery closer to the people. Collectively, all these studies point to the fact that the shift to the paperless communication requires laying a strong foundation, which is a prerequisite toward realization of environmental sustainability. These transitions to paperless

communication will not only enhances efficiency in organization operations but also reduces the environmental footprint that is primarily associated with traditional paper-based operations.

The adoption and implementation of paperless communication and record-keeping systems have revealed both successes and challenges in equal measures across different sectors in Kenya. For instance, the acceptability and usability of electronic immunization registry data entry workflows in Siaya county Kenya have demonstrated the fact that while electronic systems offer potential benefits, what is of paramount importance in realization of this benefit was the user-friendliness and staff perspective is very crucial for effective and successful adoption of these systems (Wittenauer et al. 2023). Additionally, Nandikove et al. (2018) examined technical factors affecting e-medical record system in use at Kakamega County Referral Hospital, highlighted the need for addressing the technical challenges in order to effectively utilize the e-medical system. Otieno et al. (2023) underscore the need to use cybernetics devices for effective communication toward the care and control of diseases in Kenya, underpinning the urgent necessity for the adoptions of digital solutions among healthcare facilities. In education front too, a study carried out among Kenyan universities on the effectiveness of ICT on education, have revealed the potential of digital tools in enhancing educational outcomes (Kiche, 2023). From all the above, again one can easily deduce the significance of tailored and user-centric approaches to adoption of digital paperless communication among different sectors of our governance in the spirit of successful transitions that require addressing sector-specific challenges.

A case study conducted in Kibera, Nairobi County by Awiti and Reuben (2020) on socio-economic impacts of adoption of ICT revealed that internet access and digital literacy are among the critical factors influencing the adoption of e-government services among the small and medium

enterprises in Kenya. Additionally, Njiru and Ngaba (2024) too examined the correlation between branchless banking and the performance of the commercial banks in Kenya. This study too revealed the wider impact of adoption of digital tools on financial inclusion. Mobile phone usages among the university students in Kenya underscore the importance of mobile technology in promotion of sustainable development (Ongek & Onjoro, 2020). Finally, Chege et al. (2019) also explored the impacts of ICT and digital innovation on firm performance in Kenya, again demonstrating the broad economic effects of ICT adoption. In conclusion, literary all of these studies have put adequate emphasize on the adoption of paperless communication which requires the need to address issues of digital inclusion that will ensure equitable access to technology and digital literacy, which is very significance for environmental sustainability.

Synthesizing the findings from these studies, it is evident that the transition to paperless communication in Kenya is multifaceted, requiring a holistic approach that addresses technical, socio-economic, and organizational factors. The potential for environmental sustainability through reduced paper consumption is significant, but it hinges on the successful implementation of robust and user-friendly digital systems. The studies collectively suggest that investing in ICT infrastructure, enhancing digital literacy, and ensuring equitable access to technology are crucial steps. Furthermore, adopting sector-specific strategies that address unique challenges and user needs is essential for successful transitions. The transition to paperless communication is not merely a technological shift but a cultural and organizational one, requiring a commitment to sustainability from all stakeholders. By leveraging the insights from these studies, organizations in Kenya can develop effective strategies for adopting paperless communication, contributing to both environmental sustainability and improved efficiency.

2.4 Digital Archiving as Eco-Friendly Practice for Promoting Environmental Sustainability

In its simplest definition, according to Udochukwu et al. (2021), Digital Archiving refers to the processes and other systems engaged toward providing access to and preservation of digital materials for long – term usage. The study further highlights that, this process entails digitization of analog content and also the management of digital resources, thereby ensuring their long-term accessibility and viability. Key components of digital archiving may include: - the selection, description, storage, appraisal and dissemination of the digital resources. Features and measurable characteristics of digital archiving process entails: - file format, metadata quality, storage integrity, sustainability, access control mechanism and the implementation of the preservation strategies (Udochukwu et al., 2021). This study points out digital archiving as a complex process undertaken with view of promoting the longevity and retrieval of digitized information, whereas, Schultz (2021) placed emphasis on the importance of both the creating stage and later management of the digital resources.

Effective design of successful digital archiving relies on a robust framework which comprises technological infrastructure, skilled personnel and organizational policies. As Ali and Warraich (2021) noted, assembling the process of digital archiving encompasses understanding the interplay between desktop devices and ubiquitous thus indicating the diverse pathways for digital content creation and storage. From archaeological contexts, Opgenhaffen (2022) enumerated how digital technology transforms the creation of open research archives and recording strategies, thus highlighting the effects of digital archiving on specific domains. This study further posits that the ability to maintain data integrity, search functionalities, facilitation of user access through intuitive and promotion of interoperability across platforms as indicators of a successful digital archiving,

and that all these features collectively contribute to the accessibility of digital heritage and long-term preservation.

Environmental footprints usually associated with record management based on the traditional paper-based practices can be reversed by the shift to digital archiving which present compelling opportunities. Studies conducted across the length and breadth of both geographical and cultural settings have demonstrated the increase recognition of these potentials though equally also revealing existing challenges. For instance, a study by Ocón (2021), that assessed the digitalization of the endangered cultural heritages around Southeast Asian cities have raised critical concerns over whether digital tools truly preserve or they just replace the original cultural artifacts. In the same breadth, another study conducted at Gaoqian, China by Qi et al. (2022), underscore the significance of the digital archival conservation thereby demonstrating the need for context-specific strategies. Both the studies collectively suggest the fact that digitalization offers environmental benefits such as the reduction of the physical storage and paper consumptions. These studies again put adequate emphasis on the need for being very careful when considering the adoption of digital archiving solutions so as not to interfere with the cultural preservation in its original forms and the long-term integrity of the digital records. This still goes in tandem with observation from a sister study of archives in Wuhan City of Central China by Xiao et al. (2019) which clearly picked on the security of the electronic records as a major issue of concern in digital preservation.

As a remedy to the challenges of security associated with digital archiving, the adoption of innovative technologies such as the Artificial Intelligence and the Block Chain are some of the alternatives being explored by several researchers. Wang and Yang (2021) in their study on the

development of Block Chain record keeping at the National Archives of the Korea brought out the issue of long-term preservation of digital records and trustworthiness attributed to the adoption of block chain due to its immutable nature. As a buildup on this, Sağlık and Lemieux (2023) also carried out a similar study on the potential of adoption of block chain technology toward enhancing the trust issues of digital records and their findings to support the early assertion that block chain enhances trustworthiness of the digital records besides also facilitating long term digital preservations. There is a need for building a smart system for the preservation of government digital records by harnessing the automation and intelligent archival solutions which is a growing trend in the recent past (Shaban et al. 2022). Furtherance to this, another study conducted by Jaillant and Rees (2022) on the application of AI on digital archives with focus on collaboration, trust and building shared professional ethics also revealed the significance of adoption of block chain and Artificial Intelligence in enhancing digital records integrity and long-term preservation. One thing is again clear from all the above studies, that the first pace of technological advancements though so promising should be embraced with care and the need for working on a robust framework which will ensure data integrity, accessibility and security even over long period of time in realization of long-term environmental sustainability goals.

The effective adoption and implementation of the digital archiving strategies should be preceded not only by the technological infrastructure but also by the adequate professional development and the organizational support. Žaja (2020) compared digital preservation practices among archives in Croatia, the U.S and Canada – A study that stressed the need for capacity building for information specialists. On the other hand, Bang and Kim (2021) advocated for the integration of the digital archiving into the cultural contexts for events such as Cheongju Craft Biennale in China. Additionally, there is need for standardized practices and general guideline for specific data types

as per the study conducted in Germany on archiving digital data (Göldner et al., 2023). Collectively, all these studies underscore the significance of collaborative initiatives, need for well-tailored training programs and the development of the best practices that will ensure the effective and efficient preservation of digital records across different sectors toward realization of environmental sustainability.

The shift from the traditional paper-based record management to the digital archiving is very crucial for fostering the environmental Sustainability, because of its potential to reduce the primary reliance on physical storage and its associated environmental cost. Studies across Africa countries have pointed out this fact. For instance, a study by Mosweu (2023) in Botswana posits the need for developing strong framework for digital records preservation in the cloud for the purpose of arriving at the secure and scalable solutions. Similarly, Modiba et al. (2019), propose the need to embrace innovations such as Artificial Intelligence and Cloud Storage to attain long term sustainability goals following their study on the application of disruptive technologies for record management and preservation in South Africa. Contributing to this discourse further by demonstrating practical approaches to cost effective and sustainable digital archiving was the study on the ingestion of the digital archives into the long-term storage via the use of the free open-source software conducted again in South Africa by Shekgola and Ngoepe (2024). All these studies again collectively underpinned the need for leveraging technologies so as to ensure the long-term digital records archiving and the goals of minimizing environmental impact.

Rapidly changing Metadata systems and emerging technologies such as Artificial Intelligence (AI) are also a foundation pillars for digital archiving toward effective environmental sustainability. The metadata system plays crucial roles toward preservation of digital records within the

institutions of cultural heritage in South Africa (Masenya, 2021). This study stressed the significance of metadata system in ensuring accessibility and long-term usability. This observation was expanded further by Schellnack et al. (2024) study which explored the development of smart archives with focus on the application of AI for management of audiovisual archives in Africa. The study revealed the benefits of integration of AI in the management of the audiovisual archives in supporting sustainable practices such as enhancement of efficiency and optimization of resources utilization. In a bit broader spectrum, a study by Netshakhuma (2022) brought out the nexus between climate change and the digitization of archives in South Africa with a clear message on how digitization is a crucial approach for mitigation of the environmental impact of traditional archival practices. Again, while demonstrating broader impact of ICT adoption on innovation and financial development in Africa, a study by Ejemeyovwi et al. (2020) reinforced the idea that the digital technologies are essential drivers of the sustainable development.

Adoption and the implementation of digital archiving for environmental sustainability still faces some daunting challenges especially among the public sectors despite the other side of its on its benefits. There are gaps in its implementation and thus the need for further improvement of infrastructure and policies (Matlala et al., 2022). To address the aforementioned challenges, there is need for laying a strong educational foundation including the inclusion of digital records management in archives and record curricula within open distance e-learning environment to ensure that future professionals are equipped with the necessary skills that will drive sustainable digital archiving initiatives (Ngoepe et al., 2022). The wind of digitization is sweeping across the regions in Africa, with digitization of the audio-visual Archives at National Archives of Zimbabwe already gone in record (Bishi, 2023). Again, all these studies collectively point to the importance of addressing implementation challenges, enhancing education and adapting digital archiving

practices within the specific regional contexts in order to achieve the desirable environmental sustainability goals.

Digital Archiving practices in Kenya are still not out of woods. There are notably a number of hurdles back rolling the pace of digitalization as highlighted by some studies. For instance, study by Muthoka et al. (2021), identified various challenges to adoption of digital archiving and preservation in their assessment of the Kenya National Archives and Documentation Service (KNADS). The study notably identified the need for policy frameworks and robust technological infrastructure which is lacking among most institutions. The findings from this study were backed by another study conducted in Kenya by Musandu's (2022) which termed the rapid proliferation of the ICT without commensurate archival capacity thereby threating historical research and record integrity as “the elephant in the room”. The study clearly pointed out the fact that this rapid ICT growth in Kenya is outpacing the archival infrastructure and capacity. While a sister study by Erima and Garaba (2022) which focused on public universities in Kenya underscored the intricacies of the digital archiving practices, further suggested the adoption of mixed-methods research so as to gain a comprehensive understanding. These three studies collectively pasted a picture of a national landscape where digital archiving though crucial is being hindered by policy, infrastructural and methodological challenges which have become a bottleneck toward preservation of digital records as a first step towards attainment of environmental sustainability.

The digital archiving practical adoption and implementation in Kenya differs across the sectors, thus offering more valuable insights into its potentials and shortcomings. Study by Datta and Muthama (2024) singled out the huge archival labour involved in digitization of the land records in Kenya as worrying. The study emphasized the human effort and the organizational processes

required for successful digitization, thus placing huge premium on the need for proper planning before embarking on digitization endeavors. In the academic front, there is a glaring inconsistencies and gaps which hinder effective and successful digital preservation as per the assessment of the status of digital preservation policies and plans among the institutional repositories of the selected universities in Kenya (Ndegwa et al., 2022). Their study findings pointed that many institutions do not have comprehensive policies and plans. Meanwhile, another study by Munyaka et al. (2024) demonstrated the potential of digital system in improving service deliveries and improves efficiency among healthcare sectors in Kenya. This is after they explored the adoption of e-health record management system among Kenyan public hospitals. From all these sector specific studies, one can draw the fact that proper planning and careful implementation is very crucial for utilization of the opportunities and overcoming the practical challenges hindering the digital archiving goals that will foster the environmental sustainability.

While the technological advancements is a God given opportunities to enhance record keeping practices and further contribute to the environmental sustainability through the reduction of paper usage and utilization of the physical storage, synthesizing all the above literature clearly revealed that the digital archiving in Kenya has a long way to go in surmounting the challenges highlighted. There still exists the need for adequate infrastructure, policy frameworks and skilled personnel issues to be urgently addressed. Most of these studies, Musandu (2022), Ndegwa et al. (2022) and Muthoka et al. (2021), pointed to the fact that there is necessity for comprehensive strategies both at national and at the institutional levels in order to address the aforementioned challenges. Again, one cannot lose sight of the practical insights from Munyaka et al. (2024) and Datta and Muthma (2024)**,** which clearly demonstrate the significance of context-specific strategies and the role of human aspects in digital transformation. By tackling these challenges, Kenya digital archiving

space will spontaneously grow, thus boosting it capacities to preserve its cultural heritage for posterity as well as realizing the global goal of environmental sustainability through efficient, effective and sustainable record management practices.

2.5 Adoption of Cloud Storage Solutions as Eco-Friendly Practice for Promoting Environmental Sustainability

Cloud storage solutions are defined as a virtual model of computer data storage where electronic data resides in logical pools, with the physical storage distributed across numerous servers, often spanning multiple geographic locations, and managed by a third-party hosting company. The significant and continuous growth in cloud storage technology, driven by its cost-effectiveness and inherent flexibility, has facilitated its widespread adoption across diverse sectors (Segun et al., 2024). Explaining the fundamental workings, Thangam et al. (2024) emphasized the distributed nature of these systems and the complex mechanisms necessary to ensure both data integrity and continuous availability.

At its core, the concept involves data storage via electronic devices and the internet, ensuring global accessibility. This model relies on interconnected servers forming a distributed system that inherently offers enhanced accessibility and scalability. Thangam et al. (2024) further detailed that key components include the requisite network infrastructure, extensive data centers, and sophisticated virtualization technologies, all of which are critical for reliable and efficient data management. Key performance indicators encompass bandwidth, latency, storage capacity, and the crucial measure of data durability.

Resilience and security are critical dimensions of modern cloud storage. Resilience is a critical measure of the system's ability to maintain data availability and recover swiftly from unexpected

failures (Ghosh & Lakshmi, 2022). Simultaneously, security is a non-negotiable aspect, encompassing rigorous measures to defend data against breaches, evolving cyber threats, and unauthorized access (Tabrizchi et al., 2020). The utility of cloud storage spans from personal data backup to managing vast volumes of big data for complex analytics (Zhou, 2024). The underlying technology is dependent on complex architectures and specialized software responsible for orchestrating data access, transfers, and distribution (Girau et al., 2024). Therefore, cloud storage solutions represent a comprehensive and strategic approach to data management, critically prioritizing accessibility, robust security, resilience, and scalability.

Models reveal that technological, environmental, and organizational factors critically influence cloud storage adoption. For instance, Badghish et al. (2024) applied the Technology-Organization-Environment (TOE) framework to systematically identify the multidimensional factors driving adoption across various organizational contexts. Gabutti et al. (2022) highlighted perceived benefits, external regulatory pressures, and intrinsic organizational readiness as potent adoption predictors. In the specialized context of higher education, the complex interplay of security concerns, demonstrated cost-effectiveness, and perceived ease of use significantly shape cloud storage decisions (Ploysuayngam & Tangwannawit, 2022). Stieninger (2022) offered an insightful view of internal organizational dynamics among cloud workers, underscoring the necessity of understanding multifaceted contextual factors. Collectively, these studies stress that successful adoption necessitates a deep understanding of the specific organizational and environmental contexts.

User experience (UX) is also a key determinant of sustainable adoption. Hui et al. (2024) identified reliability, enhanced accessibility, and robust data security as crucial factors shaping overall user satisfaction, thereby emphasizing UX as critical to the long-term sustainability of cloud solutions.

Crucially, cloud storage contributes tangibly to environmental sustainability by significantly reducing paper consumption and, when implemented efficiently, lowering energy usage, provided that users are actively engaged and aware of these environmental benefits (Hyun et al., 2024). Ali et al. (2020) identified demonstrable efficiency gains and a measurable reduction in environmental impact as key drivers for cloud adoption within local governments. Further research by Wulf et al. (2021) explicitly emphasized the imperative for focused studies that directly link cloud storage adoption with quantifiable sustainability outcomes.

The positive ripple effects on organizational performance fundamentally extend to broader environmental sustainability. Khayer et al. (2020) demonstrated that cloud storage leads to reduced operational costs and improved efficiency within Small and Medium-sized Enterprises (SMEs), directly translating into reduced resource consumption and a smaller environmental footprint. However, a critical perspective mandates attention to the entire cloud lifecycle, particularly the often-high energy demands of vast data centers, when conducting a comprehensive evaluation of the total environmental impact (Khan & Ali, 2021)

Cloud technologies, including cloud storage, are acting as transformative catalysts in the African context. Gao et al. (2025) highlighted the broader impact of the digital economy on environmental quality in African countries and its role in improving efficiency. Mhlongo et al. (2024) reported demonstrable efficiency improvements, while Gao et al. (2025) also suggested that organizational benefits are key adoption drivers. Conversely, Nyamwesa (2024) identified persistent barriers among Tanzanian SMEs, including pronounced security concerns, infrastructural deficits, and a lack of specialized expertise. Odun et al. (2021) similarly noted significant adoption challenges in East Africa. These findings, consistent with several others, underscore the critical need for locally tailored, strategic approaches to overcome regional constraints.

In the higher education sector, Thobejane et al. (2022) stressed the importance of robust evaluation frameworks, particularly in South Africa, for assessing varied adoption drivers and rates. Merlo et al. (2025) examined cloud adoption in record management, noting a trade-off between benefits and risks—specifically concerning data security and privacy—and emphasized the strategic necessity of focusing on critical success factors for adoption to maximize the associated environmental benefits. Collectively, these studies affirm that strategic cloud technologies minimize overall energy consumption, substantially reduce the need for physical infrastructure, and robustly support paperless operational models.

Synthesizing the literature, the adoption of cloud storage demonstrably enhances organizational efficiency and carries significant potential for environmental benefits, yet persistent barriers—particularly in developing nations—remain. Studies consistently highlight the necessity to proactively address infrastructure, security, and expertise gaps while simultaneously developing sustainable, long-term adoption strategies. Critically, much of the existing literature examines the general benefits and challenges, often not explicitly focusing on the nuanced dimensions of environmental sustainability—indicating a significant gap for focused future research.

In Kenya, research on cloud storage adoption is emerging. Odhiambo and Otieno (2020) examined adoption within Nairobi's insurance industry, identifying key influencing factors and finding that organizational, technological, and behavioral factors collectively shaped adoption decisions in public hospitals. Nyachiro et al. (2023) reported similar implementation challenges in the higher education sector, recommending specific strategic interventions and highlighting the importance of adoption strategies in research institutions. Ding et al. (2025) suggested that institutional pressures influence adoption decisions in Kenyan universities. Collectively, these studies suggest

that the organizational, environmental, and technological contexts in Kenya fundamentally shape adoption trajectories, with direct implications for sustainability outcomes.

Further studies have examined the impacts on operational efficiency. Ojijo et al. (2023) reported tangible benefits of cloud adoption in Kisumu public health facilities, including a measured reduction in resource wastage. Ding et al. (2025) documented evolving adoption trends in Kenyan banks, while Mwavali (2021) advocated for structured frameworks to guide cloud adoption among SMEs. Nyachiro et al. (2023) emphasized the strategic importance of tailored adoption strategies in research institutions. Collectively, these studies underscore the growing role of cloud storage in driving both efficiency and sustainability improvements.

Regarding adoption in public universities, Bomett and Kiprop (2021) underscored the importance of identifying critical success factors and ensuring institutional readiness. Ding et al. (2025) highlighted how external institutional pressures influence adoption decisions. Overall, the consensus is that strategic and planned cloud storage adoption effectively reduces energy use, decreases reliance on physical paper, and improves overall efficiency—thereby contributing demonstrably to organizational and environmental sustainability.

2.6 E-Waste Disposal Strategies as Eco-Friendly Practices for Promoting Environmental Sustainability

Among the multifaceted approaches geared toward mitigating the adverse environmental and health effects of disposed electronic devices are e-waste management strategies, which concern the systematic handling of electronic waste throughout its lifecycle—from collection, through segregation, to recycling and safe disposal (Arya et al., 2020). This study further highlighted key components of these strategies as the implementation of robust regulatory frameworks, including

producer responsibility, aimed at mandating manufacturers to take responsibility for their products up to end-of-life management. Effective strategies should also feature the development of efficient collection systems, such as take-back programs and collection centers, ensuring the proper channeling of e-waste (Islam et al., 2024). Successful e-waste management can be measured through indicators such as the establishment of sustainable recycling infrastructure, the rate of e-waste collected and recycled, and the reduction in hazardous substance release (Rautela et al., 2021).

E-waste management strategies also encompass the adoption of advanced recycling technologies—common ones being hydrometallurgical and pyrometallurgical processes—which help recover valuable materials and minimize landfill disposal (Goyal et al., 2024). Education campaigns and public awareness initiatives play an instrumental role in promoting responsible consumption and disposal practices, enhancing the effectiveness of collection and recycling efforts (Arya et al., 2020). Additionally, harnessing waste-to-energy conversion technologies provides a sustainable avenue for managing non-recyclable e-waste components, contributing to both waste volume reduction and energy recovery (Islam et al., 2024). The establishment of circular economy models that minimize waste generation, improve resource recovery, and decrease environmental pollution are also leading indicators of effective e-waste management strategies (Rautela et al., 2021).

The high rate of e-waste generation poses a significant global environmental challenge, calling for comprehensive and sustainable management strategies. The complexities of electronic waste regulatory frameworks, trade flows, and associated hazards necessitate robust technologies for value recovery (Ilankoon et al., 2018). This study underscores the necessity of holistic approaches

encompassing both upstream (creation) and downstream (disposal) elements to achieve effective e-waste management. Similarly, Shaikh et al. (2020) analyzed factors responsible for e-waste creation, emphasizing the need to address product design and consumption patterns to reduce waste at the source. Expanding on this, Andeobu et al. (2021) assessed e-waste generation and environmental management across Africa, Europe, and North America, revealing wide disparities in management practices and calling for harmonized regulations and technological advancements. Collectively, these studies point to the global nature of the e-waste problem and the need for integrated frameworks combining regulation, trade, and innovation.

As a remedy, researchers have explored innovative technologies and region-specific approaches. For example, Kang et al. (2020) investigated the potential of the Internet of Things (IoT) in Malaysia to enhance household e-waste collection and disposal. Yong et al. (2019), also in Malaysia, examined e-waste management and recycling operations, identifying both challenges and future prospects, and recommending tailored local solutions. From a technological perspective, Rene et al. (2021) provided a comprehensive overview of e-waste generation, recycling, and resource recovery, highlighting emerging trends in material recovery. In Oceania, Van Yken et al. (2021) reviewed technologies, enablers, and barriers in e-waste recycling, stressing regional adaptation. These studies demonstrate the significant role of innovations such as IoT and advanced recycling techniques, especially when adapted to local contexts.

Improper electronic waste disposal has severe environmental impacts, making transition to a circular economy model essential. Zhen et al. (2021) demonstrated the need to integrate circular economy principles into e-waste management frameworks to minimize harm. Proper disposal reduces toxic emissions and fosters sustainability (Zhen et al., 2021). Collectively, studies

advocate a paradigm shift where e-waste is viewed as a resource rather than waste, requiring regulatory reform, technological innovation, and behavioral change.

Developing nations also face escalating e-waste challenges. Studies highlight inadequate and inconsistent management practices, resulting in health and environmental risks. Lack of regulatory frameworks, infrastructure, and public awareness are commonly cited problems (Gollakota et al., 2020). The export of e-waste to Africa exacerbates these issues, often leading to uncontrolled dumping that worsens environmental degradation (Abalansa et al., 2021). A study of African countries revealed that many lack the infrastructure to address growing e-waste problems (Bimir, 2020).

As remedies, studies emphasize integrated, context-specific systems. Ikhlayel (2018) underlined the importance of technological innovation, policy development, and stakeholder collaboration. Massa and Archodoulaki (2023) echoed this, emphasizing socio-economic and infrastructural realities in Africa. Avis (2021) identified drivers, opportunities, and barriers, calling for country-specific strategies. Similarly, Amoyaw et al. (2019) highlighted both the economic potential and the health and environmental risks of e-waste recycling, underscoring the need for robust practices and regulation.

At the local level, the informal sector plays a crucial role. Patali et al. (2024) studied electronic repair vendors in Mwanza, Tanzania, concluding that informal actors are key to e-waste handling. They recommended integrating informal recyclers into formal systems, while providing training, safe environments, and resources. Localized strategies can thus reduce environmental impacts while creating economic opportunities.

Kenya also faces growing e-waste challenges. Ngethe (2021) emphasized the need for robust strategies integrating economic, technological, and social dimensions. Mutua (2019), focusing on Nairobi, highlighted limited awareness, weak regulations, and inadequate infrastructure. Simiyu et al. (2019) similarly evaluated environmental effects of current practices, identifying parallel issues. Collectively, these studies show that weak or absent frameworks hinder sustainability goals, necessitating urgent policy action.

On determinants of disposal practices, Kiniti et al. (2020) identified economic incentives, regulatory compliance, and corporate social responsibility as key drivers. Improper disposal, particularly of computer-related waste, poses human and environmental health risks (Maimba et al., 2019). The tendency toward indiscriminate dumping in Kenya is especially concerning. These studies propose adopting environmentally sound practices to safeguard health and sustainability.

Effective e-waste management in Kenya requires sustainable projects underpinned by technological innovation, stakeholder engagement, and financial viability. Oteyo and Ngugi (2019) emphasized collaborative efforts among public agencies, private entities, and community organizations to ensure sustainability. Collectively, the literature underscores the need for Kenya to adopt holistic strategies—policy development, awareness campaigns, infrastructure improvement, and stakeholder collaboration—aligned with the "reduce, reuse, recycle" principles to minimize environmental footprints.

2.7 Summary of Literature Gaps.

In conclusion, looking through past studies in relation to the variables under the current study, one can deduce that while the existing literature extensively explores the individual benefits of digital

record management practices such as paperless communication (Pandey et al., 2023; Yousufi, 2023), digital archiving (Opgenhaffen, 2022; Udochukwu & Oraekwe, 2021), and cloud storage solutions (Avula, 2024; Ke et al., 2020), many studies concentrate mainly on the technical features of these systems, thereby excluding broader environmental consequences. For instance, often disregarded is how cloud storage affects e-waste generation and energy consumption—important determinants of environmental sustainability (Arya et al., 2020; Ghosh et al., 2022). Considering the whole lifecycle of digital systems from implementation to disposal, there remains a need for more studies to measure the overall environmental benefits of integrated eco-friendly digital record management systems.

Even though the literature on digital record management techniques is expanding, there are still several important gaps to be filled, especially within government institutions. For instance, Pandey et al. (2023) pointed out success stories for manufacturing companies adopting paperless ecosystems, but there is still a clear lack of research on comparable frameworks for governmental institutions such as County Referral Hospitals in Kenya. The existing literature has not sufficiently addressed the bureaucratic and operational challenges that these institutions encounter when implementing digital record management systems. According to Rautela et al. (2021), the comparative analysis of waste management practices across different sectors highlights the necessity of targeted investigations into digital record management as a means of enhancing environmental sustainability in public administration. This disparity calls for new studies that explore the nexus between digital record management and environmental sustainability in greater depth.

Furthermore, there is a dearth of research on the integration of these practices within Marsabit County Teaching & Referral Hospital, despite prior studies examining the management of electronic waste (Islam et al., 2024) and the digital transformation of waste management systems in various regions (Kurniawan et al., 2022). There is a notable gap in knowledge about localized tactics that could improve environmentally friendly digital record management practices, as existing research often concentrates on general regional or sector-specific analyses. Empirical studies that assess how well these practices support environmental sustainability in local governance and their possible socio-economic effects on communities could be useful for future research. It is essential to understand these dynamics in order to create robust, context-specific frameworks that support sustainable practices.

2.8 Theoretical Framework

2.8.1 The Green Information Technology (Green IT)

The Theory of Green Information Technology (Green IT) has served as a guiding framework for this study. This theory argues that the entire information technology practice life cycle—from planning, design, implementation, and operations to disposal—must be conducted in a way that is environmentally sustainable. The relevance of this theory to the current study lies in its focus on the use of technology and its environmental impacts as a result of sustainable practices, which resonate well with the dependent variable of this study: eco-friendly digital records management practices that promote environmental sustainability at the Marsabit County Teaching & Referral Hospital. Hernandez (2020) also demonstrated that Green IT has a direct relationship with waste management, which is not only one of the fundamental components of sustainable digital endeavors but also a key independent variable in this study. By using this theory as a guide, the

current study has assessed the extent to which the County Referral Hospital's practices toward the environment as a whole, and more specifically toward digital records management (the independent variable under study), are sustainable. This theory has facilitated the examination of all initiatives designed and undertaken to mitigate the environmental impacts of ICT.

The choice of Green IT Theory and its application to the independent variables in this study is a masterstroke, since this theory has revealed specific avenues for deeper analysis. To begin with, the adoption of paperless communication—which is not only a key independent variable in this study but also a core component of Green IT—aligns with the theory's focus on reducing resource consumption. Singh and Sahu (2020) correctly argued that the use of Green IT encompasses a transformative step toward sustainability. Second, Green IT's efficient data management and cloud computing solutions have the potential to foster digital archiving, which limits the need for physical storage space and reduces energy and material waste. Nawi et al. (2024) demonstrated the relevance of these systems in subsequent Green IT developments. Third, the systematic management of e-waste is a clear example of applying Green IT to manage the life cycle of digital devices while reducing toxic waste. Hernandez (2020) provided adequate evidence that effective electronic waste management is a necessity for sustainable environments. Collectively, these variables, in the context of Green IT, illustrate how daily operations at the Marsabit County Teaching & Referral Hospital can be improved environmentally within the broader context of sustainable development.

Furthermore, the Green IT Theory has particular relevance to the governance and organizational dimensions of creating a digitally sustainable environment. Aini and Subriadi (2022) stressed the need for governance and practical approaches to actualize Green IT. With regard to the Marsabit

County Teaching & Referral Hospital, this theory enabled an analysis of how institutional policies and operational procedures aid or obstruct the implementation of sustainable electronic records management. Huang et al. (2022) also emphasized the significance of effective information management in promoting digital green innovation, connecting sustainable business practices to digital advancements. Hence, the current study investigated how the governance structures and daily operational practices across the County Referral Hospital departments facilitated the transition toward a more sustainable digital records management system, guided by the principles of Green IT.

Finally, the current study has also helped address the challenges associated with the adoption of sustainable information systems, as alluded to by Kirchner et al. (2024). These authors posited that the adoption of Green IT Theory to implement sustainable digital practices comes with its fair share of challenges. Therefore, this study enhanced the knowledge of the application of Green IT practices at the Marsabit County Teaching & Referral Hospital by analyzing the challenges to adoption and the solutions employed to overcome them. This analysis assessed the practicality of current approaches while expanding the scope for changes, ensuring that the hospital's digital records management practices are environmentally sustainable by evaluating the effectiveness of current practices and proposing recommendations for future improvement.

2.9 Conceptual Framework

The study conceptual framework demonstrated the relationship between digital record management practices and the environmental sustainability. At the core of this framework are four interconnected components: Paperless Communication, Digital archiving, Adoption of cloud storage solutions and E-waste disposal strategies which was exhaustively discussed under the first part of this literature review.

By addressing these four areas collectively, institutions like the Marsabit County Teaching & Referral Hospital can create a robust approach to minimizing record management challenges through effective management practices that resonate well with the environmental sustainability.

Figure 2.1

Conceptual Framework

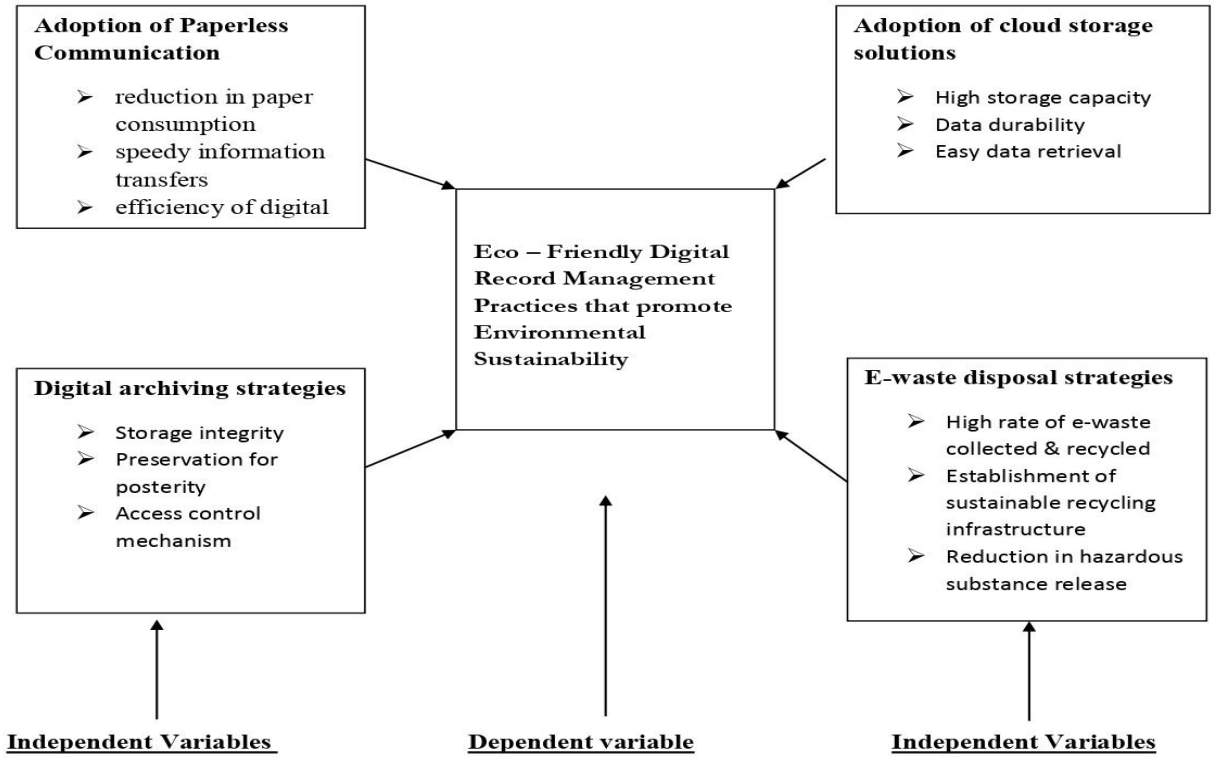


Figure 2.1 shows the anticipated relationship between the Independent variables and the dependent variable of this study. The independent variables are the main components of eco-friendly digital records management practices that promote environmental sustainability at the Marsabit County Teaching & Referral Hospital. Firstly, adoption of the Paperless Communication encompasses the use of digital means or technologies to convey information and reduce the reliance on paper-based documents. This variable is expected to have a lasting impact on the paper waste reduction and minimize carbon footprint, thereby promoting environmental sustainability.

Secondly, Digital Archiving entails the preservation and storages of electronics records in a centralized repository, thus leading to lesser need for physical storage spaces and at the same time minimizing the risk of document damage or loss. This variable was anticipated to have a positive influence on the efficient and effective management of e-records that will result into reduction of environmental degradation. Thirdly, on the other hands, Cloud Storage Solutions was anticipated to enhance the security and facilitate the remote storage of digital records, thus, reducing the need for on-site storage infrastructure while at the same time promoting data accessibility.

Fourthly, E-Waste Management Strategies encompasses the process of responsible disposal and purposeful recycling of e-waste generated from digital records management practices. This variable too was expected to enhance the mitigation of the environmental harm caused by electronic waste thus contributing to the promotion of sustainable practices. Finally, Eco-Friendly Digital Records Management that Promotes Environmental Sustainability as the dependent variable, is the outcome of the interplay & relationship between these four independent variables. It entails the effective management of digital records in a way that will minimize environmental harm thus promoting sustainable practices.

These relationships between the independent variables and the dependent variable are at times complex and interdependent. For example, the adoption of paperless communication and digital archiving can lead to a reduction in paper waste and carbon footprint, which in turn promotes environmental sustainability. Similarly, the implementation of cloud storage solutions can reduce the need for on-site storage infrastructure, leading to a decrease in e-waste generation. While on the other hand the effective management of electronic waste via sustainable approaches can easily also lead to the promotion of the environmental sustainability as envisaged by this study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The methodology section outlines the research design, population, sampling techniques, and data collection methods to be employed in this study. A descriptive research design facilitated a comprehensive assessment of eco-friendly digital record management opportunities. This approach enabled the integration of quantitative and qualitative data, offering a robust analysis of paperless communication, digital archiving, cloud storage solutions and e-waste disposal strategies at the Marsabit County Teaching & Referral Hospital

3.2. Location of the study

The study was conducted at Marsabit County Teaching & Referral Hospital, Kenya. Marsabit County is second largest and the most expansive of Kenya's 47 counties, located in the upper eastern province covering an area of 66,923km. Marsabit County borders Ethiopia to the North, Wajir County to the East, Isiolo County to the South, Samburu County to the Southwest and Turkana County to the West. The county also shares boundaries with Wajir and Mandera. It has four sub-counties: Laisamis, Saku, North Horr and Moyale. Marsabit is estimated to have a population of 459,785 of whom 53% are male and 47% female. The primary groups residing in the County include: the Borana, Gabra, Rendille, Samburu, Turkana, Burji, Dassanech, Waata, Garre, Sakuye, El Molo, Konsos and Somali. The County is predominantly arid and semi-arid. Its communities mainly engage in pastoralism. However, Saku sub-county has a forest that provides arable land for cultivation and farming. Other economic activities include agriculture, beekeeping and mining in low scale. (Marsabit County Government, 2022).

On the other hand, The Marsabit County Teaching & Referral Hospital where this study will be conducted is one of the robust department of the Marsabit County Government which was devolved fully to the county following devolution as per the dictate of the 2010 Kenya Constitution and its mandates is to build a progressive, responsive and sustainable healthcare system for accelerated attainment of the highest standard of health to all Marsabit residents and beyond (Marsabit County Government, 2022). The choice of this institution was informed by its crucial mandate revolving around its healthcare services provisions coupled with some notable elements of environmental sustainability practices. The researcher was optimistic that the study findings have a potential to trigger policy conversation on proper record management that aligned with the environmental sustainability goals.

Furthermore, this institution is ideal for this study because of the caliber of its leadership and blended compositions of its staff who come from every ward in the county and above all, the institution was recently applauded as one of the best departments within the County Government of Marsabit. Again, it current ongoing practices of use of EMR, going green initiatives, direct water supply and the adoption of solar energy also made the Marsabit County Teaching & Referral Hospital as an ideal site for this study.

3.3 Research Design

To thoroughly investigate the eco-friendly digital record management practices opportunities at the Marsabit County Teaching & Referral Hospital, descriptive survey research design was employed. This design integrated both qualitative and quantitative components of data collections to provide a holistic understanding of the research problem. The researcher zero down to this descriptive survey research design because of its suitability in enabling the researcher to effectively

describe and analyse the specific phenomenon of each variable under investigation, which, for this study was to assess eco-friendly digital records management practices that promote environmental sustainability at the Marsabit County Teaching & Referral Hospital.

Several past studies have employed this descriptive research design, a demonstration of its effectiveness in several fields of studies (Chelulei, 2020; Shidemburi, 2024). Owing to the significance of the current study especially on its focus on intersection of Digital Record Management and Environmental Sustainability, the researcher settled for a descriptive survey research design as an ideal for this study. The quantitative component of data collection involved structured surveys that quantify paperless communication, digital archiving, cloud storage solutions and e-waste disposal strategies among the staff and the respondents.

On the other hand, the qualitative component consisted direct observations and semi-structured interviews with key informants chosen from the Marsabit County Teaching & Referral Hospital top management. This qualitative data provided in-depth insights into the personal experiences, perceptions, and attitudes toward record management practices, complementing the quantitative findings. By triangulating quantitative and qualitative data, the study aimed at enhancing the validity of findings, allowing for more robust conclusions and recommendations for improvement.

3.4 Study Population

The study population comprised two primary groups at the Marsabit County Teaching & Referral Hospital: staff members from seven-line department and top management involved in the planning and the management. Top Management: This group will include 3 top management who are responsible for making policy decisions affecting management practices at the County Referral

Hospital. Staff members: This group included 165 departmental staff responsible for day-to-day handling of the patients and departmental records. Their experiences and perspectives are essential for understanding current status/challenges affecting record management. After all, these are the staff directly dealing with records on daily basis from its very creations throughout its lifespan, thus their suggestions, opinions and recommendations are very instrumental in aligning record management practices toward achieving environmental sustainability. The combination of these two groups ensured that multiple perspectives are represented in the study, providing a comprehensive understanding of record management practices as advised by (Mohammed et al., 2021).

3.5 Sampling techniques

A sampling technique is a method used to select a small group that will stand in for a larger population for a research study (Campbell et al., 2020). For participant's selection, the study employed random sampling that ensured that all departmental staff across various targeted departments have equal chance of selection but purposive sampling techniques was used in selection of top management who served as key informants. On Accessibility. The sampling frame included a comprehensive list of all staff members associated with the Marsabit County Teaching & Referral Hospital, obtained from the administrative office. This list enabled that all target population was reached so as to achieve a diversified response. The combination of random sampling methods for the departmental staff and purposive selections of key informants for top management yielded into a well-rounded dataset that adequately address the research objectives.

3.6 Sample Size

The sample size was determined based on a combination of factors, including the total population size, desired confidence level, and margin of error. Laken (2022) defined a sample size for a study

as a representative of the population picked for the study which will help in collection of data. This study targeted approximately 120 participants comprising of 3 key informants chosen from hospital management and 117 departmental staffs picked using Yamane formula to ensure sufficient data for robust statistical analysis and qualitative exploration.

Table 3.1

Sample size

Staff categories	No. of staff
Top Management	3
Departmental staff	117
Total	120

3.7 Research Instruments

To delve deeper into the eco-friendly record management practices at the Marsabit County Teaching & Referral Hospital the study employed a combination of questionnaires and interviews. This dual approach was chosen to capture both the broader perspectives of the assembly staff and the deeper, experiences of key personnel.

3.7.1 Questionnaires

The chosen participants were issued with a link to online questionnaires so as to gather their insights and opinions on the adoption of paperless communication, digital archiving strategies, adoption of cloud storage solutions, and e-waste management strategies. The decision to use questionnaires is motivated by its ability to collect primary data efficiently, eliminate biased perspectives, and provide ease in analysis, quantification, and comparison of responses while at the same time help in maintaining respondent anonymity, thus making it suitable tools for this study. The questionnaire was structured into sections based on the study variables, with a mix of

both the open-ended and closed-ended questions to gather both quantitative and qualitative data effectively. The questionnaire was divided into six sections as shown in appendix II. Section A collected data on the respondent's demographic information that was used to describe the sample characteristics, while section B gathered data on adoption of paperless communication, section C collected data on the digital archiving strategies toward promoting environmental sustainability; section D on adoption of cloud storage solutions, section E on e-waste management strategies aimed at promoting environmental sustainability and section F on the suggestions and recommendation on general eco-friendly management practices geared toward promotion of environmental sustainability. Again, A Likert scale was used to discern the respondents' attitudes and perceptions toward the adoption of eco-friendly record management practices.

3.7.2 Interviews

Semi-structured interviews were conducted with key informants, including the top management at County Referral Hospital. This approach was used because of its ability to gather in-depth information on the current record management practices, challenges, and opportunities for improvement. The interview guide was developed based on the four study variables, with open-ended questions designed to elicit detailed responses on the adoption of paperless communication, digital archiving strategies, adoption of cloud storage solutions, and e-waste management strategies. The interviews provided an opportunity to clarify any ambiguities and gather additional insights that may not have been captured through the questionnaires. The questions in interview were divided into six sections as shown in appendix III. Section A collected data on the respondent's demographic information that was used to describe the sample characteristics, while section B gathered data on adoption of paperless communication, section C collected data on the digital archiving strategies toward promoting environmental sustainability; section D on adoption

of cloud storage solutions, section E on e-waste management strategies aimed at promoting environmental sustainability and section F on the suggestions and recommendation on general eco-friendly management practices geared toward promotion of environmental sustainability

3.8 Pre-Testing of Research Instruments

The researcher took pre-testing into account in order to address any issues with the research instruments. Pre-testing helped to enhance the accuracy and the reliability of the data collection tools. It allowed the researcher to identify if there are any issues with the tool such as unclear questions or ambiguous phrases so that they are addressed if any prior to a large-scale rollout. The pre-testing sample size was determined according to Prasad et al. (2017) recommendation, which suggests that a pretest sample of 1% to 10% is sufficient to ensure validity and reliability. For the above reason, this study employed the middle limit of 5%. A simple random sampling technique was used to select 5 participants, representing 5% of the 110 staff at Machakos County Assembly. Additionally, 1 head of department was selected for interviews using purposive sampling for the purpose of ensuring their specialized insights contribution to the study. The choice of Machakos County Assembly is because of its advancement in record management practices and its resemblance in numerous characteristics of its diverse staff to that one of Marsabit County Teaching & Referral Hospital. The insights obtained from the pre-test helped the researcher in adjusting, reorganizing and further refining the questions in a more suitable ways so as to ensure there is optimal extraction of the needed data during the main data collection process.

3.9 Validity of Research Instruments

The validity of the research tools, unlike its reliability, focused on the tools ability to truly reflect or generate what the researcher wanted to discover or wanted to see, as Sürücü et al. (2020) remind

us, validity entails ensuring a real connection between the researcher observations and the reality they represent. It is all about coming up with questions that will likely and genuinely capture the essence of what the study is trying to measure, and helped in drawing conclusions that are more grounded and meaningful. Think of it as striving for a true reflection, where the study findings mirrored the phenomenon, the study was exploring. Beyond just the questions, validity also helped to answer whether or not the entire research design and approach are aligned with the goals of our study.

For this study, the researcher took several steps to ensure the data collection tool was valid. First, the researcher shared the draft questionnaire with the supervisors, whose expert feedback helped to further refine and strengthen it. The researcher also compared the results from a pre-test with the actual study findings, so as to ascertain the degree of consistency with special focus on the two key aspects of construct and content validity.

Construct validity discerned whether the tools truly measure the concepts the study is interested in. Construct validity refers to the extent to which a test measures what it is proposed to measure. It can be examined by exploring the instrument's correlation with other variables that are known, or expected, to be theoretically associated with the construct purportedly measured (Bowman N.et al 2020). Content validity, on the other hand, focused on ensuring the tool covers all relevant aspects of the concepts under study. In this study, Content validity entailed thorough review of the questions and the questionnaire to ensure comprehensive coverage of each variable, touching on the adoptions of paperless communication, digital archiving, cloud storage solutions and e-waste management strategies. The study delved into existing literature on all these variables, making sure that the questions reflect the breadth of these topics. By organizing the questionnaire into

sections that mirrored the different variables, the study aimed at ensuring each four research constructs were adequately represented.

3.10 Reliability of Research Instruments

The reliability of research tools encompasses its ability to be trust to generate consistent results, time and again, it can be compared to a well-calibrated scale – that one is sure of getting the same weight each time it is use. In this study, the researcher was interested to know if the instrument consistently captures the variables under the study, just as Sürücü and MASLAKÇI (2020) suggest. To ascertain this, the researcher used Cronbach's alpha, a way of seeing if the different parts of the instrument were all working together harmoniously. The study aimed for a score of 0.7 or higher, in line with the guidance of Hussey et al. (2025) to feel confident that all research instruments was dependable. And, of course, recognizing the fact that instruments aren't always perfect at once, the researcher took ample time to carefully review and fine-tuned it before finally using it to gather the data.

3.11 Data Collection Procedure

To ensure a smooth and seamless data collection process, the researcher obtained the necessary clearance from KeMU and NACOSTI, and also secured permission from the top management at the Marsabit County Teaching & Referral Hospital where this study was conducted.

For the questionnaire, the researcher personally shares the link to the online questionnaire with the respondents, allowing them a week to complete the questions at their own pace and without pressure. To facilitate the process, the researcher enlisted the help of representative from all the target departments for follow up on the staff who may need help in accessing and answering the questions in the online questionnaires shared with them. Throughout the process, the researcher

emphasized the importance of participation and at the same time assured the respondents that their input would be used solely for research purposes.

The researcher conducts face-to-face interviews with the selected key informants, taking care to maintain confidentiality by recording the sessions with the interviewees' prior consent. The interviews were held in private offices, with only the researcher and the respondent present.

3.12 Data Processing and Analysis

Data analysis entailed the procedures for manipulating data with the aim of allowing the researcher to find answers to research questions. A detail procedure for analysing both the qualitative and quantitative data is as indicated in the following sections.

Thematic analysis was employed to analyse qualitative data collected from interview transcripts and open-ended survey responses. This involved coding the data to identify recurring themes and notable patterns as advocated by Lester et al. (2020). By categorizing the responses, researcher drew connections between the challenges faced by staff and the potential solutions they propose based on the variables under the study.

Numerical data from surveys was analysed using descriptive statistics. This statistical analysis was useful for illustrating general trends related to paperless communication, digital archiving, cloud storage solution and digital e-waste disposal strategies. Final findings were presented through meaningful visualizations, such as table and bar graphs, to enhance understanding and accessibility.

For the quantitative data, the analysis primarily involved descriptive statistics which was used to summarize the basic features of the data, offering a straightforward overview of the sample and

the measures. The following descriptive statistics was employed: Frequencies, to determine the number of times each response option was selected by respondents. This helped in understanding the distribution of responses for each item in the questionnaire. Measures of Central Tendency: under this, the average score was calculated to determine the general tendency of responses for each item in order to arrive to a mean. Measures of Dispersion: here, the researcher used Standard Deviation in order to assess the variability or spread of the responses around the mean, providing insights into the consistency of the responses.

These descriptive statistics was used to analyse the data for each research objective by imputing the data from the survey into the Statistical Package for the Social Sciences for analysis while at the same time checking for its completeness, accuracy, and consistency so as to ensure results finding reliability. Any erroneous or missing data was addressed through data-cleaning procedures. The researcher then downloaded the completed questionnaires as Microsoft Excel files (.xls) and then imported them into statistical software for the purpose of coding. The result of the descriptive analysis was presented using tables and bar graphs. These visual aids made it easier to comprehend and interpret the data, highlighting key patterns and trends effectively. Tables: Was used to display frequencies, means, medians, modes, and standard deviations for the different variables. Graphs: Was utilized to visually represent the distribution and relationships within the data.

The choice of these presentation methods was justified by their ability to clearly and succinctly communicate complex data, making the findings accessible and understandable for a broad audience. The visual representation of data also facilitated the comparison of variables, enabling the study to effectively convey its conclusions. Finally, to model the relationship between one or more independent variables and a dependent variable, diagnostic test such as; - a regression

analysis was used to helps predict the value of the dependent variable based on the independent variable(s) while at the same time, correlation was deployed to measures the strength and direction of the relationship between two or more variables.

3.13 Ethical considerations

This study adhered to established ethical standards to protect the dignity, rights, and safety of participants. Informed consent was obtained, with respondents assured of voluntary participation, confidentiality, and the right to withdraw at any stage without penalty. Anonymity was maintained throughout data collection and reporting. The researcher obtained all necessary approvals, including authorization from Kenya Methodist University, clearance from the ethical review committee, and a research permit from the National Commission for Science, Technology, and Innovation (NACOSTI). Data were collected, analysed, and reported with integrity, and all secondary sources were properly acknowledged using APA referencing guidelines.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the analysis, interpretation, and discussion of findings based on the data collected from both questionnaire surveys and interview schedules. The results are organized according to the study variables. Descriptive statistics were computed and presented in tabular form for each variable, followed by narrative interpretations and insights from key informant interviews. To analyze the questionnaire data, the study employed a five-point Likert scale where respondents were asked to indicate their level of agreement with various statements. The scale was structured as follows: Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A), and Strongly Agree (SA). In addition to percentages and frequencies of responses, the analysis also reported the Mean (to measure the central tendency) and Standard Deviation (Std. Dev.) (To measure variability of responses). These statistics were applied consistently across all tables for clarity and comparability of results.

4.2 Reliability Test Results

To ensure consistency and dependability of the instrument used in this study, a reliability test was conducted using Cronbach's Alpha. The results are presented in Table 4.1. According to Hussey I. et al (2025), a Cronbach's Alpha value of 0.70 and above is considered acceptable thus confirming data collections tools as effective in collecting the intended data for the study variables.

Table 4.1

Cronbach's Alpha Values for Study Variables

Study Variable	Cronbach's Alpha
Paperless Communication	0.81
Digital Archiving	0.85
Cloud Storage	0.79
E-Waste Management	0.83
Eco-Friendly Practices	0.80

The reliability test findings indicated that all the study constructs achieved Cronbach's Alpha coefficients above the minimum threshold of 0.70, thus confirming internal consistency of the research instrument. Paperless Communication achieved a reliability score of 0.81, while Digital Archiving registered the highest score at 0.85, signifying strong internal consistency of its items. Cloud Storage Solutions obtained a coefficient of 0.79, which, though slightly lower than the others, still demonstrates sufficient reliability. E-Waste Management Strategies and Eco-Friendly General Practices returned coefficients of 0.83 and 0.80 respectively, further underscoring their reliability. The above are in tandem with a study by Sugiharto et al. (2024) which highlighted that all reliable methods have a co-efficient above 0.7 as a minimum requirement for acceptance.

The overall reliability of the scale was 0.84, which provides strong evidence that the questionnaire items were consistent in measuring the intended variables. These results affirm that the tool used in this study was both stable and dependable for assessing eco-friendly digital records management practices in the Marsabit County Teaching & Referral Hospital.

4.3 Respondent Characteristics

This section presents the demographic characteristics of the respondents who participated in the study. The information includes the response rate, departmental distribution, work experience, and education level of respondents. These attributes are important for contextualizing the findings as they reflect the diversity of perspectives from different staff categories within Marsabit County Teaching & Referral Hospital.

4.3.1 Response Rate

Out of the targeted respondents of 117, the study received a total of 114 valid responses translating to 97% of the response rate. This provide an adequate information and comprehensive insights into the target population as argued by the past studies among them Babbie (2020) which demonstrated the fact that any response rate ≥60% is desirable for any given research study. Thus, qualifying the generated data in this study as sufficient enough to help in analysis, interpretations and conclusion. The high response rate can be attributed to effective follow-up and the relevance of the topic to the respondents' daily work. This level of participation provides confidence that the results fairly reflect the views of the target population.

4.3.2 Departments

Respondents were drawn from various hospital departments, including Pharmacy, Nursing, Health Records and Nutrition among others. The diversity of departmental representation ensures that the findings incorporate experiences from both clinical and non-clinical perspectives. This diversity strengthens the validity of the study's conclusions as it captures how digital records management practices are applied in different functional areas.

Table 4.2

Distribution of Respondents by Department

Department	Frequency	Percentage (%)
Nursing Department	48	42.1%
Medical Laboratory	18	15.9%
Clinical Medicine Department	14	12.3%
Nutrition Department	11	9.6%
Radiology Department	9	7.9%
Health Records & Information	8	7.0%
Pharmacy Department	6	5.3%
Total	**114**	**100.0%**

The distribution of respondents by department, as presented in Table 4.2, indicates that the largest proportion of participants were drawn from the Nursing Department, accounting for 48 (42.1%) of the total respondents. This is consistent with the pivotal role nurses play in patient care and their high level of engagement with hospital information systems, making their perspectives particularly relevant to the study. The Medical Laboratory Department followed with 18 respondents (15.9%), reflecting its integral function in diagnostic processes and the need for efficient digital records management in test reporting and data storage. Respondents from the Clinical Medicine Department comprised 14 (12.3%), highlighting the involvement of clinicians in the generation and utilization of patient data for treatment decisions. The Nutrition Department contributed 11 respondents (9.6%) of responses, a group whose work involves maintaining dietary records and patient nutritional histories that also require effective information systems.

The remaining departments were represented to a lesser extent, yet their input is equally important in understanding eco-friendly digital records management from a hospital-wide perspective. The

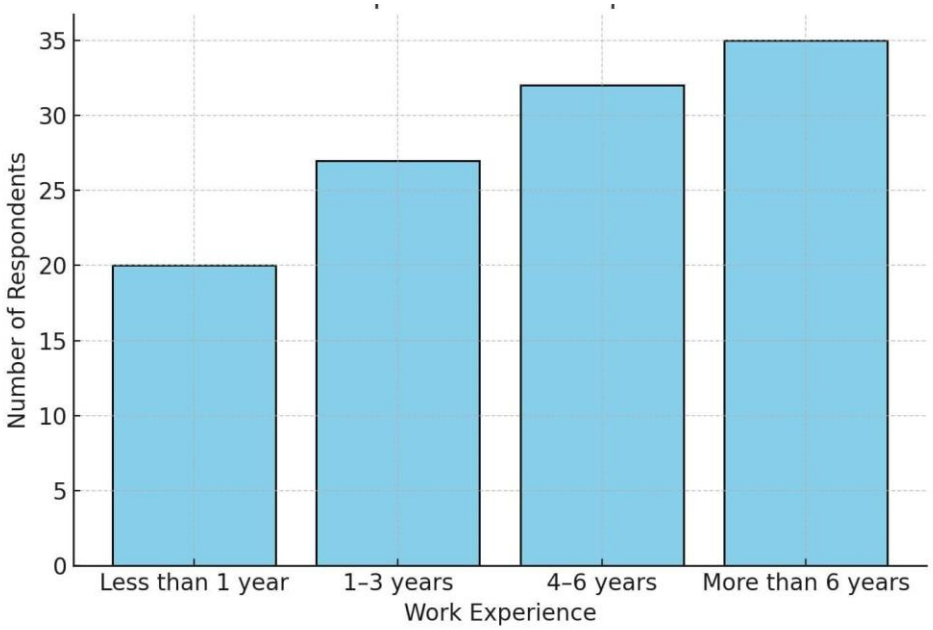
Radiology Department accounted for 9 respondents (7.9%), underscoring its reliance on digital imaging and electronic data storage to minimize paper usage. The Health Records and Information Department contributed 8 (7.0%) of responses, representing the custodians of patient records and digital archiving processes, making their insights crucial to evaluating current practices. The Pharmacy Department recorded the smallest representation at 6 (5.3%), though its role in prescription management and medication tracking directly ties into efficient, paperless systems. The diversity of departmental representation ensures a comprehensive understanding of digital records management practices across functional areas of the hospital, allowing for a holistic evaluation of how eco-friendly initiatives are integrated into various operational contexts. The respondent diversity ensures that findings reflect the broader healthcare context rather than being limited to the unique characteristics of one department as noted by Qin et al (2024).

4.3.3 Work Experience

The participants were asked the number of years they have been working at the County Teaching and Referral Hospital, the distribution of work experience among respondents was varied as shown in the figure 4.1 which though in summary illustrated the length of service of all the participants. This mix of new and experienced staff adds depth to the data by balancing fresh perspectives with institutional memory.

Figure 4.1

Work Experience of Respondents at Marsabit County Teaching & Referral Hospital



As illustrated in Figure 4.1, respondents with more than six years of work experience constituted the largest group, accounting for 35 respondents (30.7%) of the total sample. This significant proportion of long-serving staff members implies a wealth of institutional knowledge and first-hand experience in the evolution of records management practices at the Marsabit County Teaching & Referral Hospital. The findings agreed with Choi D. (2021) study which highlighted that experienced staffs are better in implementing institutional functions effectively since they understand the client's needs more comprehensively, having witnessed various client's behaviour and trends over the years. Such individuals are likely to have witnessed the gradual transition from paper-based systems to digital solutions, providing them with a deeper understanding of the opportunities and challenges inherent in adopting eco-friendly digital records management. The second-largest category comprised respondents with four to six years of experience, representing

32 respondents (28.0%). This group likely possesses substantial professional maturity while still being adaptable to technological innovations in their work environment.

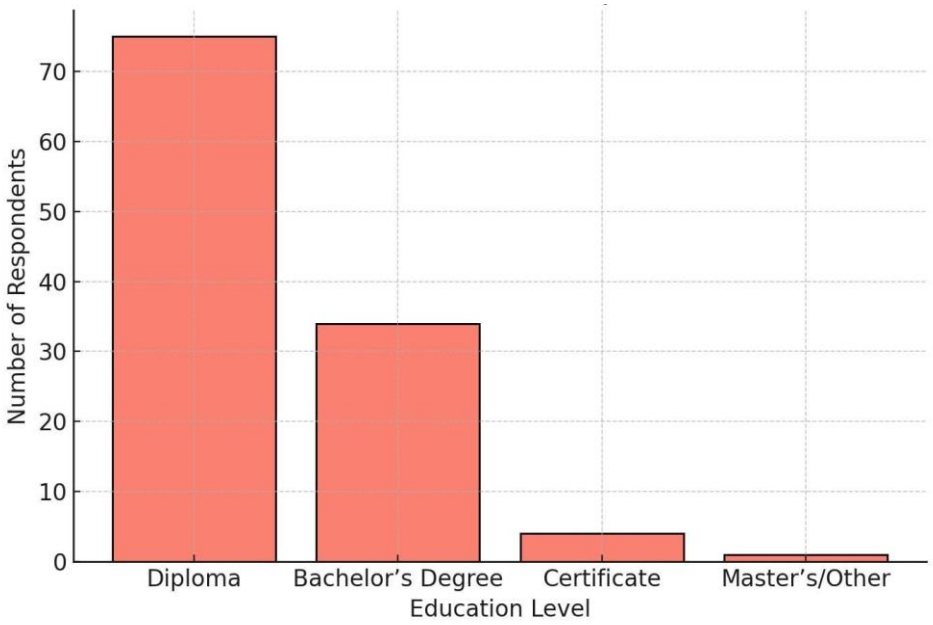
Respondents with one to three years of work experience accounted for 27 respondents (23.7%), suggesting a considerable presence of early-career professionals who may bring fresh perspectives and a higher degree of technological fluency, particularly in relation to emerging eco-friendly practices. The smallest group consisted of those with less than one year of work experience, representing 20 respondents (17.5%). Although relatively new to the hospital setting, this group offers a unique lens through which to evaluate the ease of integrating new staff into the hospital's digital systems and sustainability culture. The distribution of work experience across these categories ensures that the findings incorporate insights from both seasoned practitioners and newer entrants, resulting in a balanced evaluation of the adoption and effectiveness of environmentally sustainable records management practices.

4.3.4 Education Levels

The participants were asked to indicate their levels of education under the demographic sections of the questionnaire. The figure 4.2 displays varied educational qualifications possessed by the respondents, ranging from certificate to postgraduate level. The largest category was diploma holders, followed by degree holders. This variety in education levels reflects the diverse skill sets present in the hospital workforce, which is critical in understanding the adoption and utilization of digital systems.

Figure 4.2

Education Level of Respondents at Marsabit County Teaching & Referral Hospital



The data in figure 4.2 reveals that the majority of respondents, 75 (65.8%), held a diploma qualification. This predominance reflects the common academic entry level for many health professionals in Kenya's public healthcare sector, particularly in roles such as nursing, clinical medicine, and medical laboratory services. Diploma holders often serve as frontline healthcare workers, playing a critical role in generating, updating, and utilizing medical records, which positions them as key stakeholders in the hospital's transition to eco-friendly digital records management. The second-largest category comprised respondents with a bachelor's degree, representing 34 (29.8%). This group may include medical officers, specialized clinicians, and administrative professionals whose higher academic exposure could influence their awareness of environmental sustainability principles and openness to adopting innovative digital solutions.

Respondents with a certificate qualification accounted for only 4 respondents (3.5%), likely representing auxiliary or support staff whose involvement in records management may be more

operational than strategic. The smallest proportion of respondents, 1 (0.9%), reported holding a master's or other advanced mixed degrees. Although numerically minimal, this category is significant as it potentially reflects leadership or specialized expertise roles that can influence policy decisions related to sustainable records management practices. The diverse educational profile of the respondents ensures that perspectives from various levels of technical competence and strategic decision-making are reflected in the study findings as also posited by Sibandze B. et al (2018) which argued that diverse level of education and expertise plays an important role in developing both an awareness and an integration of professional values into practice. This variation in academic background is vital in assessing how educational attainment may shape attitudes towards the adoption and implementation of eco-friendly records management systems.

4.4 Findings Based on Research Objectives

4.4.1 Paperless Communication

The first objective of this study was to determine the level of the adoption of paperless communication that promote environmental sustainability at the Marsabit County Teaching & Referral Hospital. Under this variable, respondents were asked whether the hospital had adopted paperless communication, its potential for cost savings, and its environmental impact. The results are shown in Table 4.3

Table 4.3

Summary Responses on Paperless Communication

Statement	SD	D	N	A	S A	F	%	Mean	Std. Dev.
The Marsabit County Teaching & Referral Hospital has significantly adopted paperless communication.	6 (5.3%)	21 (18.4%)	23 (20.2%)	48 (42.1%)	16 (14.0%)	114	100	3.412	1.104
Paperless communication can lead to cost savings for the Marsabit County Teaching & Referral Hospital.	9 (7.9%)	2 (1.8%)	8 (7.0%)	63 (55.3%)	32 (28.1%)	114	100	3.939	1.067
Paperless communication can positively impact the environment.	7 (6.1%)	2 (1.8%)	8 (7.0%)	59 (51.8%)	38 (33.3%)	114	100	4.044	1.017

The findings presented in Table 4.3 reveal a moderately positive perception of paperless communication within Marsabit County Teaching & Referral Hospital. Concerning the statement that the hospital has significantly adopted paperless communication, 64 respondents (56.1%) agreed or strongly agreed, while 23 (20.2%) were neutral and 27 (23.7%) disagreed (M = 3.41**,** SD = 1.10). The strongest endorsement was observed in relation to cost savings, with 95 respondents (83.4%) agreeing or strongly agreeing that paperless communication reduces expenses, compared to only 11 (9.7%) who disagreed (M = 3.94, SD = 1.07**).** Similarly, 97 respondents (85.1%) agreed

or strongly agreed that paperless communication positively impacts the environment, with only 9 (7.9%) in disagreement and 8 (7.0%) remaining neutral (M = 4.04, SD = 1.02**).** These findings reinforce Prasetyo et al. (2020)**,** who observed that transitioning to paperless systems enhances efficiency and supports environmental sustainability in healthcare and educational institutions.

Interview responses provided further insights into the practical adoption of paperless systems. Several staff emphasized that digital platforms such as WhatsApp groups and emails have reduced dependence on printed memos, though inconsistencies persist across departments. For example, one respondent noted that "*Nursing often circulates memos electronically, but the administration still requires some notices on paper*." Another staff member highlighted that reduced printing and photocopying have already saved significant costs. These perspectives align with Unluturk and Utku (2021)**,** who documented that hospitals in Turkey benefitted from digital communication systems through substantial reductions in paper wastage, though the old practices continued to slow complete adoption.

Taken together, the quantitative and qualitative findings suggest that paperless communication at Marsabit County Teaching & Referral Hospital is partially adopted and unevenly applied**.** While staff widely acknowledge its cost-saving and environmental benefits, entrenched habits and departmental inconsistencies limit its full potential. The supporting literature emphasizes that sustainable adoption requires not only infrastructure but also adaptation and organizational enforcement. For Marsabit, this underscores the need to formalize communication policies, strengthen staff training, and institutionalize digital communication to fully realize both the financial and environmental benefits of a paperless system.

4.4.2 Digital Archiving

Findings on digital archiving practices which was the second study objective showed a generally favourable perception among respondents. Under this variable, respondents were asked about the consistency of digital archiving, its role in reducing physical storage space, and improving accessibility and sustainability. The results are presented in Table 4.4.

Table 4.4

Summary of Responses on Digital Archiving

Statement	SD	D	N	A	S A	F	%	Mean	Std. Dev.
Important records are consistently and effectively digitally archived at Marsabit County Teaching & Referral Hospital	9 (7.9%)	16 (14.0%)	20 (17.5%)	58 (50.9%)	11 (9.6%)	114	100	3.404	1.095
Digital archiving will reduce the need for physical storage space.	6 (5.3%)	0 (0.0%)	2 (1.8%)	58 (50.9%)	48 (42.1%)	114	100	4.246	0.927
Digital archiving will improve the accessibility and Environmental Sustainability.	6 (5.3%)	0 (0.0%)	1 (0.9%)	64 (56.1%)	43 (37.7%)	114	100	4.211	0.907

The findings presented in Table 4.4 reveal a generally positive perception of digital archiving at Marsabit County Teaching & Referral Hospital. Regarding whether important records are consistently and effectively digitally archived, 69 respondents (60.5%) agreed or strongly agreed, while 20 (17.5%) were neutral and 25 (21.9%) disagreed (M = 3.40**,** SD = 1.10). On the statement

that digital archiving reduces the need for physical storage space, the support was much stronger, with 106 respondents (93.0%) agreeing or strongly agreeing and only 6 (5.3%) disagreeing (M = 4.25**,** SD = 0.93**).** Similarly, 107 respondents (93.8%) agreed or strongly agreed that digital archiving improves accessibility and enhances environmental sustainability, while only 7 (6.1%) disagreed or remained neutral (M = 4.21**,** SD = 0.91**).** These results suggest that while the effectiveness of record consistency remains a challenge, staff strongly recognize the role of digital archiving in reducing physical storage needs and improving both accessibility and sustainability. These results are consistent with Udochukwu et al. (2021)**,** who emphasized that effective digital archiving plays a vital role in long-term preservation and accessibility of healthcare records, though it requires structured policies to maximize its potential.

Interview findings reinforced these quantitative patterns. Two informants noted that newer patient records are digitized, while older files remain in cabinets, leading to duplication and retrieval delays. One staff member remarked that "*sometimes the same file exists digitally and in paper form, and they do not always match*," while another observed that "*without a hospital-wide archiving policy, each department does things differently*." These challenges mirror the findings of Qi et al. (2022)**,** who demonstrated that while digital archival systems reduce physical storage burdens and enhance sustainability, fragmented adoption and lack of uniform procedures limit their effectiveness.

Overall, both the quantitative and qualitative results suggest that digital archiving at Marsabit County Teaching & Referral Hospital is partially achieved**.** While respondents recognized the benefits of improved accessibility and reduced storage demands, inconsistent implementation and absence of clear retention policies undermine the system's overall effectiveness. The corroborating

studies affirm that to realize the full potential of digital archiving, hospitals must address policy gaps and harmonize practices across departments. For Marsabit, this calls for the development of a comprehensive digital archiving framework, systematic digitization of legacy records, and stronger enforcement of standard procedures to enhance efficiency and sustainability.

4.4.3 Cloud Storage Solutions

The third objective of this study is to determine how the adoption of cloud storage solutions of digital records management promote environmental sustainability at Marsabit County Teaching & Referral Hospital. Under this variable, respondents were asked whether the hospital had embraced cloud storage, its effects on data accessibility and collaboration, and its contribution to environmental sustainability. The results are presented in Table 4.5.

Table 4.5

Summary of Responses on Cloud Storage Solutions

Statement	SD	D	N	A	S A	F	%	Mean	Std. Dev.
The Marsabit County Teaching & Referral Hospital has embraced the adoption of Cloud storage which will reduce the need for on-premises physical server infrastructure.	11 (9.6%)	22 (19.3%)	32 (28.1%)	42 (36.8%)	7 (6.1%)	114	100	3.105	1.092
Cloud storage will improve data accessibility and collaboration among staff.	2 (1.8%)	3 (2.6%)	11 (9.6%)	68 (59.6%)	30 (26.3%)	114	100	4.061	0.790
Cloud storage solutions contribute to the overall environmental sustainability efforts of the Hospital.	2 (1.8%)	3 (2.6%)	10 (8.8%)	68 (59.6%)	31 (27.2%)	114	100	4.079	0.789

The findings presented in Table 4.5 reveal mixed but generally positive perceptions of cloud storage solutions at Marsabit County Teaching & Referral Hospital. On the statement that the hospital has embraced cloud storage to reduce the need for on-premises physical servers, only 49 respondents (42.9%) agreed or strongly agreed, while 32 (28.1%) were neutral and a notable 33 (28.9%) disagreed (M = 3.11, SD = 1.09). By contrast, support was stronger for the role of cloud systems in enhancing data accessibility and collaboration, where 98 respondents (85.9%) agreed or strongly agreed, compared to only 16 (14.0%) who expressed neutrality or disagreement (M = 4.06, SD = 0.79). Similarly, 99 respondents (86.8%) agreed or strongly agreed that cloud storage contributes to environmental sustainability, while only 15 (13.2%) expressed neutrality or disagreement (M = 4.08, SD = 0.79). These findings suggest that while staff express reservations about the hospital's actual adoption level, there is broad recognition of the potential benefits of

cloud systems in terms of accessibility, collaboration, and sustainability. These findings resonate with Ogwel et al. (2021), who demonstrated that cloud adoption in public health facilities in Kisumu enhanced operational efficiency but required parallel staff capacity-building efforts for effective use.

Interviews provided further insights into these trends. A respondent observed that "*some records are stored in Google Drive and shared emails, but internet downtimes delay retrieval*," while another respondent emphasized that "*most staff have not been properly trained in cloud systems, so they rely on departmental shelves.*" Concerns were also raised regarding the security of patient data stored online. These observations align with Nyachiro et al. (2023), who emphasized the importance of structured adoption strategies—particularly staff training, policy frameworks, and cybersecurity measures—in ensuring that cloud storage delivers sustainable benefits in healthcare institutions.

Together, the quantitative and qualitative findings indicate that cloud storage is partially adopted at Marsabit County Teaching & Referral Hospital. While respondents recognized its advantages in improving collaboration and reducing risks of data loss, gaps in training, infrastructure, and policy threaten the sustainability of these gains. The corroborating literature reinforces that successful adoption requires structured strategies encompassing training, infrastructure, and governance. For Marsabit, this means that investments in reliable internet connectivity, comprehensive staff training, and strong data protection frameworks are essential for realizing the full sustainability potential of cloud storage solutions.

4.4.4 E-Waste Management

The fourth study objective was examining the existence of e-waste disposal strategies that promotes environmental sustainability at the Marsabit County Teaching & Referral Hospital. Therefore, under this variable, respondents were asked about the procedures for disposal of e-waste, efforts on repair or reuse of electronics equipment, and e-waste management practices that minimize environmental harms. Results are shown in Table 4.6.

Table 4.6

Summary of Responses on E-Waste Management Strategies

Statement	SD	D	N	A	SA	F	%	Mean	Std. Dev.
The Marsabit County Teaching & Referral Hospital has specific procedures for the disposal of electronic waste (e-waste).	10 (8.8%)	24 (21.1%)	40 (35.1%)	34 (29.8%)	6 (5.3%)	114	100	3.018	1.039
Efforts are made to repair or reuse electronic equipment before disposal.	4 (3.5%)	16 (14.0%)	21 (18.4%)	58 (50.9%)	15 (13.2%)	114	100	3.561	1.005
The current e-waste management practices effectively minimize environmental harm.	5 (4.4%)	11 (9.7%)	27 (23.9%)	56 (49.6%)	14 (12.4%)	114	100	3.558	0.981

The findings presented in Table 4.6 reveal mixed perceptions of e-waste management at Marsabit County Teaching & Referral Hospital. Concerning whether the hospital has specific procedures for the disposal of electronic waste, only 40 respondents (35.1%) agreed or strongly agreed, while

40 (35.1%) were neutral and 34 (29.9%) disagreed (M = 3.02, SD = 1.04). Regarding whether efforts are made to repair or reuse electronic equipment before disposal, 73 respondents (64.1%) agreed or strongly agreed, compared to 20 (17.5%) who disagreed and 21 (18.4%) who were neutral (M = 3.56, SD = 1.01). Similarly, 70 respondents (61.9%) agreed or strongly agreed that current e-waste management practices minimize environmental harm, while 16 (14.1%) disagreed and 27 (23.9%) were neutral (M = 3.56, SD = 0.98). These findings suggest that while staff acknowledge some positive practices such as repair, reuse, and environmentally conscious disposal, there is considerable uncertainty and inconsistency regarding the existence of formalized e-waste policies and procedures. These findings reinforce Arya et al. (2020), who stressed that robust institutional frameworks are necessary for effective e-waste management, and that fragmented approaches undermine sustainability outcomes.

Interview insights added depth to these survey results. One respondent noted that obsolete computers and printers are often stored in backrooms for years without proper disposal. Another administrator explained that "*old machines pile up because we don't have a disposal policy or budget for recycling*." While another still admitted that broken equipment is sometimes sold informally to scrap dealers, raising environmental and data security concerns. These findings echo Islam et al. (2024), who highlighted the role of structured take-back systems in ensuring safe recycling and preventing informal, unsafe disposal practices. The absence of such systems at Marsabit indicates that current informal efforts need to be transformed into structured and accountable policies.

In summary, both the quantitative and qualitative results reveal that e-waste management at Marsabit County Teaching & Referral Hospital is fragmented and underdeveloped. While there is general awareness of the issue, the lack of structured policies, clear budgets, and formalized

disposal arrangements leads to unsafe and inefficient practices. The corroborating literature demonstrates that hospitals require robust frameworks and structured take-back systems to safeguard both environmental health and data integrity. For Marsabit, the implication is that the hospital must urgently establish a comprehensive e-waste management framework, allocate resources for its implementation, and partner with certified recycling firms to achieve sustainable and compliant disposal practices.

4.4.5 Eco-Friendly General Management Practices

The study independent variable was on eco-friendly management practices that promote environmental sustainability at the Marsabit County Teaching and Referral Hospital. Therefore, Table 4.7 presents the studying findings on general eco-friendly practices aimed at enhancing environmental sustainability in and around the County Referral Hospital precincts.

Table 4.7

Summary of Responses on Eco-Friendly Practices

Statement	SD	D	N	A	SA	N	%	Mean	Std. Dev.
The Marsabit County Teaching & Referral Hospital has adopted the use of clean energy (solar) as an alternative source of energy which is eco-friendly	16 (14.2%)	38 (33.6%)	13 (11.5%)	37 (32.7%)	9 (8.0%)	114	100	2.867	1.243
The Marsabit County Teaching & Referral Hospital has adopted going green initiatives (planting of flowers and proper gardening) as one measure of promoting environmental sustainability	7 (6.1%)	7 (6.1%)	14 (12.3%)	56 (49.1%)	30 (26.3%)	114	100	3.833	1.080
The Marsabit County Teaching & Referral Hospital has reliable internet and a functional EMR system which contains all crucial information from patients.	10 (8.8%)	23 (20.2%)	23 (20.2%)	50 (43.9%)	8 (7.0%)	114	100	3.202	1.115

The findings presented in Table 4.7 show mixed but moderately positive perceptions of eco-friendly practices at Marsabit County Teaching & Referral Hospital. On the adoption of clean energy (solar) as an alternative eco-friendly source, only 46 respondents (40.7%) agreed or strongly agreed, while a majority of 54 respondents (47.8%) disagreed, and 13 (11.5%) were neutral (M = 2.87, SD = 1.24). By contrast, stronger support was expressed for the hospital's "going green" initiatives, such as planting flowers and maintaining proper gardens, where 86

respondents (75.4%) agreed or strongly agreed, compared to just 14 (12.2%) who disagreed and 14 (12.3%) who were neutral (M = 3.83, SD = 1.08). Perceptions of reliable internet and the presence of a functional EMR system were less favourable, with only 58 respondents (50.9%) agreeing or strongly agreeing, while 33 (29.0%) disagreed and 23 (20.2%) remained neutral (M = 3.20, SD = 1.12). These findings suggest that while greening and gardening initiatives are well embraced, solar energy adoption remains weak, and perceptions of ICT-driven eco-friendly practices such as EMR systems are moderate and inconsistent. These findings align with Wu et al. (2021), who demonstrated that ICT-driven sustainability initiatives can reduce carbon emissions and enhance environmental performance in institutional settings.

Interview evidence reinforced these findings but revealed uneven implementation across departments. A respondent noted that energy-saving practices, such as switching off lights and computers, are followed in some units but ignored in others. One participant stated, "*In my department, we try to save electricity, but in others, machines run the whole day."* Another added that while bins are available for waste separation, compliance is inconsistent. These perspectives resonate with Pavli et al. (2023), who stressed that institutional eco-friendly practices succeed only when supported by structured organizational frameworks and sustained policy enforcement, without which implementation becomes fragmented and inconsistent.

Overall, both survey and interview findings suggest that eco-friendly practices are partially embedded at Marsabit County Teaching & Referral Hospital. While initiatives such as energy saving, water conservation, and waste segregation are recognized, their uneven application undermines overall impact. The corroborating studies highlight that meaningful sustainability gains require not just individual awareness but also strong institutional support, structured policies,

and consistent enforcement. For Marsabit, this implies the need to strengthen hospital-wide policies, enhance monitoring mechanisms, and provide regular training to embed eco-friendly practices as an organizational culture.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the study findings, conclusions drawn from the analysed data, and relevant recommendations based on the research objectives. The aim of the study was to assess eco-friendly digital records management practices and their impact on promoting environmental sustainability at Marsabit County Teaching & Referral Hospital. The study focused on paperless communication, digital archiving, cloud storage, and e-waste management. Data collection was done using both interview schedule for Key Informants and questionnaires for departmental staffs. The study employed both random and purposive sampling for respondents (staff) and for the Key Informants respectively. Qualitative data was subjected to thematic analysis while the quantitative data was analysed using descriptive statistics. The findings reveal various level of adoptions and awareness of the eco-friendly digital records management practices even though not uniformly distributed across the hospital department. The chapter wraps up with reflections on each thematic area, providing a basis for recommendations intended to promote the adoption of environmentally friendly digital records management practices at Marsabit County Teaching & Referral Hospital.

5.2 Summary of the Key Findings

This section summarizes the major findings of the study in relation to both the background characteristics of the respondents and the four main research objectives. The study targeted staff working at Marsabit County Teaching & Referral Hospital and examined how digital records management practices contribute to environmental sustainability. The study successfully received

a high response rate, and the data collected reflects a wide demographic and departmental spread across the hospital.

5.2.1 Summary of the Response Rate

The study achieved a total of 114 valid responses out of an estimated 117 questionnaires issued, representing a high response rate of approximately 97%. This high rate of participation demonstrates the relevance of the research topic to the target population and the willingness of hospital staff to contribute to improving digital records and environmental practices.

Educational qualifications were as follows: Diploma, 75 (65.8%); Bachelor's degree, 34 (29.8%); Certificate, 4 (3.5%); and Master's, 1 (0.9%). Overall, most staff held at least diploma-level training, with substantial representation of higher qualifications supporting effective digital records management.

5.2.2 Background and Demographics

Respondents were distributed across departments as follows: Nursing, 48 (42.1%); Medical Laboratory, 18 (15.8%); Clinical Medicine, 14 (12.3%); Nutrition, 11 (9.6%); Radiology, 9 (7.9%); Health Records & Information, 8 (7.0%); and Pharmacy, 6 (5.3%). This broad distribution ensured that perspectives on digital records management and sustainability captured the operational realities of diverse hospital units.

Work experience varied across the sample: more than six years, 35 (30.7%); 4–6 years, 32 (28.0%); 1–3 years, 27 (23.7%); and less than one year, 20 (17.5%). This balance of seasoned and newer staff provided a mix of institutional memory and fresh perspectives relevant to digital transformation and green practices.

5.2.3 Paperless Communication

The findings revealed that a significant proportion of the staff recognize and support the hospital's move toward paperless communication. Over 75% of respondents acknowledged that paperless systems result in cost savings and positively impact environmental sustainability. However, 20% expressed neutral views, and some departments indicated inconsistent implementation. This suggests that while paperless communication is adopted, its full potential is yet to be realized across all hospital units.

5.2.4 Digital Archiving

More than 80% of respondents affirmed that digital archiving reduces the need for physical storage and enhances accessibility. Most staff agreed that this practice supports environmental sustainability. Nonetheless, some respondents remained neutral or disagreed on the effectiveness and consistency of digital archiving, indicating the need for stronger system integration and awareness training.

5.2.5 Cloud Storage

The responses showed moderate implementation of cloud storage solutions. While many staff members agreed that cloud storage enhances data accessibility and collaboration, a lower percentage confirmed its actual usage in the hospital. This indicates a recognition of the benefits but highlights an implementation gap that needs to be addressed to fully leverage the potential of cloud technologies for sustainability.

5.2.6 E-Waste Disposal

The findings indicated that e-waste disposal remains a weak area in the hospital's environmental management efforts. A considerable number of respondents either disagreed or were unsure whether structured e-waste disposal strategies exist. Nevertheless, some staff acknowledged efforts to repair or reuse electronic devices. This demonstrates the need for more deliberate, institution-wide e-waste management policies.

5.3 Conclusions

This section presents conclusions drawn from the findings of the study as outlined in Chapter Four. Each sub-section below corresponds to the four specific objectives of the research. The conclusions highlight the current status, perceived effectiveness, and challenges related to eco-friendly digital records management practices at Marsabit County Teaching & Referral Hospital, with a particular focus on their role in promoting environmental sustainability.

5.3.1 Paperless Communication

The study concludes that paperless communication is moderately embraced at Marsabit County Teaching & Referral Hospital. A significant number of respondents acknowledged that the hospital has adopted systems that reduce paper use, such as internal emails and electronic documentation processes. Staff widely recognized that going paperless leads to cost savings and contributes to environmental preservation. Interview data reinforced these findings: for example, Interviewee 1 noted that *'Nursing often circulates memos via WhatsApp, but administration still insists on paper notices*,' while Interviewee 2 emphasized the cost savings from reduced photocopying. Interviewee 3 further observed delays in units that continue to depend on hardcopy memos. These insights demonstrate that while there is progress, the uneven levels of adoption across departments confirm

that full implementation is yet to be realized hospital-wide. This calls for continued reinforcement and resource allocation to bridge digital adoption gaps across all units.

5.3.2 Digital Archiving

The findings indicate that digital archiving is a relatively well-accepted practice within the hospital. Respondents reported that the shift from physical to electronic recordkeeping will minimize storage demands, improved information retrieval, and contributed to green practices by reducing paper use. Most staff affirmed that digital archiving enhances accessibility and promotes sustainability. Interview insights supported these perceptions but also highlighted challenges. One participant remarked: *'Most new patient files are digitized, but older ones remain in paper form*,' while another one emphasized that digitization will reduce the burden of storage rooms. Still another one noted that '*without a hospital-wide policy, departments choose their own methods, which creates duplication*.' These perspectives illustrate that while digital archiving is progressing, a lack of uniform implementation and clear policy remains a barrier.

5.3.3 Cloud Storage Solutions

Cloud storage is recognized by respondents as a forward-looking solution with strong potential to promote environmental sustainability through digital transformation. While many respondents were aware of its benefits — including better collaboration and reduced reliance on physical infrastructure — the actual use of cloud storage at the hospital remains limited. Interview evidence confirmed this gap. Interviewee 2 stated: *'Cloud systems are not yet in use in most departments; we still rely on local shelves*,' while Interviewee 3 explained that *'the Ministry is pushing for government-approved cloud systems, but until they are cleared, we cannot migrate fully*.' Interviewee 1 expressed concerns about security, remarking: *'Cloud is the future, but people worry*

about hacking and data breaches.' These insights highlight both the recognition of cloud's potential and the institutional constraints slowing its adoption.

5.3.4 E-Waste Management Strategies

The study found that e-waste management practices are among the least developed sustainability strategies at the hospital. While some departments attempt to repair or reuse electronic equipment before disposal, a majority of respondents were unsure or disagreed that the hospital has formal e-waste procedures. Interviewees shed light on the reality of these practices. Interview participant explained: *'We store non-functional computers in a locked room, waiting for government collection*,' while another one added: *'Most old devices are just kept in storage until disposal can be arranged.*' Still another one acknowledged attempt at reuse, stating: *'Sometimes we donate or repair machines before disposal, but there is no structured recycling policy*.' These accounts confirm that informal practices dominate and underline the urgent need for a formal, hospital-wide e-waste management policy.

5.4 Recommendations

5.4.1 Paperless Communication

The Hospital Management, in collaboration with the ICT Department, should standardize the use of official hospital email systems, shared digital platforms, and electronic circulars across all departments. The hospital Procurement Office must ensure the timely provision of functional computers and stable internet connectivity. The Human Resources Department should conduct continuous staff training on paperless tools, while the Administration Office should issue and enforce a policy limiting unnecessary printing. Compliance should be monitored through regular departmental audits conducted by the heads of department.

5.4.2 Digital Archiving

The ICT Department, under the supervision of the hospital administration, should establish a centralized and interoperable digital archiving system to prevent duplication and ensure secure access to records across departments. The Hospital Management Office should allocate budgetary resources for secure servers and backup systems. The Health Records and Information Management department should organize regular workshops on digital records management in liaison with Human Resource department. The Records Office should also draft and enforce a clear retention and disposal policy, while appointing departmental focal persons to oversee compliance.

5.4.3 Cloud Storage Solutions

The ICT Department, in partnership with the Ministry of Health ICT Directorate, should spearhead the phased migration of hospital records to government-approved cloud platforms. The Hospital Management Office should prepare a phased migration plan prioritizing patient and administrative records. The ICT Department should lead staff sensitization and training on cloud usage, cybersecurity, and data protection. The management should ensure cloud adoption aligns with data protection laws. The Procurement Office should negotiate partnerships with certified cloud service providers to guarantee secure and cost-effective services.

5.4.4 E-Waste Management Strategies

The Hospital Management Office should develop and adopt a formal e-waste policy that details the collection, storage, repair, reuse, and disposal of obsolete equipment. The ICT Department should maintain an updated inventory of all ICT equipment and oversee proper disposal. The Procurement Office should prioritize environmentally friendly and recyclable ICT equipment during acquisition. The Administration Office, in collaboration with the Environmental Health

Department, should partner with certified e-waste recyclers for safe disposal. The Human Resource Unit should conduct sensitization campaigns on the dangers of e-waste and the importance of responsible disposal.

5.5 Implications of the Findings on Theories, Practices, and Policies

The findings of this study strongly affirm the relevance and practical applicability of the Green Information Technology (Green IT) Theory, which formed the theoretical foundation of this study. Green IT emphasizes the environmentally responsible use of information and communication technologies throughout their lifecycle—from procurement to disposal. In this study, practices such as paperless communication, digital archiving, and cloud storage were shown to reduce resource consumption and minimize environmental degradation, thereby validating the Green IT framework in a real-world healthcare setting.

From a practical and policy standpoint, the findings imply that there is a pressing need for institutions, especially in public health, to develop and implement eco-friendly ICT strategies. Policies must be tailored to encourage not just the adoption of green technologies but also the integration of environmental objectives into digital transformation plans. At the national level, the Ministry of Health and relevant ICT bodies should create standardized frameworks that support the rollout of sustainable ICT practices across all public health facilities. This study contributes to this effort by providing empirical evidence that environmentally sound digital records management is both feasible and beneficial.

5.6 Suggestions for Further Research

Although this study focused on a single institution, future research could expand the scope by conducting comparative studies across multiple public hospitals within Kenya or the East African

region. Such comparative analyses would help determine whether the challenges and opportunities identified at Marsabit County Teaching & Referral Hospital are shared across similar institutions. This would also provide a broader basis for policy recommendations and offer deeper insights into regional readiness for green ICT adoption.

Moreover, further research could focus on exploring the economic and operational impacts of implementing eco-friendly digital systems in the healthcare sector. Studies that examine the cost-benefit ratio of cloud-based records versus traditional on-premise systems, or the financial implications of formal e-waste disposal policies, would be particularly valuable. Another promising area for inquiry could be the role of staff digital literacy in determining the success of green ICT initiatives, offering pathways for tailored capacity-building interventions.

REFERENCES

Ahirwar, R., & Tripathi, A. (2021). E-waste management: A review of recycling process, environmental and occupational health hazards, and potential solutions. *Environmental Nanotechnology, Monitoring & Management, 15,* 100409. https://doi.org/10.1016/j.enmm.2020.100409

Aini, N., & Subriadi, A. (2022). Governance and practice approach of green information technology. *Procedia Computer Science, 197,* 318–327. https://doi.org/10.1016/j.procs.2021.12.186

Ali, I., & Warraich, N. (2021). Modeling the process of personal digital archiving through ubiquitous and desktop devices: A systematic review. *Journal of Librarianship and Information Science, 54*(1), 132–143. https://doi.org/10.1177/0961000621996410

Al-Sharafi, M. A., Iranmanesh, M., Al-Emran, M., Alzahrani, A. I., Herzallah, F., & Jamil, N. (2023). Determinants of cloud computing integration and its impact on sustainable performance in SMEs: An empirical investigation using the SEM-ANN approach. *Heliyon*, *9*(5), e16299. https://doi.org/10.1016/j.heliyon.2023.e16299

Al-Orainat, J. K. S., Ngah, A. H., Shamsuddin, M. S., Eneizan, B., Al-Gasawneh, J. A., Ngah, S., & Kamalrulzaman, N. I. (2024). Investigating the adoption of digital library by postgraduate students in Jordan: An enhanced UTAUT model. *Decision Science Letters, 13*(4), 897–908. https://doi.org/10.5267/j.dsl.2024.8.002

Arya, S., & Kumar, S. (2020). E-waste in India at a glance: Current trends, regulations, challenges and management strategies. *Journal of Cleaner Production, 271,* 122707. https://doi.org/10.1016/j.jclepro.2020.122707

Asubiaro, T. (2020). Digital archiving by Nigerian and foreign authors in a low-resource context: A content analysis of publications on natural language processing of Nigerian languages. *Proceedings of the Annual Conference of the Canadian Association for Information Science (CAIS),* 1–6. https://doi.org/10.29173/cais1175

Avula, A. (2024). Understanding cloud computing: How data storage works in the cloud. *International Journal for Multidisciplinary Research, 6*(6), 33472. https://doi.org/10.36948/ijfmr.2024.v06i06.33472

Badghish, S., & Soomro, Y. A. (2024). Artificial intelligence adoption by SMEs to achieve Sustainable business performance: Application of Technology–Organization–Environment Framework. *Sustainability*, *16*(5), 1864. https://doi.org/10.3390/su16051864

Bimir, M. N. (2020). Revisiting e-waste management practices in selected African countries. *Journal of the Air & Waste Management Association, 70*(7), 659–669. https://doi.org/10.1080/10962247.2020.1769769

Borchard, R., Zeiss, R., & Recker, J. (2021). Digitalization of waste management: Insights from German private and public waste management firms. *Waste Management & Research, 40*(6), 775–792. https://doi.org/10.1177/0734242X211029173

Böhringer, C., Keller, A., & van der Werf, E. (2021). Are carbon tariffs a "green" protectionist tool? *Energy Economics, 96,* 105152. https://doi.org/10.1016/j.eneco.2021.105152

Charfeddine, L., Hussain, B., & Kahia, M. (2024). Analysis of the impact of information and communication technology, digitalization, renewable energy and financial development on environmental sustainability. *Renewable and Sustainable Energy Reviews, 197,* 114609. https://doi.org/10.1016/j.rser.2024.114609

Charfeddine, L., & Umlai, M. (2023). ICT sector, digitization and environmental sustainability: A systematic review of the literature from 2000 to 2022. *Renewable and Sustainable Energy Reviews, 184,* 113482. https://doi.org/10.1016/j.rser.2023.113482

Chen, W., Zhu, C., Cheung, Q., Wu, S., Zhang, J., & Cao, J. (2024). How does digitization enable green innovation? Evidence from Chinese listed companies. *Business Strategy and the Environment, 33*(5), 3832–3854. https://doi.org/10.1002/bse.3672

Chemjor, E. M., Lagat, C., & Maru, L. (2017). Effects of Technology context on cloud computing adoption in small and medium enterprises in Nairobi County, Kenya. *IOSR Journal of Business and Management*, *19*(05), 70–80. https://doi.org/10.9790/487x-1905057080

Choi, D. (2021). A study on the major selection motivation, major commitment, career decision-making self-efficacy of college students majoring in eating out and cooking. *Foodservice Management Society of Korea Journal, 24*(3), 205–219. https://doi.org/10.47584/jfm.2021.24.3.205

Clark, S., & Miles, M. (2021). Assessing the integration of environmental justice and sustainability in practice: A review of the literature. *Sustainability, 13*(20), 11238. https://doi.org/10.3390/su132011238

Claude, K. J. (2024). The impact of records management on the effectiveness of human resource management in the public sector. *International Journal of Research and Innovation in Social Science, 8*(5), 1040–1060. https://doi.org/10.47772/ijriss.2024.805072

Cui, L., Weng, S., Nadeem, A., Rafique, M., & Shahzad, U. (2021). Determinants of environmental sustainability using ecological footprint as a measure: Evidence from

leading economic complex and renewable energy producing countries. *Renewable Energy, 177,* 254–267. https://doi.org/10.1016/j.renene.2021.11.075

Ding, H., & Wang, Z. (2025). The Influence of Institutional Pressures on Environmental, Social, and Governance Responsibility Fulfillment: Insights from Chinese Listed Firms. *Sustainability*, *17*(9), 3982. https://doi.org/10.3390/su17093982

Ebrahimi, K., & North, L. A. (2017). Effective strategies for enhancing waste management at university campuses. *International Journal of Sustainability in Higher Education, 18*(7), 1123–1141. https://doi.org/10.1108/ijshe-01-2016-0017

Enakrire, R., Oladokun, B., Nsirim, O., & Gaitanou, P. (2024). Paperless libraries: The trending way to go in the fifth industrial revolution. *Business Information Review, 41*(2), 97–107. https://doi.org/10.1177/02663821241289793

Evans, J. (2021). Recordkeeping for climate action: A Canadian perspective. *Archivaria, 91,* 56–83. https://archivaria.ca/index.php/archivaria/article/view/13876

Farrukh, A., Mathrani, S., & Taskin, N. (2020). Investigating the theoretical constructs of a green lean six sigma approach towards environmental sustainability: A systematic literature review and future directions. *Sustainability, 12*(19), 8247. https://doi.org/10.3390/su12198247

Feroz, A. K., Zo, H., & Chiravuri, A. (2021). Digital transformation and environmental sustainability: A review and research agenda. *Sustainability, 13*(3), 1530. https://doi.org/10.3390/su13031530

Gabutti, I., Colizzi, C., & Sanna, T. (2022). Assessing Organizational Readiness to Change through a Framework Applied to Hospitals. *Public Organization Review*, *23*(1), 1–22. https://doi.org/10.1007/s11115-022-00628-7

Gao, L., & Wen, H. (2025). Digital Economy and Environmental Sustainability: Analysis of Cross-Country Coordination. *Sustainability*, *17*(5), 1840. https://doi.org/10.3390/su17051840

Girau, R., Anedda, M., Presta, R., Corpino, S., Ruiu, P., Fadda, M., Lam, C., & Giusto, D. (2024). Definition and implementation of the Cloud Infrastructure for the integration of the Human Digital Twin in the Social Internet of Things. *Computer Networks*, *251*, 110632. https://doi.org/10.1016/j.comnet.2024.110632

Ghosh, A., & Lakshmi, J. (2022). Understanding the resiliency of cloud storage services. *2022 IEEE 27th Pacific Rim International Symposium on Dependable Computing (PRDC),* 172–183. https://doi.org/10.1109/PRDC55274.2022.00031

Goyal, S., & Gupta, S. (2024). A comprehensive review of current techniques, issues, and technological advancements in sustainable e-waste management. *e-Prime – Advances in Electrical Engineering, Electronics and Energy, 3,* 100702. https://doi.org/10.1016/j.prime.2024.100702

Gupta, R., Sharma, S., & Saha, P. (2021). Sustainable indicators for digital record management: A lifecycle approach. *International Journal of Information Management, 56,* 102285. https://doi.org/10.1016/j.ijinfomgt.2020.102285

Hardiyanti, M., Rizki, S., Putri, R., Hanggini, A., & Febrianto, A. (2023). Role of paperless office systems in supporting office automation efforts. *Majalah Bisnis & IPTEK, 16*(1), 361–370. https://doi.org/10.55208/bistek.v16i1.361

Hernandez, A. (2020). Green information technology usage. In M. Khosrow-Pour (Ed.), *Waste management* (pp. 112–127). IGI Global. https://doi.org/10.4018/978-1-7998-1210-4.ch069

Huang, W., Chau, K., Kit, I., Nureen, N., Irfan, M., & Dilanchiev, A. (2022). Relating sustainable business development practices and information management in promoting digital green innovation: Evidence from China. *Frontiers in Psychology, 13,* 930138. https://doi.org/10.3389/fpsyg.2022.930138

Hui, S. C., Kwok, M. Y., Kong, E. W., & Chiu, D. K. (2023a). Information security and technical issues of cloud storage services: a qualitative study on university students in Hong Kong. *Library Hi Tech*, *42*(5), 1406–1425. https://doi.org/10.1108/lht-11-2022-0533

Hyun, D., Jang, E., Lee, J., & Kim, T. (2024). Green cloud: Supporting sustainable behavior by helping users remove unnecessary photos from cloud storage service. *Extended Abstracts of the CHI Conference on Human Factors in Computing Systems,* 1–6. https://doi.org/10.1145/3613905.3647968

Islam, M., Khatun, M., & Mourshed, M. (2024). An in-depth analysis and review of management strategies for e-waste in the South Asian region: A way forward towards waste to energy conversion and sustainability. *Heliyon, 10,* e28707. https://doi.org/10.1016/j.heliyon.2024.e28707

Intergovernmental Panel on Climate Change. (2021). *Climate change 2021: The physical science basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press. https://doi.org/10.1017/9781009157896

International Energy Agency. (2022). *World energy outlook 2022.* OECD Publishing. https://doi.org/10.1787/4312c35b-en

Khan, F., & Ali, Y. (2021). A facilitating framework for a developing country to adopt smart waste management in the context of circular economy. *Environmental Science and Pollution Research*, *29*(18), 26336–26351. https://doi.org/10.1007/s11356-021-17573-5

Kirchner-Krath, J., Morschheuser, B., Sicevic, N., Xi, N., Korflesch, H., & Hamari, J. (2024). Challenges in the adoption of sustainability information systems: A study on green IS in organizations. *International Journal of Information Management, 77,* 102754. https://doi.org/10.1016/j.ijinfomgt.2024.102754

Krisnayanto, N., Panyahuti, N., Gunawan, A. A. N., Windiarti, I. S., Nasution, U. B., Rosini, N., Utomo, S. T., & Asuhadi, S. (2024). Investigating the role of digital transformation, digital knowledge management and digital innovation on sustainable performance (SDG) of SMEs. *Journal of Lifestyle and SDGs Review, 4*(3), e02047. https://doi.org/10.47172/2965-730x.sdgsreview.v4.n03.pe02047

Kui, D., & Pramono, R. (2023). A conceptual framework combining environmental worldview, organizational learning, and strategic planning contributing to sustainable development. *Journal of Infrastructure, Policy and Development, 7*(2), 2126. https://doi.org/10.24294/jipd.v7i2.2126

Kurniawan, T., Setiawan, B., & Santoso, D. (2022). Digital transformation of waste management: A review from emerging economies. *Waste Management, 150,* 34–45. https://doi.org/10.1016/j.wasman.2022.07.014

Landum, M., Moura, M. M. M., & Reis, L. (2023). Towards Green IT: Assessing the environmental impact of public administration. *Energies, 17*(1), 57. https://doi.org/10.3390/en17010057

Landum, M., Moura, M., & Reis, L. (2020). ICT good practices in alignment with Green IT. *Proceedings of the 17th Iberian Conference on Information Systems and Technologies (CISTI),* 1–6. https://doi.org/10.23919/cisti49556.2020.9141166

Lemieux, V. L., & Werner, J. (2023). Protecting privacy in digital records: The potential of privacy enhancing technologies. *Journal on Computing and Cultural Heritage, 16*(2), 1–14. https://doi.org/10.1145/3633477

Ly, B., Dem, T., Ly, R., Sorn, S., & Doeur, B. (2024). Exploring the nexus of digital inclusion and environmental sustainability: Insights from Cambodia. *Information Technology for Development, 30*(3), 1–18. https://doi.org/10.1080/02681102.2024.2345381

Maina, J., & Mwiti, F. M. (2024). Analyzing sustainability efforts in supporting the Green Library Initiative by Kenyan university libraries. *African Journal of Science Technology and Social Sciences, 2*(2), 205–213. https://doi.org/10.58506/ajstss.v2i2.214

Marsabit County Government. (2022). *About Marsabit County Teaching & Referral Hospital*. https://www.marsabit.go.ke/health-department

Melo, I. C., Queiroz, G. A., Alves, P. N., Junior, T. B., Yushimito, W. F., & Pereira, J. (2023). Sustainable digital transformation in small and medium enterprises (SMEs): A review on performance. *Heliyon, 9*(3), e13908. https://doi.org/10.1016/j.heliyon.2023.e13908

Müller, S., Hoffman, J., & Keller, M. (2021). Measuring social equity in sustainability transitions. *Journal of Environmental Policy & Planning, 23*(6), 789–806. https://doi.org/10.1080/1523908X.2021.1905399

Merlo, T. R., Fard, F., & Hawamdeh, S. (2025). Cloud Computing's Impact on the Digital Transformation of the Enterprise: A Mixed-Methods Approach. *Sustainability*, *17*(13), 5755. https://doi.org/10.3390/su17135755

Mersico, L., Abroshan, H., Sanchez-Velazquez, E., Saheer, L. B., Simandjuntak, S., Dhar-Bhattacharjee, S., Al-Haddad, R., Saeed, N., & Saxena, A. (2024). Challenges and Solutions for Sustainable ICT: The role of File Storage. *Sustainability*, *16*(18), 8043. https://doi.org/10.3390/su16188043

Mwanzu, A., Bosire-Ogechi, E., & Odero, D. (2023). Green initiatives towards environmental sustainability: Insights from libraries in Kenya. *IFLA Journal, 49*(2), 298–314. https://doi.org/10.1177/03400352221135012

Mwavali, A. (2021). A framework for cloud computing adoption by SMEs in Kenya. *World Journal of Innovative Research*, *10*(4). https://doi.org/10.31871/wjir.10.4.29

Nathaniel, S. P., Adeleye, N., & Bekun, F. (2021). Environmental pressures in Africa: Urbanization, energy consumption, and carbon emissions. *Environmental Science and Pollution Research, 28*(3), 3069–3084. https://doi.org/10.1007/s11356-020-10656-0

Nawi, M., Fauzi, M., Ting, I., Wider, W., & Amaka, G. (2024). Green information technology and green information systems: Science mapping of present and future trends. *Kybernetes, 53*(4), 1284–1301. https://doi.org/10.1108/k-10-2023-2139

Ngoepe, M., Jacobs, L., & Mojapelo, M. (2022). Inclusion of digital records in the archives and records management curricula in a comprehensive open distance e-learning environment. *Information Development, 40*(2), 190–201. https://doi.org/10.1177/02666669221081812

Nyachiro, A., Ondimu, K., & Mafura, G. (2023). Adoption Strategy for Cloud Computing in Research Institutions: A Structured Literature review. *Journal of Computer and Communications*, *11*(04), 63–78. https://doi.org/10.4236/jcc.2023.114004

Obi, H. E. (2023). Sustainable practices of environmental management in the preservation of archives in public libraries in Rivers State. *American Journal of Public Administration*

and Digital Information Studies, 1(2), 50–60. https://grnjournal.us/index.php/AJPDIS/article/view/50

Ogwel, B., Otieno, G., & Odhiambo-Otieno, G. (2020). Cloud computing adoption by public hospitals in Kenya: a technological, organisational and behavioural perspective. *International Journal of Scientific and Research Publications*, *10*(1), p9707. https://doi.org/10.29322/ijsrp.10.01.2020.p9707

Ojijo, A. D. (2023). Solid Waste Value Addition and Sustainable Development in Kisumu county, Kenya. *Zenodo (CERN European Organization for Nuclear Research)*. https://doi.org/10.5281/zenodo.8024685

Opgenhaffen, L. (2022). Archives in action: The impact of digital technology on archaeological recording strategies and ensuing open research archives. *Digital Applications in Archaeology and Cultural Heritage, 27,* e00231. https://doi.org/10.1016/j.daach.2022.e00231

Pandey, R. D., Sarkar, P., & Singh, S. (2023). Success factors for the adoption of paperless ecosystem in manufacturing firms. *Technology & Engineering Management Conference – Asia Pacific,* 1–7. https://doi.org/10.1109/temscon-aspac59527.2023.10531547

Pellegrini, L., Locatelli, M., Meschini, S., Pattini, G., Seghezzi, E., Tagliabue, L. C., & Di Giuda, G. M. (2021). Information modelling management and green public procurement for waste management and environmental renovation of brownfields. *Sustainability, 13*(15), 8585. https://doi.org/10.3390/su13158585

Peluaga, I., Fernandes, J., & Natraj, S. (2022). Towards environmentally sustainable long-term digital preservation. *International Journal of Digital Curation, 17*(1), 6–20. https://doi.org/10.2218/ijdc.v17i1.848

Prasetyo, S., Damaraji, G., & Kusumawardani, S. (2020). A review of the challenges of paperless concept in the Society 5.0. *International Journal of Industrial Engineering and Engineering Management, 2*(1), 1–12. https://doi.org/10.24002/ijieem.v2i1.3755

Qin, T., Gu, M., Wang, Y., Yang, Y., Guo, J., Li, X., Wang, Y., Gao, J., & Bai, Y. (2024). Preferences of medical staff for providing health education service: A discrete choice experiment in Beijing, China. *Patient Education and Counseling, 124,* 108282. https://doi.org/10.1016/j.pec.2024.108282

Raut, S., Saxena, A., Leggette, W., Patil, S., Hsu, V., & Archer, D. (2023). Workload management for sustainability with storage systems in hybrid cloud deployment. *2023 IEEE Women in Technology Conference (WINTECHCON),* 1–6. https://doi.org/10.1109/wintechcon58518.2023.10276943

Rautela, R., Arya, S., Vishwakarma, S., Lee, J., Kim, K., & Kumar, S. (2021). E-waste management and its effects on the environment and human health. *Science of the Total Environment, 773,* 145623. https://doi.org/10.1016/j.scitotenv.2021.145623

Rowe, R. (2024). Digital records management: The history of your city. *Certified Public Manager® Applied Research, 5*(1), 1–15. https://scholarworks.sfasu.edu/cpmar/vol5/iss1/1

Ruggerio, C. (2021). Sustainability and sustainable development: A review of principles and definitions. *Science of the Total Environment, 786,* 147481. https://doi.org/10.1016/j.scitotenv.2021.147481

Sakalasooriya, N. (2021). Conceptual analysis of sustainability and sustainable development. *Open Journal of Social Sciences, 9*(3), 1–12. https://doi.org/10.4236/jss.2021.93026

Salomi, M. J. A., & Maciel, R. F. (2017). Document management and process automation in a paperless healthcare institution. *Technology and Investment, 8*(3), 167–178. https://doi.org/10.4236/ti.2017.83015

Sayegh, A., Ahmad, S., Alfaqeeh, K., & Singh, S. (2022). Factors affecting e-government adoption in the UAE public sector organisations: The knowledge management perspective. *Journal of Knowledge Management, 27*(4), 717–737. https://doi.org/10.1108/jkm-09-2021-0681

Segun-Falade, N. O. D., Osundare, N. O. S., Kedi, N. W. E., Okeleke, N. P. A., Ijomah, N. T. I., & Abdul-Azeez, N. O. Y. (2024). Assessing the transformative impact of cloud computing on software deployment and management. *Computer Science & IT Research Journal*, *5*(8), 2062–2082. https://doi.org/10.51594/csitrj.v5i8.1492

Schultz, W. (2021). Digitization and digital archiving (2nd ed.). *Journal of Web Librarianship, 16*(2), 80–90. https://doi.org/10.1080/19322909.2021.2007626

Sharma, A., Kumari, A., Sharma, V., Al-Farouni, M., & Mishra, S. (2023). Consolidation of cloud computing in smart and sustainable environment. *2023 International Conference for Technological Engineering and Its Applications in Sustainable Development (ICTEASD),* 86–91. https://doi.org/10.1109/icteasd57136.2023.10585245

Shonhe, L., & Grand, B. (2019). Implementation of electronic records management systems. *Records Management Journal, 30*(1), 43–62. https://doi.org/10.1108/rmj-03-2019-0013

Singh, M., & Sahu, G. (2020). Towards adoption of Green IS: A literature review using classification methodology. *International Journal of Information Management, 54,* 102147. https://doi.org/10.1016/j.ijinfomgt.2020.102147

Sugiharto, H., & Setyaedhi, H. (2024). Comparative test of Cronbach's alpha reliability coefficient, KR-20, KR-21, and split-half method. *Journal of Education Research and Evaluation, 8*(1), 53–62. https://doi.org/10.23887/jere.v8i1.68164

Swaleh, M., & Wabwoba, F. (2023). Green Computing: A Comprehensive review of Sustainable IT practices. *International Journal of Computer Applications Technology and Research*. https://doi.org/10.7753/ijcatr1212.1009

Tabrizchi, H., & Rafsanjani, M. (2020). A survey on security challenges in cloud computing: Issues, threats, and solutions. *The Journal of Supercomputing, 76*(12), 9493–9532. https://doi.org/10.1007/s11227-020-03213-1

Tamasiga, P., Onyeaka, H., & Ouassou, E. H. (2022). Unlocking the green economy in African countries: An integrated framework of FinTech as an enabler of the transition to sustainability. *Energies, 15*(22), 8658. https://doi.org/10.3390/en15228658

Tennakoon, W., Janadari, M., & Wattuhewa, I. (2024). Environmental sustainability practices: A systematic literature review. *European Journal of Sustainable Development Research, 8*(2), 14604. https://doi.org/10.29333/ejosdr/14604

Thangam, D., Muniraju, H., Ramesh, R., Narasimhaiah, R., Khan, N. M. A., Booshan, S., Booshan, B., Manickam, T., & Ganesh, R. S. (2024). Impact of data centers on power consumption, climate change, and sustainability. In *Advances in computational intelligence and robotics book series* (pp. 60–83). https://doi.org/10.4018/979-8-3693-1552-1.ch004

Too, C., Bomett, E., & Kiprop, C. (2021). Critical success factors for adoption of cloud computing in public universities in Kenya. *European Journal of Education Studies*, *8*(10). https://doi.org/10.46827/ejes.v8i10.3939

Traoré, A., & Asongu, S. (2023). The diffusion of green technology, governance and CO2 emissions in Sub-Saharan Africa. *Management of Environmental Quality: An International Journal, 35*(2), 463–484. https://doi.org/10.1108/meq-05-2023-0151

Tripathi, D. R., Sarve, D. I., & Khobragade, S. R. (2024). Investigating the impact of cloud computing on environmental sustainability. *International Journal for Research in Applied Science and Engineering Technology*, *12*(10), 318–325. https://doi.org/10.22214/ijraset.2024.64515

Truong, T. C. (2022). The impact of digital transformation on environmental sustainability. *Advances in Multimedia, 2022,* 632432. https://doi.org/10.1155/2022/6324325

Tsai, C. H., Eghdam, A., Davoody, N., Wright, G., Flowerday, S., & Koch, S. (2020). Effects of electronic health record implementation and barriers to adoption and use: A scoping review. *Life, 10*(12), 327. https://doi.org/10.3390/life10120327

Udochukwu, D., & Oraekwe, C. (2021). Digital archiving. In A. Tripathi (Ed.), *Advances in library and information science* (pp. 55–72). IGI Global. https://doi.org/10.4018/978-1-7998-6618-3.ch005

United Nations Environment Programme. (2022). *Measuring biodiversity for sustainability: Indicators and approaches.* UNEP. https://wedocs.unep.org/20.500.11822/39743

Wani, A. H., Parry, A. H., Khanday, S. A., & Gojwari, T. A. (2019). Improvement in radiographic quality workflow due to use of digital imaging and picture archiving and communication system. *International Journal of Advances in Medicine, 6*(3), 701–705. https://doi.org/10.18203/2349-3933.ijam20191518

Wen, H., Lee, C., & Song, Z. (2021). Digitalization and environment: How does ICT affect enterprise environmental performance? *Environmental Science and Pollution Research, 28*(48), 54826–54841. https://doi.org/10.1007/s11356-021-14474-5

Wishah, R., & Abdulbaqi, A. S. (2023). Security and integrity of medical log records management in the cloud storage. *Journal of Discrete Mathematical Sciences and Cryptography, 26*(7), 1961–1970. https://doi.org/10.47974/jdmsc-1784

Wong, C. W. Y., Wong, C. Y., Boon-Itt, S., & Tang, A. K. Y. (2021). Strategies for building environmental transparency and accountability. *Sustainability, 13*(16), 9116. https://doi.org/10.3390/su13169116

Xu, J., She, S., & Liu, W. (2022). Role of digitalization in environment, social and governance, and sustainability: Review-based study for implications. *Frontiers in Psychology, 13,* 961057. https://doi.org/10.3389/fpsyg.2022.961057

Yang, G., & Deng, F. (2023). Can digitalization improve enterprise sustainability? Evidence from the resilience perspective of Chinese firms. *Heliyon, 9*(3), e14607. https://doi.org/10.1016/j.heliyon.2023.e14607

Yenugula, M., Sahoo, S. K., & Goswami, S. S. (2023). Cloud computing for sustainable development: An analysis of environmental, economic and social benefits. *Journal of Future Sustainability*, *4*(1), 59–66. https://doi.org/10.5267/j.jfs.2024.1.005

Yousufi, M. (2023). Exploring paperless working: A step towards low carbon footprint. *European Journal of Sustainable Development Research, 7*(1), 13410. https://doi.org/10.29333/ejosdr/13410

Yuzgenc, I. U., & Aydemir, E. (2023). Sustainable ERP systems: A green perspective. *International Conference on Pioneer and Innovative Studies, 1,* 533–538. https://doi.org/10.59287/icpis.886

Zhen, Z., Malik, M., Khan, A., Ali, N., Malik, S., & Bilal, M. (2021). Environmental impacts of hazardous waste and management strategies to reconcile circular economy and eco-sustainability. *Science of the Total Environment, 800,* 150856. https://doi.org/10.1016/j.scitotenv.2021.150856

Zhou, J. (2024). Comparison of cloud storage in the field of personal data and big data. *Highlights in Science, Engineering and Technology, 48,* 575–586. https://doi.org/10.54097/wqsgs575