AN INTEGRATED MODEL FOR E-HEALTH IMPLEMENTATION IN KENYA

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DECLARATION

I the undersigned, declare that this Thesis is my original work and has not been presented elsewhere for a degree or any other award.

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APROVAL

We the undersigned certify that we have read and hereby recommend for acceptance of Masinde Muliro University of Science and Technology a Thesis entitled, "An integrated model for e-health implementation, Kenya".

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DEDICATION

This dissertation is dedicated to my son Dawood Shirandula and my parents, Osen and Anipha Shirandula.

ABSTRACT

Healthcare Systems have enormous benefits associated with them. However, they face numerous challenges which have forced developing countries to focus on digital interventions known as e-health Technologies. Kenya, as a developing country, is not left behind regarding the challenges of e-health. With the vision of efficient implementation and use of e-health, there is need to develop a model that will enable the improvement of effective e-health. The purpose of the study was to investigate the factors influencing adoption and implementation of e-health in Kenya. The objectives of the study were to determine the current status of e-health implementation in Kenya, determining critical factors that affects the implementation of e-health Technologies in health sector in Kenya and to develop a model for e-health implementation in Kenya. The Study used Normalization Process Theory (NPT), Actor Network Theory (ANT) and Technology Organization and Environmental Framework (TOE) to underpin the study. Data was collected using structured questionnaire and interview of key informants. The quantitative data was then coded and analyzed using both descriptive and inferential statistics and the qualitative data was analyzed using thematic analysis. Pragmatist research philosophy was adopted given the multiple realities and the fact that it fitted well with deductive and inductive approaches. The study population included 1243 healthcare workers from which a sample of 303 respondents were obtained using stratified sampling. The findings of the research indicated that social factors were significant predictor of e-health implementation where ($p=0.005<0.05$), organizational factors were significant predictor of e-health implementation where ($p=0.002<0.05$), technological factors were significant predictor of e-health implementation where ($p=0.000<0.05$) and environmental factors were significant predictor of e-health implementation where ($p=0.048<0.05$). From the outcomes of this study, a model of e-health implementation was realized to guide the process of effective e-health development and used. The study concluded that there was need for various stakeholders to reflect on organizational, social and environmental relationship and interaction with technical aspect as technological factor was the major factor that affect e-health implementation in Kenya. The model developed is a basis upon which future implementation of e-health can be based. It was recommended that for effective implementation, there is need for a well-defined implementation plan for e-health. The study further recommends for research on e-health adoption.

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ABBREVIATIONS AND ACRONYMS

EHR- Electronic health records

EMR- Electronic medical records

e-health-electronic/digital health

ICT-Information and Communication Technology

TAM-Technology Acceptance Model

WHO- World Health Organization

PHR-Patient health records

DSS-Decision support system

OPERATIONAL DEFINITION OF TERMS

Electronic health records (EHR): In electronic health records, a patient's paper chart is transformed into a digital one (EHR). EHRs are patient-centered, real-time records that provide rapid, secure access to information to authorized users.

Electronic medical records (EMR): Electronic medical records are the digital equivalent of the paper records or charts that are stored in a doctor's office (EMR). The generic patient data collected by the particular medical practice and frequently seen in EMRs include therapy and medical history.

Information and Communication Technology (ICT): "Information and Communication Technologies" is abbreviated as ICT. It stands for technology that provide access to information through telecommunications. This includes additional kinds of communication as well as the Internet, wireless networks, mobile devices, and many others.

Information Technology (IT): Information technology is the use of computers to store, retrieve, transport, and manipulate data or information (IT). In the context of a business or other enterprise, this is routinely done. IT is regarded to be a part of information and communications technology (ICT).

Technology Acceptance Model (TAM): The "Technology Acceptance Model" (TAM), a theory of information systems, defines how users embrace and make use of new technology.

Perceived usefulness (PU) – Perceived usefulness (PU), according to Fred Davis, is "the degree to which a person believes that using a certain system would improve his or her effectiveness at work."

Unified Theory of Acceptance and Use of Technology (UTAUT): The Unified Theory of Adoption and Use of Technology (UTAUT), a model for technology acceptance, was created by Venkatesh and colleagues in "User Acceptance of Information Technology: Toward a Unified View." In order to better understand users' initial information system usage goals and subsequent usage behavior, the UTAUT was created. Expectations for performance, effort, societal impact, and conducive conditions are listed in that order as the four fundamental constructs.

e-health: The term "e-health," which refers to the use of information and communications technologies in healthcare, is defined as "an emerging field at the intersection of medical informatics, public health, and business, referring to health services and information delivered or enhanced through the Internet and related technologies."

World Health Organization (WHO): World Health Organization (WHO): The World Health Organization (WHO) is a branch of the UN that manages worldwide public health issues. It was established on April 7, 1948, and Geneva, Switzerland, serves as its headquarters. Participating in the UN Development Group is the WHO.

Healthcare Information and Management Systems Society (HIMSS): A non-profit organization based in the United States, the Healthcare Information and Management Systems Society (HIMSS), strives to improve the quality, safety, accessibility, and financial effectiveness of healthcare services. In 1961, it was founded as the Hospital Management Systems Society. It is presently in Chicago, Illinois. The society's members include more than 68,000 people, 600 companies, and more than 400 charity organizations (as of March 2018). HIMSS is a 501(c)6 corporation in the US.

International Health Regulation (IHR): International Health Regulations (IHR): Are a body of law that has global legal force and is applicable to 196 nations, including all WHO Member States. The IHR, which became effective on June 15, 2007, mandates that governments notify WHO of certain disease outbreaks and public health incidents.

International Telecommunication Union (ITU): The International Telecommunication Union (ITU) is a UN entity with the responsibility of coordinating global telecommunications activities and services. The ITU is the oldest still-existing international organization. It was first established in 1865 as the International Telegraph Union.

CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter presents the research background, problem statement, objectives, the research questions, and justification.

1.2 Background of the study

According to the World Health Organization, health is "a state of complete physical, mental, and social well-being and not only the absence of sickness" (WHO). The body is what "physical" refers to. Mental health refers to one's thoughts and emotions [1]. Everyone in the world has to be healthy, meaning that people in every nation should be in good health. By health, we refer to a person's overall state of wellbeing, including not just their ability to access medical care but also their ability to conduct a socially and economically useful life. It is essential to remove all barriers to health [2]. One technology being utilized to lower health-related barriers is e-health. Information and Communication Technologies (ICT) are used in a safe and cost-effective manner to support the health and health-related fields, such as health services, health surveillance, literature, education, knowledge, and research in those fields [3]. The use of Information and Communication Technology (ICT) for health is known as "e-health" according to the World Health Organization (WHO). According to a report by the WHO and the International Telecommunication Union (ITU), e-health pilots are underway in Sub-Saharan Africa, although most of them have failed in practice.

In developing countries such as Kenya, some segments of the population do not have access to basic health services due to the fact that service providers are far from their homes or due

to the lack of trained personnel, equipment or drugs [4]. Most developing countries are faced with rising health care costs, changing disease burdens, resilience of health care workers, and societal expectations [5] [6]. Therefore, the majority of nations, both developed and developing are working to lower or regulate costs while increasing access to high-quality services. One of the technologies enabling access to high-quality care for those living in rural and isolated places is e-health. By offering timely information for illness management, e-prescribing, clinical decision support systems, prevention, and diagnostics, it has the potential to empower communities and patients [7]. In summary, e-health has improved the accuracy of diagnosis and treatment, ensured appropriate and evidence-based care, improved communication and information sharing between patients and care givers, for more person-centered care, and commitment before treatment, among other aspects of the healthcare system. Second, e-health has improved institutional efficiency through real-time information availability, resource optimization, and a decrease in fragmentation, duplication, and unnecessary care. Third, equity has enabled people to make better health decisions by increasing access to high-quality healthcare for those with a range of diseases in rural, isolated, and underdeveloped areas. Fourth, accountability which has played a major role in increasing openness through better information exchange and communication to foster greater participation from the public and local authorities. Finally, sustainability and resilience, which have increased the system's overall adaptability and strengthened the monitoring of hazards to public health [8]. [9].

Lack of funding was a problem for the majority of developing nations, including Kenya [10], which made it difficult to provide healthcare providers with modern equipment. The adoption of e-health by service providers for short-term or long-term requirements was also

hampered by inadequate strategies, guidelines, or procedures [11]. The poor budget plan given to healthcare organizations was yet another issue [12]. Another obstacle to the adoption of e-health was lack of knowledge and skills in Information and Communication Tchnologies (ICT) [13]. Diverse users of standards and guidelines are not involved in the e-health development process. The adoption and implementation of e-health was a challenge for developing and even developed countries due to lack of infrastructure, security concerns, and variety of other challenges.

Despite the enormous advantages of e-health adoption, such as telemedicine, m-health, bar code technology, radio frequency identification, and clinical decision support systems, picture archiving and communication systems significantly advanced patient welfare, nutritional management, and text management, all of which improved the standard of healthcare services provided to patients [14] [15]. Studies reveal that acceptance rates for e-health are quite low in both industrialized and developing nations, despite all of its advantages [16] [17]. Therefore, the necessity for e-health system acceptance and deployment to be improved was of importance to this study. In order to construct an integrated model for sustainable e-health implementation, the researcher investigated the elements that influenced e-health acceptance and implementation as well as the tactics that improved it.

Global health is crucial to both national security and the safety of citizens traveling outside the countries like the US. With the exception of extensive international travel, commerce, and economics, almost every industry on the planet is becoming more and more globalized, necessitating the globalization of health. It's difficult for a week to go by without some eye-

catching report about the rise of health threats for instance infectious diseases [18]. We have international health regulations (IHR) that take into account hazards to public health around the world. They have been created to limit disruptions to global travel and trade while also preventing the spread of illnesses across borders. They encourage nations to cooperate and exchange information about recognized illnesses and public health issues of relevance to the entire world [19]. We were interested in improving health, minimize disparities, and ensuring security from external risks that cross national borders [20].

Health professionals and the government are focusing on e-health as a solution to the problems that the healthcare sector in developing countries like Kenya is facing [8]. Despite the documented enormous benefits of e-health like telemedicine, m-health, bar code technology, radio frequency identification, and clinical decision support systems, picture archiving & communication system significantly developed patient welfare, nutritional management, and text management, which generally have enhanced the quality of healthcare services delivered to the patients[13].

At all levels of health care delivery in Kenya, the country has a vision to establish an environment that will guarantee the acceptance, deployment, and efficient use of e-health Technologies. The monitoring and evaluation, health research development, and informatics industries are currently at odds in Kenya, where the Kenya e-health Development Unit answers to the Ministry of ICT (MOIST). It is difficult to evaluate, keep track of, and control the e-health systems used in Kenya since they are not sufficiently structured.

The usage of ICT is one of the major forces behind social, economic, and political progress, according to the Kenyan government. As a result, the integration of e-health technology

including telemedicine, health information systems, and eLearning into health systems has accelerated. Statistics show that Kenya has at least one e-health project in more than 35 counties. However, because the majority of these projects are supported by NGOs and development partners, there are concerns about ownership and sustainability. One of the difficulties in adopting and implementing e-health in Kenya is the absence of locally relevant standards and regulations [25]. They therefore, chose to impose criteria from industrialized nations that don't even apply to Kenya. Poor infrastructure, low literacy, lack of technical skills, unstable electricity, lack of money and lack of government support for e-health initiatives are among other issues that e-health must overcome.

Technology-wise, the acceptance and application of e-health advances was the only thing that might spur the healthcare industry to produce improved medical results. The achievement of Vision 2030 goals is made possible by e-health, which guarantees high-quality access to delivery of healthcare regardless of religion, economics or political affiliation.

The researcher reviewed the models and theories that served as the study's foundation to address the problems that hinders the adoption and implementation of e-health. They had factors that affected user behavior and other moderators that produced structures with more explanatory power, making them appropriate for research.

1.3 Statement of the research Problem

For healthcare professionals, e-health is essential for lowering costs and raising quality. Studies have demonstrated that despite all the advantages of e-health in both developed and

developing nations, acceptance and sustainable implementation of e-health are very low or underutilized [16] [17]. There is a large gap between the moment an organization applies e-health technology and its sustainable application to achieve the expected return. Therefore, there is need to bridge the gap in adoption and maintenance of e-health technology implementation [22]. To fill this gap, this study was conducted to evaluate the difficulties in the process of adoption and implementation of e-health which was due to various manipulation factors, their interactions, and perceived benefits. Therefore, the study aimed at investigating the organizational, environmental, and technological interactions and their effects on the adoption and implementation of e-health.

1.4 Objectives of the study

1.4.1 General objective

The primary objective of this study was to investigate critical factors that influence e-health and thereafter develop e-health implementation model in Kenya.

1.4.2 Specific objectives

i. To determine the status of e-health implementation in Kenya.

ii. To determine critical factors that affects the implementation of e-health Technologies in health sector in Kenya.

iii. To develop a model for e-health implementation in Kenya.

1.4.3 Research Questions

i. What is the status of e-health implementation in Kenya*?*

ii. What are the essential factors that affect implementation of e-health in Kenya?

iii. How can a model for e-health be developed in Kenya.

1.5 Justification

Information and communication technology is used in the integrated approach to raise the quality and accessibility of healthcare services. The model demonstrates how technology is used to gather, store, retrieve, and transmit patient information in an ethical, well-organized, efficient and safe manner.

1.6 Significance

The study enhances the state and local health systems by creating an integrated paradigm. While the healthcare industry offers a single route for objective electronic health information and services. The results of this study have significant implications for the theory and practice of e-health's justifiable adoption and long-term deployment in Kenya's healthcare system. The integrated model created by this study has been adjusted to carry out the stated goal in Kenya and other developing countries.

1.7 The Scope of Study

The scope covered people from the health and ICT industries, as well as end consumers and public or private partners who were among the researchers. They worked on the concept, development, and implementation of the research in order to acquire good results. e-health systems are being adopted by both the private and public healthcare sectors. Therefore, for ensuring that the outcome reflects the views of both sectors, the research focused on the participants drawn from both the public and the private sector. The research also focused on the western Kenya as a region with the focus of Kakamega County. The study did not focus

on other regions since it would broaden the scope and hence this would cause challenges to the researcher in obtaining the results at the right time.

1.8 Assumption

It was assumed that e-health and ICT advancements would enhance Kenyans' health and wellbeing. The traditional health care delivery and access paradigm was expected to undergo a drastic change with the adoption of e-health.

1.9 Limitation

Selecting the appropriate theories to meet the study topic was the researcher's first obstacle during the study. The problem was addressed by the researcher reading extensively on relevant study topics and theories that supported the study. The problem was addressed by the researcher getting the input from experts across discipline during seminars. Another challenge was choosing the right methodology, the researcher had a problem of deciding the correct procedure for conducting the study. The problem was addressed by the researcher consulting other researchers and doing pilot study to test it before starting the real research. The researcher had a challenge when dealing with data analysis when dealing with the collected data, the problem was how to make logic of data that had been collected. The problem was addressed by the researcher doing a lot of literature review and employing the use of software for data analysis.

The other limitation experienced during the study was the attitude of the participants. Some participants were not willing to provide information regarding their knowledge of using the e-health systems. This limited the quantity of data that was collected in the facilities that the participants belonged to. In order to get over this restriction, the researcher had to reassure

the informants that the data they were giving was private and would only be utilized for the research. Funding of the research was also a limitation. The research required funding in-order to have all the data properly gathered and analyzed. But since the research was solely funded by the researcher, there was no enough funds to support the entire operation of the research. The researcher had therefore to operate within the scope of available funds and also to limit the research to Kakamega county in order to collect and properly analyze data.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter reviews relevant research on the topic of e-health Technology concepts, as well as related studies, reviews of goals based on literature, models, frameworks, theories, Conceptual framework, and hypothesis.

In Kenya and across the globe, there is a surge in the use of ICT-related technology such mobile or portable gadgets [23]. Mobile device users can access many forms of information at any time and from any location [24]. Health care facility services are not excluded. All medical professionals' surgeons, specialists, consultants, and doctors need access to health information in order to streamline procedures and reduce workload. The majority of healthcare companies have adopted electronic information systems, but these systems mostly focus on internal operations.

The U.S. trade association for the manufacturing of healthcare information technology is called HIMSS. In contrast to other corporate sectors and other technologically advanced industries, HIMSS has found that EHR adoption rates in the United States have been lower than expected. The key cause, in addition to initial costs and lost productivity during EMR deployment, is the inefficiency of currently available EMRs [25]. In its usability research from 2011, the U.S. Numerous particular problems that healthcare professionals had reported were detailed by the National Institute of Standards and Technology of the Department of Commerce [26]. According to reports, the EHR used by the US military has

serious usability problems [27]. Improvements in EHR usability were thought to be made in the context of communication between a doctor and patient [28].

The use of mobile devices like smartphones and tablets by surgeons and medical professionals is growing quickly [29]. In 2012, 1369 medical doctors, training managers, and other healthcare practitioners participated in a survey to determine how they used mobile devices in their work [30]. This represents 62.6% of the total respondents. In order to enable clinicians to view patient records from a distance, mobile devices have become increasingly capable of being integrated with electronic health record systems. The majority of devices were add-ons for desk-top EHR systems, communicating and accessing files remotely through a variety of software. The advantages of having immediate access to patient records at any time and from anywhere were obvious, but they also raised a number of security concerns. Practices needed comprehensive procedures that manage security measures and patient privacy laws as mobile systems became more common [31].

In a hospital, electronic medical records are a vital asset that must be safeguarded so that only patients and authorized individuals have access to its contents. A set of standards called Health Level 7 (HL7) is used to transfer organizational and medical data between hospital information systems. Security was one of the key concerns about sharing information in medical facilities. To prevent information exposure, a system that sends health information needs to be protected. The use of mobile devices is expanding, and with it come many information security challenges. Mobile device access to medical data necessitates security measures that guarantee its availability, confidentiality, and integrity[32] [33].

The concept of a national centralized server architecture for healthcare data has not been well embraced in wealthy nations like the United States, Great Britain, and Germany. Privacy and security concerns have been raised in relation to this model [34] [35].

Around 150 people, including doctors, nurses, technicians, and billing clerks, are said to be accessible to 600,000 clients, suppliers, and other firms that handle providers' billing data, according to claims made by the Los Angeles Times [36]. Recent exposures of protected data gaps in centralized data warehouses, in banking and other financial companies, in the retail business, and in government systems have raised questions about the safety of centrally storing electronic medical records [37]. As with any other type of data transaction on the internet, records sent over the internet are subject to the same security risks.

Some people believed that using electronic medical records (EMR) or electronic health records (HER) technology compromised patient security and privacy. According to statistics [38], over 112 million data breaches involving health care records were documented in the United States alone in 2015. EMR enhances patient care, but it also creates a great deal of confusion. With employees who don't work in the practice, sharing EMR data is difficult. Patient records must frequently be printed out in case information needs to be shared with a specialist. This becomes an issue, especially when the patient is routinely seen by different institutions or specialists. Additionally, even though a single, sizable organization employs several separate departments, each of which frequently uses specialized EMR software that does not exchange data, there are still issues. As a result, issues with information integration and interoperability that support comprehensive patient care were also raised, in addition to privacy and security concerns. Due to the difficulty and cost of transferring between

packages, EMR software suppliers have successfully locked in their customers. Establishing links for sending and receiving patient data to other systems might cost anywhere between $5,000 and $50,000, depending on the ERM software vendor [39].

While treating a patient, a doctor has access to the patient's records. The patient owns the records, so they shouldn't be made publicly accessible to other doctors without the patient's permission. Hackers are increasingly targeting health-related information.

More than 100 million different pieces of health care data were stolen in just 2016 alone. Due to their concern for the security of the system holding their data, patients start to worry about the integrity of their information and may as a result choose to withhold certain details.

2.2 Key concepts on e-health Implementation

2.2.1 Definition

There are several definitions of what is meant by the term "e-health," with some authors referring just to the use of the internet in healthcare and others more widely referring to the use of computers in healthcare [40]. This study used the term "e-health" to refer to the use of Information and Communication Technology (ICT) for health-related reasons [41].

2.2.2 e-health knowledge

The ability to seek out, investigate and comprehend health information obtained from an electronic source to use it to address a health issue is known as having an understanding of e-health [42] [43]. The ability to use the internet for health purposes permits one who possesses e-health knowledge and abilities to succeed. One can participate completely in making well-informed statements about one's health while also protecting themselves from

harm by being knowledgeable [43]. Anyone familiar with e-health is aware of the risk of coming across unreliable internet resources [44].

2.2.3 Data interchange

One of the main barriers to the acceptance and implementation of e-health in developing nations like Kenya or even developed nations worldwide was the worry over privacy issues involving the patient records. The data's confidentiality has been the key problem. We have data exchange on both the front end and the back end. In contrast, the patient was involved in the front end by sending the doctor a photo and information about themselves. However, the patient was not involved in the back end; for instance, when a patient visits a doctor, they are asked for their health data, which may include prescription medicine, x-ray images, or results from blood tests. Without the patient's knowledge, these behaviors allow the doctor to learn about things like allergies [45].

2.2.4 Benefits of e-health

Slow acceptance and implementation rates in industrialized nations were a result of things like a lack of supportive policies from the government or healthcare organizations. The challenges posed by healthcare professionals like general practitioners or the complexity of the technology used [47].

There are several causes that lead to e-health, but the main motivators are the service providers. [48] The adoption and implementation of e-health alters how work is conducted. whereby the implementation of ICT infrastructure will naturally alter the employment design of linked health professionals. If the healthcare practitioners are not encouraged or happy,

it's likely that the innovation won't happen. Additionally, if the supplier of health services lacks characteristics essential to change or is incapable of adjusting to new approaches, the acceptance and implementation may fail [49] [50].

The following benefits are provided by e-health.

a) Online counseling, therapy, and recovery. Particularly in rural and underdeveloped areas where healthcare services are scarce or nonexistent, e-health makes it simple to get healthcare services.

b) Communication: EHR enhances integration and coordination of healthcare. Whereby e-health offers guidance to professionals and patients on how to save, report, and collect health data through the usage of EHR and patient health records (PHR).

c) Self-management: EHRs offer resources for self-care. By monitoring their behavior and coping with adherence to therapy, tools give feedback and help to patients.

d) It aids in decision-making: A decision support system (DSS) links several clinical officers' evidence regarding the optimal course of therapy.

e) Risk analysis, preventive intervention, and monitoring are made possible through e-health.

2.2.5 e-health problems

a) Safety and secrecy

Privacy has been e-health's key concern because a patient's health situation and how they are handled are very sensitive and personal matters [51]. Nevertheless, tracking is made simpler by e-health technology because it makes it easy to look for a patient's information without

that person's knowledge or consent. The patient health information must be kept secure and confidential, there is need for acceptable standards in this area. Safety has remained one of the biggest concern with e-health. [52].

b) Mismanagement and exploitation

When it comes to e-health, there are no set guidelines for how to prevent drug theft or receive therapy or prescription online [51]. In nations like the US, each state has its own regulations regarding the delivery of pharmaceuticals online, which makes it difficult to manage [51]. e-health is available worldwide and people are left wondering whether the person caring for them on the other end is a healthcare provider [53].

c) Online access

The fundamental advantage of e-health is how it enhances information availability and offers opportunities for healthcare providers, but it also presents a serious obstacle. The difficulty is illustrated by the fact that few individuals in undeveloped nations have access to the internet, leaving those who require medical treatment as the only group without it. Lack of computer literacy among the elderly and the inadequate infrastructure provides significant challenges for e-health technology [54].

d) Reliability of online information

The issue is that it can be difficult for someone to distinguish between accurate and unreliable information that is supplied online [55]. Most websites frequently make it obvious that the information they provide is true, but they should not be held liable for the accuracy of data they provide or for improper handling [51].

e) Real time contact

It was anticipated that e-health would offer 24/7 provider and customer access to services via the internet, this is also a significant issue due to lack of personal real-time communication, it may be difficult to respond to requests promptly because we might not be online at the time they are made. This could be dangerous if we were experiencing a critical situation [53].

f) Physical contact replacement

Direct social and physical touch is replaced by e-health. There are concerns regarding how high-quality healthcare will be delivered virtually and without human contact [52]. Additionally, there are no regulations or formalities for online health care delivery [52]. These give users of e-health Technologies the impression that medicine lacks empathy, which makes them uncomfortable and discourages doctors from using technology as a consultant owing to the higher risk of misunderstanding [56].

2.3 Related studies

Research on the problems in adopting e-health in developing countries was undertaken in May 2019 [57]: The main objective of the study was to conduct a literature evaluation to learn more about the hurdles in implementing e-health in developing countries. The analysts used a descriptive literature review as their method of analysis. Utilizing inductive content analysis and the social control method theory, data analysis was done utilizing the cryptography framework. This study's main flaw was that it relied heavily on a literature review for its foundation, which meant that its conclusion was reliant on what was known at the time of the study's publication. Five primary factors anticipated performance, facilitating

environments, expected efforts, threat assessments, and social influence were the focus of this study. But there are other factors that influence the adoption of e-health that were not covered in the study, like technical and operational difficulties.

In 2017, a study was carried out that was a literature review on the challenges of adopting e-health in rural areas in poor countries: A case study of Ghana [58]. The major goal of this study was to investigate the difficulties in implementing e-health in developing nations, with Ghana as the case study. The researcher employed a descriptive literature study as the approach, and to examine the data gathered, she used an inductive analysis and a coding system based on the normalization process theory. Most implementation obstacles for e-health, including a lack of ICT infrastructure, ICT skills shortage, aversion to adopting ICT, security, a lack of a clear legal and legislative framework, and budgetary concerns, were covered in the study. The study's main weakness, which directly affects how e-health is implemented in Ghana, was that it failed to take into account the cultural aspects of the country's population.

The prospects and difficulties of Mhealth implementation in developing countries were reviewed by researchers in November 2019 [59]. In order to identify issues with Mhealth deployment in developing nations and suggest solutions, the study sought to identify difficulties and opportunities. As the approach for the study, the researcher carried out a qualitative and systematic review. A proposal for a solution to each of the difficulties was made after they had been recognized. This study's primary shortcoming was the lack of comparisons with Ghana's urban areas and its primary focus on Mhealth in rural areas. The study, however, pointed out the challenges in implementing Mhealth and offered a solution.

A study that was conducted in May 2019 and used a rural hospital in Pakistan as its case study to examine the anticipated difficulties in implementing E-health [60] was published. Examining implementation issues with e-health in hospitals in rural Pakistan was the study's primary goal. A qualitative technique was used by the researcher to gather data while using interviews and a literature study as the methodology. The investigator used their own conceptual table to analyze the information that was collected.

The fact that only eight people were chosen as a sample size was the study's major flaw. This sample size was insufficient to accurately reflect the opinions and attitudes of the entire populace. The required subjects were located at several hospitals, but the investigator was unable to reach them. The study's findings therefore point to some response imbalances. Furthermore, just five implementation-related papers were examined, which means that the conclusions may not be as accurate as they may be given that other research suggests there are many more barriers than just those five. The study's main strength was the way the researcher proposed that the various ministries in Pakistan cooperate and coordinate to find answers to the issues that were found.

A study on a strategy for telemedicine adoption in Sri Lanka was done in September 2016 [61]. The study looked at the elements that were bringing telemedicine to Sri Lanka's rural communities. Both quantitative and qualitative methodologies were used in the study's hybrid methodology. When telemedicine was implemented in Sri Lanka, an investigation was conducted to determine the effects of infrastructure, technology, and culture. This study's primary flaw was its omission of additional elements including organizational and environmental influences. The study's key strength was the utilization of the literature review

to ascertain what other researchers had previously done. The next step was fieldwork, during which information was obtained by conducting interviews.

A study was conducted to examine the patient's perspective on the factors influencing the adoption of e-health in developing countries [62]. By include privacy and trust in the technology acceptance model, the investigation's major objective was to determine factors that affected the adoption and use of e-health applications in Bangladesh from the viewpoints of patients. A structured questionnaire survey was used by the researchers as their approach. The study largely focused on perceived usability, perceived utility, trust, and privacy as factors influencing the adoption of e-health. This proved to be a flaw since the study excluded factors like infrastructure, culture, and skills, which affect how quickly technology is adopted. The study did, however, have some advantages. The poll included more than 350 participants from both private and governmental hospitals in Dhaka, making up a good sample group.

In the South African province of the Eastern Cape, ICT applications are being used as e-health solutions in rural healthcare. The study concentrated on the elements that were thought to hinder South Africa's province's usage of ICT as a successful e-health solution.

Tamblyn and others the creation and assessment of a primary care integrated electronic prescription and drug management system. Although the development and use of integrated electronic prescribing systems was the primary goal of the study, patients with more complex fragmented care were more frequently using the systems.

The Influence of Buyer Mixes on Electronic Health Record Adoption by Physicians by Nir Menachemi et al. This study looked at the relationship that currently exists between buyer mix and EHR adoption.

An investigation was conducted to look at the elements that affect the adoption of e-health in developing nations, with a primary focus on the patient's viewpoint. The study had ramifications for both theory and practice in the field of e-health in a developing nation. In that study, TAM was utilized as the model, and it was expanded by adding more variables. The results of the study showed that if the interface was friendly to use, it was also gender sensitive. [63]. Contrary to prior studies, this study revealed that there was no significant correlation between privacy acceptance and electronic health records.

2.4 Review of Objectives Based on Literature

2.4.1 To establish factors that determines e-health implementation and the status in Kenya.

Nigeria was used as the case study in a study to ascertain the variables influencing the adoption of e-health technology in underdeveloped nations [180]. The study's findings showed that acceptance and implementation were at a low level, and for those health service providers who were employing systems, application was typically in the pilot stages and wasn't properly coordinated. Lack of technology infrastructures and a lack of inclusive national policies and plans were identified as the main issues. Additionally, the healthcare industry specialists were not fully leveraging the technologies [57] [58].

Additionally, it was discovered that the healthcare professional's ICT literacy was related to and had an impact on their readiness to employ e-health technology [59]. The employees of

healthcare organizations that were fully conversant in ICT were upbeat about the new e-health technology. The challenges affecting adoption and its deployment were divided into six categories based on the findings of the research conducted in Nigeria and other developing nations, as well as other published collected works. These categories were as follows: [60] one ICT infrastructure, which includes hardware, software, and networking. Using ICT tools and its application are two ICT knowledge and experience related topics. Funding and three financial arrangements. The attitudes, willingness, and belief of healthcare professionals in implementing e-health technology were four human resource challenges. The first five administrative security barriers had a connection to management rules, but the remaining six security ones dealt with privacy and trust in the use of e-health technology [61].

Some research' conclusions indicate that healthcare in underdeveloped countries is not adequately funded. For instance, Nigeria's budget was only 4.4% in 2016 and 4.1% in 2017. This was not in line with the World Health Organization's recommendation that healthcare consume at least 13% of the national budget. Low funding had an impact on strategy developers, which in turn had an impact on the nation's overall productivity [62]. [63].

The political, social, and technological difficulties in Kenya, e-health is now in its infancy. It is quite expensive to purchase e-health systems. Users of those systems in Kenya have little experience with ICT, and there are issues with the interoperability of e-health systems there. There is no prospect of patient confidentiality or privacy violations in Kenya, nor is there a robust regulatory structure [64]. Kenya, Nigeria, Bangladesh, Tanzania, and other countries are a few instances of developing countries. They also see the adoption of e-health

technology as a driver to accelerate information dissemination and increase access to health [65]. are using ICT to address concerns with access, value, and cost of healthcare.

2.4.2 Global state of e-health

There is no standardized method for implementing e-health systems, the condition of e-health globally is not the same. In affluent nations like Sweden, Australia, and the Netherlands, primary care general practitioners use electronic health records (EHR) at rates of 90 percent, 55 percent, and 62 percent, respectively [75]. At least 50% of the e-health Technology providers in the three developed nations use EHR. Only 1.2% of hospitals in other wealthy nations, such as Japan, have implemented EHR, though [75]. Despite stable economies and significant technology dissemination, the adoption and implementation of e-health seem to be substantially lowered in industrialized countries like the USA, Japan, and others. According to a national survey on electronic health records conducted by the National Center in the US, different states have different rates of EHR usage, with New Jersey having a usage rate of 54% and Massachusetts having a usage rate of 89%. Therefore, other criteria, such as technical support, expertise using ICT, and those that cannot be generalized but need to be contextualized, such as accessibility of technology, were more important in determining the adoption and implementation of e-health than accessibility of technology itself. This conclusion was drawn from the international state of e-health. This analysis was conducted to identify factors in various contexts.

2.4.3 Strategies that enhance e-health implementation.

The health ministry establishes general guidelines while self-governing agencies oversee facts in industrialized nations like Australia, Germany, Korea, and others, leading to

tremendously advanced infrastructure. Before any new knowledge was authorized for use in any practical settings, they considered a number of factors, such as: familiarity with the new technology; rules for the new technology; systematic and inclusive adaptation of the new technology; and ensuring that the recommendations were appropriate for a particular locale. [64]. Most wealthy nations employ toolkits. For instance, they follow best practice guidelines, which provide a method for a methodical, well-thought-out implementation [76]. They have data in their toolbox to support the claim that when the following conditions are met, there is a higher chance of successfully adopting e-health: all leaders at all levels are dedicated to facilitating guideline implementation. Through planned procedures including all pertinent parties, such guidelines are chosen for implementation. The technology is adapted to the local environment and the environment's preparedness for adoption is evaluated. Any impediments are evaluated and handled if there are any. They incorporate an evaluation of the effects of those recommendations into the process, and they supply the necessary resources in a sufficient amount.

Additionally, industrialized nations provide yearly capacity development on a variety of best practice guidelines (BPG) and how to put them into reality. [77] [78] [79].

The most important problems identified from a survey of the literature on e-health adoption and implementation fall into the following categories: ICT proficiency and e-health infrastructures, policies and legislation.

2.4.4 Existing models in e-health

Although there are several e-health theories in use, in this study we were primarily interested in the ones that concern implementation and acceptance. The most well-known theories

include the technology acceptance model (TAM) [80], the unified theory of acceptance and use of technology (UTAUT) [50], the theory of planned behavior [82], and others.

Although ICT is widely used in e-health, it has been argued that the field requires a fresh, complex model that can be customized to meet the needs of both service providers and users [83]. Other research indicates that one of the reasons e-health was not widely used and adopted was worried about the security of personal data against unwanted access.

2.4.5 Develop an enhanced model for e-health information system.

Researchers have used a variety of models, including TAM, TAM2, TAM3, and UTAUT. Upon reviewing the various adoption models used in this investigation. Extension of the unified theory of technology acceptance and use is necessary for e-health Technologies to handle security-related challenges. For instance, TAM2, which was established by Venkatesh and Davis as an extension of TAM, had significant explanatory constraints. To address perceived ease of use and usage intention, TAM3 was developed [84] while maintaining the TAM limitation in place and adding additional key determinants.

2.5 Models and Theoretical Frameworks

This section is a description of the models and theoretical frameworks that the researcher used to support or frame the investigation. The researcher went over the concepts that were used in this section's investigation. The researcher proposed a model for the implementation of e-health Technologies based on the studied theories and established assumptions to be tested by the model that was proposed.

2.5.1 Technology-organization-environment framework (TOE)

Process innovation, radical innovation, and incremental innovation are three different types of innovation. Product innovation is used when dealing with the creation, distribution, and marketing of new consumer goods and services. According to Poutama et al., [85], however, the adoption of e-health will fall under this category of process innovation if they are working to enhance the production process by introducing new methods, using novel mechanisms, and putting into place production systems that change customary operations and distributions that handle data processing and services.

It is more comprehensive, the TOE framework is better able to explain an organization's adoption of a new technology because it includes an environmental setting that is not included in the diffusion of innovation (DOI) theory. According to Oliveira and Martins [86], the framework has a better theoretical foundation and the ability to be used to e-health adoption. It was created in 1990 by Tornatzky and Fleischer and highlighted three elements that affected how technology advances were adopted and used within organizations. Technology was the initial factor, and both internal and foreign technologies were involved.

The first two were organizational, which entails characterizing the organization's size and scope, the complexity of its management, its quality, its activities and the availability of technology, as well as its financial resources. The last set of determinants was the environment, which, according to Tornayzky and Fleischer [87], includes the company, the sector and interactions with other companies and the government.

External pressure or organizational readiness in terms of financial capability, the instruction at hand and the perceived benefits are regular empirically supported variables of e-health adoption, according to Lacovou et al. [88], Chau and TAM 1997, and Zhu et al. [89]. The TOE framework's elements were identified as follows:

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Table 2.1: Elements of TOE

Technological	
1. Comparative advantage	Point to which an innovation appears better than the idea it replaces
2. Compatibility	Innovation that is consistent with existing values, past experiences and adopts needs.
3. Complexity	Point to which innovation appears as relatively difficult to understand and use.
Organizational	
1. Top management support	Support of management (CEO) on E-health Technology
2. Organizational readiness (size) cost/financial and technical resources)	Comparing different level of hospital on innovation adaption, financial constraints, and lack of professional expertise.
3. Information intensity	Information is present for the product or service of E-health Technology
4. Managerial time	Time required to plan and implement the new E-health
Environmental	
1. Competition	Competitions and rivalry increase innovations
2. Administration support	Strategies by administration to encourage the health services to adopt E-health.
3. User readiness	Lack of user readiness Influences the adoption process and is an inhibitor towards e-health use.

To comprehend the acceptance and deployment of various information systems, for instance, some studies have employed the TOE framework. E-commerce Martins and Oliveira 2009 ERP, Liu 2008 2008's Pan and Jang's E-Business 2003 Zhu et al.

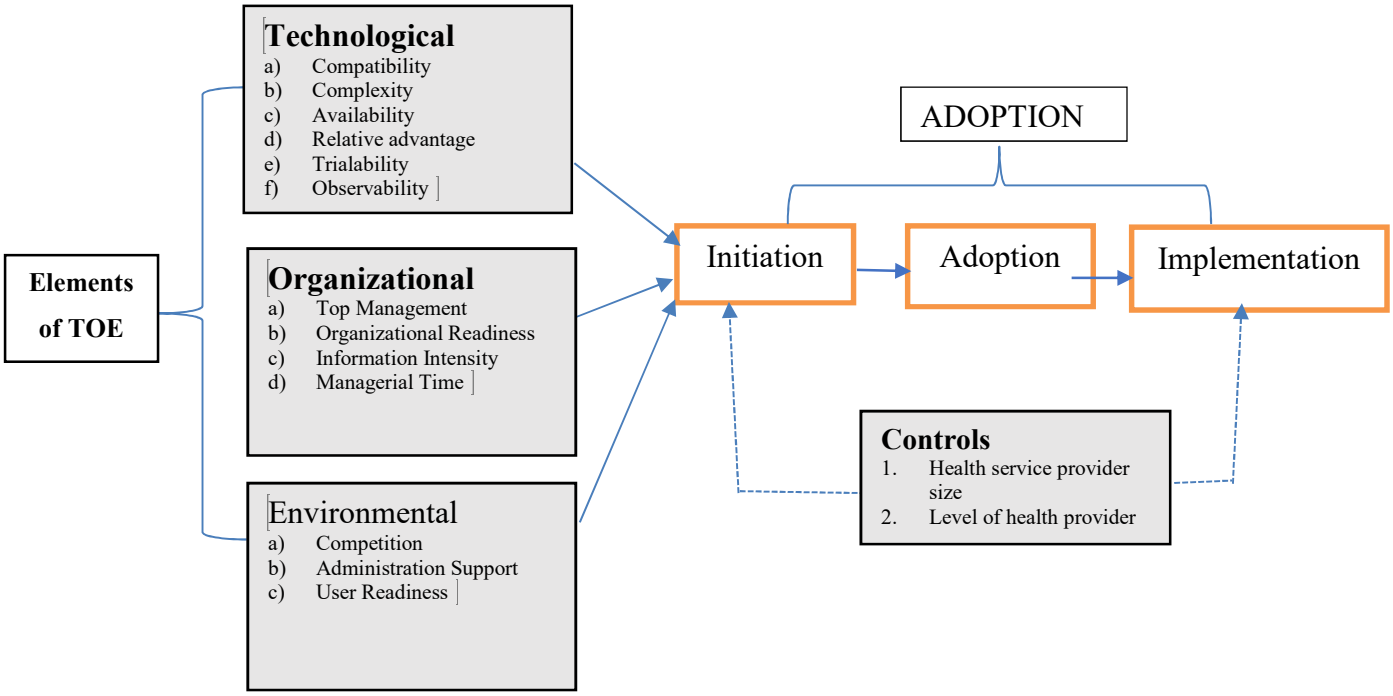


Figure 2.1: TOE Framework and Innovation diffusion

2.5.2 Normalization process theory

e-health technology installation is currently plagued by issues [90]. The normalization process theory (NPT) discusses the components necessary for new technology (e-health) to be implemented and integrated into ordinary work in a normalized way.

The normalization process idea categorizes factors that support and hinder the incorporation of novel technologies, such as e-health, into routine practice [91]. The idea explains how e-health technology works, from its first adoption to the point at which it is so ingrained or entrenched in routine practice, notably when it becomes normalized [92]. Being an action

theory, NPT is interested in defining what people do. That is socially organized work or implementation; repeatedly carrying out certain chores that are ingrained and maintain long-standing social norms [93]. The hypothesis was created using the normalization process model to take into account how players rationalize their actions [93]. The four basic constructs of NPT each denote a social action reproduction mechanism. Each construct describes various types of work that individuals carry out in relation to a set of practices, such as e-health technology [94]. Coherence, cognitive participation, communal action, and reflexive monitoring are NPT components that explain people's actions rather than their attitudes or beliefs.

2.5.2.1 Coherence

It tries to ascertain whether the innovation of e-health technology makes sense to those engaged in the implementation work, either individually or collectively, when faced with the challenge of operationalizing some established procedures [94]. It is then broken into four sub-components that examine various implementation components in further detail. The following are some examples of coherent's constituent elements: **Second**, it has a community specification; how well people collaborate to create a shared understanding of the objectives, goals, and anticipated rewards of the new technology will determine how well this is done (e-health). An example of a group of researchers working to incorporate an e-health system into a healthcare system is (adopting and implementing). Three, it has **individual specification**, meaning that each contributor makes an effort to comprehend their particular duties and responsibilities in relation to a certain set of practices. For instance, doctors utilizing the new e-health technology must have a thorough awareness of the effort necessary

to obtain informed consent from other stakeholders, such as patients [94]. Fourth is **internalization**- is the sense of making that involves employees who are aware of the benefits, importance, and worth of e-health technology. [94]. Coherence has been employed in several research as a key to implementing, embedding, and integrating technology into routine practice [95]. [96]

2.5.2.2 Cognitive participation

It looks to see if the stakeholders are on board with carrying out the work. Building and maintaining a community of practice around a technology like e-health requires interpersonal work [94]. It has four components, just like coherence: one is **initiation;** the main issue is whether or not important contributors are trying to advance a collection of newly developed or reformed activities (like e-health). For instance, setting up and integrating E-health Technologies requires the effort of a small group of managers and professionals who are responsible for creating the framework, policies, procedures, norms, and protocols before enlisting the help of others to carry out the necessary tasks [94].

Enrolment-contributors may need to band together with others to contribute to the labor required by the new system, such as e-health. The third step is legitimation, which involves convincing contributors that their participation is appropriate and that they can contribute useful ideas to the technology (e-health) [94]. Fourth is **activation—** Once it has begun, the participants must decide as a group what steps must be taken to survive and continue to be involved [94].

2.5.2.3 Collective action

It tries to describe the tasks that must be completed for implementation to occur. It is the administrative effort done by individuals to implement E-health technology. It has four components, just as the other structures. The original NPT construct was this one [94]. The initial components are **interactional workability;** when people try to operationalize a set of services in regular contexts, they engage in interactional work with other people, objects, and other set elements. Two, the **relational integration,** it illustrates how members work to establish responsibility and maintain faith in a set of guidelines [94]. Three, the term **"skill set workability**" refers to the division of labor that is established around a group of tasks as they are operationalized in real-world contexts and the work allocation that underpins it. Last but not least, collective action, is **contextual integration,** it describes resource work in which services are managed by allocating various types of resources and putting rules, plans, and processes into practice [94]. The adoption of new services through technology, like e-health, is typically viewed as a management issue.

2.5.2.4 Reflective monitoring

It aims to learn how those concerned evaluate implementation work. People must do assessments to determine how new technological developments, such as e-health, will affect them and those around them [94]. It has four components, just as other structures. i.e., **Systematization:** Participants must gather data in a number of ways in order to assess its effectiveness and use for both them and other people [94]. **Communal appraisal -** where people work together to evaluate the worth of a technology, in this case e-health, informally or formally [94]. **Individual appraisal:** People evaluate how it will affect them. Finally is

reconfiguration, which may result in modifying methods, redefining procedures, or even altering the group of new technologies as a whole [94].

The NPT theory is quite adaptable. It was modified by the researchers for this investigation because it might make them aware of crucial aspects of carrying out this study. It is possible to identify the constraints on researchers and challenges to effective implementation using each NPT component [97]. There are fewer odds for successful implementation when there is low coherence, low cognitive participation, group action, or reflective monitoring [97]. For instance, implementation will suffer if e-health technology does not make much sense to healthcare providers and other stakeholders, and if it does not offer anything novel that stands out as being low coherence [97].

Figure 2.2 below depicts the four concepts that are affected by a confluence of processes and social agreements, as well as the organizational factors and social arrangements at play. As a result, the social and organizational context explains elements that facilitate or impair individuals' and groups' efforts to put innovations into reality on a daily basis. It has been noticed from the literature evaluation of numerous investigations that NPT supports the conceptual knowledge of implementation procedures and outcomes across a wide spectrum of health care backgrounds. NPT has strong validity in establishing and evaluating innovation implementation techniques, as shown by [98] from the study. [99].

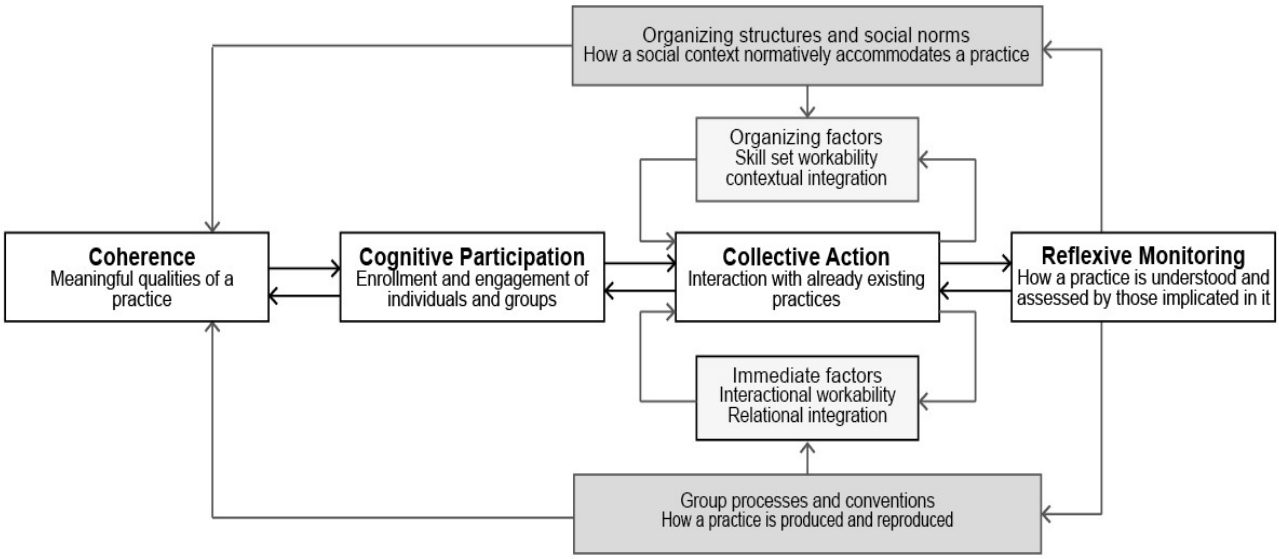


Figure 2.2: Conceptual Visualization Model of Normalization Process Theory (NPT)

2.5.3 Actor-network theory (ANT)

The actor network theory places a strong emphasis on all outside factors in scenarios where no one player acts alone. The focus on non-living things and their impacts on social processes is one of ANT's primary pillars. Actors include all entities with a source of action, whether they are human or non-human, including organizations, professionals, and technological advancements [100] [101]. An actor can only perform alongside other people [102]. ANT dispels the notion that technology has an impact on people as an outside force. Instead, it is believed to have developed from social interest, similar to professional or financial interest, and to have the power to influence social interaction [103].

Associations between network participants or interactions between actors are the main activity in ANT. The world of today is made up of networks, which encompass social, technological, philosophical, and human beings. These entities are all referred to as actors in the network [104].

The basic goal of ANT is to investigate and theorize the formation of networks. Because there are many components, this research was predicated on how the many pieces of a network combine to produce the entire network. For instance, technological, organizational, environmental, and social elements with several subcomponents and various linkages that exist between them stabilize them [106].

The performance of the entire system will be impacted, for instance, if an actor, regardless of status, is removed from or added to the network, as would happen, for instance, with the adoption of e-health technology in a setting like a county hospital [107]. Intermediaries and mediators help actors connect with one another. Depending on the input, intermediaries' output will vary. That is to say, results are not always what were anticipated to be produced. The mediator in this situation is the one who converts the input into the unexpected result [108]. For instance, additional factors like environmental or sociological factors can affect how the implementation of e-health technology in an organization affects the services provided. The social environment, according to ANT, is made up of a variety of mediators that have an influence on erratic social outcomes. This study was based on this, as well.

2.5.4 The ANT approach to E-health adoption and implementation

ANT encourages understanding how various certainties are viewed and sanctioned by different players in order to present a more futuristic image of the self-motivated linkages between different actors without abandoning their interrelatedness. This is significant when taking into account the dynamic nature of the healthcare industry, as well as administration-driven innovation [110]. ANT is a useful tool for analyzing how IT adoption and health care reform are changing [106]. For instance, Lowe cited ANT, a group looking into reforms to

New Zealand's health policies, and asserted that it was a network inside of a wider network of political and other groups. As a result, the government registered the managers and provided them with the tools they needed to implement the suggested reforms. The managers in turn hired different groups and made different infrastructure or equipment purchases in order to reorganize the current network in accordance with the new government policies focusing on quantification, which were developed in response to government worries about the inefficiency in the health service as a result of some changes in the health sector where nurses are now more powerful than doctors [111].

Hospitals and end users must be involved in the implementation and usage of EHR when it is purchased by the government from a select group of commercial suppliers. The national strategy has undergone some changes because of the government's structure and the budget cuts, and the network's power dynamics have changed, moving away from top-down implementation strategies led by the government and toward increased input from regional hospitals and users in New Zealand [112]. This is an excellent example of how the deployment of new technology, such as e-health, causes power to move in a network.

Therefore, it's crucial to analyze and record network changes because doing so can improve future adoption and deployment of new technology by indicating what needs to be focused on and the long-term effects it will have. For instance, while implementing new technology, some issues could be transient and disappear as usage rises.

2.5.5 Social learning/ social cognitive theory (SCT)

The social learning theory (SLT), first put forth by Albert Bandura in the 1960s, eventually gave rise to the social cognitive theory (SCT). People learn about new technologies through observing others use them, according to the SCT learning theory. It may be important to one's personality to embrace technology. However, social psychologists concur that a person's upbringing affects their actions and, consequently, their ability to think. People learn how to use new technologies by emulating others and making use of the environmental, behavioral, and cognitive aspects that have an impact on growth in triadic relationships. Every event one witnesses has the power to alter their behavior (cognition). Consequently, one's birth environment may also affect later conduct [113].

According to general philosophies of social learning, learning can happen without changing behavior [105]. Although the most frequent indicator of adoption is a change in behavior, this is not a requirement. Social learning theorists are persuaded that people's adoption of technology may not be evident in their performance because they can do so simply by observing others using it. They go on to say that because of our interdependence, psychological behavior of individuals or groups can be directly influenced [115].

2.5.5.1 Theoretical foundation

SCT is presented from an agentic perspective, which contends that people are proactive, self-developing, self-regulating, and reflective rather than being influenced by their environment [116]. Individual, proxy, and collective agency modes [117]: Individual agency involves having an impact on the environment; proxy agency entails using another person's efforts to

protect individuals' interests; and collective agency involves a collection of individuals cooperating to achieve a common goal.

The ability of humans has developed over time, and they currently possess characteristics of highly developed neurological systems that allow people to learn knowledge and abilities through both direct and indirect usage of symbols [113]. We are capable of symbolic expression, self-control, self-reflection, and vicarious experience. One of the characteristics of humans is the ability to adopt knowledge and abilities via information exchange through a variety of mediums. People can learn about their own behaviors by simply observing. The capacity for cognitive development that humans currently possess is this one. The majority of people's information demands are met by the mass media rather than through trial-and-error methods.

The process of acquiring information in SCT is closely tied to the observation of models. Either interpersonal imitations or media sources serve as the models. Real modeling gives a variety of guidelines and tactics for handling various situations [80]. People need to be aware of the possible results before adopting a certain technology, such as E-health. They predict comparable results when implementing the technology but do not anticipate the actual rewards or penalties suffered by the model. Modeling thus affects cognition and behavior. The environment in which one was raised has a significant impact on this expectation. For instance, the predicted outcomes of the implementation of E-health in the USA included the disclosure of data to thirty parties, which might not be relevant in the Kenyan context.

Self-efficacy is the degree of confidence in one's capacity to carry out an action successfully. Even though later theories, including the Theory of Planned Behavior, included this

component, self-efficacy is unique to SCT. One's unique qualities and other personal factors, as well as environmental circumstances, have an impact on self-efficacy (barriers and facilitators). The extent to which a person believes they can master a specific skill is known as self-efficacy. Operates on action through intervening processes that are affective, cognitive, and motivational [119]. Low self-efficacy can cause a person to lack confidence and believe they are incapable of performing successfully, which makes them avoid difficult jobs. Most of the time, this occurs in developing world. Self-efficacy is therefore crucial for behavior performance. Participants are more likely to accept and use new E-health technology if they have a high level of self-efficacy.

Self-efficacy can be enhanced through gaining experience, which can assist one in completing straightforward tasks, and by engaging in social modeling, which can offer a recognizable representation of the methods used to attain goals. Additionally, by enhancing one's physical and emotional well-being and by verbally persuading someone to finish a task, one can increase one's sense of self-efficacy [120].

SCT has been used in real-world contexts to explain classroom motivation, learning, and accomplishment as well as other facets of human function, like job choice and organizational adoption of new technology [121].

2.5.5.2 Relevance of SCT

The theory suggests that learning occurs in a social context with dynamic and reciprocal connections between the person, environment, and behavior, SCT is a very relevant theory for this research. Due to its emphasis on learning, which takes place in a social setting, SCT

was pertinent to our study. It considers teaching others, learning via observations, and modeling.

2.5.6 Theory of Diffusion of Innovation (DOI)

The diffusion of technology, according to Rogers [122], is the process by which technology is introduced to various social systems utilizing a variety of media. According to the hypothesis, humans must go through various stages before they can either adopt or reject new technologies. This list includes knowledge (information, facts, or awareness), persuasion (persuasion, instigation, or conversion), judgment (decision, conclusion, or evaluation), application (operation, execution, or effecting), and endorsement (validation, authorization, or approval). The five stages identified in this study are essential for influencing people to either accept or reject technology. In the persuasive phase, for instance, variables including complexity, compatibility, observability, trialability, and proportional advantages were considered. This study examined the impact of each of these persuasion phase characteristics on the adoption of electronic health records.

The impact of challenges with persuasion on the adoption of technology has been the subject of numerous studies. Compatibility was discovered to be a crucial issue that could predict end-user technology acceptance or resistance, according to Zhang et al's research [123]. Culture and prior product experience may influence end users' comfort level with innovation [124]. They also asserted that innovation would be eagerly welcomed if it were claimed to be well-matched with experience, ideologies, and level of living. According to Dunphy and Teo compatibility is alleged to be positively correlated with diffusion rate and negatively correlated with end-user resistance [125], [126].

According to Cooper and Tan [127] [126], numerous research has demonstrated that difficult innovations require more skill and labor to increase adoption and reduce the likelihood of end user resistance. According to Lehmann and Holak's qualitative study [124], it is thought that less complex innovations are more readily embraced by end users. Hu, Chau Sheng, and Tam, however, assert that medical professionals are typically competent to pick up and use new technologies. Therefore, technology's complexity cannot stop its adoption [128].

It is frequently asserted that an invention's relative benefit is favorably correlated with the rate of acceptance of the innovation and negatively correlated with end user resistance [122]. According to Putzer and Park, observability may have an impact on how quickly new technologies are adopted. They contend that an innovation is more likely to be embraced if end users get the chance to see it in action [129].

2.5.7 Theory of Cooperate Sustainability

According to the theory of Cooperate Sustainability, all groups of stakeholders using a deployed technology, and not only the companies' shareholders, should gain more from the existence of companies. According to Freeman and Reed [175], stakeholders are social groups without whose support technological use and organization, or company would cease to exist. According to this theory, every stakeholder to benefit from a technology has the right to have access to any information that is related to proper usage of technology and social issues [176]. According to the recent literature, many companies do not clearly examine the social and environmental disclosure in a complete way [177]. Aside from the above theory, the legitimacy theory could equally be used for the analysis of the social dimension of technology sustainability use. According to this theory, the users of a system

must ensure that their system operates in such way that there is alignment with the societal needs in order to gain the title of legitimate. Moreover, companies are part of a broader system and do not have the sole right to resources [178]. So, companies must prove and earn the right to use them, in a legitimate way. Sustainability has become a critical perspective in managing firms via a holistic approach by considering economic, environmental, and social dimensions of firms. This theory comes in handy regarding the sustainable use of e-health in developing countries, otherwise systems will be used over a short duration of time and then ceases to exist. Three pillars of sustainability are enhanced by this theory:

2.5.7.1 Economic sustainability of e-health technology

Economic factors are one of the key factors in the long-term sustainability of e-health implementation [34]. Research studies report the economic attractiveness of e-health interventions to wider groups of stakeholders [35]. Yet there have been few economic evaluation research studies in developing countries [35]. In developing countries, where there is a scarcity of resources, the economic factor plays a significant role in the long-term sustainability of e-health. Short-term grants from donor agencies to developing countries need to consider not only the initial investment, but also ongoing maintenance costs to sustain the e-health system [34]. Costs associated with the initial investment, change management, human resources, training, and maintenance are direct costs of an e-health intervention [32].

2.5.7.2 Social sustainability of e-health technology

'Social subsystem' refers to the relationship between people within and across organizations [36]. The e-health system can show long-term sustainability if the end-users within the

organization accept the technology. The individuals' feelings about the usefulness of the system, their motivation, the user's problem-solving skills, competence, and confidence to use the system are factors that have a direct influence on the process and performance of an e-health system [24]. The end-users' skill in using electronic systems is lower in developing countries than in developed countries. So sustainable e-health needs to consider the end-users' attitudes to accepting the technology to ensure social sustainability.

2.5.7.3 Organizational sustainability of e-health technology

It is not logical to exclude organizational sustainability in the process of sustainable e-health implementation, because an e-health system is implemented and used within an organization. The organizational sustainability of e-health is influenced by factors such as organizational structure, procedures, culture, rules, values and practices, resources, management support, supervision, and leadership. Organizational determinants affect the success of e-health technologies directly or indirectly [24]. The shortage of resources, poor ICT infrastructure, and an unreliable electricity supply deter the long-term sustainability of e-health systems in developing countries.

In summary, the technological, social, organizational, and economic factors of e-health implementation are well-covered in many separate research studies. However, the complexity that arises from the interplay among the technological factor with social, organizational, and economic factors of e-health implementation in healthcare settings requires further research. The nonlinear nature of e-health implementation can be understood through the study of the socio-technical, techno-organizational, and techno-economic factors of e-health implementation.

2.5.8 Summary on models and theories

Actor Network Theory, Diffusion of Innovation Theory, Normalization Process Theory (NPT), and Technology Organization Environmental Framework were the models and theories used in the study. The three theories were evaluated along with a framework in this study, and the theories filled up any holes that the study had. This study's goal was to assess the overall idea behind the theories and models about the adoption and use of E-health that had been identified. The conceptual framework for the study was created from there, as indicated in figure 2.4.

Table 2.2 summarizes key concepts and how they relate to the organization, and Table 2.3 summarizes theories or frameworks and their limitations.

Table 2.2: Summary of organization background its variables and theories or frameworks affecting adoption and implementation of the innovation

CONTEXTS	VARIABLES	THEORIES OR FRAMEWORKS
Social	Cyber security User acceptance User readiness Computer efficacy	NPT ANT
Organizationa l	Top management support readiness Cost/financial Human resources Size/structure Culture	NPT TOE framework ANT
Technology	Compatibility Complexity Availability Relative advantage Trialability Observability	NPT TOE framework ANT
Environment	Competition Administration pressure Government support	TOE

	External support Business partner	

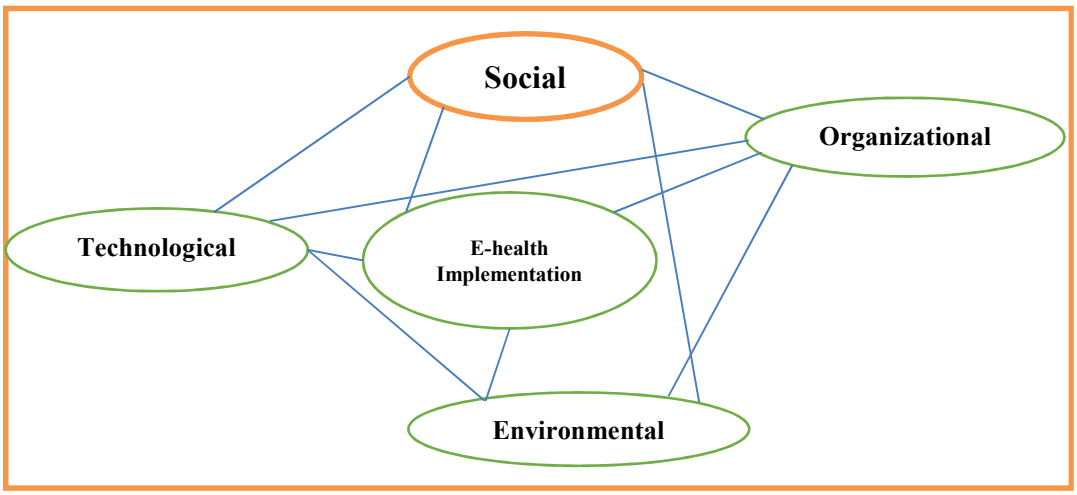
Table 2.3: Summary of theories/frameworks and their limitations

Theories/frameworks	**Author**	**Components**	**Concepts/ Components**	**Limitations**
Normalization process theory (NPT)	May et al, 2006	coherence; cognitive participation; collective action; and reflexive monitoring	Used to understand the dynamics of implementing, embedding, and integrating some new technology or complex intervention.	No environmental factors
Actor network theory (ANT)	Bruno Latour, Michel Callon and John Law, 1980	Actors, objects, and Actor-Networks	Everything in the social and natural worlds exists in constantly shifting networks of relationships. It posits that nothing exists	Vague boundaries, Equality of all actors (Power struggle within network)

			outside those relationships	
Technology organization and environmental framework (TOE)	Tornatzky & Fleischer 1990	Technology, organization, and environment	It describes fact ors that influence technology adoption and its likelihood.	No social factors
Diffusion of innovation theory	Everett Rogers 1962	Innovation, Communicati on, time, social system	It explains how, over time, an idea or product gains momentum and diffuses (or spreads) through a specific population or social system	Context dependent rather than predictive. Social support not taken care of
Social Cognitive Theory (SCT)	Albert Bandura 1960s	People Behavior Environment	Emphasizes the dynamic interaction between people (personal factors), their behavior, and their environments	Loosely Structured, disregarding the biological and hormonal predispositions , Neglect of Maturation and Lifespan Behavior Changes

2.5.9 Theoretical framework that informs the study

The many theoretical aspects that connect the several study-relevant elements are depicted in Figure 2.3 below. This is based on the Actor-Network Theory (ANT) components [100][101].



Source: author

Figure 2.3: The Theoretical Framework that informs the Study

2.6 Conceptual Framework

The conceptual framework outlines the process through which participation in the research is anticipated to result in the intended results and offers the investigator particulars to evaluate. The primary subjects to be investigated, which comprise important elements, ideas, and variables, may be represented graphically or simply by written artifacts.

The study was guided by the conceptual framework shown in Figure 2.4, which also served as the basis for the model that was developed at the study's conclusion. The framework is deemed acceptable for this research because it gave health professionals a clear standard for understanding essential measurements in an environment that helped them successfully embrace E-health in a variety of settings. Macro, meso, micro, and social learning are the four essential units of measurement [63]. The independent variable was the factor that was

manipulated to observe its effects. At the macro level study had the organizational factors like: top management, readiness of the organization, financial of the organization, technical resources and information density. This macro factors openly affects the extent to which contextual factors at the meso level affect the e-health implementation.

There are appropriate factors at meso level like, technology which include: compatibility, complexity, relative advantage, trial-ability and observability, which directly affect the implementation of e-health solutions at the micro level. The third level was micro which was environmental factors such as competition, administration, and support from government. Lastly the social learning which combined user acceptance, user readiness and collaboration between stakeholders. All these factors affect e-health implementation. Improved e-health implementation was the dependent variables in the study with factors like efficiency, effectiveness and timeliness. Assuming that the health care industry is complex, the researcher looked for a means to help explain the complexity interaction between the various interested parties and issues that are crucial to the implementation of E-health. The conceptual framework diagram in figure 2.4, which depicts the essential elements driving e-health adoption and their interrelationships, theorizes this. The framework and the way its ideas interact are utilized to direct and develop the study's remaining hypotheses. Models and theories with constructs relevant to these elements were employed to support the investigation based on this.Therefore, throughout the remainder of the study, the framework and the integration of its concepts were utilized. This served as the foundation for the study, which was supported by theories and a framework with constructs connected to these elements. The researcher then developed on this framework to create an integrated model for long-term adoption of e-health.

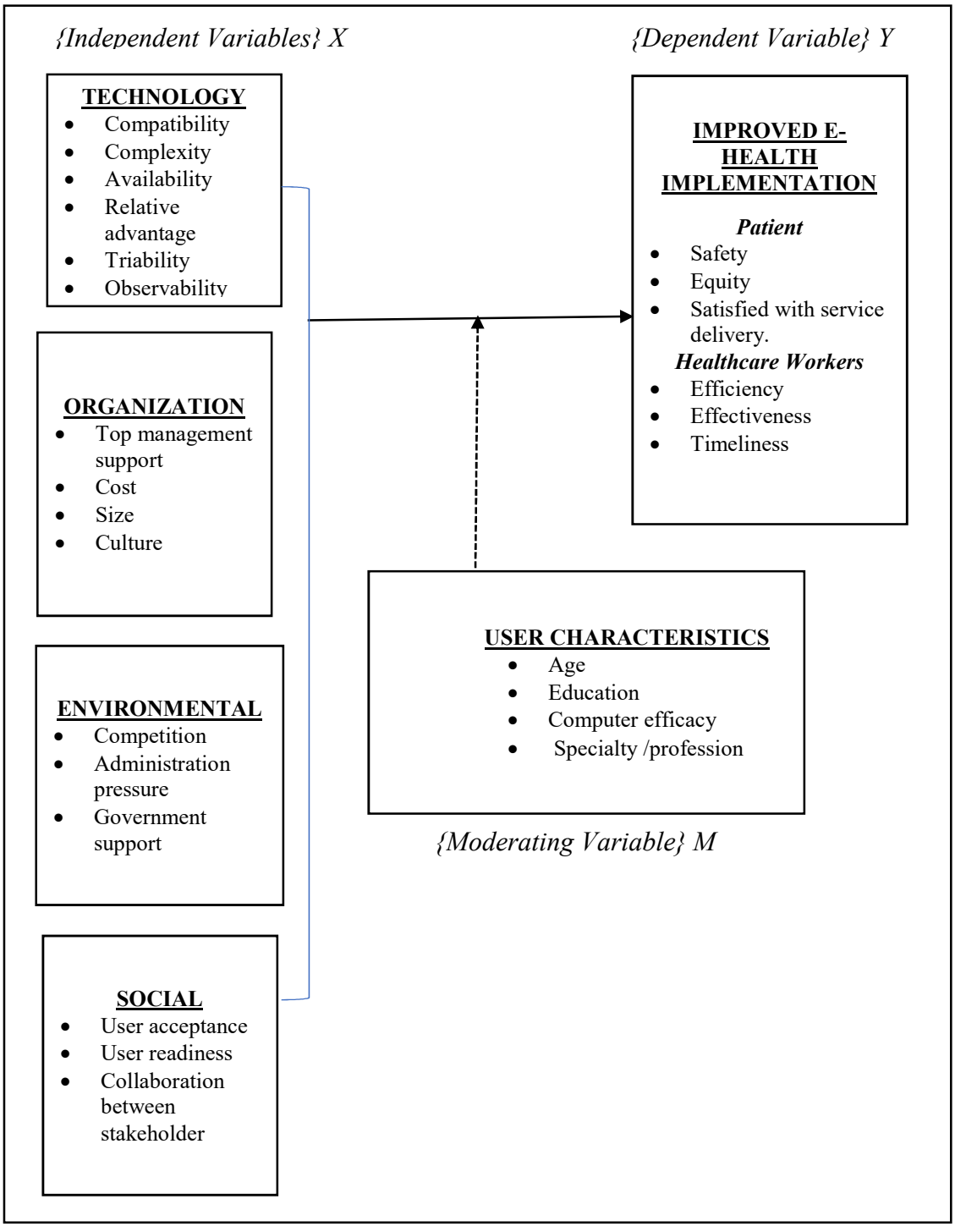


Figure 2.4: A Conceptual Framework for the study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides an overview of the research's general methodology. It addressed the research design, the paradigm and philosophies of the research, the approach, tactics, time frame of research, research methodology, target population, sampling, and study site, data collection reliability and validity, and ethical concerns.

3.2 Research Philosophy

Research philosophy is considered an idea about the collection, interpretation and analysis of data collected [180]. It forms the first layer of the research basis which is the most critical layer. Hence, the study adopted this layer to replicate vital norms, belief and opinions as the researcher understood the world; as per Simpson allegation which seeks to account for existing experience [181], this layer therefore, influenced the researcher's strategy in relation to the research method adopted for the study.

A number of philosophies are in this layer of the research onion as they relate to epistemology, ontology, and axiology. Authors have had varied belief on this; some broadly classifying the philosophies as positivism and post-positivism. However others have classified this philosophy layer into different philosophies; the most important being positivism, realism, interpretivism, and pragmatism that influence the way in which the researcher thinks about the research process.

This study adopted both positivist and pragmatist views. Pragmatist seeks to account for lived experience [183]. Pragmatism is concerned more with certain relationships among

things and phenomena, specifically between antecedents and consequences [184]. As a result, pragmatism presented a suitable framework within which to understand both the quantitative and qualitative part of the study. Though positivism emphasizes hypothesis, it also accounts for quantitative studies and hence generalizability which for that reason made it an acceptable philosophy for the study.

3.3 Research Design

It's proclaimed that research design provides direction for collecting and analyzing data in a given study [175]. Research design is regarded as deriving its significance from its role as a critical line between the theories and arguments that informs the research and the empirical data collected [176]. A research study design can be of three type's i.e. Explanatory or Exploratory or descriptive type [177]. They vary based on type or on purpose of the research or on the stage of the research process. The objective of this study was to determine the status of e-health implementation in Kenya, the factors that affects the implementation and develop model for e-health implementation. In the study, a theoretical framework that describes technological, environmental, organizational and socio-technical relational issues was developed and applied. Throughout the development stage of the study, exploratory techniques were used. The study used mixed methodology, which followed the following path [178]: exploratory design; philosophical assumptions; initiated from positivism for the quantitative stage, then change to constructivism for the qualitative stage. As a result, this investigation was characterized by exploratory, descriptive and explanatory designs; incorporating all the components of a mixed study and its philosophical expectations of positivism, constructivism and pragmatism.

Figure 3.1 below represent research process as an onion with several layers and methodologies [180]; which must be applied correctly when conducting research. The author state that when applying the research onion, each layer must consistently be taken into consideration before data collection and data analysis, at the center of onion is addressed which also is core to the research process. Figure 3.1 illustrates the contents of the onion layers which is the focus for discussion in the next subsection from the outer layer to the center: philosophies, approaches, strategies, choice, time horizons, and techniques and procedures as they informed the study.

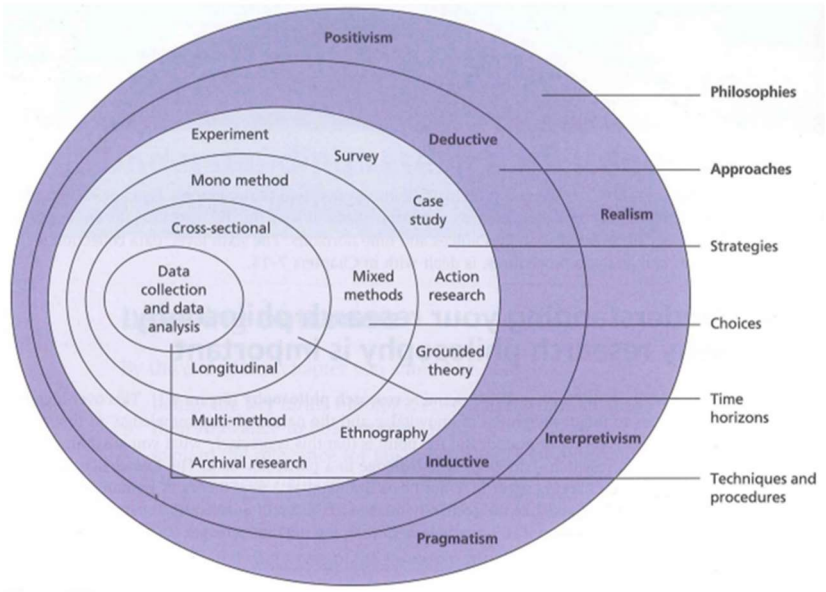


Figure 3.1 Research Onion: (Source- Saunders et al, 2009)

3.4 Research Approach

This is the second layer of the research onion [179]. The layer has two approach the deductive and inductive approaches. The inductive approach focuses on using the literature to identify theories and philosophies that the researcher used to test data. Whereas, the

deductive approach involves collecting data and developing a theory based on the results of data analysis [179]. However, given the mixed method approach, the study adopted both inductive and deductive approaches. The study focused on determining the current status of e-health, factors affecting e-health implementation first through an extensive literature review (secondary data-study) leading to the development of a framework (an inductive path of: observation, pattern, tentative hypotheses and theory); which then used an empirical study, i.e. collected data guided by the theory. These were then tested and validated (a deductive path of: theory, hypotheses). The study was attached by the search for and development of a conceptual framework to guide the research; creating a framework and methods that was used to answer the research questions.

3.5 Research Strategies

Research strategy is the third layer of research onion [179]. This study used the case study because it is usually associated with the deductive approach as per the view of Al Zefeiti and Mohamad, 2015. It is also a popular and common strategy in research and most frequently used to answer who, what, where, how much and how many [179].

The study used a case study methodology and a study questionnaire. This approach focused the study on a particular background environment. The health care provider case study was used as a research approach to aid in a better understanding of the case that supplied e-health Technologies. The case study organization for this study was the Kakamega general county referral hospital and other healthcare facilities in Kakamega county.

The case study approach helped to resolve such problems, with a focus on the research concerns based on the influences of those difficulties on the case study health service

providers. This was highly significant in terms of the applicability of the research's findings and the effects that taking the findings into account had on a specific health service provider. This would have been different if the study's results had been applied in a more general manner without taking case study health service providers into account.

3.6 Research Methods

Both quantitative and qualitative research methods were used in this study to align with the pragmatist research philosophy. This was accomplished through the use of primary research, in which respondents to the primary research were surveyed in a structured manner. The respondents, who were individuals or experts with knowledge of e-health and ICT in healthcare service providers' facilities, included the county referral hospital and other healthcare institutions in Kakamega county.

The quantitative approach was chosen because it focused on exact measurements and the statistical or numerical analysis of data obtained through questionnaires. While handling the non-numerical qualitative data obtained through the use of interviews, the qualitative approach was applied. In order to explain a particular occurrence, the quantitative method concentrated on gathering numerical data and generalizing it across the board [130]. In order to isolate particular study variables and then look for correlations and linkages, the researcher employed quantitative methodologies [131]. A bigger study can be conducted using a quantitative approach, which increases the number of issues covered and improves the generalizability of the findings. Due to the nature of the research methods used in the data gathering process, the researcher needed both qualitative and quantitative research to complete this study. Additionally, it enabled the researcher to compare several groups without being biased in any way [131].

3.7 The study area

The project's goal was to find case study locations with various environmental conditions, levels of e-health Technology usage, and policies. The cost element, the availability of healthcare facilities at various levels, the potential for change and e-health breakthroughs, as well as adoption and implementation of e-health, were the key criteria the researcher utilized to take into account the study region.

The following hospital were studied from the urban area: Kakamega County General Teaching & referral Hospital, Butere District Hospital and Malava district Hospital. The following were selected from rural areas: Luakanda Distric Hospital, Ziwa Sub Distric Hospital and Lukuyan sub county Hospital

After determined the criteria for selecting the study sites, the researcher undertook data collection exercise as follows

a) Referred through experts in health and informatics to generate a list of potential e-Health initiatives and a list of people to interview to learn more about each initiative;

b) Explored secondary data, department of Health, and other suitable websites for information about national and local e-health initiatives and strategies.

c) The research instrument were prepared for the collection of data; both questionnaire, and interview.

d) The researcher interviewed key informants for their views on which e-health initiatives were to be sampled and why.

e) Research assistants were trained by the researcher with the help of two other research experts' one in technology and the other in health matters.

f) The research instruments were validated by the researcher in consultation with experts from health and informatics.

g) The researcher and his assistants did a pilot of the research instruments in a setting that was not part of the study sites to test for validity and reliability.

3.8 Target Population

Population is defined as the complete number of components: organizations, individuals, or items that are chosen to be measured as the sample of the study [185]. The target population of research is viewed as the total of all individuals relevant to the research study that share some common set of characteristics [186]. In an ideal world, it would be fine to collect data from the entire population under investigation; nevertheless, this is not feasible in most instances since, the population is often very large besides other limitations. Thus, a representative sample of the population must be drawn. The target population comprised of all Doctors and Clinicians, Pharmacist, physicians, nurses, medical record officers, office administrator store keepers and lab technicians from healthcare facilities in Kakamega county made up the population under study. The general population of Kakamega county healthcare workers including office administrators was 2029 [172]. From this population, 1243 included nurses and other healthcare workers who were directly involved in the operation of e-health systems, and the remaining 895, included all the other workers supporting healthcare services. It is from this population that the sample investigated was drawn. This study targeted healthcare workers (Doctors and Nurses), ICT staff, record keepers, store managers, pharmacists and lab technicians in the facilities within the county.

It included: staff handling inpatients and outpatients, laboratories, clinics, and store management.

Table 3.1: The population of healthcare staff according to (Kakamega Health workers, 2020)

S/No.	Category of Participant	Population
1	Doctors and clinical officers	347
2	Nurses	676
3	ICTs	41
4	Lab Technicians	45
5	Office Administrators	61
6	Store Keepers	21
7	Pharmacists	26
8	Record Keepers	26
	TOTALS	**1243**

3.9 Sampling Techniques

Sampling is proclaimed as the selection of a subset of cases of the total number of components in order to be able to draw general conclusions about the entire body of components [187]. The choice of a suitable method of sampling helps generalize results, especially for large population, it is usually for a research study to investigate the total population due to time and financial constraints. To achieve the research objective, it is suggested that the researchers should make a conclusion about the sample of the target population [188].

It's observed that sampling design is usually divided into two categories: probability sampling and non-probability sampling [189]. The probability sampling always involves the process of random selection at some stage [190]. While others state that probability sampling is most commonly associated with surveys and experimental research strategies [179]. As a result, the sample participants for the questionnaires were randomly selected from the data of each of the healthcare facility's service providers to reduce bias associated with selecting certain subpopulations [191]. Nevertheless, the bias is only applicable to quantitative part of the study and not the qualitative part which is naturally biased. It is further stated that random sampling plan generally allows each participant of the selected population to have an equal probability of being selected [192].

3.10 Quantitative survey sample size

There is an argument that no matter the type of research methods used be it quantitative or qualitative for data collection and analysis, researchers without doubt face difficulties in seeking to study everyone, in all places, doing all things [193]. In lieu of this, researchers are urged to consider choosing a sample to study and then generalize the results to the whole population. There are many approaches, including a number of different formulas, for calculating sample size. Determining the sample size needed to be representative of the focused population. The sample size of this study was based on Yamane's formula [194]. Below is the mathematical illustration for the Yamane formula. n=N/(1+N(e)2) where: n signifies the sample size N signifies the population under the study e signifies the margin error equivalent to 0.05.

$$n = \frac{N}{1 + N(e^2)}$$

n = the desired sample size

N = the total population

e = the level of statistical significance

Therefore, the sample size for students is:

$$n = \frac{1243}{1 + 1243(0.05^2)} = 303$$

Sample strata

$\text{nh} = \frac{Nh}{N} * n$

The sample size for doctors and clinical officers

$n\square = \frac{347}{1243} * 303 = 85$

The sample size for Nurses

$n\square = \frac{676}{1243} * 303 = 164$

The sample size for ICTS

$n\square = \frac{41}{1243} * 303 = 10$

The sample size for Lab Technicians

$n\square = \frac{45}{1243} * 303 = 11$

The sample size for Office Administration

$$n\square = \frac{61}{1243} * 303 = 15$$

The sample size for Store Keepers

$$n\square = \frac{21}{1243} * 303 = 5$$

The sample size for Pharmacists

$$n\square = \frac{28}{1243} * 303 = 7$$

The sample size for Record Keepers

$$n\square = \frac{24}{1243} * 303 = 6$$

Table 3.2: Sample size of participants to participate in the study (Source: Author)

S/No.	Category of Participant	Population	Sample Size
1	Doctors and clinical offices	347	85
2	Nurses	676	164
3	ICTs	41	10
4	Lab Technicians	45	11
5	Office Administrators	61	15
6	Store Keepers	21	5
7	Pharmacists	28	7
8	Record Keepers	24	6
	TOTALS	**1243**	**303**

3.11 Data collection procedure

The process of gathering data entails gathering information from pertinent sources to answer research questions, test hypotheses, and assess results. Two categories that we have were utilized in this study. Primary data collection methods included gathering information from respondents and secondary sources. The structured questionnaire from the original research used a logical method. The questionnaire, which served as the primary research tool, allowed respondents to express their opinions. The structured questionnaire was specifically designed to examine how the social responsibility of healthcare service providers complemented their stated goals. The questionnaire was created in such a way that every respondent could only provide closed-ended responses. Additionally, the researcher used secondary research, which involved reading scholarly books, reports, and articles. Two

research experts, one from the technology industry and the other from the health sector, collaborated with the researcher. The two experts contributed to the validation of the research tools. The research instrument was then tested for validity and reliability in a pilot study in a setting unrelated to the study area.

3.11.1 Questionnaire development process

Section One of the questionnaire collected demographic data; Section Two covered Implementation (electronic health records; Computerized Provider Order Entry (COPE); Clinical Decision Support Tools; Lab and Test Results; Pharmacy Information Systems; and Patient Service); Section Three covered the Conceptual Framework (Environmental Factors; Organizational Factors; Social Factors; and Technological Factors); and Section Four covered the Patient Service. The questionnaire was developed by using the approach suggested by Churchil and Lacobucci in 2018 [173].

3.11.2 Interview

Interviews were the primary method of gathering information to find out more about people's or individual customs and beliefs [22]. Semi-structured interviews provide the interviewer some autonomy and give them the freedom to veer [43], which may lead the discussion in a route the interviewer had not anticipated. This is why the researcher used this form of interviewing. The researcher also employed semi-structured interviews since she desired to learn more about the subjects and fully understand the responses provided. An audio recorder was used to capture the responses from the interviews. The information was first recorded and then arranged using the proper naming rules; the coded data was then translated into text. The information was then carefully examined to highlight the key themes and to spot

and eliminate any potential biases [93]. This was accomplished by highlighting and assigning a code to pertinent words, phrases, sentences, or paragraphs. To determine the final results of the interviews, the annotated data were segmented, and the segments were then examined.

Face-to-face interviews with employees who had been chosen at random to be interviewed provided the data. Semi-structured interviews were conducted to ascertain the facts as well as the implementers' perceptions of what transpired [23].

3.12 Addressing study objectives

Each objective was addressed with a comprehensive questionnaire. The following details were supplied for each research question: IT personnel, administrators, and healthcare professionals.

Objective I: To determine the status of e-health implementation in Kenya.

To assess the level of e-health in Kenya, objective one set out to do so. The number of hospital staff members using e-health systems, the types of staff members currently using e-health, whether the hospital had workflow policies for integrating e-health functions, whether the e-health they were using was certified by the Certificate Commission for Health Information Technology (CCHIT), and other factors were examined by the researcher to this end. This was accomplished by distributing a questionnaire to the respondents who were randomly selected, as well as by using the data acquired from secondary studies.

The following questions were included in the questionnaire that was created to gather information about the current situation: the respondents were asked to describe the state of e-health in their facilities by stating whether it was installed and in use throughout, in some,

or not at all. Second, they had to say whether employees could use the e-health system. Additionally, they had to include people who regularly used e-health at the time.

Objective II: To determine critical factors that affects the implementation of e-health Technologies in health sector in Kenya.

Hypothesis: the following hypothesis were formulated to guide the study for objective two.

$H_0$1 Environmental factors have effects on e-health implementation

$H_0$2 Organizational factors have effects on e-health implementation

$H_0$3 Social factors have effects on e-health implementation

$H_0$4 Technological factors have effect on e-health implementation.

The second objective set out to investigate the elements that influence the uptake and application of e-health. This was accomplished by distributing a questionnaire to the sampled respondents and collecting information from secondary data. The following questions were included in a questionnaire that was created to gather information on the factors that affect the deployment of e-health:

Environmental factors: Government funding, the legal framework, policies, the availability of infrastructure, including energy and power backups, political support, and NGO support were all topics that were developed into questions.

Organizational factors: All of the following were investigated: top management support for learning or training, hiring qualified human resources, readiness to switch to new technologies, organization culture, and organization culture to involve all stakeholders.

Social factors: Questions were created about the system's implications on individual security, user readiness, user acceptance of e-health, effects on task distribution to persons, and collaboration and partnership between stakeholders.

Technological factors: The population could benefit from using e-health, was compatible with staff responsibilities, was compatible with organizational working styles, could be tested before adoption and implementation, and had a track record of success in other nations. Questions about whether people could resist technology adoption because learning how to use it was challenging, whether e-health technology was simpler to use, and other issues were brought up.

Objective III: To develop an integrated model for e-health implementation in Kenya.

To develop the model for the deployment of E-health Technologies, a detailed secondary data analysis was carried out to identify existing sustainable e-health implementation methods and their shortcomings. The second step involved identifying all the variables that both directly and indirectly affect the implementation of e-health from the qualitative and quantitative data collected and assessed. Thirdly, all subjects or components from empirical data (primary) and secondary data were gathered and evaluated to establish the framework for the new model. The relationships between all the aspects affecting the implementation of e-health were then illustrated in a diagram, which was the fourth phase. Careful examination of the diagram was done in order to ensure the model's applicability and validity.

3.13 Data Analysis Strategy

The focus of any scientific research is to answer the question that the research is trying to solve. The question is transformed into the form of a statement called a hypothesis which is to be tested by the study [195]. It's suggested that statistical techniques are a major tool for data analysis. In the study, Statistical Package for Social Sciences (SPSS) was used to analyze the collected data and test the research hypotheses. Further, a plug-in macro from Hayes called Process was added to SPSS to enhance its analytical properties, more so specific to intervention process which sought to give a more accurate explanation of the causal-effect the Independent Variable has on Dependent Variable suggesting cause and effect relationship between variables, thus testing the conceptual framework.

3.13.1 Descriptive and Inferential analysis

This study involved different research hypotheses and objectives; a number of statistical techniques were used. Descriptive statistics which dealt with the presentation of numerical facts, in tables form; stated differently, summarizes essential features of data- central tendency, variability, and distribution in either of these formats; also, it involved relationships between variables, it involved techniques like regression, principal components, factor analysis, Logistic Regression, Probit Analysis. While the inferential statistics involves techniques for making inferences about the whole population on the basis of data gathered from samples; i.e. estimates, predictions, forecasts, generalizations were used to provide a description of the mean and standard deviation and to check for significant correlations and relationships between responses from different questions and views as related to the implementation of e-health in their setting. For this study, correlation a measure of association between two variables; the variables were however not designated as

dependent or independent but rather used to find out if there was a statistically significant relationship between variables, also regression and Factor analyses were used to investigate the relationship between the independent variable and dependent variable.

Objective one was achieved by reviewing of the previous studies and the stated questions in the questionnaire. The deliverable of this objective was a survey paper that was published. Objective two which sought to find out critical factors affecting e-health was to be achieved by inferential statistical analysis to show relationship and effects of factors to e-health implementation. The Statistical analysis like correlation and ANOVA were used to analyze. Objective three which sought to develop a model. The model was to be derived from the inferential statistical results obtained in objective two. The model was to be presented as diagram or an equation combining the variables or factors and their effects on e-health implementation.

3.13.2 Intervention and Cause-Effect

As per the questions about mechanisms or process invoke the concept of intervention. Since the study had both mechanisms and e-health implementation determinants acting as process as depicted in the conceptual framework figure. 2.4, it was therefore imperative to include intervention and causal-effect study and analysis to help answer questions arising from the same. Although there are many methods that can be used to estimate the paths in these models, the study achieved its goals through a series of steps as outlined by Baron and Kenny[197] which ran as follows for this study, there was one intermediaries M: X_1,X_2, X_3 and X_4 as an independent variable must be correlated with Y a dependent variable; the X's must be correlated with both M and Y; M must also be correlated with Y, holding constant any direct effect of X on Y; When the effect of M on Y is removed, X is no longer correlated

with Y complete intervention or the correlation between X and Y is reduced partial intervention.

Each of the four factors were tested separately in the causal steps method: First it was demonstrated that the zero-order correlation between X and Y ignoring M is significant; then it was also demonstrated that the zero-order correlation between X's and M ignoring Y is significant. A multiple regression analysis was then conducted; predicting Y from X's and M. The partial effect of M controlling for X's must be significant. Finally, direct effect of X's on Y was tested. This is the Beta weight for X in the multiple regression. For complete intervention, the Beta must be not significantly different from 0. For partial intervention, this Beta must be less than the zero-order correlation of X and Y.

The above procedures were achieved by running matrix from Hayes SPSS process macros for bootstrapped intervention analysis, on the raw data, which they also recommend especially when sample size is not large.

3.14 Reliability and validity

3.14.1 Reliability

It's stated that reliability of a measure mainly concerns two aspects, the repeatability how consistent are the results when data is collected in the same way at another point in time and the internal consistency or how stable is the measurement across its items[198]. In order to test for the repeatability of a measurement, additional data would have to be collected to Test and Retest; nevertheless, doing so is not feasible in the scope of this study due to limits in time and resources. Reliability was thus assessed in terms of the measurements of internal consistency. One of the most well-established measures for internal consistency is the

Cronbach alpha, which measures how well a set of observable variable items addresses the latent variable or how they are correlated [199], which was also used in this study to assess reliability. Cronbach's alpha was calculated based on the correlations of the individual scale items with each other and is the most commonly used indicator of scale reliability. This value should ideally be above 0.7. For low correlations, the value is below 0.7 and for high correlations, the value is above 0.7 [200].

3.14.2 Validity

In order to ensure content authenticity, Waltz and Bausell's endorsement was employed by the researcher. To evaluate the validity of the study's content, the researcher employed the content validity index (CVI). Experts rated the items using a Likert scale with 4 points for relevance and transparency. For each item, a CVI value of 0.78 or above was deemed acceptable. [135]. The medical and academic communities supplied the specialists. The expert assessed the instrument's design to determine whether it accurately measured a specific set of items in accordance with the study.

After the measurement was established, the researcher ran a number of analytical procedures. In order to determine whether the study's results were applicable to other situations with a similar setting, the researcher also did internal and external validity analyses. Internal validity involved establishing the causal relationship between variables (independent and dependent variables).

3.14.3 Piloting

The suitability of the instruments employed for data collection was examined [123]. For a pilot study, a pilot sample that represents 1% to 10% of the whole sample can be used. A

pilot study to evaluate the suitability of the data collection methods was conducted at the Kakamega County Referral Facility. The county referral facility's nurses, doctors, and ICT officials were among the 14 responders who received questionnaires (10 men and 4 women). The feedback from the pilot study was used to finally finalize the data collection methods that were employed in the study.

3.15 Ethical issues

All oversight and organizational permissions for the study were handled by the ethical review boards from the collaborating institutions. The essential approvals for the study were given by the Graduate School and School of Computing and Informatics at MMUST (See Appendix 6). Additionally, NACOSTI granted permission for the conduct of research (See Appendix 4). However, all necessary considerations for participant autonomy, privacy, and confidentiality were taken into account during the data collection for the e-health study in accordance with the legislative standards and research procedures.

Since the data the researcher was gathering had no direct or indirect impact on the respondents or the research assistants, the researcher opted not to seek ethical approval. If the procedure is thought to be damaging to the research subjects, ethical permissions are deemed necessary [156].

For the purpose of collecting data, a letter of introduction from Masinde Muliro University of Science and Technology was received; it outlined the study's objectives and highlighted the importance of cooperating with the researcher. The researcher also received a letter of support from the MMUST ethical review board.

3.16 Summary

The data collection tools (questionnaires and interview schedules) were created to gather information that addresses the research questions and reaches the study's unique goals. The three sections of the questionnaire addressed the three primary goals of the study. The information gathered from Section A of the questionnaire (see Appendix 2) was evaluated to ascertain the opinions of the healthcare professionals on the utilization of e-health Technologies in healthcare institutions in Kenya in order to ascertain the present status of e-health Technology in Kenya. The main target group were the healthcare workers who directly interact with the e-health systems in Kakamega. The data was gathered using both surveys and interviews. To assess the state of e-health in Kenya, information was also gathered from previously published research on e-health technology (secondary data).

The researcher obtained information from the empirical literature that brought forth elements that affect the usage of e-health in Kenya in order to identify the crucial factors that influence the deployment of e-health Technologies in the health sector in Kenya today (objective 2). The conceptual structure was built on these elements. Information on the many elements that have an impact on the adoption of e-health in Kenya was gathered using questionnaires in Section B of the questionnaire (see Appendix 2). The data collected was coded and analyzed the Chapter 4 and conclusions drawn in Chapter 5 of the thesis.

The data obtained from objective one and two together with the section 3 of the data collection tool (questionnaire) allowed the researcher to develop a model that informed on the sustainable e-health Technology in Kenya and can be used to help the health service providers to appropriately implement e-health Technologies in Kenya and beyond for the benefit to both the workers and the patients being handled in these facilities.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Overview

The methodology and design of the study were covered in the chapter preceding. The data from the study on factors influencing sustainable e-health Technology are discussed in the chapter. The creation of an integrated model for a sustainable e-health Technology is discussed using a theory as a foundation. It is also discussed how to comprehend and evaluate potential enhancement strategies that might enhance the implementation. The objectives, which are discussed in greater detail in chapter one, set the framework for how the study's findings are explained. These goals included learning more about the state of e-health Technology in Kenya, identifying crucial elements that influence the rollout of e-health Technologies in Kenya's health sector, and creating a model for long-term e-health Technology in Kenya.

4.2 Reliability and validity tests

An instrument's consistency in measuring what it is intended to assess, or reliability, was established by first ensuring internal consistency and then carrying out a pilot study. If a survey's Cronbach's Alpha coefficient is higher than 0.70, it is regarded as reliable [136].

The reliability test in SPSS was used to conduct a correlation study on the dependent variable and the four independent variables. The findings are displayed in Table 4.1.

Table 4.1: Reliability Test

Variable	Cronbach alpha
Social factors	.819
Organizational factors	.872
Technological factors	.918
Environmental factors	.894
Implementation of E-health	.858

According to the results, each variable examined had a Cronbach's Alpha value greater than 0.7, satisfying the 0.7 requirement for data internal consistency [137]. The construct validity and reliability of the construct alphas employed in the study were believed to be sufficiently high. The study's constructs have a significant link with one another.

4.2.1 Regression Analysis Assumption Tests

Before regression analysis is conducted, various statistical assumptions must be met. In this study, the following tests were conducted and presented as below: Linearity, Homoscedasticity Test, Shapiro-Wilk Test of Normality, and Multi-Collinearity Test.

4.2.2 Heteroscedasticity Test

Homoscedasticity is a situation that occurs in datasets that have a large range between the largest and smallest observed values. When heteroscedasticity is observed in the residual plots, it is important to determine whether pure or impure heteroscedasticity has occurred because the solutions are different. Failure to correct heteroscedasticity invalidates statistical tests of significance such as regression analysis and increase the chance of wrong inference. In this study, Levene statistic was used to test the null hypothesis that the variance of the

explained variable are equal across all levels of explanatory variables. The results are presented in Table 4.9

Table 4.9: Test for Heteroscedasticity/ Homoscedasticity

Variables	Levene Statistic	df1	df2	Sig.
Social factors	2.182	4	299	.251
Organizational factors	2.919	4	299	.165
Technological factors	3.015	4	299	.148
Environmental factors	2.813	4	299	.226
Implementation of E-health	2.915	4	299	.127

The Levene statistics is significant when $p < 0.05$ resulting in the rejection of the null hypothesis. From Table 4.9, all the p values are greater than 0.05, hence we accept the null hypothesis and conclude that the variances of the dependent variable are not steady across different levels of the explanatory variables. This implies that the assumption of homogeneity of variance was full filled.

4.2.3 Tests of Normality

The study conducted the Shapiro-Wilk test to test for normality in the study. Normality test was done at 95% confidence interval. If the p-value is less than 0.05, then the null hypothesis is rejected and there is evidence that the data tested is not from a normally distributed population. If the p-value is greater than 0.05, then the null hypothesis stating that the data came from a normally distributed population is accepted. The results in the study indicate that the p value was 0.017 which implies that data tested is not from a normally distributed population. The findings are as shown in Table 4.10 below.

Table 4.10 Tests for normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	DF	Sig.	Statistic	DF	Sig.
Organizational	.114	326	.078	.945	227	.017

a. Significance correction

Source: Researcher (2022)

4.2.4 Multicollinearity Test

Multicollinearity test was also done in the study to determine whether the variables of the study were highly correlated, thus implying that one variable may be linearly predicted from the other with high levels of accuracy. Findings are as shown in Table 4.11. If the VIF value lies between 1 – 10, then there is no multicollinearity. If the VIF value is less than 1 or more than 10, then there is multicollinearity.

Table 4.11 Tests for multicollinearity

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)	.112	228
	Organizational performance	1.015	1.022

a. Dependent variable: E-health adoption

Source: Researcher (2022)

As shown in Table 4.11, the VIF value was 1.022 which indicates that there were no multicollinearity issues in the study.

4.3 Response Rate

A total of three hundred and three (303) people took part in the study. 303 of the 303 questionnaires that were delivered to the sampled respondents in this study were completed and returned. Table 4.2 below provides an overview of the questionnaire return rate.

Table 4.2: Questionnaire Return Rate

		Frequency	Percent
Valid	Returned	303	100
	Total		100.0

303 of the questionnaires were correctly filled and were used for the analysis in this study. This corresponded to a 100% return rate on the survey, which is within the bounds of a large sample size [138].

4.4 Demographic Characteristics of the Respondents

The study aimed to collect general data about the respondents' gender, educational attainment, age, specialization or profession, level of comfort, and work status inside a hospital. Although not all the information acquired from the six questions in this part was necessary for the study, it did help to contextualize the findings and produce the appropriate approval in line with the objectives. Understanding the respondent's profile was the main goal of this part. A summary of the descriptive analysis for the participant's demographic profile is shown in Table 4.3 below.

Table 4.3: Demographic details for participant

Variable	Category	Frequency N	Percentage
Gender	Male	184	60.7
	Female	119	39.3
	Total	303	100.0
Highest level of education	Certificate	24	**8.0**
	Diploma	168	**55.4**
	Degree	79	25.9
	Masters	32	10.7
	Total	303	100.0
Age range	20-25 years	43	14.3
	26-30 years	95	31.3
	31-35 years	62	20.5
	36-40 years	41	13.4
	Above 41 Years	62	20.5
	Total	303	100.0
Specialty/profession	Clinician	92	30.4
	Pharmacist	33	10.7
	Lab technician	81	26.8
	Nurse	59	19.6
	Radiologist	24	8.0
	Doctor general	14	4.5
	Total	303	100.0
Level of comfort	extremely anxious	11	3.6
	anxious	65	21.4
	neutral	43	14.3
	not very anxious	87	28.6
	completely at easy	97	32.1
	Total	303	100.0
Hospital level	level 1	27	8.9
	level2	100	33.0
	level 3	79	25.9
	level 4	70	23.2
	level 5	27	8.9
	Total	303	100.0

Gender

According to Table 4.3, there were 44 (39.3%) women and 68 (60.7%) men. The findings indicate that there were more male respondents than female respondents. The fact that both men and women participated in the study was important to notice because they were helpful in the adoption and deployment of the technology to prevent gender inequities. The findings, however, are at odds with assertions that most workers in healthcare systems are women and that many workplace policies continue to discriminate against women. Even though various studies have shown that women are frequently pushed to conform to male work paradigms that disregard their demands [139], This suggests that the findings are in line with those of the World Health Organization, which asserted that many societies have societal systems that encourage women's marginalization and oppression through cultural norms. This may be the reason why women are often placed in jobs that provide them less access to and authority over resources for health care. According to this report, there are more men than women. This suggests that there are more males than women employed in the health sector in the area where this survey was conducted.

Highest level of education

Only a small fraction of respondents held a master's degree or above, with 9 (8.0%) for certificates and 12 (10.7%) for master's degrees. 62 (55.4%) of the respondents held a diploma, making up the bulk of the sample. Following that was having a bachelor's degree, which received 29 responses, or 25.9% of those who participated in the study, as shown in Table 4.3 below. This suggests that, in contrast to other industries, the majority of health sector specialists are not motivated to further their studies. Comparatively to individuals with

low levels of education, people with high levels of education are more likely to use technology, such as e-health.

Age range

For purposes of description, the respondents were divided into five age groups: those under the age of 20; those between the ages of 20 and 25; those between the ages of 26 and 30; those between the ages of 31 and 35; those between the ages of 36 and 40; and those over the age of 41. In order to help the researcher, correlate the numerous factors with an age-wise distribution, the participants were asked for their age. In this study, the age group 26–30 years had the highest percentage of respondents (31.3%), followed by the age groups 31–35 years and beyond 41 years, where 23 respondents each represented 20.5% for each age group. According to Table 4.3 below, the minority included 15 and 16 respondents, or 13.4% and 14.3%, respectively, from the age groups 36–40 years and 20–25 years. For the reason that most of the respondents, it was predicted that the results of the survey will show that adoption and deployment of e-health technology shouldn't be an issue. Similar studies have found that younger people are more inclined than older people to accept and use technology.

Specialty/ profession

The respondents were divided into 6 groups: general practitioners, radiologists, nurses, pharmacists, and lab technicians. With 34, 30, 22 responses, or 30.4%, 26.8%, and 19.6% respectively, the bulk of respondents were clinicians, followed by lab technicians and nurses. With 5, 9, and 12 respondents, or 4.5%, 8.0%, and 10.7%, respectively, as indicated in table 4.3 below, general practitioners, radiologists, and pharmacists made up the minority. This suggests that the professionals are not spread equally. This can be due to an uneven distribution of these occupations within the health industry.

Rate level of comfort with the use of computer

According to Table 4.3's findings, the majority of people were comfortable using computers, at 36 or 32.1%, followed by 32 people who weren't overly concerned, at 28.6%, and only 16 people who were neutral, at 14.3%. As indicated in Table 4.3 below, the minority who reported feeling really worried included 4 respondents, or 3.6% of the total. The findings demonstrate the importance of including technology education into the health curriculum as some respondents to the survey are both neutral and severely concerned.

Hospital level

According to Kenya's health system, the respondents were selected from the country's five hospital levels. A national referral hospital at Level 6 was not included. Level 3, a health facility administered by at least one doctor, had 29 respondents, or 25.9%, while level 2, which is a health dispensary and are run by clinical officers, had 37 or 33.0% of the total. There were 26 respondents, or 23.2%, at Level 4, the county hospital supervised by the director, a medic. Level 1 and level 5 each had 10 or 8.9% of the minority's representation, as indicated in Table 4.3 below. Between level 1 and level 5, there are community facilities and a county referral hospital. Levels one through five are managed by certified medical clinical officers, whereas level one is managed by chief executive officers who are also doctors. This suggests that there was no bias in the selection of the respondents based on the findings; it shows that those working in county hospitals, who happen to represent those in urban settings, and those working in community level 1 were both represented, who happen to represent those in rural settings.

4.5 Descriptive Statistics on the status of e-health Technology in Kenya

The number of hospital employees who could use an e-health system, the types of employees who were using e-health, whether the hospital had workflow policies for integrating e-health functions, whether the e-health they were using was certified by the Certificate Commission for Health Information Technology (CCHIT), and whether the e-health they were having could track and record data were all examined in this section, which examined the state of e-health in Kenya.

4.5.1 Hospital e-health Technology status

How would you characterize the implementation state of hospital e-health? was the question posed to the participants. The results are shown in Table 4.4 below. The majority, 50 (44.6%), reported that the hospital had an e-health installed in some departments and being used by some staff, followed by the minority, 35 (31.3%), who reported that the hospital had an e-health installed and being used by all departments, all staff, and all providers. Only 27 (24.1%) reported that the hospital did not currently have an e-health implemented or being used. This was consistent with Kenya's National e-health Strategy 2011-2017, which noted some flaws in its SWOT analysis study, including: Absence of a National e-health policy and plan to oversee the execution of e-health duties or creativity, insufficient e-health staff, and existing institutions that train professionals lack e-health capabilities in their curriculum [166].

Table 4.4: Describe your hospital e-health Technology status

		Frequency	Percent
Valid	e-health is installed and in use for all department	95	31.3
	e-health installed in some department and in use by some staff	135	44.6
	hospital do not have an e-health implemented or in use currently	73	24.1
	Total	303	100.0

4.5.2 Estimated number of staff able and currently using e-health system on daily basis

Participants in the implementation were asked to estimate the number of hospital personnel, including administrators, doctors, and nurses, who were able to and were currently using the e-health system, as shown in Table 4.5. The majority of respondents said that 52 (46.4%) of employees were able and using an e-health system, followed by 35 (31.3%) employees who were using an e-health system less than half of the time. However, we received some responses 15 (13.4%), which indicated that e-health systems were not applicable at all—and others 10 (8.9%), which claimed that no one was utilizing e-health systems. This shows that despite having an e-health system, some facilities lack it or have staff members who are unable to use it. This is in accordance with the Kenya National e-health Strategy, which identified one of the problems as their health staff's lack of computers or internet access [166]. Additionally, several facilities reportedly lacked access to electricity, while those that did experienced some interruptions.

Table 4.5: Estimated number of staff currently using e-health system on daily basis

		Frequency	Percent
Valid	None	27	8.9
	Less than a half	95	31.3
	More than a half	140	46.4
	Not applicable	41	13.4
	Total	303	100.0

4.5.3 Employee type currently using e-health on daily basis

The third implementation participant was asked to indicate the category of employees who used e-health on a regular basis. The majority of the workforce consisted of administrative personnel, with 233 (76.8%), followed by schedulers and billing personnel with 43 (14.3%), although critical personnel like nurses and doctors weren't regularly using the system, as indicated in Table 4.6 below. This is in line with Rianne and colleagues' research on e-health in primary care, which noted that while its use was recommended, its applicability and efficacy for primary care had only been partially proven [141]. Despite their low usage and quality, they claimed that there were 325,000 mobile health apps available in just 2017 alone.

Table 4.6: Employee type currently using e-health on daily basis

		Frequency	Percent
Valid	Administrative staff	233	76.8
	Schedulers and billing staff	43	14.3
	Not applicable	27	8.9
	Nurse and Physicians	0	0.0

	Total	303	100.0

4.5.4 Hospital having workflow design/ policies to integrate e-health functions

The researcher was interested in knowing whether the hospital had workflows or rules that integrated e-health functions into practice as a fourth implementation factor. According to Table 4.7 below, the majority 165(54.5%) and minority 138(45.5%) both answered "yes." Although the majority agreed that there were policies, the number that disagreed was too high, suggesting that either there were no policies or the workforce was unaware of them. These findings are at odds with Kenya's national e-health policy 2016–2030, which includes a part that outlines regulatory or workflow policies or philosophies that encourage the adoption of e-health innovations by the healthcare industry in order to achieve improved healthcare outcomes [73].

Table 4.7: Hospital having workflow design/ policies to integrate e-health functions

		Frequency	Percent
Valid	Yes	165	54.5
	No	138	45.5
	Total	303	100.0

4.5.5 e-health you are using is certified by CCHIT

The researcher wanted to know three things regarding electronic health records: first, if the hospital was using an e-health that had been certified by the Certification Commission for Health Information Technology (CCHIT); second, if the e-health could track and record; and third, if it could produce claims for some or all insurers. Table 4.8 below reveals that just 65 (21.4%) of respondents were certain that it was certified, while 89 (29.5%) claimed it was not. The remaining 149 (49.1%) were unsure. The fact that a sizable 49.1% of respondents

were unsure whether their system was certified suggests that doctors and service providers are taking a considerable risk with the e-health they have invested in. The compatibility of the e-health cannot be guaranteed by two doctors and service providers. Three, they cannot guarantee that e-health adoption would result in a better return on investment. Finally, they are unsure if patient information is secured in terms of privacy.

Table 4.8: e-health you are using is certified by CCHIT

		Frequency	Percent
Valid	Not sure	149	49.1
	Yes	65	21.4
	No	89	29.5
	Total	303	100.0

4.5.6 e-health has ability to track and record

Physicians and service providers are at considerable risk with the e-health they have invested in, according to the big percentage of 49.1% who were unsure whether their system was accredited. It is impossible for two doctors and service providers to guarantee e-health compatibility. Three, they cannot guarantee that implementing e-health will increase quality or provide a return on investment. Fourth, they doubt whether patient information is secured in terms of privacy. The e-health system that was chosen can use the documented data to keep high-risk patients out of the hospital [143]. With only 35.75 percent, service providers are unable to guarantee the accuracy and legibility of their data since they have not completely eradicated paper records. Due to the fact that data replication is still occurring, data is probably not current. Therefore, there is a chance of losing paperwork. Since there

are so many files available, retrieving medical records to check for potential trends without capturing the data will be challenging.

Table 4.9: e-health has ability to track and record

		Frequency	Percent
Valid	Yes	195	64.3
	No	108	35.7
	Total	303	100.0

4.5.7 e-health has the ability to generate claims for some or all insurers

Results from the question about whether respondents could generate insurance claims via e-health are shown in Table 4.10 below. Only 87 people (28.5%) disagreed, making up the majority of 216 who said "yes." This suggests that embracing e-health will improve accessibility, portability, and transparency. However, it also implies that there would be more data taken by unauthorized individuals compared to paper medical records, as indicated by the accepted increase in security requirements of e-health as incorporated in the health information and accessibility Act [144] [145].

TABLE 4.10: E-HEALTH HAS THE ABILITY TO GENERATE CLAIMS FOR SOME OR ALL INSURERS

		Frequency	Percent
Valid	Yes	216	71.4
	No	87	28.6
	Total	303	100.0

4.5.8 Computerized Provider Order Entry (CPOE*)*

A computer program called Computerized Provider Order Entry (CPOE) enables a doctor to submit electronic orders for diagnostic and therapeutic services (such prescription drugs, lab tests, and other tests) rather than writing them down on order forms or prescription pads. The computer verifies the order against dosage guidelines, looks for allergies or drug combinations, and alerts the doctor to any possible problems. The researcher was interested in learning three things: (1) whether the hospital's e-health system had a computerized provider order entry (CPOE) function; (2) whether this function was integrated with other systems, such that a provider could enter medication orders, which would then be electronically sent to a pharmacy to be filled; and (3) whether there were any obstacles to using CPOE for all provider orders.

4.6 e-health has a computerized provider order entry (CPOE) function

Results are shown in Table 4.11 below based on whether e-health had CPOE. The majority of respondents, 173 (57.1%), agreed that e-health featured a computerized provider order entry (CPOE) function, while 130 (42.9%) disagreed. This suggests that those doctors are electronically prescribing patient services, eliminating the need for handwritten paperwork. Thus, hospitals that have used CPOE have shown improvements in quality, efficiency, and safety. By encouraging the use of evidence-based treatment, they have been able to decrease pharmaceutical errors by minimizing unnecessary testing [146]. But logically, 42.9% of respondents indicated they had not changed from using the traditional order methods of paper, telephone, fax, and verbal communication. This suggests that CPOE system adoption and installation are still not providing providers with all of the expected advantages. This suggests that there is a problem with patient records being accessible. Additionally, it means

that doctors cannot work remotely and yet have access to information about patients' prior visits. [147].

Table 4.11: e-health has a computerized provider order entry (CPOE) function

		Frequency	Percent
Valid	Yes	173	57.1
	No	130	42.9
	Total	303	100.0

4.12.1 The CPOE function integrated with other systems

The CPOE function's integration with other systems was the subject of a second inquiry. For instance, prescriptions for medications are inputted by a provider, sent electronically to a pharmacy, and filled there without the prescription being printed or faxed. According to table 4.12 below, the majority (181, or 59.8%) claimed that it was not integrated whereas just 122, or 40.2%, agreed. These findings were consistent with Steven R. Simon's assessment, which noted that the majority of hospitals in the United States lacked CPOE systems despite the potential advantages associated with their adoption for more than 20 years [148].

Table 4.12: The CPOE function integrated with other systems

		Frequency	Percent
Valid	Yes	122	40.2
	No	181	59.8
	Total	303	100.0

4.12.2 The barriers to using CPOE for all provider orders

The third aspect of CPOE that was looked into was whether there were any obstacles to implementing it for all provider orders. The majority (135/44.6%) cited the need for staff or provider training as the second biggest obstacle, followed by those who claimed using handwritten or paper orders was the biggest barrier (52/17.0%). Sustainability (regular network outages) was in the minority with 5 (1.8%), followed by hardware difficulties with 16 (5.4%). Despite the fact that there were 65 of them (21.4%), they were negligible in comparison to those who reported other impediments. The findings, as shown in Table 4.13 below, are consistent with research by Steven R. Simon, who noted in his report that health service providers encounter a variety of challenges to adopting CPOE, ranging from resistance among physicians, surgeons, and other medical professionals to the expense of systems [148].

Table 4.13: The barriers to using CPOE for all provider orders

		Frequency	Percent
Valid	Not applicable	65	21.4
	Still using handwritten or paper orders	135	44.6
	Require staff or provider training	52	17.0
	In process of building in orders into system	19	6.3
	Requires system upgrade	11	3.6
	Hardware issues	16	5.4
	Sustainability (frequent network breakdown	5	1.8
	Total	303	100.0

4.6.1 Clinical decision support tools (CDST)

4.12.1.1 e-health has clinical decision support

The CDST are crucial components of e-health. These instruments serve as warnings for probable mistakes, serve as a reminder to provide preventive care, aid in diagnosis, and support treatment strategies. Most e-health systems come equipped with both simple and sophisticated decision support tools. The researcher was interested in finding out if e-health offered clinical decision support tools that healthcare professionals may use at the point of treatment, such as prescription guidelines and care plans for chronic conditions. Table 4.14 below shows that 195 (64.3%) respondents reported having no CDST, 103 (33.9%) had confirmed having it, and just 1.8% were unsure. This suggests that CDST has been adopted

and is being implemented, albeit slowly, which is consistent with Gardner's report that the process by which clinical data was gathered along with medical information and put them into a formula that computers could manipulate to support in decision making was still in its infancy stage [149].

Table 4.14: e-health has clinical decision support

		Frequency	Percent
Valid	Yes	103	33.9
	No	195	64.3
	Not sure	5	1.8
	Total	303	100.0

4.12.1.2 Clinic use a link to clinical decision-making support tools for high diagnostic imaging

Participants were nonetheless questioned on the CDST if their hospital employed e-health or provided a link to clinical decision-support tools for advanced diagnostic imaging. According to Table 4.15 below, the bulk of respondents, 210 (69.6%), followed by 87 (28.6%), replied "no." Only 1.8% were unsure. This shows that e-health adoption and implementation are still in their early phases [149]. Despite a lengthy list of decisions by service providers to purchase e-health, widespread acceptance and implementation have still not been completed for the majority of service providers. Workflow integration has been a hindrance to deployment, according to the National Academy of Medicine report [150].

Table 4.15: Clinic use a link to clinical decision-making support tools for high diagnostic imaging

		Frequency	Percent
Valid	Yes	87	28.6
	No	210	69.6
	Not sure	6	1.8
	Total	303	100.0

4.12.1.3 EHR system have alerts that provider see during an encounter with patient

The researcher subsequently questioned the participants to determine whether their EHR system featured alerts or pop-ups that clinicians view during an encounter with a patient. The results are shown in Table 4.16 below. With 146 (48.2%), the majority responded "no" when asked if their clinic's e-health system included alerts. With 57 (18.8%), it was followed by the affirmative responses "yes" for patient- or condition-specific reminders, "yes" for probable drug interactions, and "no" for those whose clinic could have used alerts but had not activated the feature, respectively. This suggests that HER did not include pop-up messages, which are intended to assist general practitioners by sending timely reminders and alerts, maybe because most doctors are reluctant to include warnings that might interfere with normal workflow programs.

Table 4.16: EHR system have alerts that provider see during an encounter with patient

		Frequency	Percent
Valid	Yes-for potential drug interaction	54	17.9
	Yes- for patient specific or conditions specific reminder	57	18.8
	No our clinic has the ability to use alerts, but the function is not turned on	46	15.2
	No- Our clinic's e-health does not have alerts.	146	48.2
	Total	303	100.0

4.6.2 Lab and test results

4.12.2.1 Clinics e-health store lab values and test results

A laboratory test is a procedure through which a medical professional obtains a sample of a patient's blood, urine, or body tissue in order to learn more about their health. The majority of lab tests are used to identify, screen for, or track a particular disease or condition. The researcher was looking at whether the clinic's e-health system was keeping track of test results and lab values. The majority, 187 (61.6%), answered negatively, while only 116 (38.4%) agreed. This suggests that although the implementation was occurring at a very modest rate of 38.4%, as evidenced by the findings in table 4.17 below.

Table 4.17: Clinics e-health store lab values and test results

		Frequency	Percent
Valid	Yes	116	38.4
	No	187	61.6
	Total	303	100.0

4.12.2.2 Clinic use computerized system to retrieve lab and diagnostic test results

However, when it came to lab and test results, participants were questioned about whether their facility used a computerized system to access lab and diagnostic test results. With 238 (78.6%), the majority of them stated that they did not use electronic systems, but rather paper, faxes, or phone calls to obtain all lab and diagnostic results, and only 11 (3.6%) people claimed that some but not all test results were being accessed by providers using computers. It appears from this that although e-health has been adopted, deployment view lab and diagnostic results. After that, 54 (17.9%) people claimed to be utilizing computers but it is still in its early stages. Instead of using computers, the majority of people still use paper.

Table 4.18: Clinic use computerized system to retrieve lab and diagnostic test results

		Frequency	Percent
Valid	Yes-provider use computers to access all lab and diagnostic test results	54	17.9
	Yes- providers use computer to access some but not all test results	11	3.6
	Not really- providers primarily use paper, fax, or phone call to view lab and diagnostic test results	238	78.6

	Total	303	100.0

4.6.3 Pharmacy information system (PIS)

The PIS, which is a part of the hospital information system, keeps data and provides tools for managing and organizing medications in pharmacies. It can function both alone and as part of a larger system, such as computerized physician order entry (CPOE) [151]. The operational PIS has a user interface, data entry, and security restrictions to protect patient data [152].

4.12.3.1 Hospital has an electronic pharmacy information system separate from e-health

The researcher asked if their hospital has a separate electronic pharmacy information system from e-health. The majority, 189 (62.5%), stated that their e-health system had a pharmacy component, whereas 114 (37.5%) stated that they had a separate pharmacy system from e-health (see table 4.19 below).

Table 4.19: Hospital has an electronic pharmacy information system separate from e-health

		Frequency	Percent
Valid	Yes-we have separate pharmacy system from our e-health	114	37.5
	No-we have an e-health system that has a pharmacy component	189	62.5
	Total	303	100.0

4.12.3.2 Electronic pharmacy system has the ability to print or fax a prescription

On PIS, the researcher further questioned respondents about their electronic pharmacy systems' ability to fax or print a prescription. The majority, 43 (38.4%), gave the "no" response, while 34 (30.4%) and 35 (31.3%), respectively, gave the "yes" response and were unsure of whether their system could print. Results from table 4.20 below confirm the existence of PIS or e-health, but table 4.21 below suggests that the adopted e-health is not fully implemented.

Table 4.20: Electronic pharmacy system has the ability to print or fax a prescription

		Frequency	Percent
Valid	Yes	92	30.4
	No	116	38.4
	I do not know	95	31.3
	Total	303	100.0

4.12.3.3 Clinic use any of the following electronic pharmacy system functions: Provide generic alternatives to medications as a list

The respondents were asked if their facility provided a list of generic alternatives to drugs while using the electronic pharmacy system. Although 81 (26.8%) respondents said their facility used an electronic pharmacy system to offer generic versions of drugs, the adoption of e-health was still relatively low, as shown in Table 4.21 below. The majority, 114 (37.5%), did not know, followed by those who rejected it, at 108 (35.7%).

Table 4.21: Clinic use any of the following electronic pharmacy system functions: Provide generic alternatives to medications as a list

		Frequency	Percent
Valid	Yes	81	26.8
	No	108	35.7
	I do not know	114	37.5
	Total	303	100.0

4.12.3.4 Provide point-of-prescribing generic alternatives

The researcher was interested in learning whether the respondents' e-health offered a point of prescribing generic substitutes. According to Table 4.22 below, the results indicate that 62 people (20.5%) confirmed that there are point-of-prescribing generic alternatives, while 154 respondents (50.9%) indicated that they were unsure. In contrast, 87 respondents (28.6%) disagreed that prescribing generic alternatives had any benefit. This would imply that Kenyan pharmacies are subject to restrictions on generic medications because of governmental laws. The findings run counter to an investigation conducted in 2014 in the US, which claimed that generic medications accounted for 88% of the 4.3 billion prescriptions written [153].

Table 4.22: Provide point-of-prescribing generic alternatives

		Frequency	Percent
Valid	Yes	62	20.5
	No	87	28.6
	i do not know	154	50.9
	Total	303	100.0

4.12.3.5 Provide cost comparisons of drugs within therapeutic classes

When asked if they had price comparisons of medications within therapeutic classes, the respondents said yes. As indicated in Table 4.23 below, the majority—157 (51.8%)—said they don't know, followed by 92 (30.4%) who answered they don't compare, and only 43 (14.3%) who replied yes, they do compare. Since drug prices are cited as a major barrier preventing approximately 2 billion people worldwide in developing countries from accessing necessary treatment, it is implied that e-health is still in its infancy [154]. Since drugs are sold at various prices, it is necessary to ensure comparisons in order to be able to purchase drugs at fair prices. to ensure comparisons so that one can buy pharmaceuticals at fair pricing.

Table 4.23: Provide cost comparisons of drugs within therapeutic classes

		Frequency	Percent
Valid	Yes	43	14.3
	No	92	30.4
	I do not know	157	51.8
	None response	11	3.6
Total		303	100.0

4.12.3.6 Electronic pharmacy system performs medication reconciliation

The researcher also looked into the electronic pharmacy system's ability to reconcile prescriptions and compare the medications being prescribed to those the patients had already been taking. 130 (42.9%) respondents stated they weren't using this feature, followed by 100 (33.0%) who claimed they didn't know. The minority, as indicated in Table 4.24 below, were

those who replied yes to some prescriptions and some encounters but not all of them. Only 59 (19.6%) of respondents said yes to every prescription at every encounter. The majority were either responding "no," "I don't utilize it," or "I don't know if the electronic pharmacy system does medication reconciliation," which suggests that the first step of demonstrating the meaningful usage of e-health could not be demonstrated [155].

Table 4.24: Electronic pharmacy system perform medication reconciliation

		Frequency	Percent
Valid	Yes, for every prescription at every encounter	59	19.6
	Yes, for some prescriptions and some encounters	14	4.5
	No, we do not have or use this function	130	42.9
	I do not know	100	33.0
	Total	303	100.0

4.6.4 Patient services

The final phase of the investigation's execution focused on patient services. The primary duties of a hospital are quite similar to those of customer service; however, they are performed in a medical environment. It entails a front desk, verbal interactions, payment collecting, the upkeep of patient records, scheduling, and making sure the patients are pleased with their visit. The first question about patient services involved asking the participants if their hospital allowed patients to schedule appointments online. According to Table 4.25 below, the majority of respondents (241, or 79.5%) indicated they did not offered online scheduling, followed by 32 (10.7%) who said they did for some encounters or

providers, and 30 (9.8%), who said they did so for all encounters or providers. The findings refute the assertion made by Healthcare Consumer Trends in 2019 that people appreciate convenience, which claimed that 51.3% of all patients listed convenience and access as the most important aspects of health care that influenced their decisions [156]. It was superior to all other services, especially in terms of care quality. Because the majority of health care providers do not use online scheduling, the research's findings indicate that convenience is not a top priority for them. According to the results of a health care checkup survey, 73% of Americans said they would use the internet so frequently that almost half of them would consider using it instead of doctors to communicate in order to quickly obtain lab results, make appointment requests, pay medical bills, and get in touch with their doctor's workplace. The capacity to communicate and execute important healthcare chores online, making it convenient to use it whenever and wherever [157].

Table 4.25: Hospital offers on-line scheduling for patients

		Frequency	Percent
Valid	Yes - For all encounters/providers	30	9.8
	Yes - For some encounters/providers	32	10.7
	No	241	79.5
	Total	303	100.0

4.12.4.1 Hospital offers on-line bill payment for patients

The participants were questioned regarding their hospital's availability of online bill payments for patients in the second section of patient services. 127 (42.0%) of the patients said no, 106 (34.8%) said yes for all patients, and only 70 (23.2%) said yes for some patients,

as indicated in Table 4.36. These findings also go against the findings of the health care checkup survey and Healthcare Consumer Trends in 2019.

Table 4.26: Hospital offers on-line bill payment for patients

		Frequency	Percent
Valid	Yes - For all patients	106	34.8
	Yes - For some patients (such as self-pay)	70	23.2
	No	127	42.0
	Total	303	100.0

4.12.4.2 Hospital allows patients to access their e-health on-line

The participants were questioned about their hospital's policy on allowing patients to access their e-health online during the final segment of patient services. As indicated in Table 4.27 below, the majority rejected it, with 273 (90.2%) rejecting it, while only 30 (9.8) said it was available online. This suggests that e-health is still in its infancy and that service providers lack true competitive advantage, according to a Gartner report that noted that adopting and implementing e-health online decisions in the medical industry today is a market differentiator that, when adopted and implemented, puts the facility ahead of the competition [158].

Table 4.27: Hospital allows patients to access their e-health on-line

		Frequency	Percent
Valid	Yes	30	9.8
	No	273	90.2
	Total	303	100.0

4.6.5 Results from qualitative data (thematic)

Interviews was conducted in-depth with a total of 12 study respondents about the variables that influence the adoption of e-health. As specified in the interview schedule (Appendix 4), this comprised the qualitative study and was categorized under environmental, organizational, social, and technological aspects. The following theme analysis was done on the emerging issues from the qualitative data:

The participants were questioned regarding their opinions of government funding, budgetary allocations, and grants for e-health. Several responders mentioned how the Covid-19 outbreak had slowed Kenya's economic growth.

They cited a factor that they believed would probably lead the national government to restrict budgetary support for medical facilities.

The majority of respondents stated that most healthcare reforms in Kenya politically fail and only take place when there is a chance of opportunities like a change of government, an economic boom, a civil war, or resources from donors. The respondents were also asked what they thought about political support for e-health. Other interviewees also noted political backing, citing the Kenya e-health Policy (2016-2030), Health Act No. 21 of 2017, and the Draft Kenya National e-health Strategy 2019-2023 as examples of existing constitutional and legal provisions that discuss e-health in Kenya.

On organizational issues, the participants were cross-examined to determine whether the organization had well-trained employees and whether its infrastructure was well-connected. The main problem that was revealed by the interview was that most healthcare institutions in rural areas lacked electricity and had weak internet connections. While the majority of the

workforce and the facilities with power connections lacked the necessary competence to assist the implementation procedures. Some said that the personnel lacked technological expertise and that the facilities had few IT officers.

On organizational factors, the participants were cross-examined if the organization had well-trained staff and if it was well connected in terms of infrastructures. The key issue that emerged from the interview showed that most health facilities in rural areas were not connected with electricity and also internet connection was poor. While those facilities with electricity connected had inadequate expertise for advice and most of the staff were not qualified to support the implementation processes. Some said the staff was not technically qualified and facilities had very few IT officers.

4.7 Implementation of e-health Technologies in health sector in Kenya

4.7.1 Relationship of environmental factors

The implementation of e-health depend on the environmental elements shown in Table 4.28 below, which were derived from primary studies and categorized according to six basic categories: Government funding through budgetary allocation or grants, Government-developed legal framework or regulations that encourage e-health Infrastructures like electricity and backup power sources like solar, standby generators, and networks are readily available and functional, and government implementation bodies at the facility level, support from donors, NGO/FBOs, and political support.

In the scale of 1-5(where 1=Strongly Disagree (SD), 2=Disagree (D), 3= Undecided (U), 4= Agree (A); 5 =Strongly Agree (SA)

Table 4.28: Descriptive statistics on Environmental factors

Description	N	SD (%)	D (%)	U (%)	A (%)	SA (%)	Mean	S.D
Government Funding by allocation of budget or grants	**303**	27 (8.9)	49 (16.1)	92 (30.4)	73 (24.1)	62 (20.5)	3.31	1.223
Legal framework or policies formulated by the government providing support to E-health	**303**	27 (8.9)	46 (15.2)	68 (22.3)	113 (37.5)	49 (16.1)	3.37	1.185
Infrastructure like electricity and power backup like electricity, solar, stand by generator and network readily available and working.	**303**	27 (8.9)	17 (5.4)	70 (23.2)	97 (32.1)	92 (30.4)	3.70	1.214
Government Implementation body at the facility level	**303**	14 (4.5)	49 (16.1)	95 (31.3)	110 (36.6)	35 (11.6)	3.35	1.029
Political support	**303**	57 (18.8)	89 (29.5)	62 (20.5)	54 (17.9)	41 (13.4)	2.78	1.313
NGO/FBO and donors support	**303**	16 (5.4)	76 (25.0)	59 (19.6)	100 (33.0)	52 (17.0)	3.31	1.178

According to the results, 34 (30.4%) of the participants in the study were undecided about government funding by budget allocation or grants, even though there were 27 (24.1%) and 23 (20.5%) participants who agreed and strongly agreed with the study's findings,

respectively. There were also 10.9% and 16.1% of participants who disagreed with the study's findings in terms of how strongly they felt about the topic. According to national and county health budget analyses for 2018–19, it appears that although the government is allocating funds, a large portion of those funds may be going toward personnel emoluments, which were high at 76% as opposed to 50–60%. As a result, the counties must increase their funding for essential inputs like e-health in order to improve services [159]. This indicates that counties need to enhance funding for development. According to the statistics, 16.1% of respondents disagree that the government finances by allocating budget or grants, which agrees with the report on health budget analysis of 2018/2019 that county per capita allocations are still low, averaging Ksh 253 as opposed to the WHO recommendation of Ksh 8,600 [159].

The majority of respondents 37.5% agreed and 16.1% highly agreed on the legal framework or policies the government has developed to encourage e-health. However, 22.3% were unsure, and 8.9% and 15.2% strongly disagreed and disagreed, respectively. The Kenya Health Policy (2014-2030), which mandates that the nation deliver the highest standard of healthcare possible, was formed by the Ministry of Health, however the majority of stakeholders are unaware of this. More than 15.2% of respondents disagreeing that Kenya lacks a framework or policy set by the government runs counter to the Kenya e-health Policy, which denotes a responsibility to use modernizations in information and communication technology to enhance Kenya's health and wellbeing. Our e-health Policy offers an all-encompassing and creative approach to tackling a wide range of e-health activities, and our studies mark a significant break from conventional healthcare delivery and access paradigms. The policy is also annexed to Kenya's 2010 Constitution, Vision 2030, the 2006

ICT Policy, and the Health Policy (2014-2030) [73]. As a result, if a significant portion of participants strongly disagree or are unsure, the policy needs to be made available to the stakeholders so that they are aware of it.

The majority of respondents 32.1% agreed that electricity is available, followed by 30.4% who strongly agreed. Infrastructures such as electricity and power backups—such as the solar, stand-by generator, and networks—are also readily available and functional. However, was found that 23.2% of people who were unsure and 8.9% people who strongly disagreed. This indicates that a hospital may not have network access, solar power, or a generator. These are essential for the effective acceptance and implementation of e-health systems [73]. Electricity is one such required infrastructure that must be in place because there is a push to develop e-health systems.

Regarding political support, the majority of participants 29.3% are not in agreement, followed by 18.8% who are firmly opposed, and 20.5% who are unsure. Only 17.9% and 13.4% of respondents, respectively, strongly agreed and agreed that we had political support. The results do not reflect the assertion made in Ayub Manya's presentation on e-health and Mobile Strategies in Kenya [160] that political backing will create an atmosphere that will be favorable for e-health. Thus, it is not always the case that political involvement can contribute to creating the ideal implementation environment for e-health.

A majority of respondents 33.0% agreed with the statement about faith-based and nongovernmental organizations, and 17.0% strongly agreed. However, we also had 25.0% of respondents who strongly disagreed, indicating that some of our health facilities did not receive assistance from NGOs. Furthermore, it became clear from the discussion of government spending priorities that a supportive environment for the adoption and use of e-

health was lacking. Due to inadequate support from the government and NGOs, these data suggested that the majority of hospitals were functioning within budgetary constraints. It may be difficult to adopt and implement e-health because to low support from the government, FBO, and NGOs, as well as the fact that doing so is expensive and requires more resources [161]. The funding of the health sectors affects the adoption of e-health [138]. This indicates that higher funding from NGO/FBO and donors assistance is substantially correlated with the adoption of e-health even in cases of wealthy countries, and this should apply to Kenya as well [161].

4.13.1.2 $H_0$1 Environmental factors Testing

Table 4.29 presents the correlation analyses' findings. The results indicated that environmental factors and the Implementation of e-health Technologies had a substantial, favorable, and significant relationship. A Pearson correlation coefficient of r=0.716 and p-value =0.002<0.05 level of significance, show this. This suggests that a rise in environmental services leads to a rise in the use of e-health Technologies.

Table 4.29: Correlation analysis

		Implementation of e-health Technologies	Environmental factors
Implementation of e-health Technologies	Pearson Correlation	1	
	Sig. (1-tailed)		
Environmental factors	Pearson Correlation	.716	1
	Sig. (1-tailed)	.002	

*. Correlation is significant at the 0.05 level (1-tailed).

4.7.2 Relationship of Organizational factors

The implementation of e-health is a multi-step process that affects the entire workforce. It is the responsibility of the organization to establish a sound implementation plan because introducing a new method necessitates learning.

When it comes to the adoption and implementation of e-health, organizational elements are crucial. These characteristics are included in Table 4.30 below.

In the scale of 1-5(where 1=Strongly Disagree (SD), 2=Disagree (D), 3= Undecided (U), 4= Agree (A); 5 =Strongly Agree (SA)

Table 4.30: Descriptive statistics on Organizational factors

Description	N	SD (%)	D (%)	U (%)	A (%)	SA (%)	Mean	S.D
Top management support by providing learning and training environment	**303**	27 (8.9)	19 (6.3)	6 (1.8)	146 (48.2)	105 (34.8)	3.94	1.195
Top management support by providing funds for hiring qualified human resource	**303**	5 (1.8)	27 (8.9)	43 (14.3)	141 (46.4)	87 (28.6)	3.91	0.973
Top management support for readiness to change to new technology	**303**	11 (3.6)	5 (1.8)	54 (17.9)	141 (46.4)	92 (30.4)	3.98	0.939
An organizational culture that is supportive of effective change management	**303**	0 (0.0)	19 (6.3)	54 (17.9)	122 (40.2)	108 (35.7)	4.05	0.889
Top management culture to involve all stakeholder including all staff in	**303**	19 (6.3)	37 (12.5)	19 (6.3)	114 (37.5)	114 (37.5)	3.88	1.224

planning and development								
The freedom that the organization has in terms of authorizing or commissioning new services	**303**	16 (5.4)	24 (8.0)	57 (18.8)	130 (42.9)	76 (25.00)	3.74	1.088

They were organized into six categories based on primary studies. Top management supports the employment of talented human resources by funding the process, top management supports the organization's readiness to adopt new technologies, and top management supports by creating an environment that is conducive to learning. A top management culture that involves all stakeholders, including all staff, in planning and development, as well as the flexibility the organization has when it comes to authorizing or commissioning new services. These factors all contribute to an organizational culture that supports effective change management. At 48.2% in favor and 34.8% strongly in favor, respondents agreed that top management should encourage learning and training environments. Only 1.8% of people were unsure. This suggests that the top management has a high-level duty to support a resource that is used for learning and to provide funding for the hiring of skilled human resources in accordance with the findings in Table 4.30 below. 28.6% strongly agreed, whereas 46.4% agreed with them. A mean score of 3.98 indicates that management is in favor of being ready to adopt new technologies, according to the results. With a mean score of 4.05 and a 0.0% strongly disagreeing response rate, organizational culture supports efficient change management. This means the degree of management support in providing resources for training, education, hiring skilled personnel, transitioning to new technologies, involving all stakeholders, including all staff, in planning and development, and enabling or

commissioning new services for adoption e-health and implementation is consistent with what others have done, for example, when examining predictors, correlates, and biases in a study of IT innovation adoption by Jeyaraj et al., they stated that top management is one of the main predictors of IT innovation [162]. Administrative staff are catalysts for change and can be the main cause of resistance or overcome resistance by collaborating with other stakeholders and reinforcing principles through an articulated idea for the organization, and play an important role in persuading members to accept and implement new technologies such as e-health [163] [164].

4.13.2.2 $H_0$2 Organizational factors testing

Table 4.31 presents the correlation analyses' findings. The results showed that organizational characteristics and the Implementation of e-health Technologies had a strong, favorable, and significant relationship. There was a positive significant relationship between organizational factors and implementation of e-health Technologies with a Pearson correlation coefficient r=0.226, p-value=0.003<0.05 which was significant at a 0.05 level of significance. This implies that increased organizational factors increase implementation of e-health Technologies.

Table 4.31: Correlation analysis

		Implementation of e-health Technologies	Organizational factors
Implementation of e-health Technologies	Pearson Correlation	1	
	Sig. (1-tailed)		
Organizational factors	Pearson Correlation	.226*	1
	Sig. (1-tailed)	.003	

*. Correlation is significant at the 0.05 level (1-tailed).

4.7.3 Relationship of Social factors

Many complex systems that involve the interaction between people, technology, and context that must be taken into account during the implementation process are described by social factors, which are frequently employed. Social considerations affect user acceptance of e-health and impact how it is implemented.

The acceptance and implementation of e-health are critically influenced by social factors, which are listed in Table 4.32 below.

In the scale of 1-5(where 1=Strongly Disagree (SD), 2=Disagree (D), 3= Undecided (U), 4= Agree (A); 5 =Strongly Agree (SA)

Table 4.32: Descriptive statistics on social factors

Description	N	SD (%)	D (%)	U (%)	A (%)	SA (%)	Mean	S.D
Impact of the system on individual security in their work	**303**	11 (3.6)	49 (16.1)	73 (24.1)	108 (35.7)	62 (20.5)	3.54	1.098
Level of user acceptance of the E-system	**303**	5 (1.8)	30 (9.8)	62 (20.5)	133 (43.8)	73 (24.1)	3.79	0.981
Level of user readiness to use the E-Systems	**303**	0 (0.0)	35 (11.6)	52 (17.0)	146 (48.2)	70 (23.2)	3.83	0.919
Effects of the system on the allocation of work to individuals	**303**	0 (0.0)	59 (19.6)	65 (21.4)	122 (40.2)	57 (18.8)	3.58	1.010
The balance between the needs of individual users of	**303**	0 (0.0)	62 (20.5)	84 (27.7)	111 (36.6)	46 (15.2)	3.46	0.986

the system, and the organization itself								
Collaboration and partnership between stakeholders	**303**	16 (5.4)	30 (9.8)	111 (36.6)	87 (28.6)	59 (19.6)	3.47	1.082

These features were taken from primary studies and grouped into six categories: impact of the system on people's personal security at work, User ready to use the E-Systems, User acceptance of the E-Systems, effects of the system on how work is distributed to people, The harmony between the requirements of system users as individuals, the company as a whole, and Partnerships and cooperation between stakeholders.

The majority, 35.7%, strongly agreed, followed by 20.5% who strongly agreed and the minority, 4 (3.6%) who strongly disagreed, on the impact of the system on individual security in their place of employment. On the other hand, 24.1% of people were unsure. The study's participants must have paid close attention to the confidentiality of their records if the study's mean was 3.54, which suggests that they did. Since only 16.1% of respondents felt that their information was protected, the findings supported the findings of a study by Ancker et al. [165] who claimed that discussing their health information online had a negative impact on it.

The majority of users 43.8%, agreed with the E-level systems of user acceptance, followed by 24.1%), who highly agreed. 9.8% of the participants disagreed, and 2 (1.8%) of them severely disagreed. 23 people, or 20.5%, were unsure. Based on the percentage of respondents who were unsure or disagreed, it appears that despite the advantages of implementing e-health, a number of respondents are still unsure or opposed to the new technology.

The majority agreed with 54 (48.2%) and 26 (23.2%) strongly agreed, while the minority disagreed on the subject of user readiness to utilize e-health with 0 (0.0%) and 13 (11.6%). Even though there were 19 (17.1%) undecided among the respondents, this indicates that the majority of them had a high level of desire to embrace and apply the system.

According to the findings shown in Table 4.32 below, which show that the majority of the respondents, 45 (40.2%) and 21 (18.8%), agreed and strongly agreed correspondingly, the respondents agreed that adopting and implementing new technology has consequences on the allocation of work to persons.

The majority of 41 respondents (36.6%) agreed that there should be a balance between the needs of system users as individuals and those of the business as a whole. It was nonetheless followed by a sizable portion of people who were undecided, with 31 (17.7%) and 23 (20.5%) disagreeing. This suggests that the balance between human wants and organizational needs may lead the implementation of new technologies to fail.

Collaboration and partnership amongst stakeholders was the final social element to be evaluated, and the majority of respondents (41, or 36.6%), followed by 32, or 28.6%, and were unsure. According to the results, there were 6 (5.4%) who disagreed and 11 (9.8%) who severely disagreed. The findings were at odds with a Kenyan report from April 2011 on the Kenya National e-health Strategy, which stated that "collaboration was fundamental to the successful implementation of e-health that participants in developing and implementing e-health project were to be leaders in some cases and collaborators in others. Health care professionals were crucial to the delivery of e-health and were crucial partners in improving the health outcome in Kenya" [166].

4.13.3.2 $H_0$3 Social factors Testing

The results of the correlation analysis are given in Table 4.33. The findings showed that there is a strong positive and significant relationship between social factors and the Implementation of e-health Technologies. This is reflected by Pearson correlation coefficient r=0.057, p-value =0.001<0.05 which was significant at 0.05 level of significance. This means that increasing social factors increase the adoption of e-health Technologies.

Table 4.33: Correlation analysis

		Implementation of e-health Technologies	Social factors
Implementation of e-health Technologies	Pearson Correlation	1	
	Sig. (1-tailed)		
Social factors	Pearson Correlation	.057*	1
	Sig. (1-tailed)	.001	

*. Correlation is significant at the 0.05 level (1-tailed).

4.7.4 Relationship of Technological factors

The characteristics of innovation, which is e-health, are illustrated by technological factors, as indicated in Table 4.34. The six primary factors were compatibility, complexity, availability, relative advantage, trial-ability, and observability. These were taken from the conceptual framework. As stated in Table 4.34, the six primary components were further separated into 19 technological sub-factors.

Table 4.34: Descriptive statistics on Technological factors

Description	N	SD (%)	D (%)	U (%)	A (%)	SA (%)	Mean	S.D
Would you agree to collect medical data by means of mobile devices	**303**	19 (6.3)	27 (8.9)	70 (23.2)	138 (45.5)	49 (16.1)	3.44	1.072
Would you agree to send SMS to make people aware of different methods of disease prevention	**303**	11 (3.6)	100 33.0)	73 (24.1)	65 (21.4)	54 (17.9)	3.74	0.975
Would you agree to use mobile devices for diagnostic support	**303**	11 (3.6)	92 (30.4)	116 (38.4)	62 (20.5)	22 (7.1)	3.27	1.040
Would you agree to use mobile devices for treatment support	**303**	19 (6.3)	27 (8.9)	70 (23.2)	138 (45.5)	49 (16.1)	3.56	1.064
Would you avoid adopting E-health because Technology (ICT) are difficult	**303**	100 (33.0)	73 (24.1)	54 (17.9)	65 (21.4)	11 (3.6)	2.38	1.247
Would you not adopt E-health applications because they are difficult to learn	**303**	11 (3.6)	32 (10.7)	59 (19.6)	152 (50.0)	49 (16.1)	4.24	0.883
You would adopt E-health because E-health devices are easier to use	**303**	0 (0.0)	19 (6.3)	8 (2.7)	135 (44.6)	141 (46.4)	4.31	0.806
Can E-health reduce the amount of effort spent on executing some tasks	**303**	8 (2.7)	8 (2.7)	22 (7.1)	122 (40.2)	143 (47.3)	4.27	0.910
If E-health is adopted and implemented can population benefit from healthcare services	**303**	0 (0.0)	30 (9.8)	33 (10.7)	162 (53.6)	78 (25.9)	3.96	0.874
There will be an increase in prevention and awareness of diseases should E-health be adopted and implemented	**303**	0 (0.0)	46 (15.2)	43 (14.3)	173 (57.1)	41 (13.4)	3.69	0.891
E-health is compatible with what you need to execute in your daily activities	**303**	0 (0.0)	30 (9.8)	38 (12.5)	173 57.1)	62 (20.5)	3.88	0.846

E-health is compatible with your organizational working style and ethics	**303**	0 (0.0)	21 (7.1)	41 (13.4)	206 (67.9)	35 (11.6)	3.84	0.717
Would you first test E-health before adopting it and implementing	**303**	0 (0.0)	11 (3.6)	11 (3.6)	154 (50.9)	127 (42.0)	4.31	0.711
Would you adopt E-health because it has proven to work in other countries	**303**	8 (2.7)	78 (25.9)	22 (7.1)	133 (43.8)	62 (20.5)	3.54	1.162
Would you first adopt E-health and then evaluate the results	**303**	49 (16.1)	57 (18.8)	38 (12.5)	108 (35.7)	51 (17.0)	3.19	1.359
Are you willing to adopt E-health immediately without trying it	**303**	86 (28.6)	141 (46.4)	49 (16.1)	19 (6.3)	8 (2.7)	2.08	0.969
Want to see tangible results of E-health adoption before Adopting and implementing	**303**	0 (0.0)	32 (10.7)	38 (12.5)	108 (35.7)	125 (41.1)	4.07	0.984
Access to ICT equipment's and facilities; electronic communication infrastructure; ICT processing and storage services	**303**	0 (0.0)	32 (10.7)	76 (25.0)	130 (42.9)	65 (21.4)	3.75	0.915
Availability of technical support in using the system	**303**	11 (3.6)	16 (5.4)	43 (14.3)	133 (43.8)	100 (33.0)	3.97	1.009

The respondents were asked if they could consent to the mobile device collection of medical data. 51 people (45.5%) were in favor, and 18 of them (16.1%) strongly agreed. 26 (23.2%) people were unsure, while 10 (8.9%) people disagreed. This suggests that some people are unwilling to use technology, even if it is still available and includes mobile devices. This is equally true of the acceptance and use of e-health. In addition, they were asked if they would be willing to use mobile devices for diagnostic support or to send SMS to inform people about various disease prevention techniques. The responses to these two questions were remarkably similar, with the majority of respondents remaining undecided at 27 (24.1%) and

43 (38.4%), respectively. 34 (30.4%) disagreed, while 37 (33.0%) did. This shows that people are avoiding the use of technology for treatment support even if it is still available.

Second, the respondents were quizzed on the difficulty of the technology and asked if they would be able to delay adopting E-health because of it. 37 people, or 33.0%, strongly disagreed, followed by 27 people, or 24.1%, and 4 people, or 3.6%, strongly agreed. This suggests that despite the difficulty of adopting new technology, they were willing to use it. They were also questioned if the complexity of the E-health applications prevented them from adopting them. Contrary to the claim of ICT difficulty, the majority of people were in agreement. With 18 (16.1%) strongly agreeing and 56 (50.0%) agreeing. E-health was more widely used since the equipment was simpler to operate. A mean of 4.31 indicates that the majority agreed, with 50 (44.6%) agreeing and 52 (46.4% strongly agreeing). However, when it came to difficulty, they all believed that E-health would be used since the devices are simpler to use. The majority, 52 (46.4%) strongly agreed, with 50 (44.6%) following. The complexity findings were consistent with earlier research, such as Marie-Louise Jung's study on the transition from traditional healthcare to electronic health records, which sought to understand how people felt about receiving care online. In a system like e-health, Marie defined perceived ease of use as being free of effort, which is freedom from difficulty or substantial effort. Both complexity and expected effort were correlated with ease of use [167]. In his study, Marie found that attitudes about utilizing e-health were significantly positively impacted by perceived ease of use.

Third, the respondents were questioned about relative advantage, with the first sub-factor being to ascertain whether e-health was beneficial. The majority strongly agreed (53, 47.3%), followed by 45, 40.2%, and the minority (3, 2.7%), who strongly disagreed, that E-

health minimizes the amount of work required to carry out specific tasks. The population would gain from healthcare services if e-health were embraced and put into practice, which was the second relative advantage. 60 people (53.6%) were in favor, followed by 29 people (24.9%) who were extremely in favor and 0 people (0%), who were strongly opposed. The findings agreed with Moore and Benbast, who claimed that a new innovation or technology, like e-health, is superior to its successor.

Forth, according to Rogers' definition of e-health [167], the respondent was questioned about what degree of e-health was allegedly compatible with the current values, experience, and needs of the reasons it was being accepted. The first sub-factor was to determine whether E-health could be used in conjunction with what was required for one's everyday activities. 64 (57.1%) of the respondents agreed, followed by 23 (20.5%), but the fact that there were also 11 (9.8%) who disagreed and 14 (12.5%) who were unsure suggests that e-health was comprised of preexisting values. The second critical aspect involved determining whether E-health was compatible with organizational working practices and ethics. 76 people (67.9%) said they agreed, and 13 people (11.6%) said they strongly agreed. Only 15 (13.4%) of the minorities were indecisive, which was 8 (7.1%). The outcomes support Marie's assertion in his compatibility study that compatibility has a significant direct impact on attitude toward the adoption of e-health [167]. Wu and Wang discovered that compatibility was a more important factor in choosing partners than even perceived usefulness. In the online environment where e-health is practiced, compatibility was considered to be the main motivator. According to Rogers, e-health's use becomes more obvious if it is in line with how people normally conduct themselves [168]. According to Marie's study, a participant will be more likely to regard the usage of e-health as being beneficial as well if they believe

utilizing it is compatible with them. Fifth, Triability questions were asked to the respondents to determine the extent to which e-health may be used sparingly. In order to accept and deploy e-health, the first sub-factor involved determining if they would first test it. 57 people (50.9%) and 47 people (42.0%) were in agreement. Four (3.6%), the same as the minority and the undecided. Whether or if someone would adopt e-health first, then assess the outcomes, was the second sub-factor to be considered. The majority strongly agreed with 19 (17.0%), followed by 19 (35.7%), and the minority was indecisive with 14(12.5%), followed by 18(16.1%), strongly disagreeing.

4.13.4.2 $H_0$4 Technological factors Testing

Table 4.35 presents the results of the correlation analysis. According to the data, there is a significant, positive and significant correlation between technological parameters and Implementation of e-health Technologies. Pearson's correlation coefficient r=0.452, p-value =0.0080.05 and a significance level of 0.05 indicate that this is the case. This suggests that an increase in technological variables leads to an increase in the use of e-health Technologies.

Table 4.35: Correlation analysis

		Implementation of e-health Technologies	Technological factors
Implementation of e-health Technologies	Pearson Correlation	1	
	Sig. (1-tailed)		
Technological factors	Pearson Correlation	.452*	1
	Sig. (1-tailed)	.008	

*. Correlation is significant at the 0.05 level (1-tailed).

4.8 Model development

4.8.1 Preliminary model review

The comprehensive integrated model, and the social, organizational, environmental, and technological aspects that went into creating this model are all described in this part. The model's application and validation were then discussed, along with the implications for the acceptance and implementation of e-health.

4.8.2 Model fundamentals

The ideas and models from the fields of information technology and health informatics served as the foundation for the holistic integrated model and composite metrics. They consist of the NPT (Normalization Process Theory), ANT (Actor Network Theory), TOE (Technology Organization Environmental Framework).

4.8.3 Model variables

There are four variables in the composite metrics and holistic integrated model. Social, organizational, environmental, and technical are these. They are explained below.

Social the social variables cover computer effectiveness, user preparation, user acceptance, and cyber security.

Organizational top management support, readiness, cost/financial, human resources, size/structure, and culture are among the organizational variables.

Environment competition, administrative pressure, government support, external support, and business partner are all topics that the environment touches on.

Technology compatibility, Complexity, Availability, Relative Advantage, Trial Capability, and Observability are the technological aspects that are addressed.

The model's defining factors, which have a direct impact on the adoption and implementation of e-health, are the four variables mentioned above. Based on a social technical approach, the factors are. Every variable can change other variables by its implementation effort. Figure 4.1 depicts the model, and the four variables are described after the extended framework.

According to the researchers, if an organization can coordinate its efforts with the four criteria, it will be able to increase the adoption and implementation of e-health by e-health facilities. For instance, adhering to traditional health laws, regulations, policies, government interaction with stakeholders, and others might speed up the acceptance and use of the technology.

4.8.4 An integrated model for e-health Technology in Kenya.

Table 4.35: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.657[a]	.531	.537	4.13026

Source: Researcher (2022)

From the study findings in Table 4.35, the value of R-square is 0.531. This implies that, 53.1% of variation of e-health adoption was explained by social factors, organizational, and environmental factors.

An ANOVA test is used to determine whether the model is significant in predicting e-health adoption. At 0.05 level of significance, ANOVA test showed that in this model the independent variables namely; Social, organizational, technological, and environmental factors were predictors of e-health adoption as indicated by significance value = 0.001, which is less than the 0.05 significance level ($p = 0.001 < 0.05$).

Table 4.36: ANOVA Table

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	303.126	4	75.781	6.291	.001[b]
	Residual	1288.874	107	12.046		
	Total	1592.000	111			

a. Predictors: (Constant), Social, Organizational, Technological, Environmental

b. Dependent Variable: E-health Technology

From the findings in Table 4.36 above; at the 5% significance level, social factors are a significant predictor of e-health Implementation ($p=0.005<0.05$). Organizational factors were a significant predictor of e-health Implementation ($p=0.002<0.05$). Technological factors were a significant predictor of E-health Implementation where ($p=0.000<0.05$). Environmental factors were a significant predictor of e-health Implementation where ($p=0.048<0.05$).

Table 4.37: Model Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	11.895	2.067		5.755	.001
	Social	.124	.080	.166	1.546	.005
	Organizational	.331	.106	.432	3.127	.002
	Technological	.466	.114	.608	4.098	.000
	Environmental	.158	.077	.222	2.052	.043

a. Dependent Variable: E-health Technology

Source: Researcher (2021)

Letting Y be E-health Technology, X_1 be social factors, X_2 be organizational factors, X_3 technological factors, and X_4 be environmental factors, using the regression coefficients in Table 4-43., we have;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \quad (1)$$

$$Y = 11.895 + 0.124 * X_1 + 0.331 * X_2 + 0.466 * X_3 + 0.158 * X_4 \quad (2)$$

From the equation above, the unstandardized coefficient of social factors is 0.124, organizational factors is 0.331, technological factors is 0.466 and environmental factors is 0.158. Improving employee's social factors by one unit increases e-health implementation by 0.124, increasing organizational productivity by one unit increases e-health implementation by 0.331, increasing technological factors by one unit will increase e-health implementation by 0.466 implementation, and finally a unit increase in environmental practices leads to a 0.158 increase in e-health implementation. A model that includes the variables is shown below.

Exploratory factor analysis (EFA)

Exploratory factor analysis (EFA) can be described as an ordered simplification of interrelated measures. EFA is traditionally used to explore the possible underlying factor structure of a set of observed variables without imposing a prior structure on the outcome. By performing EFA, a basic factor structure was determined.

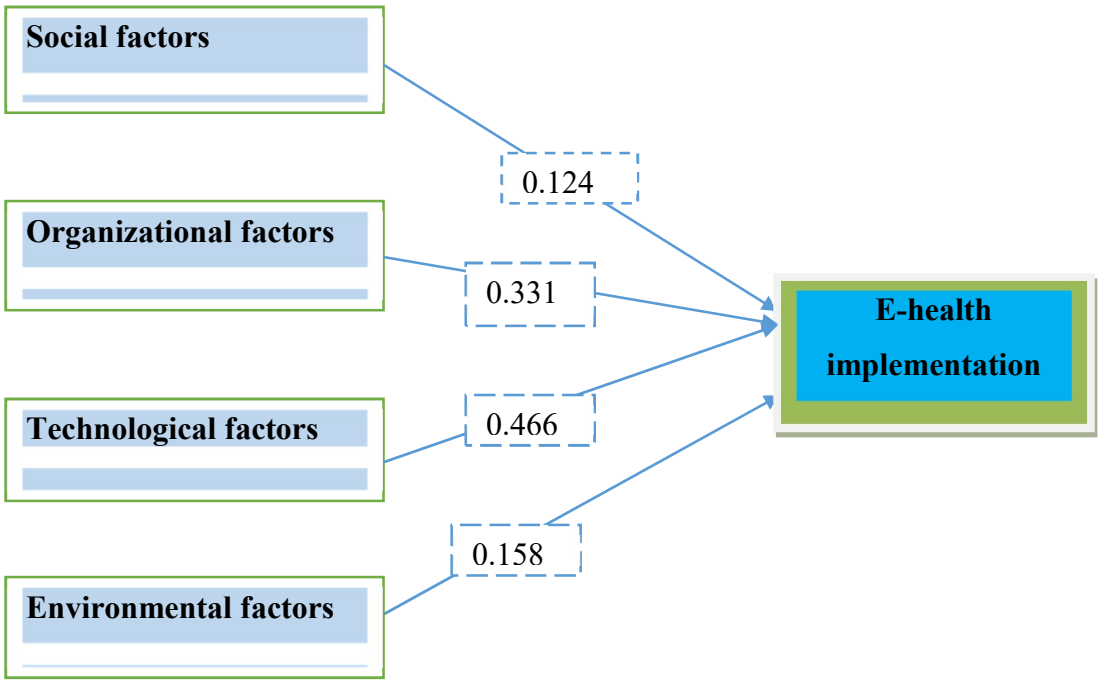


Figure 4.1: Model incorporating the variables.

The following methodology was used to evaluate the impact of e-health Technology among the stakeholders.

$$Y = \hat{\beta}_{10} + \hat{\beta}_{11} X + \hat{\beta}_{12} M + \beta_{13} X * M \quad (3)$$

Where,

β_0 = Y-intercept/constant

Y = E-health Technology

X = External factors (Social, environmental, organizational)

M =Technological factors

$X * M$ = Interaction between technological and external factors

$\hat{\beta}_{11}$ = main effect of external factors on e-health Technology

$\hat{\beta}_{12}$ = Main effect of technological factors on e-health Technology

$\hat{\beta}_{13}$ = interaction effect between external factors, technological factors, and e-health Technology

The study tested the interaction between external factors, technological factors and e-health Technology. A significant change in the R-squared value indicated the presence of an effect from the implementation of e-health. The adjusted R^2 of model a is 0.327 and its R^2 is 0.315 for the main model with technological factors, whereas when the interaction of technological factors with main predictor variable is introduced in the model, R^2 is 0.393, with adjusted R^2 falling to 0.381. The variations in the two cases of R^2 for each model are less than 0.5. This small change means that the models are valid and stable for predicting technological factors and e-health Technology with 31.5% and 38.1% variance, respectively.

Table 4.38: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df 1	df 2	Sig. F Change
1	.447[a]	.327	.315	6.62695	.326	104.517	2	291	.003
2	.492[b]	.393	.381	5.12480	.029	7.624	1	290	.002

a. Predictors: (Constant), external factors, technological factors

b. Predictors: (Constant), external factors, technological factors

c. Dependent Variable: e-health Technology

As a result, the considerable connection demonstrates how outside influences influence how e-health is implemented and how technological elements affect that relationship. Examining

the regression weights shown in Table 4.42 reveals that, while the primary influence of technological factors was 0.239, the main influence of external factors was 0.147. The implication is that technological variables determine the course that the deployment of e-health will follow.

Table 4.39: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.370	2.269		4.130	.000
	External factors	.168	.020	.419	8.321	.001
	Technological factors	.495	.074	.336	6.663	.002
2	(Constant)	9.432	1.673		7.120	.000
	External factors	.147	.018	.389	6.182	.000
	Technological factors	.239	.036	.282	4.567	.020
	External factors * technological factors	.107	.022	.118	3.227	.001

a. Dependent variable: E-health Technology

Therefore, the hypothesized moderation model was confirmed to be:

$$Y = 9.432 + 0.147 * X + 0.239 * M + 0.107 * X * M \quad \textbf{(4)}$$

According to the model above, M has an impact on both the intercept and the YX slope. Different intercepts and slopes of line YX would be produced by different values of M (the moderator variable). The unstandardized moderator regression coefficient is 0.107 points. This means that the slope between technological elements and outside variables will rise by 0.107 for every unit increase in e-health Technology. On the other hand, a unit increase in technological elements causes a 0.239-percentage-point rise in the slope pertaining to the

adoption of e-health. This demonstrates that in the model's validation, technological factors are the key motivator for the implementation of e-health.

4.9 Framework for e-health Implementation.

A framework has been created as an extension of the model after it. The study assessed other frameworks, such as TOE and strategies that have been used before developing the integrated holistic model for sustainable e-health Technology in Kenya. It also established the current status of e-health Technology in Kenya, then outlined critical factors that affect the implementation of e-health Technologies in Kenya's health sector. The foundation for this framework was created by empirical data that was statistically collected based on the research objectives and backed by a literature assessment. This data indicated the gaps in the existing methodologies and frameworks.

The quantitative data that was gathered, examined, and backed by secondary data was current for the framework-development process. Additionally, the other two ideas supported the development. In this inquiry, the researcher noted the shortcomings of each theory. As a result, careful examination of each theory increased comprehension, which in turn facilitated the creation of the complete holistic model. The ANT, TOE, and NPT theories and frameworks that were examined each had various shortcomings, as shown in Table 2.3.

The social context in TOE was lacking, but the social context in NPT was there, but TOE also lacked an environmental context, and environmental components are essential for enabling the environment. The study had numerous components, such as technology, organization, environment, and social elements, with distinct sub-components, and different associations which exist between them that make them stable. This research was focused on

how parts of a network construct the overall network. As a result, ANT assisted in combining all the components of the two theories. In order to create a single entity that interacts with technical aspects as a separate entity, the three factors (organizational, environmental, and social) were integrated. As a result, the framework for implementing e-health was designed. The study was divided into four layers: the foundation (environmental, organizational, and social variables), the enabler (technology), the innovation (e-health), and the effects (benefits). The first two sections are regarded as advocates for the effective application of e-health. The third component is innovation, and the fourth component is the benefits that have been reaped as a result of the effective adoption of e-health. Numerous subcomponents of the first two segments are shown in Figure 4.2 below

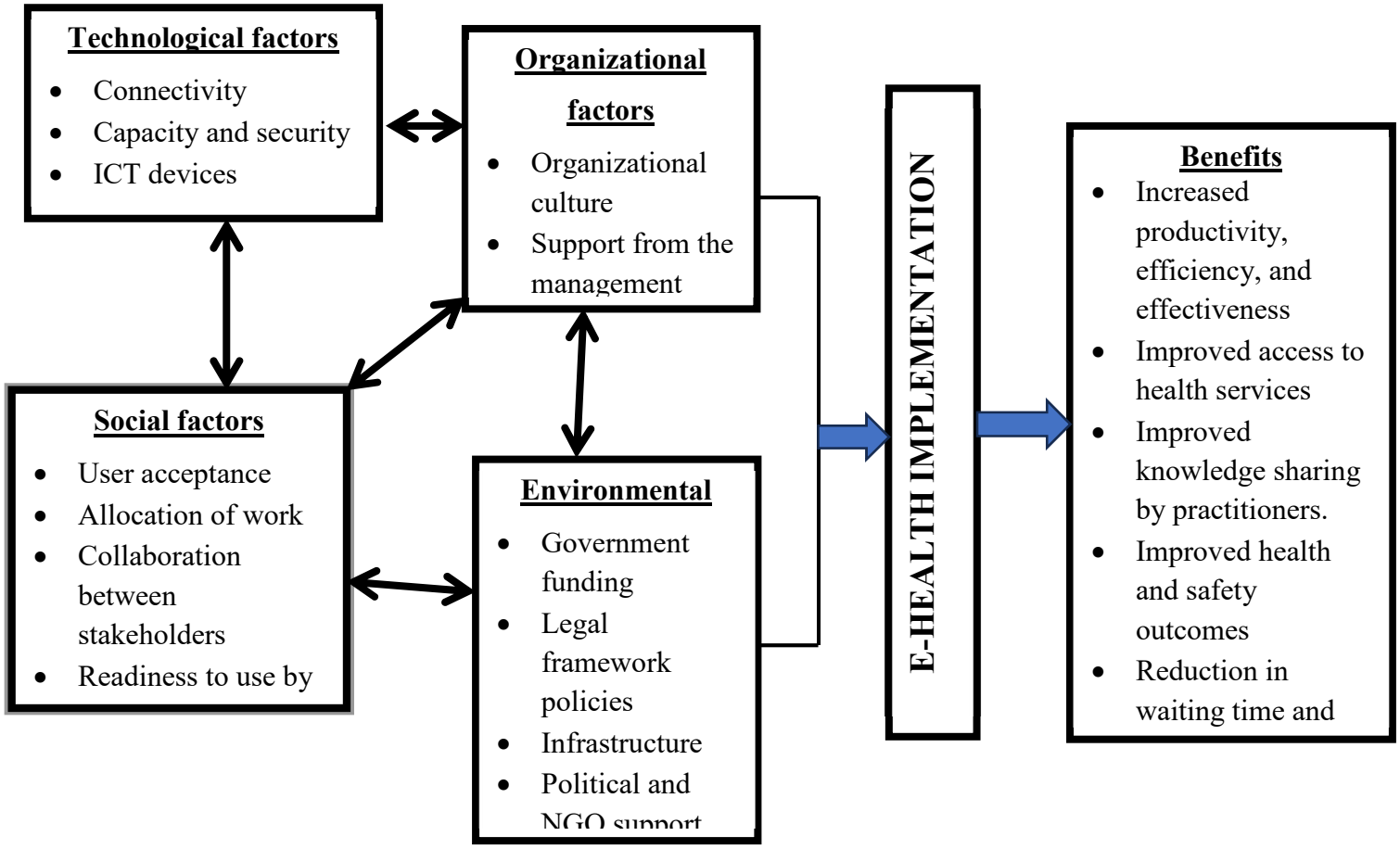


Figure 4.2: Framework for e-health implementation

Base (social, organizational, and environmental), facilitator (technology), innovator (e-health), and impacts are the main contexts (benefits). This framework's basis served as its conceptual cornerstone, providing the external support background necessary for the other organizational operations to succeed.

The study has the following organizational sub-factors: organizational culture, management support, top management support for employing qualified employees, and top management support for adopting new technologies. The multi-step process of e-health Technology affects all workers or employees. A successful adoption of a new process like e-health would necessitate learning, thus it is the responsibility of the organization to establish a well-thought-out plan. Table 4.36 lists the organizational factors in summary. Empirical findings and findings from earlier studies show that top management must completely commit to and support the process for the new technology to be adopted and implemented successfully [169]. The e-health technology plan must be managed by the managers. They frequently encourage innovation and participate in decisions regarding technology adoption. One of the primary forces driving competition is the support offered by managers [170]. For that reason, it seems sense to acknowledge that top management support affects the choice to embrace and utilize e-health technology.

The study also have environmental elements as a foundation, and these factors have the following sub-factors: infrastructure, political and NGO support, financing from the government, and legal and policy frameworks. According to table 4.34. The analysis revealed a statistically significant correlation between the environmental sub-factors and the choice to embrace and use e-health technology. The research recommends that, in addition to technical competence, the environment of the company should also be

considered when evaluating the technology for acceptance and implementation of the e-health sector. On the other hand, health facilities could embrace and implement e-health technology in order to keep up with their competition rather than because of the anticipated benefits and returns to the organization.

The social component, the third base factor, is made up of social sub-categories that are crucial for the acceptance and implementation of e-health and were deduced from primary studies and categorized under the six main factors, as shown in Table 4.38: impact of the system on people's personal security at work, User ready to use the E-Systems, User acceptance of the E-Systems, effects of the system on how work is distributed to people, the harmony between the requirements of individual system users, the company as a whole, and stakeholder collaboration and cooperation. The relationship between individuals within and outside of hearth facilities is brought up by the sub-system in society. Long-term sustainability is ensured if the end user in healthcare institutions accepts e-health technology [171]. People's perceptions of the usefulness or efficacy of e-health, their motivation, and their ability to utilize it effectively in terms of their knowledge and confidence are all elements that have a direct impact on how well it works.

The responsibilities, tasks, and regulations of the healthcare facilities are included in the list of social sub-systems [171]. The ability of e-health to handle stakeholder issues including behavior, needs, and culture in the processes used to develop, implement, and manage them is indicated by social aspects. People's behaviors are influenced by societal variables, such as the usefulness and usability of e-health.

The second tier of criteria was technological, and it concentrated on how effectively e-health could meet the needs of its primary target audience. It examined the following

technological sub-factors: compatibility, complexity, availability, relative advantage, trialability, and observability. In contrast to earlier studies, the technology in this one was kept distinct from other aspects like organization and environment. Technology is employed in this study as a driver of innovation rather than as its engine. Technology is utilized to support organizational processes, social factor processing, and environmental factor services. Three is the e-health layer in this study, which is the innovation. If e-health is used, it can improve outcomes in terms of health and safety, access to healthcare services, knowledge sharing among practitioners, productivity, efficiency, and effectiveness, or it can shorten the time needed to complete a task or produce an improvement. If all of these are realized, the benefits of the e-health innovation comprise the fourth layer, which is the impact of the invention.

This study found that not all problems can be solved by technology; rather, it simply assists or supports efforts to create new goods and services or enhance existing ones. Without the use of technology, a number of improvements take place. For instance, environmental factors like governmental funding or legal framework regulations can increase productivity and efficiency without necessarily incorporating technology.

4.10 Validation of the framework

The integrated model that were established for e-health implementation are validated in this part. There are three main divisions. Previous, the researchers carried out a qualitative review; next, they carried out a quantitative evaluation; and finally, a report detailing the conclusions and suggestions from the first two processes was published.

In order to understand the model's mathematical foundation and the design utilized to process the data and create the model, the qualitative examination included an assessment

of the existing document records. Review of the data utilized and explanation of data cleaning. The procedures and standards that were followed in the selection of the variables and their transformation were examined. The expert was then questioned. The researcher evaluated the hypotheses in this section, including their validity, traits, and premises. It was possible to identify the model platform's capabilities, as well as its history and logic. The model's technical and functional capabilities were examined. Data were analyzed by the researcher to assess modeling possibilities throughout the quantitative examination. During the data analysis, the researcher evaluated the dataset's completeness and the accuracy of the sample.

After its creation, the model underwent three rounds of validation. The model variables were first evaluated or assessed, including their range or depth, their types and classification, and their techniques or measures in comparison to those mentioned in the e-health literature review. The second was a meeting with an expert for consultation to ascertain whether they concur with the model's components. The final step involved comparison with the investigational inquiries. The actions are described below.

4.10.1 Evaluation of the model variable

In May 2019, research was conducted to determine the difficulties in implementing e-health in poor nations [57] after reviewing similar studies. The developed model had most of the assessment measures mapped to it, but the technical and operational difficulties were not, thus they were included to the new model.

A study was conducted in 2017 that was a literature analysis on the difficulties in implementing e-health in rural societies in underdeveloped countries: A case study of Ghana [58]. Most of the factors in this study could be mapped to the current model, such as a lack

of ICT infrastructure, ICT skills, resistance to using ICT, security, the legal and policy framework, and financial concerns; however, there was a problem with the culture dimension, which directly affected the implementation of e-health.

On the best way to implement telemedicine in Sri Lanka, research was conducted in September 2016 [61]. Whereas in the new model certain elements were established where some measures, such as organizational and environmental factors, were not included in the study.

4.10.2 Expert consultation

The researcher met with three specialists for consultation after developing the model (health practitioner, Information Technology expert and analytic expert). They offered their written comments and critique of the model in an anonymous form. They responded to questions about the model's logic, whether it was incomplete or needed improvement, and how much work it would take to implement the model in e-health facilities. Based on their feedback, changes were made to the model that simplified it, such as removing technology from the base context and replacing it with the base dimensions, as seen in figure 4.2.

4.10.3 Results of validation

The adoption and implementation model for e-health was discussed in this section. It considers the relevant contributing factors. Technological, organizational, environmental, and social variables are the model's four conceptual variables. Adoption and implementation of e-health are defined by the sub-factors that each variable has. The model has completed initial validation and been recommended as the most common paradigm for the adoption and implementation of e-health.

In many hospitals, ICT integration into the healthcare system is still in its infancy. Even though the majority of private hospitals have engaged in patient interactions using various e-health management tools, public hospitals are still in the early stages of development. Private healthcare facilities typically have a disjointed system that is not connected to other healthcare facilities. This illustrates that Kenya's larger healthcare industry is still working to implement e-health.

A model was presented to important players in the Kenyan health sector, and they were asked to rate how much the services connected to it were provided in their companies as: very high (5), high (4), medium (3), low (2), and very low (1). Table 4.40 shows their responses.

Table 4.40: Stakeholder validation test

E-health system use	N	Mean	Std. Deviation
Paper material usage	52	3.5495	1.0027
Medical records/images retrieval	52	3.4725	.96129
Discharge summaries done electronically	52	3.3077	.96215
Scheduling and appointment reports	52	3.7651	.94884
Sign-off/review of inpatient observation charts	52	3.6374	.83088

According to the respondents, they were keen to have functional systems because e-health technologies were better than manual methods. These claims are supported by the following responses from the respondents:

"E-health uses ICT applications to deliver healthcare, therefore it offers quicker access to patients' medical histories. This results in shorter wait times and more precise patient diagnoses."

Primarily, the replies show that the stakeholders recognize the potential that e-health systems have to enhance healthcare delivery. It was clear that the stakeholders agreed on the importance of implementing e-health systems. However, the stakeholders also voiced worries about potential difficulties with the model's implementation;

"In order to offer people better and better healthcare services, I think the first step should be to look for alternatives to current policies. However, they must be easily accessible and available at all times if the e-health system is to function." (Respondent 2)

"We have not yet encountered a fully operational e-health system, despite the existence of a few systems within the business. It would be expected that the systems would need to be well-structured and compatible. This would significantly aid universities in sharing data" (Respondent 3)

"Meeting user criteria are vital any success of the system. Therefore, the model should be altered to fit the specific organizational demands setting. Additionally, there must to be an online support system that helps people solve issues as they arise. This facilitates technical support for system usage." (Respondent 3).

Other respondents had conflicting opinions about whether or not implementing the e-health system would increase the system's level of quality;

"First and foremost, we shouldn't be talking about the quality of e-health systems since they just exist in principle. Quality may therefore not be a concern, but the systems' implementation and validation should come first". (Respondent 5)

"The relationship between the quality of e-health systems and their implementation is unclear to me, however the system should have intuitive user interfaces for simple navigation" (Respondent 6).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Overview

This section summarizes the findings, discussions, conclusions, and suggestions from the study for further research. These are broken down into five sections: the first part 5.2 presents a summary of results, the second part 5.3 discusses findings in relation to the study's objectives, the third part 5.4 presents the study's conclusion, the fourth part 5.5 presents the study's recommendations, and the fifth part 5.6 offers ideas for further research.

5.2 Summary

The study's goal was to identify factors that affect the adoption of sustainable e-health practices using a theoretical framework as a starting point for comprehension and analysis of implementation-enhancing strategies that would eventually lead to the creation of an integrated, comprehensive model for sustainable e-health practices. To direct the investigation, three research goals were developed. The first research goal was to ascertain Kenya's existing level of e-health adoption. The second research goal was to identify important variables that influence how well e-health Technologies are implemented in Kenya's health sector. The third goal was to create a sustainable, all-encompassing strategy for e-health Technology in Kenya.

The study used a case study methodology and a study questionnaire. Over 303 people made up a sample of the study, which was taken from healthcare facilities in Kakamega county with a wide range of levels or sizes of facilities (levele1 to level 5). Other factors were

considered to be the same across the study sites to guarantee consistency, resulting in confidence in the findings.

Objective 1: The current state of Kenya's adoption of e-health. This was done to determine how many hospital employees were able to use an e-health system, what kinds of employees were using one, whether the hospital had workflow policies for integrating e-health functions, whether the e-health they were using was certified by the Certificate Commission for Health Information Technology (CCHIT), and whether the e-health they had could track and record data.

The objective of the study was to determine whether the facilities had Computerized Provider Order Entry (CPOE), a computer program that enables a physician to electronically enter orders for diagnostic and therapeutic services such as prescription drugs, laboratory tests, and other tests rather than writing them down on order forms or prescription pads. And if other systems were integrated with the CPOE function, for instance: medicine orders are submitted by a provider and sent electronically to a pharmacy to see if there were any obstacles to implementing CPOE for all provider orders, we looked at them.

The study looked at whether the facilities used clinical decision support tools like medication guides and chronic condition care plans, as well as whether they used laboratory tests to collect samples of patients' blood, urine, or body tissue to learn more about their health and determine whether they could store test results and lab values.

The purpose of the study was to determine whether there existed a distinct electronic pharmacy information system from e-health that could print or fax prescriptions, do medication reconciliation, and compare the medications being prescribed with those the patients had already been taking.

The study's final component of goal one looked at patient service, including whether or not facilities offered online scheduling, online bill payment, and online access to e-health.

based on a literature review (chapter two on objective one) Musa Ahmed Zayyad conducted a study using Nigeria as a case study to identify the variables influencing the sustainability adoption of E-health technology in underdeveloped nations. The study found that the use of systems by health service providers was largely in the pilot stage, with low levels of adoption and implementation. The three main issues that were identified were: a lack of national policies and plans that were inclusive, a lack of technical infrastructures, and a lack of full technology utilization by healthcare practitioners. [66] [67]. As a result, obstacles to adoption and usage were divided into six categories, including: [69] one ICT infrastructure, Two ICT expertise and practical experience with ICT tools and applications, three funding and financial arrangements, Six security obstacles related to privacy and trusts in using e-health technology follow the first five administrative obstacles, which are related to management policies. The remaining four human resource obstacles are related to attitudes, willingness, and belief of healthcare professionals in using e-health technology [70].

Objective 2: Important elements that influence how e-health Technologies are implemented in Kenya's health sector from actual data and a literature analysis, several factors—both enablers and barriers—were gleaned (chapter 2 section 2.4.1, 2.4.2, 2.5.1 and 2.5.3). A variety of factors that were identified in the literature affected the uptake and application of e-health. The conceptual framework clearly identified the contributing factors, such as social (cyber security, user acceptance, user readiness, and computer efficacy), organizational (top management support, readiness, cost or financial, human resource, size or stricture, and culture), technological (compatibility, complexity, availability, relative advantage, trial-

ability, observability), and environmental (competition, administration pressure, government support, external support, and business).

According to a report, initiatives should be made to support acceptance and implementation of e-health through strategies and other variables. It was divided into four main clusters based on the empirical study. The interaction of the variables is depicted in figures 7 and 8. Six key technological criteria, as given in Table 4.40, were used to showcase the characteristics of e-health as an innovation. As stated in Table 4.40, the six primary components were further separated into 19 technological sub-factors. Even when technology like mobile devices were readily available, some individuals still did not want to utilize them. On the other hand, even when the technology was challenging, some still wanted to use it. According to the empirical study, a participant is more likely to value e-health as a service if they believe using it is compatible with them.

The term "social" was frequently used to characterize a variety of intricate systems that required interaction between people, technology, and context to be taken into account during the development process. Users' acceptance of e-health and how it is implemented are influenced by social factors. It was observed that study participants paid close attention to the privacy of personal information, and that social variables, as indicated in Table 4.37, were crucial in the adoption and implementation of e-health. Despite the advantages of e-health adoption, some participants remained unsure about the new technology, even though most respondents showed a high level of enthusiasm to embrace and deploy the system.

Organizations must have a solid plan in place for the introduction of e-health technologies to be successful. Organizational variables, which are included under the six key elements in

Table 4.36, were crucial in the acceptance and implementation of e-health. These factors were derived from primary investigations. The management was supportive of the transition to new technology. The management is also supporting the adoption and implementation of e-health by authorizing or commissioning new services, providing resources for training, learning, hiring qualified human resources, switching to new technology, involving all stakeholders, including all staff, in planning and development.

Environmental factors are crucial for the acceptance and implementation of e-health, as illustrated in Table 4.34. According to the national and county health budget study for 2018–19, the majority of the budgetary allotment—76% as opposed to 50–60%—is for employee emoluments. To improve services, more funding must be given to essential inputs like e-health. We have an e-health Policy that offers an all-encompassing and creative approach to dealing with a wide range of e-health practices and research that mark a significant divergence from conventional healthcare delivery and access methods. The Kenyan Constitution of 2010, Vision 2030, the ICT Policy of 2006, and the Health Policy all include the policy as an attachment (2014-2030). The attached policy is sadly unknown to stakeholders. Some hospitals lack energy due to solar, generator, or network issues. Due to inadequate support from the government and NGO's, the majority of hospitals operate within tight financial limitations.

5.3 Conclusion

From the empirical findings, literature studies, and discussions that the research's goals were successfully met. The inquiry emphasizes the advancements made and the shortcomings that remain in Kenya's health systems with regard to the country's adoption of e-health. The study may assert that there is good desire towards successful e-health Technologies even if Kenya

is still in the early stages of deployment. The analysis found that there is still much work to be done before adoption and implementation are successfully implemented at public healthcare facilities. This served as the foundation for the proposed model for implementing e-health (see figure 4.1 and 4.2).

According to this analysis, the suggested structure will ensure that e-health is implemented sustainably. Chapter four provides an in-depth exploration of the framework. The framework is the outcome of in-depth analysis of the shortcomings and inadequacies in the existing frameworks. Additionally, it is founded on a comprehensive conceptual and theoretical framework made up of four key elements that interact both equally and in part to develop e-health innovation, which in turn results in benefits for beneficiaries. When a reliability test was conducted using SPSS, the conceptual and theoretical frameworks were validated, and the linkages between their constituent parts were statistically proven.

The findings of the inquiry have demonstrated that there are still issues with integrating technology in healthcare institutions. Some healthcare facilities lack technological infrastructures, and the majority of facilities are unable to implement e-health due to budgetary constraints that prevent them from purchasing the infrastructure, equipment, training programs, and change management necessary to implement the related new technology (e-health).

The adoption and implementation of e-health are likely to be often delayed throughout health facilities as a result of the emphasized problems not being resolved. According to the analysis, most health facilities will remain in experimental or trial stages and won't be able to reach the threshold required to advance them to successful status for the implementation of e-health. The study demonstrates that stakeholders must critically consider how

organizational, social, and environmental relationships and interactions relate to and affect the technological aspect.

The following contributions are from the investigations: one contribution to the body of knowledge was made by the research through the development of the Framework for e-health Technology (figure 4.2) by extending TOE frameworks. This served as the research's direction. Whereas the created framework can be applied to change the current situation and fully implement it in all healthcare facilities. The created framework provides participants with guidance on the crucial components and regular mechanisms that would affect the implementation of e-health.

Academically, the second contribution involved the development of a model (see figure 4.1 and equation 1).

5.4 Recommendation

i. The study suggests that all medical institutions have access to infrastructures like electricity and power backup, such as solar panels and standby generators. Because they are a necessity for all forms of information technology and are a significant impediment to the adoption of e-health Technologies.

ii. In view of the emergence of e-health, the result recommends additional research on acceptance and implementation.

iii. Governmental procedures and structure must be established to provide current direction and control of the national e-health initiative down to the county and sub-county levels.

5.5 Future Research

To advance research on e-health adoption and implementation in developing countries, it is important to carryout research on digital transformations in relation to palliative healthcare in which various factors that affect the use of e-health can be analyzed for both public and private e-health systems.

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APPENDICES

6.1 Appendix 1: QUESTIONNAIRE

Invitation paragraph

You have been invited to participate in a research project. It's critical that you comprehend the rationale behind this study's execution and what it contains before making a choice. Before you may participate, please read the following material carefully and feel free to talk with your friends about it. In the event that you are unclear about something, ask for clarification, and you will receive additional information. Consider your involvement options before making your decision.

Thank you for reading this.

What is the purpose of the study?

With a theory as a foundation, the goal of this study is to identify elements that affect sustainable e-health implementation. By understanding and examining implementation techniques, it is hoped that an integrated model and composite metrics for sustainable e-health implementation will be developed.

Specifically, this study intends to:

a) To determine the current status of e-health implementation in Kenya.
b) To determine critical factors that affects the implementation of e-health Technologies in health sector in Kenya
c) To develop an integrated model for sustainable e-health implementation in Kenya.

This study will answer the following research questions:

a) What is the current status of e-health implementation in Kenya?
b) What critical factors affects the implementation of e-health Technologies in health sector in Kenya
c) What models for e-health implementation are there?

The study is expected to be carried out from 5th May 2022 to 30th September 2022

Why have I been chosen?

You have been chosen because you either play a role in using the e-health systems in the health facilities within Kakamega County (either private facility or public facility) therefore you have experience from your interaction with the systems or you have an opinion with regard to the use of e-health systems.

Do I have to take part?

It is up to you to decide whether or not to take part. If you decide to take, part you are still free to withdraw at any time and without giving reason.

Thank you.

SECTION A: DEMOGRAPHIC DETAILS		
S/N	**QUESTION**	**RESPONSE**
A1.	What is your Gender?	1. Male ☐ 2. Female ☐
A2.	What is your highest level of education?	1. High School ☐ 2. Certificate ☐ 3. Diploma ☐ 4. Degree ☐ 5. Masters ☐ 6. PhD ☐
A3.	What is your age range?	1. **20-25** Years ☐ 2. **26-30** Years ☐ 3. **31-35** Years ☐ 4. **36-40** Years ☐ 5. **Above 41** Years ☐
A4.	What is your specialty or profession or Practitioner?	1. Clinician ☐ 2. Nurse ☐ 3. Administrator ☐ 4. Pharmacist ☐

		5. Radiologist ☐ 6. Doctor (General) ☐ 7. Lab Technician ☐ 8. Network/System Administrator ☐
A5.	Please rate your level of comfort with the use of computer- based technology	1. Extremely anxious ☐ 2. Anxious ☐ 3. Normal ☐ 4. At Ease ☐ 5. Completely at ease ☐
A6.	Your hospital information (level): level 1, 2, 3 or 4	1. LEVEL 1 ☐ 2. LEVEL 2 ☐ 3. LEVEL 3 ☐ 4. LEVEL 4 ☐ 5. LEVEL 5 ☐

SECTION B: ISSUES AFFECTING E-HEALTH IMPLEMENTATION

Indicate how the following factors positively or negatively affect the daily use of E-health systems of health practitioner

Scale of 5: 1=Strongly disagree 2=Disagree 3=Undecided 4=Agree 5=Strongly agree

Environment Factors (Factors External to the Organization)		
S/N	**QUESTION**	**RESPONSE**
B1.	Government funding by allocation of budget or grants.	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
		1. Strongly disagree ☐

B2.	Legal framework or policies formulated by the government providing support to E-health	2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B3.	Infrastructure like electricity, sola, stand by generator and network readily available and working	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B4.	Government Implementation body at the facility level	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B5	Political support	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B6.	NGO support	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐

Organization

S/N	**QUESTION**	**RESPONSE**
		1. Strongly disagree ☐

B7.	Top management support by providing learning and training environment	2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B8.	Top management support by providing funds for hiring qualified human resource	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B9.	Top management support for readiness to change to new technology	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B10.	An organizational culture that is supportive of effective change management	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B11.	Top management culture to involve all stakeholder including all staff in planning and development.	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B12.	The freedom that the organization has in terms of authorizing or commissioning new services	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐

Social

S/N	QUESTION	RESPONSE
B13.	Impact of the system on individual security in their work	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B14.	Level of user acceptance of the E-system	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B15.	Level of user readiness to use the E-Systems	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B16.	Effects of the system on the allocation of work to individuals	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B17.	The balance between the needs of individual users of the system, and the organization itself	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B18.		1. Strongly disagree ☐ 2. Disagree ☐

	Collaboration and partnership between stakeholders.	3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐

Technology (Complexity, Comparative Advantage, Compatibility, Trial-ability, Observability)

S/N	QUESTION	RESPONSE
B19.	Would you agree to collect medical data by means of mobile devices	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B20.	Would you agree to send SMS to make people aware of different methods of disease prevention	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B21.	Would you agree to use mobile devices for diagnostic support?	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B22.	Would you agree to use mobile devices for treatment support?	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B23.	Would you avoid adopting E-health because Technology (ICT) are difficult	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
		1. Strongly disagree ☐

B24.	Would you not adopt E-health applications because they are difficult to learn?	2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B25.	You would adopt E-health because E-health devices are easier to use	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B26.	Is E-health is useful	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B27.	Can E-health reduce the amount of effort spent on executing some tasks	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B28.	Can larger portion of the population benefit from healthcare services if E-health is adopted and implemented.	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B29.	There will be an increase in prevention and awareness of diseases should E-health be adopted and implemented.	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
		1. Strongly disagree ☐

B30.	E-health is compatible with your duties	2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B31.	E-health is compatible with what you need to execute in your daily activities	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B32.	E-health is compatible with your organizational working style and ethics	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B33.	Would you first test E-health before adopting it and implementing	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B34.	Would you adopt E-health because it has proven to work in other countries	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B35.	Would you first adopt E-health and then evaluate the results?	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
		1. Strongly disagree ☐

B36.	A you willing to adopt E-health immediately without trying it	2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B37.	Will you need to see tangible results of E-health adoption before Adopting and implementing it.	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B38.	Access to ICT equipment's and facilities; electronic communication infrastructure; ICT processing and storage services	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐
B39.	Availability of technical support in using the system	1. Strongly disagree ☐ 2. Disagree ☐ 3. Undecided ☐ 4. Agree ☐ 5. Strongly Agree ☐

Section C: Implementation

C1. At the moment, how would you describe your hospital's E-health implementation status?

(a) The hospital has an E-health installed and in use for all departments, all staff, and all providers

1. Yes ☐
2. No ☐

(b) The hospital has an E-health that is installed in some or all departments and in use by some of the staff and providers

1. Yes ☐
2. No ☐

(c) The hospital does not have an E-health implemented or in use currently

1. Yes ☐

2. No ☐

C2. Estimated number of hospital employees able to use and currently using your E-health system (including scheduling, doctors, nurses, assistants, administrators etc.).

(a) None (0% of employees) ☐
(b) Some (Less than half of employees) ☐
(c) Most (more than half of employees) ☐
(d) All (100% of employees) ☐
(e) Not Applicable ☐

C3. Select the employee types currently using E-health on daily basis.

a) Administrative staff ☐
b) Schedulers and/or billing staff ☐
c) Call center staff ☐
d) Ancillary support ☐
e) Nurses ☐
f) Physicians ☐
g) Other employee types (please specify) ☐
h) Not Applicable ☐

C4. Does your hospital have workflow designs/policies that integrate E-health functions into practice?

a). Yes ☐

b). No ☐

Electronic Health Record

C5. A you aware if the E-health your hospital is using is certified by the Certification Commission for Health Information Technology (CCHIT)?

a). Yes ☐

b). No ☐

c). Not Sure ☐

C6. Does your E-health have the ability to track and record? The following: Patient demographic information, patient medical issues, lab values, medication.

a). Yes ☐

b). No ☐

C7. Does the E-health have the ability to generate claims for some or all insurers?

a). Yes ☐

b). No ☐

Computerized Provider Order Entry (CPOE*)*

DESCRIPTION: Computerized Provider Order Entry (CPOE) is a computer application that allows a medical doctors order for diagnostic and treatment services (such as medications, laboratory, and other tests) to be entered electronically instead of being recorded on order sheets or prescription pads. The computer compares the order against standards for dosing, checks for allergies or interactions with other medications, and warns the physician about potential problems.

C8. Does your hospital E-health have a Computerized Provider Order Entry (CPOE) function?

a). Yes ☐

b). No ☐

C9. Is the CPOE function integrated with other systems (example: medication orders are entered by a provider and electronically transmitted to a pharmacy and filled without printing/faxing the order)?

a). Yes ☐

b). No ☐

C10. What are the barriers to using CPOE for all provider orders? (Select all that apply)

a) Not applicable - using CPOE 100% of the time
b) Still using handwritten or paper orders per provider preference
c) Requires staff and/or provider training
d) In process of building in orders into system
e) Requires a system upgrade
f) Hardware issues (computers not available in all exam rooms, etc.)
g) Other (please specify)

Clinical Decision Support Tools

C11. Does your E-health have clinical decision support tools for example medication guides, chronic condition care plans, etc. that providers can use at the point of care?

a). Yes ☐

b). No ☐

C12. Does your clinic use the E-health or a link to clinical decision-making support tools for high tech diagnostic imaging?

a). Yes ☐

b). No ☐

C13. Does your EHR system have alerts or pop-ups that providers see during an encounter with a patient?

a) Yes - For potential drug interactions

b) Yes - For patient-specific or condition specific reminders (e.g., foot exams for diabetics or glucose tests for pregnant women)
c) Yes - For preventive care services due (e.g., mammograms or influenza vaccinations)
d) No - Our clinic has the ability to use alerts, but the function is not turned on
e) No - Our clinic's E-health does not have alerts

C14. From the list below pick the barriers to using tools for clinical decision making at the point of care?

a) Not applicable - using CD 100% of the time
b) Requires staff and/or provider training
c) Requires resources to build/implement
d) Requires a system upgrade
e) Hardware issues (computers not available in all rooms, etc.)
f) Not applicable - There are no barriers to using the E-health clinical decision-making tools
g) Other (please specify)

Lab and Test Results

C15. Does your clinic's E-health store lab values and test results?

a). Yes ☐

b). No ☐

C16. Does your clinic use a computerized system to retrieve lab and diagnostic test results?

a) Yes - providers use a computer to access all lab and diagnostic test results
b) Yes - providers use a computer to access some, but not all, lab and diagnostic test results
c) Not really - providers primarily use paper, faxes, or phone calls to view lab and diagnostic test results

EHR's in Clinical Practice

C17. Can your E-health produce a clinical summary of a visit?

a). Yes ☐

b). No ☐

Pharmacy Information Systems

C18. Does your hospital have an electronic pharmacy information system, separate from an E-health if you have an E-health?

a) Yes - We have a separate pharmacy system from our E-health
b) No - We have an E-health system that has a pharmacy component

C19. Does your electronic pharmacy system have the ability to print or fax a prescription?

a). Yes ☐

b). No ☐

c). I do not know ☐

C20. Does your clinic use any of the following electronic pharmacy system functions: Provide generic alternatives to medications as a list

a). Yes ☐

b). No ☐

c). I do not know ☐

C21. Provide point-of-prescribing generic alternatives

a). Yes ☐

b). No ☐

c). I do not know ☐

C22. Provide cost comparisons of drugs within therapeutic classes

a). Yes ☐

b). No ☐

c). I do not know ☐

C23. Does your electronic pharmacy system perform medication reconciliation (provides/compares the drug being prescribed with the other medications the patient has been taking)?

a) Yes, for every prescription at every encounter
b) Yes, for some prescriptions and some encounters
c) No, we do not have or use this function
d) I do not know

Patient services

C24. Does your hospital offer on-line scheduling for patients?

a) Yes - For all encounters/providers
b) Yes - For some encounters/providers
c) No

C25. Does your hospital offer on-line bill payment for patients?

a) Yes - For all patients
b) Yes - For some patients (such as self-pay)
c) No

C26. Does your hospital have and use on-line prescription refill requests?

a). Yes ☐

b). No ☐

C27. Does your hospital allow patients to access their E-health on-line?

a). Yes ☐

b). No ☐

6.2 Appendix 2: INTERVIEW GUIDE

a) How do you perceive government funding and allocation of budget and grants to health facilities in Kenya?
b) What is your view on support health facilities receive from the political class in Kenya?
c) Does your health facility have trained staff to handle the e-health technology?
d) Is your health facility well connected with internet?
e) Are users ready for e-health?

6.3 Appendix 3: RESEARCH PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **944772**

Date of Issue: **12/October/2020**

RESEARCH LICENSE

This is to Certify that Mr.. ayub HUSSEIN shirandula of Masinde Muliro University of Science and Technology, has been licensed to conduct research in Kakamega on the topic: HOLISTIC INTERGRATED MODEL FOR SUSTAINABLE EHEALTH IMPLEMENTATION KENYA. for the period ending : 12/October/2021.

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Figure 6.1: Research Permit

6.4 Appendix 4: PUBLICATIONS

From this research work, the following publications have been made:

i. E-health Implementation in Kenya: Current position Ayub H. Shirandula[1], Kelvin K. Omieno[2], Jasper Ondulo[3] *(The International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), Volume 8, Issue 4, July-August 2022).*

ii. Critical Environmental Factors that Affect the Implementation of E-health in Kenya Ayub H. Shirandula[1], Kelvin K. Omieno[2], Jasper Ondulo[3] *(The International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), Volume 8, Issue 4, July-August 2022).*

6.5 APPENDIX 5: Table for determining minimum returned sample size for a given population size for continuous and categorical data.

Popula-	Sample size									
tion size	Categorical data (margin of error=.05), =2						Continuous data (margin of error=.03), =4			
10	90% confidence		95% confidence		99% confidence		90% confidence		95% confidence	99% confidence Level
	Level		Level		Level		Level		Level	
					10					10
15	15		15		15		14		15	15
20	19		20		20		19		19	20
25	23		24		25		23		23	24
30	28		28		29		26		27	29
35	31		33		34		30		31	33
40	35		37		38		33		35	37
50	43		45		47		40		43	46
60	50		52		56		46		49	54
70	56		60		64		52		56	61
80	62		67		72		57		62	69
90	68		73		80		61		68	76
100	74		80		87		66		73	83
110	79		86		95		70		78	89
120	84		92		102		74		83	96
130	88		98		109		77		88	102
140	93		103		116		81		92	108
150	97		108		123		84		97	114
160	101		113		129		87		101	119
170	105		118		136		90		104	125
180	109		123		142		92		108	130
190	112		128		148		95		111	135
200	116		132		154		97		115	140
220	122		140		166		102		121	150
250	130		152		182		108		130	163
300	143		169		207		116		142	182
350	153		184		230		123		152	200
400	162		196		250		128		161	215
						94				