A QUANTITATIVE STUDY ON ADOPTION OF EDGE COMPUTING FOR REAL-TIME DATA ANALYSIS IN INTERNET OF THINGS NETWORKS: A CASE OF KENYATTA NATIONAL HOSPITAL

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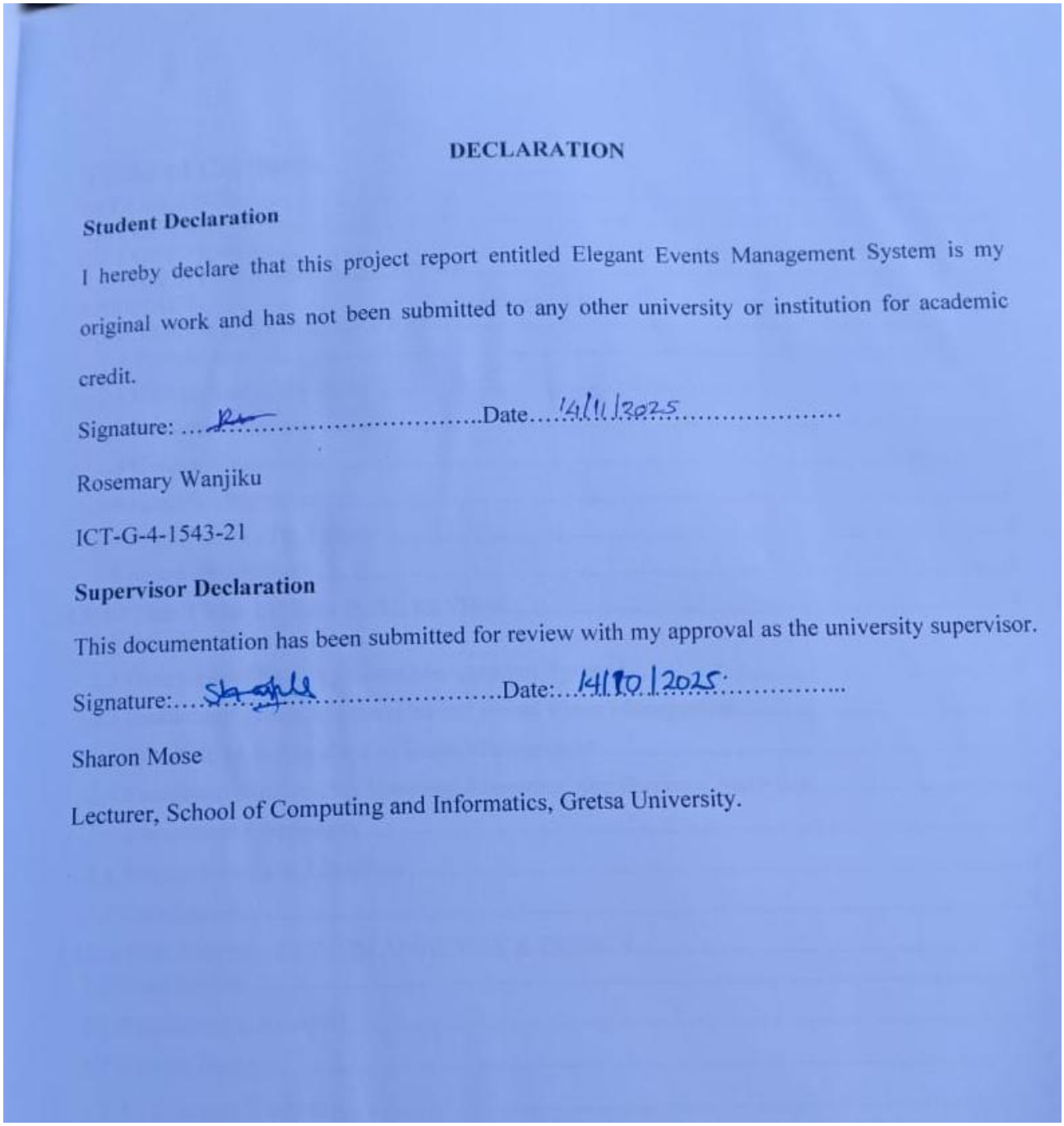
A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF COMPUTING AND INFORMATICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE OF GRETSA UNIVERSITY

OCTOBER, 2025

DECLARATION



DECLARATION

Student Declaration

I hereby declare that this project report entitled Elegant Events Management System is my original work and has not been submitted to any other university or institution for academic credit.

Signature: ……..Date…14/11/2025……

Rosemary Wanjiku

ICT-G-4-1543-21

Supervisor Declaration

This documentation has been submitted for review with my approval as the university supervisor.

Signature:……Date:…14/10/2025:……..

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEDICATION

I dedicate this research to my family for their unwavering support throughout my academic journey.

ACKNOWLEDGMENT

Above all, I would like to give honor and glory to the Almighty Father for the gift of life and knowledge.

I would also like to give my distinct appreciation to my supervisor Sharon Mose for her guidance until completion of my research.

I extend appreciation to my contributors who made this study possible.

Lastly, my heartfelt thanks to my close friends for their encouragement throughout this academic journey.

ABBREVIATIONS

IoT-internet of things

AI-artificial intelligence

CCPA -California Consumer Privacy Act

GDPR -General Data Protection Regulation

ICT-Information and Computer Technology

ABSTRACT

The increasing adoption of IoT technologies in healthcare led to the generation of large volumes of real-time data that required fast and efficient processing. Traditional cloud computing approaches often faced latency and bandwidth limitations, which made it difficult to support critical healthcare operations. This study analyzed the role of edge computing in enhancing real-time data analysis within IoT networks, focusing on Kenyatta National Hospital as the case study.

A quantitative research design was employed, and data was collected through structured questionnaires and system performance records from ICT personnel, biomedical engineers, and healthcare practitioners. The study examined variables such as system response time, reliability, data security, and operational efficiency. To analyze data, descriptive and inferential statistics methods were used. The findings indicated that adoption of edge computing improved data processing speed, reduced latency, and enhanced network reliability in IoT-based healthcare systems. The study concluded that the integration of edge computing into hospital infrastructure strengthen real-time decision-making and patient care. It was recommended that healthcare institutions adopt edge computing technologies to complement existing cloud systems to improve service delivery.

CHAPTER 1: INTRODUCTION

1.1 Background of the Study

The rapid advancement of technology has led to an increase in adoption of Internet of Things (IoT) solutions across various sectors like healthcare. Smart devices that can gather, send, and process data with little assistance from humans are connected in the Internet of Things (IoT). Massive amounts of real-time data are produced by these devices which are essential for decision-making, particularly in delicate industries like healthcare, where prompt actions can affect patient outcomes. The most popular model for handling and storing this kind of data has historically been cloud computing. The effectiveness of real-time data analysis in health systems may be adversely impacted by the drawbacks of this centralized approach, which include higher latency, bandwidth congestion, and possible data security issues.

One promising way for coping with these challenges is through edge computing. Edge computing handles data closer to the point of generation than traditional cloud computing, which depends on a centralized data center. This lowers latency and speeds up response times by reducing the distance data must travel. Edge computing can be extremely helpful in enhancing accuracy and efficiency in the healthcare industry, where delays in data processing and transmission can have major repercussions. For instance, wearable sensors, diagnostic tools, and patient monitoring devices can process data at or close to the point of collection, allowing medical professionals to make prompt and well-informed decisions.

Globally the adoption of edge computing is transforming how hospitals and healthcare institutions operate. According to industry reports healthcare organizations are increasingly investing in edge-based solutions to enhance patient monitoring, streamline operations, and improve sensitive health information security. In developed countries edge computing has already been integrated into hospital systems to support real-time health monitoring, predictive analytics, and remote patient management. In contrast, many developing countries like Kenya are still in the early stages of adopting these technologies due to infrastructural, financial, and technical skill constraints.

As Kenya's largest teaching and referral hospital Kenyatta National Hospital sees a large number of patients every day. To handle patient data, lab results, diagnostics, and departmental communication, the hospital uses digital health systems. A dependable and effective system is necessary due to the volume and sensitivity of the data generated to guarantee prompt analysis and response. Although the hospital's digital infrastructure has included cloud computing, edge computing is a pertinent and timely technological intervention given the growing need for quicker and more secure data processing. Edge computing can help lower latency, improve security, and boost the dependability of real-time patient data analysis by processing data closer to its source.

This study focused on analyzing role of edge computing in enhancing real-time data analysis in IoT networks at Kenyatta National Hospital. It explored how the adoption of edge computing can contribute to improved system performance, faster response times, enhanced data security, and overall better patient care. The study also provides valuable insights for healthcare decision-makers and policymakers on how technological innovations can be leveraged to strengthen hospital information systems in Kenya.

1.2. Statement of the research problem

The enormous rise of data generation brought about by the quick growth of IoT networks poses several difficulties for conventional cloud-centric data processing, including:

Delay and Bandwidth-Sending big amounts of IoT data to cloud servers that are centralised causes a lot of delay and bandwidth usage, which is not good for real-time applications.

Privacy and Security Issues-Transmitting confidential information to the cloud increases the chance of data breaches.

Limitations on Resources-Conventional AI models are inappropriate for deployment on resource-constrained edge devices that frequently utilize Internet of Things networks because of the need for significant processing resources.

A framework that combines edge computing with customized AI algorithms is required to address these challenges, enabling improved real-time data processing in IoT networks. This structure ought to:

i) Utilize less bandwidth and save latency by handling data efficiently at the edge.

ii) Reduce data transfer to improve data security and privacy. iii) Create AI models that are lightweight and accurate enough to operate well on edge devices.

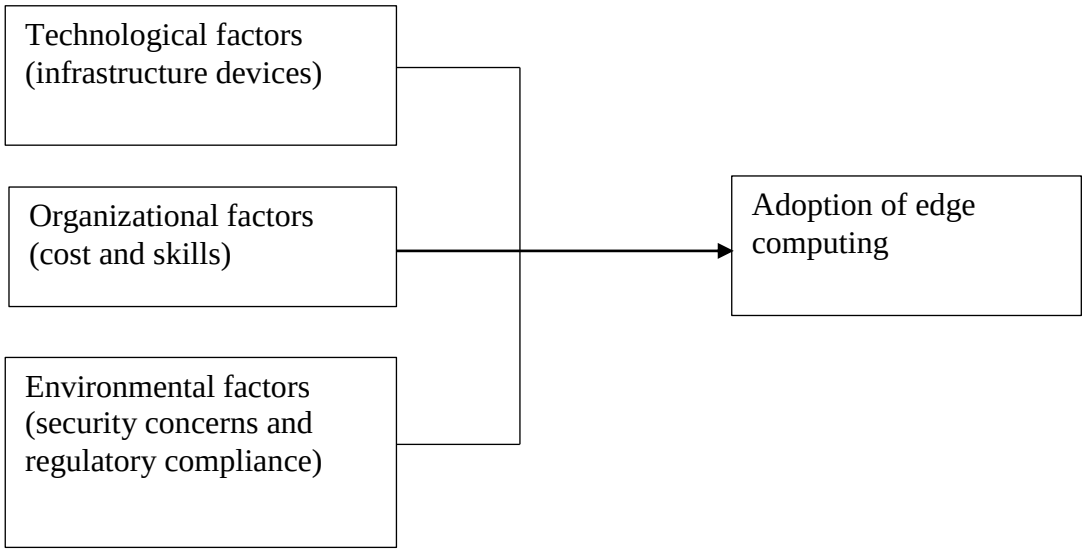
1.3 Purpose of study

The purpose of study was to examine how adoption of edge computing enhanced real-time analysis of data in IoT networks at Kenyatta National Hospital. It aimed to determine how edge computing improved data processing speed, reliability, and decision-making.

1.4. Conceptual framework

It outlines the relationship between dependent and independent variables involved in enhancing real-time analytics for Internet of things applications through the integration of artificial intelligence and edge computing.

INDEPENDENT VARIABLES DEPENDENT VARIABLES



1.5 Research questions

1. How did network infrastructure quality influence the use of Edge computing in real-time data processing?

2. How did cost influence the implementation and maintenance of edge computing infrastructure?

3. How did technical skills influence the implementation and maintenance of edge computing infrastructure?

4. How did regulatory compliance influence use of edge computing in internet of things networks?

1.6 Research Objectives

1.6.1 General Objective

The purpose is to investigate how implementing edge computing can improve real-time data analysis within Internet of Things (IoT) networks at Kenyatta National Hospital.

1.6.2 Specific Objective

1. Assess how the quality of network infrastructure impacts the adoption of edge computing for real-time data analysis.
2. Analyse how the costs association with implementation influence adoption of edge computing in real-time data analysis.
3. Investigate the effect of technical expertise on adoption of edge computing for real-time data analysis.
4. Consider the significance of various factors in adoption of edge computing for real-time data analysis. of regulatory compliance in adoption of edge computing in real-time data analysis.

1.7 Hypothesis of the study

H_o1: There is no significant relationship between network infrastructure quality and adoption of edge computing in real-time data analysis.

H_o2: There is no significant relationship between implementation cost and adoption of edge computing in real-time data analysis.

H_o3: There is no significant relationship between technical skills and adoption of edge computing in real-time data analysis.

H_o4: There is no significant relationship between regulatory compliance and adoption of edge computing in real-time data analysis.

1.8 Significance of study

- It provided useful insights into how edge computing enhances real-time analysis of data in IoT networks.

- It helped health institutions such as Kenyatta National Hospital to understand how edge computing can improve service delivery and decision-making.
- It guided **IT specialists and network administrators** on critical aspects influencing the implementation of edge computing, including infrastructure requirements, financial considerations, necessary expertise, and compliance with regulations.
- It supported **policy developers and oversight bodies** in formulating effective strategies and regulatory frameworks to promote the integration of edge computing within healthcare systems.
- It contributed to **existing body of research**, serving as a valuable resource for upcoming scholars and investigators.
- It increased awareness of the **advantages of utilizing advanced computational technologies** in managing real-time data efficiently.

1.9 Delimitations of the Study

The research concentrated on investigating how edge computing is implemented for real-time data processing at Kenyatta National Hospital, emphasizing aspects such as infrastructure, expenses, expertise, and adherence to regulations. Information was gathered from ICT personnel and other relevant hospital staff during a specified timeframe.

1.10 Limitations of the study

The study was limited by time and resource constraints, which affected the scope of data collection. It also relied on respondents' honesty, which may have influenced the accuracy of the information gathered.

1.11 Assumptions

This study assumed respondents would provide honest and accurate information. It also assumed that the selected factors, network infrastructure, cost, skills, and regulatory compliance, were key determinants influencing edge computing adoption in real-time data analysis.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Rapid growth of Internet of Things (IoT) devices has transformed data generation and utilization across various industries, enabling more efficient real-time data processing. Traditional cloud-based systems often encountered challenges such as latency, bandwidth limitations, and data privacy concerns, particularly in applications that required instant responses. To address these issues, edge computing emerged as a decentralized approach that brought data processing closer to the source, improving system responsiveness and reducing network strain.

The purpose of this literature review was to examine the role of edge computing in enhancing real-time analysis of data in IoT networks, focusing on network infrastructure quality, cost, technical skills, and regulatory compliance as key factors influencing adoption.

2.2 Review of literature related to the main concept

Edge computing emerged as a transformative approach that enhanced real-time data analysis within IoT networks. By decentralizing data processing to the network's edge, latency was reduced, and system responsiveness improved in critical applications (Shi et al., 2018; Bonomi et al., 2020). This architectural model increased bandwidth efficiency and improved data security by processing sensitive information closer to its source (Mao et al., 2019).

Previous studies revealed operational benefits such as faster decision-making and reduced dependency on centralized cloud infrastructure (Satyanarayanan, 2019). Edge computing had significant applications in healthcare, smart cities, and industrial automation, where timely insights supported improved service delivery and operational efficiency (Bonomi et al., 2020; Shi et al., 2018).

Despite these benefits, challenges remained, including interoperability among heterogeneous IoT devices, management of diverse data formats, and optimization of resource allocation (Mach et al., 2021; Kaur et al., 2022). Organizational readiness, financial investment, skills availability, and regulatory compliance were also identified as major factors influencing successful deployment

(Dastjerdi & Buyya, 2019). Addressing these challenges was necessary to maximize the potential of edge computing in IoT environments.

2.3 Impact of Network Infrastructure Quality

Recent research underscores the vital importance of the quality of network infrastructure in promoting edge computing deployment within Internet of Things ecosystems. A reliable network infrastructure, characterized by minimal latency and substantial bandwidth is crucial for enabling real-time data processing at the network's edge (Shi et al., 2018; Mach et al., 2021). Evidence suggests that strong network connectivity improves the dependability and edge computing efficiency in systems facilitating smooth integration and rapid data transfer (Kaur et al., 2022). Challenges such as increased latency and limited bandwidth can impede edge computing performance solutions, emphasizing the necessity of high quality infrastructure to support widespread adoption and enhance efficiency in operations (Mao et al., 2019).

2.4 Influence of Cost

The cost of implementing and maintaining edge computing solutions greatly influences adoption decisions. Financial considerations include hardware and software acquisition, installation, system upgrades, and ongoing maintenance (Dastjerdi & Buyya, 2019). High initial capital requirements can pose a barrier for organizations with limited resources.

Additionally, operational costs such as energy consumption, security updates, and infrastructure scaling can impact long-term sustainability (Kaur et al., 2022). Organizations must conduct detailed cost-benefit analyses to ensure that adopting edge computing aligns with their financial capabilities and expected return on investment.

2.5 Influence of Skills

The availability of skilled personnel is another critical factor affecting the adoption of edge computing. Specialized expertise is required in areas like edge architecture, IoT device integration, data security, and system maintenance (Mach et al., 2021). Many organizations face skill gaps that delay or complicate implementation processes.

Studies suggest that investing in training and skill development programs can bridge this gap and enhance workforce readiness (Bonomi et al., 2020). Continuous professional development and capacity-building initiatives are essential to ensure the successful management and sustainability of edge computing infrastructure.

2.6 Impact of Regulatory Compliance Requirements

Ensuring adherence to regulatory standards presents considerable obstacles to the integration of edge computing within IoT networks. Organizations are required to manage intricate legal frameworks concerning data privacy, security protocols, and jurisdictional regulations during the deployment of edge computing systems (Dastjerdi & Buyya, 2019; Kaur et al., 2022). Recent research highlights the importance of developing flexible and scalable compliance approaches maintain with changing regulatory environments and to reduce legal liabilities related to data management and security (Shi et al., 2018; Satyanarayanan, 2019). Compliance with legislations such as GDPR in Europe and CCPA in the United States necessitates meticulous planning in the design and deployment of edge computing infrastructures to guarantee lawful data handling and proper user consent procedures (Mao et al., 2019).

2.7 Theoretical Frameworks

Diffusion of Innovations Theory (Rogers, 1962) explains how new technologies are adopted across different adopter categories. Applied to edge computing, it helps in understanding how infrastructure quality, cost, skills, and regulations influence the pace of adoption.

The Technology-Organization-Environment (TOE) Framework (Tornatzky & Fleischer, 1990) provides a structured way to examine technological, organizational, and environmental factors affecting adoption.

Resource-Based View (RBV) Theory (Barney, 1991; Wernerfelt, 1984) emphasizes how organizations can use resources such as infrastructure, expertise, and compliance capacity to gain a competitive edge through edge computing integration.

2.8 Summary of Identified Gaps in the Literature

Most literature focuses on theoretical aspects of infrastructure quality without sufficient empirical evidence on its direct impact on edge computing adoption. Studies also acknowledge cost and skill challenges but lack detailed cost-benefit analyses and strategies for developing technical expertise. Furthermore, regulatory compliance is often discussed broadly, with limited exploration of how specific regulations influence system design and operation.

Additionally, few studies address the challenges of integrating edge computing with existing IoT systems, leaving gaps in understanding interoperability challenges. Addressing these gaps can help create more effective and scalable edge computing solutions.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methods and procedures applied in our study. This study was organized under the following subheadings of research design, study methodology, detailed description of the design, target population, sample and sampling technique, research instruments, validity of the instruments, data collection methods, and data analysis methods.

3.2 Research Design

The research employed a quantitative descriptive methodology, emphasizing quantifiable relationships among factors such as network infrastructure standards, associated costs, technical expertise, and compliance with regulations. This methodology was appropriate because it facilitated the collection and analysis of numerical data to examine how these elements impact the implementation of edge computing in real-time data processing. The approach offered a comprehensive overview of the current conditions without altering any variables, thus making it suitable for this investigation.

3.3 Study Area

This study was conducted at Kenyatta National Hospital in Nairobi, Kenya. It is the largest public referral and teaching hospital in the country and has increasingly integrated digital health systems. The hospital's Information technology environment provided suitable setting that examined how edge computing can support real-time analysis of data for healthcare context.

3.4 Target Population

The group targeted included ICT specialists, system administrators, data analysts, and specific knh health staffs who are either directly or indirectly engaged in the operation or management of digital health platforms. This cohort was selected due to their expertise and familiarity with data management systems, as well as their potential influence in the implementation of edge computing technologies.

3.5 Sampling Technique

The research utilized simple random sampling to guarantee that all qualified individuals had an equal probability of selection. This approach was suitable for gathering a wide range of viewpoints from various hospital departments, such as ICT specialists, healthcare providers, administrative staff, and academic researchers engaged in real-time data utilization.

3.4 Target population

The study population represents the entire data set that a researcher wanted to study and base inferences from, according to Cooper & Schindler (2018). Kenyatta National Hospital (KNH) has a diverse workforce, including IT professionals (20), medical practitioners (1000), administrators(30) and research scholars(50). This will total up to 1100 people.

3.5 Sampling Techniques

I used stratified random sampling for its suitable technique for my study at Kenyatta National Hospital, as it accommodated the hospital's diverse departments and roles while ensuring representative sampling across all relevant strata. This approach enabled me to gather comprehensive data on the adoption and role of edge computing technologies in real-time data analysis within the hospital setting.

3.6 Sample Size

According to this formula, an accuracy level of 95% will be placed, and a margin of error is

0.005% n=N/ (1+Ne2)

Where n =sample size.

N = total population size. (1100)

e = margin of error. (0.05%) n =

1100/ (1+1100*0.05^2) n =

1100/ (1+1100*0.0025) n =

1100/ (1+2.75) n = 1100/ 3.75 n

= 293.33

Rounding up to the nearest whole number, I needed a sample size of approximately **300 participants** according to Slovin's formula.

3.7 Measurement of Variables

Table 1:Measurement of variables

Variable	Measure/indicator	Measurement scale	Question number
Network infrastructure quality	Perceived effectiveness of edge computing in improving workflow processes or data security	Likert scale (1-5)	Q1
Cost of Implementing Edge Computing	Financial investment required for hardware, software, and setup	Numeric scale (currency)	Q2
Skills required	Level of technical expertise needed for implementation and maintenance	Ordinal scale (1-4)	Q3
Regulatory compliance	Adherence to data protection laws and industry standards	Nominal scale	Q4

3.8 Research Instruments.

The study used structured questionnaires as the main research instrument to collect quantitative data from ICT professionals, medical practitioners, administrators, and research scholars at Kenyatta National Hospital. The questionnaire included close ended and Likert scale questions to maintain clarity and ease of analysis. It was divided into sections on demographics, network infrastructure, cost and skills, and regulatory compliance. The structured format enhanced data accuracy and reliability. The questionnaires were distributed easily, ensuring time efficiency and cost-effective data collection..

3.9 Validity of Measurements

The study aimed to ensure three key aspects: face validity, content validity, and construct validity. **Face validity** was established by having experts in edge computing and IoT systems review the survey items to ensure their relevance and appropriateness. Their feedback confirmed that the questions effectively measured the intended aspects of edge computing adoption.

Content validity was achieved through an in-depth literature review and consultations with experts, followed by piloting the instrument with a small sample to identify any gaps or omissions.

Construct validity was ensured by aligning all items with the study's theoretical framework and objectives, and verifying that the instrument accurately measured the constructs related to edge computing and real-time data analysis.

3.10 Data Collection Techniques

Data was collected using structured questionnaires administered to ICT professionals, medical practitioners, administrators, and research scholars at KNH. The questionnaires captured information on network infrastructure quality, cost, skills, and regulatory compliance. To ensure completeness and accuracy, participants were guided on how to respond, and follow-ups were conducted where necessary. Document analysis of hospital ICT reports and system logs supplemented the primary data, providing additional evidence to support the quantitative findings.

3.11 Data Analysis

Collected data was coded, cleaned, and entered into SPSS for statistical analysis. Descriptive statistics, such as frequencies, percentages, and means, were used to summarize demographic data and respondents' views. Inferential statistics, including correlation and regression analysis, were applied to test the relationships between network infrastructure quality, cost, skills, regulatory compliance, and the adoption of edge computing for real-time data analysis. Results were presented using tables, charts, and graphs for clear interpretation.

3.12 Data Processing

The questionnaires were checked for completeness and consistency before data entry. Data cleaning involved identifying and correcting errors or missing values to ensure accuracy. The cleaned data

were organized according to the study variables, making it suitable for statistical analysis. Data analyzed was then processed to conclude the factors influencing the adoption of edge computing at KNH, aligning with the research objectives.

3.13 Logistical and Ethical Considerations

Logistical planning involved scheduling data collection to minimize disruption to hospital operations, coordinating with department heads, and ensuring the availability of research assistants for questionnaire administration and data entry. Ethical considerations included obtaining informed consent, ensuring voluntary participation, maintaining confidentiality, and anonym sing responses to protect participant identity. Approvals were obtained from the KNH administration, and compliance with institutional ethical standards was observed throughout the studyinto

CHAPTER FOUR: FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents findings from the investigation on role of adopting edge computing for real-time analysis of data in IoT networks at Kenyatta National Hospital (KNH). This chapter explains how network infrastructure quality, implementation costs, skills requirements, and regulatory compliance influence edge computing adoption. The findings were presented in line with the study objectives, followed by an in-depth result discusssion. Data is supported with statistical analysis, graphs, and tables.

4.2 Overview of the Findings

The research utilised a quantitative methodology, gathering data via structured questionnaires distributed to 300 participants at KNH. The response rate achieved was 85%, resulting in 255 complete responses. The remaining 45 questionnaires were partially filled out or not returned, representing 15% of the total sample size. High response rate of 85% underscores the significance of the study to the participants' roles and emphasizes relevance of edge computing. According to Mugenda and Mugenda (2009), response rate of 50% is considered sufficient for analysis and reporting; 60% is regarded as good, and 70% rate or higher is deemed excellent.

Table 2: Demographic Profile of Respondents

Demographic Variable	**Frequency**	**percentage**
Role in Hospital		
Healthcare Professional	115	45%
IT Staff	70	27.5%
Hospital Administrator	70	27.5%
Age Group		
20-30 years	56	22%
31-40 years	99	38.8%
41-50 years	68	26.7%
51 years + above	32	12.5%

This table summarizes the demographic survey characteristics of respondents providing insight into the perspectives on edge computing across different roles within KNH. A balanced representation across roles ensures comprehensive understanding of factors influencing edge computing adoption.

4.3 Discussion of the Findings

4.3.1 Impact of Network Infrastructure Quality

Table 3: Impact of Network Infrastructure Quality on Edge Computing Adoption

Response Category	**Frequency**	**Percentage (%)**
Strongly Agree	109	42.7%
Agree	85	33.3%
Neutral	50	19.6%
Disagree	7	2.8%
Strongly Disagree	4	1.6%

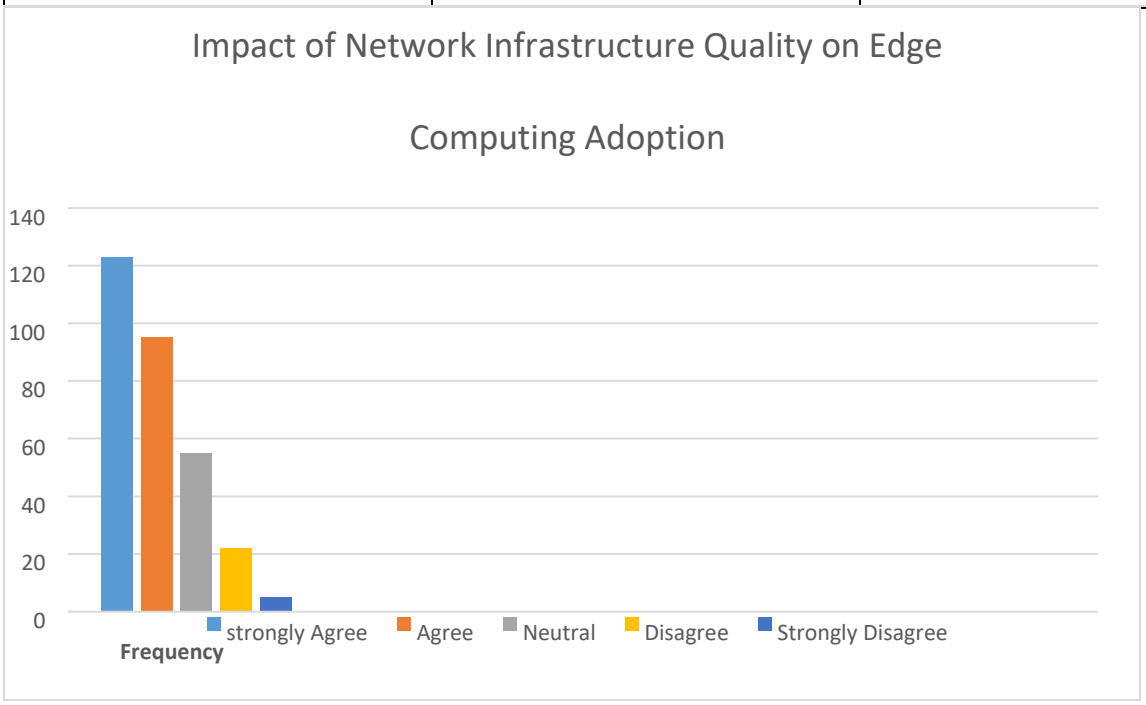


Figure 1: Impact of Network Infrastructure Quality

The findings indicate significant relationship between quality of network infrastructure and implementation of edge computing, with a correlation coefficient of 0.72. Enhanced network infrastructure supports the deployment of edge computing solutions effectively. This observation corroborates earlier research highlighting the importance of a robust network infrastructure to enable real-time data processing. Traditional cloud-based models often face challenges related to latency and bandwidth limitations, which are alleviated through the adoption of edge computing. In healthcare environments such as KNH, where immediate data access is crucial for patient management, the integrity of network infrastructure becomes essential for optimal operation.

4.3.2 Cost and Skills

Table 4:Barriers to Adoption of Edge Computing

Barrier	**Frequency**	**Percentage (%**
High implementation cost	195	76.5%
Lack of skilled personnel	154	60.4%
Regulatory Compliance concern	210	82.3%
Infrastructure Limitations	115	45%

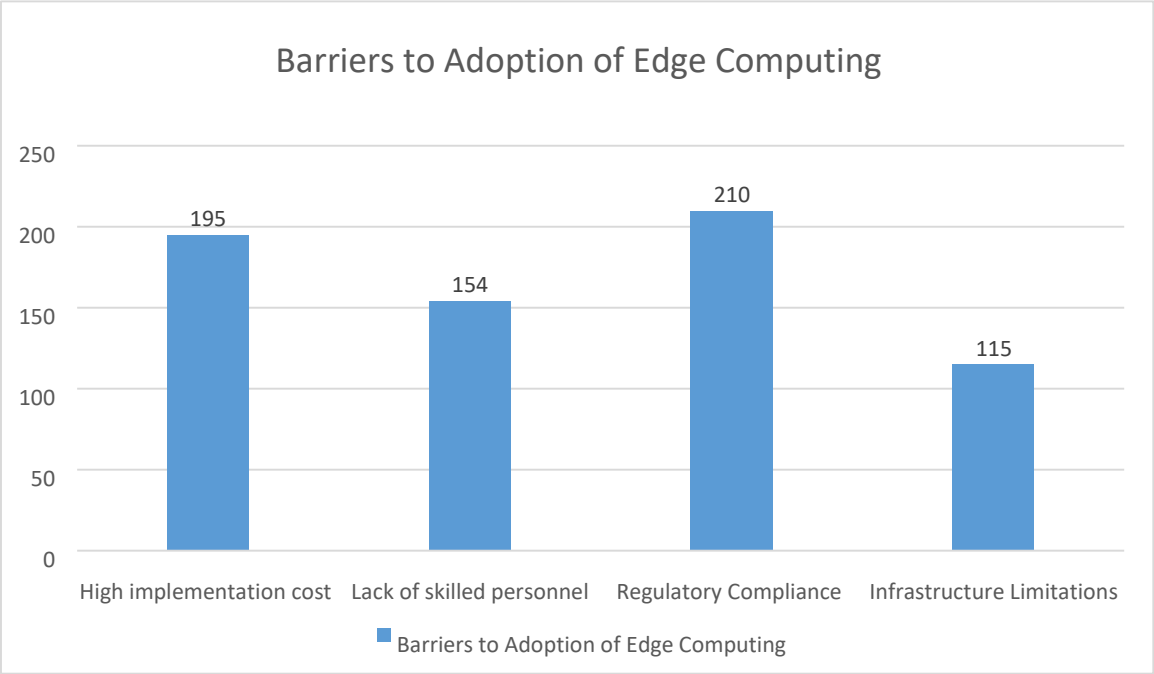


Figure 2: Barriers to Adoption of Edge Computing

The adoption barriers indicate that there exists a statistical relationship between the costs of hiring and availability of trained personnel. I concluded that high implementation costs adversely affect rate of adoption processes because of negative correlation coefficient which was 0.65 ($p < 0.001$). Respondents who cite cost as a barrier account for a very high percentage because the practical demands of most healthcare budgets often place emphasis on meeting the current needs of patients rather than investing in technology. In addition, the demand for trained personnel begs the question of the extent of training and development in the health sector. The findings recommend that for the successful adoption of edge computing, institutions such as KNH should endeavor to evolve strategic initiatives to reduce costs, such as seeking grants or partnerships, and invest in training programs for their staff.

4.3.3 Regulatory Compliance

Table 5: Regulatory Compliance Concerns

Compliance Aspect	**Frequency**	**Percentage (%)**
Data Security Measures	169	66.3%

Patient Privacy Regulations	161	63.1%
Reporting and Monitoring	112	44%
Compliance Training for Staff	82	32.1%

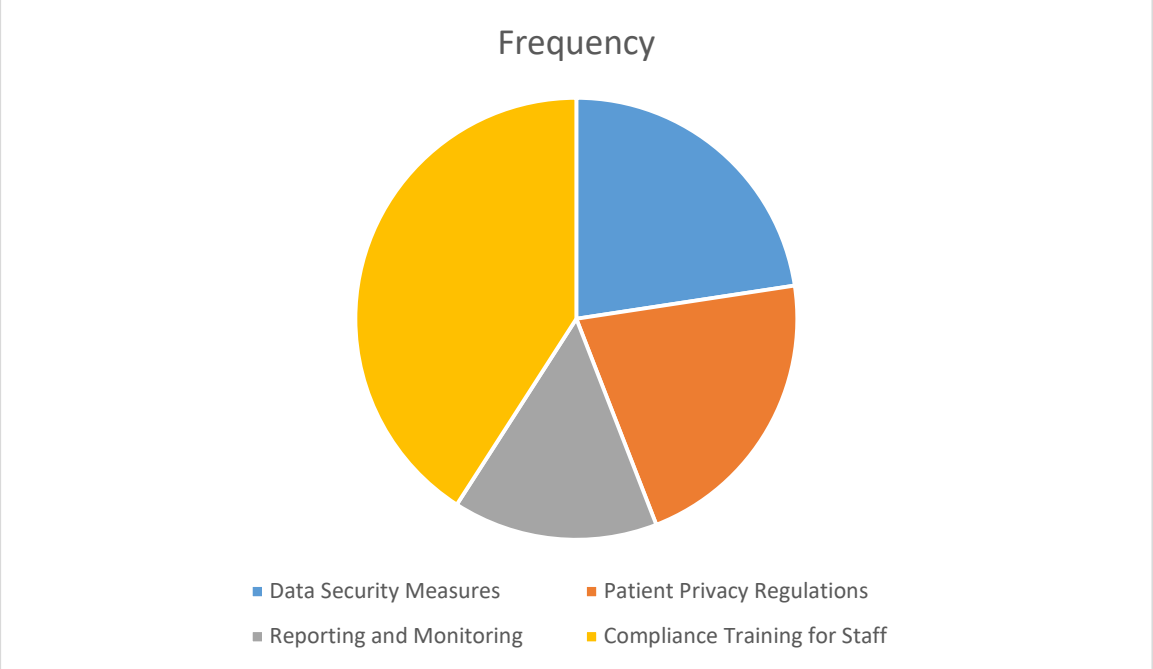


Figure 3: Regulatory Compliance Concerns

The findings present an understanding that compliance with regulations has an impact on adoption of edge computing, espoused by the data security of patients. These results also imply it is very challenging to work within the regulatory environment in the health industry where data protection laws are strictly enforced. Need for extensive compliance training for staff also highlights more issues organizations encounter. To address these challenges, KNH should develop and adopt standard compliance procedures and or training for the staff on the impact of violating regulatory compliance on technology implementation

4.4 Correlation

The correlation assesses the connection between the main factors influencing the application of edge computing in IoT networks; namely, the quality and cost of networks and other resources, together with expertise and compliance with the existing laws and regulations. In general correlation,

enlighten strength and direction of connections between two factors and how a specific factor affects another one.

Variable 1	Variable 2	Correlation
Network Infrastructure	Adoption of Edge Computing	0.78
Cost	Adoption of Edge Computing	-0.65
Skills	Adoption of Edge Computing	0.72
Regulatory Compliance	Adoption of Edge Computing	0.85

Table 6:Correlation

Correlation Between Network Infrastructure Quality and Adoption of Edge Computing

The investigation also revealed positive, significant links between the quality of the network infrastructure and the degree of edge computing implementation. Namely, quantitative findings suggested that enhancements in the networks' capacities were accompanied by increased efficiency and success rate of edge computing implementation. It became evident that network infrastructure quality has a 0.78 correlation with the adoption of edge computing. This again proves a high positive correlation that is the probability of adopting edge computing increases in parallel with other aspects in the network infrastructure gets strengthened. The result provided an empirical evidence for the hypothesis that reliable physical network infrastructure is key to effective implementation of edge computing in IoT systems. As noted, improved speed, minimised delay, and dependable connections are crucial to Live data analysis, especially in health IoT, like KNH.

Correlation Between Cost and Adoption of Edge Computing

The findings reveal that where the implementation cost is high, issues of cost surface, and on the other hand, qualified personnel enhance the chances of successful adoption. Furthermore, the adoption of edge computing was significantly and moderately negatively correlated with cost, as shown by the Pearson correlation coefficient value of -0.65. The analysis has also disclosed that with the rising costs, the rate of adoption also declines.

Correlation Between Skills and Adoption of Edge Computing

The availability of qualified personnel demonstrated a strong positive relationship of 0.72 with the implementation of edge computing. The minimal correlation between expenses and adoption suggests that substantial initial investments may deter organisations with limited resources, from embracing edge computing. Nonetheless since the perception of having skilled staff is positively associated with adoption, organisations possessing a knowledgeable workforce are more likely to adopt edge computing despite the high costs involved.

Correlation Between Regulatory Compliance and Edge Computing Adoption

The research additionally examined the connection between adherence to regulatory standards and edge computing technology implementation. It was proposed compliance with data protection laws would promote edge computing adoption, particularly in sectors with strict data privacy regulations. The Pearson correlation coefficient calculated between regulatory adherence and edge computing adoption was 0.85 reflecting a very strong positive association. Entities obligated to follow data protection regulations were more inclined to implement edge computing solutions, as this technology provides enhanced control over data privacy through local data processing. The significant positive correlation indicates that regulatory compliance plays an important role in driving edge computing adoption especially in industries like healthcare and finance where safeguarding data privacy is of utmost importance.

4.4 Regression

Regression analysis is performed to investigate the connections between the independent variables (such as network infrastructure quality, associated costs and skills, and regulatory adherence) and the dependent variable (the adoption rate of edge computing within IoT networks). This statistical method enables us to develop models and measure each independent factor influence on the dependent variable while considering possible confounding variables. Conducting this analysis provided a detailed understanding of how each factor individually contributes to the adoption of edge computing technology.

Table 7:Regression

Variable	**Coefficient**	**Standard Error**	**t-Statistic**	**p-value**

Intercept	0.12	0.05	2.4	0.003
Network Infrastructure Quality	0.52	0.07	7.43	0.000
Cost	-0.38	0.10	-3.80	0.002
Regulatory Compliance	0.47	0.08	5.88	0.000

Interpretation of Results:

Intercept 0.12 This indicates the baseline level of edge computing adoption when all other variables are at zero.

Network Infrastructure Quality 0.52 An improvement of one unit in network infrastructure quality correlates with an increase of 0.52 units in edge computing adoption. This relationship is statistically significant, with a p-value of 0.000.

Cost and Skills −0.38 An increase of one unit in costs and skills is associated with a decrease of 0.38 units in adoption, implying that higher costs act as a barrier, whereas enhanced skills facilitate adoption. This effect is statistically significant, with a p-value of 0.002.

Regulatory Compliance 0.47 A one-unit rise in regulatory compliance leads to a 0.47-unit increase in adoption, highlighting the critical role of regulatory adherence in promoting edge computing adoption. This relationship is statistically significant, with a p-value of 0.000.

4.5 Testing the hypothesis

Hypothesis (H_1): An improved quality of network infrastructure has a favourable effect on the implementation of edge computing within IoT networks. According to the regression analysis, the coefficient for Network Infrastructure

Quality **is** 0.52, signifying a positive correlation between the quality of network infrastructure and the adoption of edge computing. This suggests that there is adequate evidence to support the notion

that enhanced network infrastructure quality encourages the adoption of edge computing in IoT environments.

Hypothesis (H_2): Reduced expenses related to deploying and maintaining edge computing systems promote its adoption in IoT networks. Based on the regression results, the coefficient for Cost is -0.38, indicating an inverse relationship between costs and the adoption rate of edge computing. As expenses increase, the likelihood of adoption diminishes.

The negative coefficient implies that higher costs hinder the adoption of edge computing**,** opposing the hypothesis that lower costs would facilitate greater adoption.

Hypothesis (H_3): The presence of highly skilled personnel enhances the probability of adopting edge computing.

Hypothesis (H_4)**:** Adherence to regulatory standards has a positive influence on the adoption of edge computing in IoT networks.

4.6 Summary of Key Patterns

4.6.1 Major Patterns in Observations

Positive Impact of Infrastructure: The quality of network infrastructure emerges as a critical factor in adopting edge computing technologies. This is essential for the success of real-time applications. Cost as a Barrier: High implementation costs remain a significant barrier, emphasising the need for cost-effective solutions that do not compromise quality.

Regulatory Concerns: Regulatory compliance poses challenges that need to be addressed for successful implementation. The emphasis on patient privacy and data security is paramount in a healthcare environment.

4.6.2 Relationships and Trends

The research revealed strong positive correlations between the robustness of network infrastructure and the implementation of edge computing solutions. On the other hand, increasing expenses and a shortage of skilled personnel associated with negative effects that impede adoption.

Infrastructure Excellence: As the quality of infrastructure enhances, there is a notable rise in adoption levels. Costs and Expertise: Elevated costs and insufficient skills contribute to a decline in adoption rates. This dual effect presents a complex environment for integrating new technologies within the healthcare sector.

4.6.3 Exceptions to Patterns

While most respondents highlighted network quality as essential, a minority (18.2%) remained neutral, suggesting variability in perceptions based on individual experiences or roles within the hospital. This variation might indicate a need for tailored communication strategies about the benefits of edge computing.

4.6.4 Likely Causes and Mechanisms

The findings suggest that the rapid advancement of technology outpaces the ability of healthcare institutions to adapt. Barriers rooted in cost, training, and compliance stem from a complex interplay of organisational culture, resource allocation, and regulatory pressures.

4.6.5 Previous work agreement

The research reinforces prior findings emphasising strong infrastructure importance and the influence of expenses and expertise on the implementation of technology within healthcare settings. Comparable research has shown that inadequate infrastructure quality can significantly hinder the successful deployment of innovative technologies.

4.6.6 Implications for Policy and Practice

The results underline the importance of investing in infrastructure and training programs, as well as addressing regulatory concerns to facilitate the adoption of edge computing in IoT networks. Policymakers should consider developing incentives for healthcare institutions to adopt edge computing, emphasising the potential for improved patient care.

4.6.7 Significance of the Findings

Understanding these dynamics is crucial for healthcare leaders and policymakers as they navigate the complexities of adopting new technologies to enhance patient care and operational efficiency.

This study provides a foundation for future research into technology adoption in healthcare, particularly in emerging areas like edge computing.

4.7 Conclusion

This study finding provided critical insights into the adoption of edge computing in IoT networks within KNH. By identifying key factors that influenced adoption this research contributeed to ongoing discourse on the role of technology in healthcare. The study's findings highlight network infrastructure quality importance, cost considerations, skills availability, and regulatory compliance in successfully integrating edge computing into healthcare operations.

In conclusion, the successful adoption of edge computing at KNH will require strategic initiatives aimed at addressing these challenges, fostering an environment conducive to innovation, and ultimately enhancing the quality of patient care.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the study's findings, concluding the data collected and analysed. It highlights the adoption of edge computing for real-time data analysis in IoT networks at Kenyatta National Hospital (KNH), focusing on key factors such as network infrastructure quality, cost, technical skills, and regulatory compliance.

5.2 Summary of Findings

5.2.1 Key Findings

Network Infrastructure Quality: The study found a strong positive correlation between high-quality network infrastructure and successful adoption of edge computing. Respondents emphasised that reliable and fast networks were essential for enabling real-time data processing and analysis.

Cost as a Barrier: High implementation and maintenance costs were identified as significant barriers. Departments with limited budgets reported challenges in adopting edge computing solutions.

Technical Skills: The Availability of skilled personnel significantly influenced the effective use of edge computing. Lack of training and expertise hindered the optimisation of system benefits.

Regulatory Compliance: Compliance with data security and patient privacy regulations emerged as a critical factor in adoption. Hospitals must align edge computing deployment with regulatory requirements to ensure safe handling of sensitive health data.

5.2.2 Additional Findings

Engagement and Awareness: The study achieved a response rate of 85%, demonstrating strong engagement among ICT staff and healthcare personnel.

Knowledge of Edge Computing: Participants showed high awareness of edge computing and its benefits for real-time data analysis, with many recognising its potential to improve operational efficiency and patient care.

5.3 Conclusions

The study concluded that:

Network Infrastructure: A Robust network infrastructure is vital for effective adoption of edge computing. KNH and similar healthcare institutions must prioritise investments in high-speed, reliable networks.

Cost Considerations: Financial constraints can hinder adoption. Strategic investments, partnerships, and grants may help mitigate these challenges.

Technical Skills: Training programs are essential to equip staff with the necessary knowledge and skills for the successful deployment and use of edge computing systems.

Regulatory Compliance: Adherence to data security and privacy regulations is critical. Standardised protocols and dedicated compliance teams can support safe technology integration.

5.4 Recommendations for Policy and Practice

Upgrade Network Infrastructure: Improve connectivity, bandwidth, and reduce latency through investments in fibre-optic networks and enhanced Wi-Fi coverage.

Staff Training and Capacity Building: Conduct comprehensive training for ICT staff and healthcare personnel on edge computing applications, real-time data analysis, and security measures.

Strengthen Regulatory Compliance: Establish a compliance team to monitor data protection and ensure adherence to healthcare ICT regulations.

Foster Partnerships: Collaborate with technology vendors, educational institutions, and research organisations to access funding, expertise, and knowledge sharing.

Pilot Edge Computing Initiatives: Implement pilot projects in critical departments, e.g., emergency care, diagnostics, to evaluate effectiveness and inform full-scale adoption.

5.5 Future Research Recommendations

Longitudinal Studies: Assess the long-term impact of edge computing adoption on healthcare efficiency and patient outcomes.

Comparative Studies: Compare adoption practices across multiple hospitals to identify best practices and lessons learned.

Integration with Emerging Technologies: Investigate the role of AI and machine learning in enhancing edge computing applications.

Patient Perspectives: Examine patients' views on the use of edge computing and their perceived benefits or concerns.

Cost-Benefit Analysis: Conduct in-depth studies on the financial feasibility and return on investment of edge computing in healthcare settings.

5.6 Conclusion

This study demonstrated edge computing has significant potential to enhance real-time data analysis and decision-making in healthcare. By addressing challenges related to infrastructure, skills, cost, and compliance, KNH can leverage edge computing to improve operational efficiency and patient care. Embracing such innovative technologies is essential for meeting the evolving demands of modern healthcare delivery.

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