



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF COMPUTING AND INFORMATICS

DEPARTMENT OF INFORMATICS

**Designing a Health Information System Adoption Roadmap for Quality Healthcare in
Namibia**

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DECLARATION

I, **SINTE CHRISTABEL MUTELO** hereby declare that the work contained in this research proposal for Master in Informatics research, entitled: **“Designing of Health Information System Adoption Roadmap for Quality Healthcare in Namibia”**, is my own original work and that has not previously in its entirety or in part submitted at any university or other higher education institution for the award of a degree.

I further declare that all sources of information I will use in this research will be fully acknowledged in accordance with the institution rules.

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Signature of the Supervisor

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LIST OF ACRONYMS AND ABBREVIATIONS

- AT : Activity Theory
- DHIS : District Health Information System
- DSS : Decision support systems
- EHR : Electronic Health Record
- ESS : Executive Support System
- ICT : Information and Communication Technology
- IT : Information Technology
- IS : Information System
- IOM : Institute of Medicine
- HMIS : Health Management Information Systems
- HC : HealthCare
- HIE : Health Information Exchange
- HIS : Health Information System
- HIT : Health Information Technology
- MSH: Management Science for Health
- MoHSS: Ministry of Health and Social Services
- SQ : Service Quality
- TRM : Technology Roadmap
- OPM : Office of the Prime Minister
- PS : Permanent Secretary

TWG : Technical Working Group

PHR : Personal Health Records

QH : Quality Healthcare

USAID: United States Agency for International Development

WHO : World Health Organisation

DEFINITION OF CONCEPTS:

Adoption- the act or the process of beginning to use something new or different, the process of giving an official acceptance or approval to something.

Healthcare- These are efforts made to maintain or restore physical, mental, or emotional well-being especially by trained and licensed professionals.

Health Information Systems- The backbone or the primary system used to integrate or interface with various applications throughout any healthcare delivery organisation. These systems communicate information between the point of care or clinical units and various departments within the institution.

Health Information Technology- The technical aspects of processing health data and records, including classification and coding, abstracting, registry development, storage, and so on.

Quality- the Institute of Medicine defines healthcare quality as the degree to which healthcare services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.

Roadmap- A roadmap is a plan that brings an organisation to be able to align its technologies and communicates vision, attracts resources from business and government, stimulates investigations and monitors progress.

ABSTRACT

The Ministry of Health and Social Service (MoHSS), as part of the government of The Republic of Namibia and with the help of Non-Governmental Organisation (NGOs), has implemented Health Information Systems (HIS) within its different directorates to maximise the quality of care. Healthcare Information Systems offer benefits such as improving service delivery, providing real-time information, reducing organisation and personnel costs, and improving the quality of patient care. However, these benefits may not be seen in organisations where systems implementation and the adoption of policies and procedures are not adequately custom-made for systems users. Currently, the MoHSS has over 60 systems within its different directorates, with some functional and some not. Furthermore, there is no roadmap to guide the Ministry in the planning and adopting of HIS and the integration of existing systems donated by NGOs. Hence, to ensure maximised potential of the HIS, the MoHSS should have a clearly documented and ready-for-implementation roadmap that can serve as a strategic guide to the implementation of HIS.

This research provides a roadmap which will guide HIS adoption to enhance quality healthcare in Namibia. Based on the research objectives, a qualitative method approach was selected. A case study strategy was adopted for the Ministry of Health and Social Services. Interviews, documents, and questionnaires were used to collect data about the case studies.

Activity Theory (AT) was applied during data analysis. AT provided a deeper understanding about employees and technologies that could affect the development of a roadmap. The findings showed that governance, stakeholder involvement, HIS strategic plans, HIS experts and IS infrastructures are factors to take into consideration in the adoption of HIS by the Ministry.

A roadmap for the implementation of HIS was developed based on the interpretation of the data. The roadmap provides a guide for the planning, selection, implementation, and adoption of HIS to produce quality healthcare services in Namibia.

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Information and Communication Technology (ICT) has seen success in many sectors where it has been applied (Carroll, Travers, Richardsn, 2016). ICTs have enabled organisations to become more secure and improve the quality of services (Song, Baker & Davis, 2013). The benefits of ICTs in improving all aspects of patient care, including care, effectiveness, patient-centeredness, communication, learning, timeliness, efficiency, and equity are noted within the health sector (Kiberu, Mars, & Scott, 2017). This has led to the introduction of electronic health services, telemedicine and better healthcare services (Jeyakodi, 2015). In Namibia, the Ministry of Health and Social Services (MoHSS) has implemented Health Information Systems (HIS) to fully benefit from ICTs in healthcare (Karon, & Dlodlo, 2017, September). According to Karon and Dlodlo (2017), the MoHSS uses HIS such as Electronic Records Management (ERM) systems, the DHIS2, EPI INFO and eHealth, and many more.

The adoption of HIS came about through donations from developed countries such as the United States via the non-profit organisation USAID (WHO, 2015). A combined and effective Health Information System (HIS) is vital to advancement the quality of health service delivery and improve health outcomes (Dinev, Albano, Xu, D'Atri, & Hart, 2016). Currently, the MoHSS has over 60 systems within its different directorates, with some functional and some not (Gebre-Mariam, & Fruijtjer, 2018). The table below summarises four broad thematic areas of HIS identified within the Ministry.

Table 1.1 Four thematic areas of HIS in Namibian healthcare

1. DATA AND INFORMATION	2. TECHNOLOGY, PROTOCOLS, AND THE HUMAN INTERFACE
There is a lack of interoperability. Information is often extracted into printed format from multiple electronic systems (e.g. the Electronic Patient Management System [EPMS], the Extended Tuberculosis Register [ETR], private sector HIV data, MediTech, and SysPro), then manually re-	The infrastructure for both local and wider-area Information and Communication Technology (ICT) is either inadequate or totally absent, and a lack of required hardware and software at multiple levels essentially makes inaccessible key current systems (e.g. the Human Resource

<p>entered in other electronic systems or MOHSS Summary Forms (e.g. Mister Sister Mobile Health Services, Pharm Access, the Integrated Financial Management System [IFMS]).</p>	<p>Information Management System [HRIMS], IFMS) and most planned systems (e.g. the Integrated HealthCare Management System [IHCIMS], the Human Capacity Management System [HCMS]). This also means that facilities are not properly operational and interlinked throughout the health system.</p>
<p>3. INFORMATION PRODUCTS, DATA USE, AND KNOWLEDGE MANAGEMENT</p> <p>Analytical capacity, resources (including human), practices, and tools are limited.</p>	<p>4. MANAGEMENT, COORDINATION, AND IMPLEMENTATION</p> <p>In general, the skills available do not meet the required, relatively higher, degree of basic computer and specific system user literacy, system administrator competencies, and technical support capacity that are critical for some current and most upcoming systems (e.g. IHCIMS, HCMS, the District Health Information System [DHIS] 1.4, NDW)</p>

HIS and systems in MoHSS adopted from Khan and Edwards (2012).

The success of the implementation of ICTs in health requires proper planning. Many researchers from different fields of study have used a roadmap in various areas such as government policy formulation (Gershman, Bredikhin, & Vishnevskiy, 2016). Cho, Yoon and Kim (2016) noted that a roadmap is a key tool to predict technological changes and align with strategic business objectives to enable decision-making. This kind of roadmap could strengthen the Namibian health sector. A roadmap allows management to be strategic in implementing new or improved technology, provides clear resourcing needs, and provides a structured way of governing changes. The Namibian healthcare sector therefore needs a roadmap to restructure and redesign HIS adoptions.

HIS is defined as people using technology and business processes to manage health operations within an organisation to improve the quality of services (Jardim, 2013). The benefits of HIS are well known from the knowledge of healthcare providers who have adopted it. This is evident from the literature on HIS implementation. HIS allows for access to complete health information and computerised clinical decision support on specific patients (Davis, Currey, Howk, DeSordi, Boise, Fagnan & Vuckovic, 2014). Accordingly, health information technology (HIT), which translates into HIS, is increasingly part of quality healthcare delivery services (Rozenblum, Miller, Pearson, Marielli, Grando, & Bates, 2015). This research will focus on designing an HIS adoption roadmap for quality healthcare in Namibia.

This chapter covers the background of HIS in Namibia, the problem statement of this study, the preliminary literature review and proposed framework, and the research methodology and plan.

1.2 RESEARCH BACKGROUND

A roadmap is a plan that enables an organisation to align its technologies and become innovative (Tidd & Bessant 2018). A well-constructed roadmap clearly outlines technological requirements and main components. To Bloomberg and Volpe (2018) a roadmap is developed as a text or diagram to answer the questions *where are we now?*, *where do we want to go?*, *how do we go there?* and *what should we do to get there?* This means that if it is properly developed, a roadmap has the capability of leading to sustainable HIS implementation.

The Namibian health sector needs a clear roadmap for HIS adoption. Although the ministry has taken a powerful approach to accelerating the HIS process under the newly founded HIS directorate, the absence of an HIS strategic plan or policy may hinder adoption. One of the assessments done in the Ministry found that “much of the effort to date has been uncoordinated and directed mostly to isolated technical aspects of the HIS and not to institutional, coordination, and other behavioural aspects” (Khan & Edwards, 2012, p.15). Furthermore, mechanisms to effectively engage the leadership of MoHSS and other national agencies is in process (Mabirizi, Phulu, Churfo, Mwinga, Mazibuko, Sagwa, & Hafner, 2018). To deal with the complexity of HIS from adoption to implementation, concrete planning must

be in place. A systematic approach that guides the healthcare organisation to establish their HIS objectives and translate them to functional and technical operations is required.

Additionally, HIS can improve the quality of healthcare services and management. The implementation of HIS is widespread, even if healthcare practitioners do not make use of it to achieve quality healthcare services (Jeyakodi, 2015). Positive perceptions exist in the expected outcome that HIS adoption will improve processes and enhance healthcare quality (Oaikhena, 2016).

The use of HIS has advanced over the years. HIS is an integrated system that collects, analyses, evaluates, stores, and disseminates health data and information for use in healthcare (Seitio-Kgokgwe, Mashalla, Seloilwe, & Chida, 2016, May). It further enables evidence-based decision making and improvement in the healthcare of the population (Califf, Robb, Bindman, Briggs, Collins, Conway, & Dymek 2016).

Despite these opportunities, the adoption of technology for healthcare is not universal. Healthcare organisations face challenges due to trends and the introduction of new software and hardware (Jardim, 2013). ICT infrastructure development is ongoing, and progress is visible in the HIS systems that are implemented in some public hospitals in Namibia (Karon, 2015).

Poor infrastructure and lack of healthcare systems are some of the factors that may lead to poor quality healthcare and spending too many resources on different technologies.

From the Namibian perspective, HIS was created for routine data collection, analysis and reporting (World Health Organisation, 2015). Currently, HIS is one of several solutions aimed at supporting and improving healthcare. With the successful adoption of e-health, healthcare has become technology-driven (Binhadyna & Wickramasinglhe, 2015). A wide range of HIS such as e-health, tele-health, Health Information Exchange (HIE) and Electronic Document Management Systems (EDMS) ensure quality healthcare. One of the challenges that organisations face is developing policies and strategies that can facilitate social benefits by leveraging ICTs. Thus, this research is concerned with designing an HIS adoption roadmap for quality healthcare delivery in Namibia.

1.3 PROBLEM STATEMENT

Despite a variety of efforts to embrace technologies within the health sector, adoption and usage of HIS in Namibia are still low. There are challenges facing the health sector in Namibia as a result of technology changes, system implementation issues, and isolated systems. Studies show that the implementation of HIS has been ongoing, and that it has impacted health service delivery in Namibia (Karon, 2015). However, Ongundaini (2016) claims that there are limitations in terms of usability and functionality, and that these systems are not user-friendly or integrated. Groves, Kayyali, Knott, and Kuiken (2016) mention that technology savings in healthcare leads to greatly improved healthcare quality, including safety, effectiveness, patient-centeredness, time and efficiency. However, this is not the case in Namibia. The current implementation of HIS does not support or enhance quality healthcare services. HIS developers and implementers have not considered the quality of health service delivery. In addition, non-usage of the e-Health Information System defeats the objectives of its adoption, in the sense that the plan to improve and deliver quality healthcare service in the public sector is not being achieved as envisaged (Oaikhena, 2016). A roadmap for HIS adoption could mitigate some of the challenges and encourage the use of HIS.

In Namibia, roadmaps are gaining momentum. Several articles have been written on the roadmap for bio-oil energy (outlining strategies to achieve bioenergy usage in Namibia) and Vision 2030. For example, Namibia's roadmap to industrialization is one. And the Integrating desalination with concentrating solar thermal power: A Namibian case study. Renewable energy (Hoffmann & Dall, 2018).

Consideration of HIS adoption has not been prioritised thus far, but this research proposes an HIS roadmap to impact healthcare quality in Namibia. The proposed roadmap is intended to explore the possible effects of HIS adoption on health services by engaging all stakeholders.

1.4 RESEARCH OBJECTIVES AND RESEARCH QUESTIONS

In order to provide a solution to the highlighted problem, the following objectives are proposed.

Main Objective

The main research objective is:

To design a Health Information System adoption roadmap to enable quality healthcare in Namibia.

The secondary objectives of the research are:

- i. To evaluate the current state of HIS and roadmaps within the MoHSS in Namibia.
- ii. To assess HIS technologies for quality healthcare.
- iii. To analyse the components of HIS roadmap adoption.

Research Questions

The main research question is:

How should an HIS adoption roadmap be designed to enhance the quality of healthcare in Namibia?

To address the main research question, the following secondary questions are asked:

- i. What is the current state of HIS and roadmaps in Namibia?
- ii. What HIS technologies are used for quality healthcare?
- iii. What is the current adoption of HIS in Namibia?
- iv. What are the HIS roadmap adoption components?

1.5 RESEARCH METHODOLOGY

Research methodology covers methods, techniques, and approaches towards guidance to research (Creswell & Creswell, 2017). Thus, the research methodology describes the steps which the study took in order to reach the defined research objectives, including studying the research problem and its background. The research strategy, design, data collection techniques and analysis discussed below were selected according to the study's objectives and are further discussed in Chapters 3 and 4.

Two methods are used in research enquiries: qualitative and quantitative. The differences are revealed by the research objectives, questions and data collection techniques. This research used the qualitative method.

1.5.1 Research strategy: Qualitative method

The study adopted a qualitative research method because of its suitability to assist the researcher in answering questions to meet the research objectives. Graneheim, Lindgren & Lundman (2017) note that qualitative methods can be used at varying levels of abstraction and interpretation. Therefore, qualitative methodology depends on human perceptions and understanding, and accordingly it attempts to capture and group social phenomena with their meanings. To Rahman (2017), "qualitative research is any type of research that produces findings not by statistical procedures. It can refer to research about persons' lives, lived experiences, behaviours, emotions, and feelings as well as about organisational functioning, social movements, cultural phenomena, and interactions between nations" (p.103). Since this research is about the organisational environment and interactions between people and systems, it was found fit to use the qualitative method.

1.5.2 Research design: A case study approach

Case study research involves the "intensive study of a single unit for the purpose of understanding a larger class of (similar) units observed at a single point in time or over some delimited period of time" (Baskarada, 2014, p.3). Based on the research objectives, a case study research approach was considered. The Ministry of Health and Social Services (MoHSS) was used as a case study. Two directorates (HIS and Research, and Policy Planning and Human Resources) and one of the Ministry's stakeholder organisations (USAID Management Science for Health) were selected to represent the MoHSS. The selection was because of the role of the directorates and their direct link to HIS within the Ministry.

The population figures in the table shows the number of employees by directorate or division.

Table 1.2 Sample Population

Directorate/Partner	Population	Sample	Data Collection
Policy Planning & Human Resource Development	120	50	Questionnaire and Focus Group
USAID (Management Science for Health)	21	20	Interviews and Questionnaire
Health Information Systems and Research	11	10	Interviews
TOTAL	152	80	

The table shows the population stakeholders targeted for the research. Only key players involved in HIS policy-making and implementation, and users of HIS were approached.

1.5.3 Data Collection

Qualitative research relies mostly on non-numeric data, such as interviews and observations, in contrast to quantitative research, which employs numeric data such as scores, and metrics. For this study, data was collected by means of semi-structured interviews, questionnaires and documentation from the Ministry directorates, primarily USAID Management Science for Health. A semi-structured interview was used as the primary data collection technique because it allows for flexibility and fullness of data. A questionnaire was used to obtain qualitative data about the applicability, usability, and development of a technology roadmap from different HIS and IT roadmap experts. Furthermore, the documents acquired during interviews were studied in two ways. Firstly, the documents were reviewed to check if they support the interviews’ transcribed data. Secondly, the documents were reviewed against the research objectives, to be discussed in Chapter 4.

1.5.4 Data Analysis

Data analysis entails the steps of making sense of the data collected. Boyd and Crawford (in Najafabadi, Villanustre, Khoshgoftaar, Seliya, Wald and Muharemagic, 2015) state that data

analysis is concerned with minimizing a huge amount of data collected. The data analysis process is important to make the data meaningful. Activity Theory (AT) theory was adopted for data analysis in this research.

1.6 RESEARCH SIGNIFICANCE

The purpose of this study is to develop a Health Information Systems (HIS) adoption roadmap for quality healthcare in Namibia. The study will contribute to the body of knowledge concerning the effective use of HIS. The results can assist the health sector by outlining the strategies to follow when an organisation is implementing HIS. This roadmap will go a long way in assisting the MoHSS stakeholders in implementing HIS in Namibia. Furthermore, the research will improve the quality of healthcare and patient outcomes by using external data from all healthcare systems and organisations.

1.7 RESEARCH SCOPE

The research is specifically aimed at the design of an HIS adoption roadmap in the health sector context of Namibia as a developing country.

1.8 ETHICAL CONSIDERATIONS

Before data collection, permission letters from NUST FCI were sent to the MoHSS's HIS and Research directorate via the PS office (APPENDIX G). The letter served as proof that the research would abide by the university's code of ethics. The Ministry responded by requesting the research proposal, which was sent and approved (APPENDIX H). Further, the application form for ethical clearance for research and data collection was completed in the FCI. The certificate was obtained in June 2018 (APPENDIX I). The data collected was only to be used for the purpose of this research. Data sharing of the research was between the researcher and the supervisor only.

With the interview process, the interviewees were briefed on the objectives of the researcher and an approval letter from the Ministry was submitted. The researcher requested permission to record the interview dialogues for the purposes of analysis, and informed the interviewees that participation in the interview was at their free will. In addition, it was explained to them and they were guaranteed during interviews that their identities would under no circumstances be revealed to any third party during or after the research without their

consent. The agreement to conduct and record conversations of the interviews was permitted by those who took part.

Regarding the questionnaire, participants' email addresses were obtained from the HIS division's director's office. The list was for HIS TWG and stakeholders. Emails were sent through requesting participation in an online questionnaire, which collected feedback anonymously.

1.9 DELINEATION AND LIMITATIONS

The researcher was responsible for securing appointments with the relevant offices within the MoHSS's identified population, as well as for collecting data and analysing it. The research was limited to the MoHSS primary HIS directorate, and Policy Planning and HR in the Khomas region. Other regions were excluded from the research..

1.10 THESIS OUTLINE

This thesis is outlined into six chapters as below:

Chapter 2: HIS Adoption and Quality Healthcare

This chapter presents a review of the literature relating to the research. In addition, the reinforcement theory that was used for data analysis is discussed.

Chapter 3: Roadmaps in Healthcare

This chapter discusses the role of the roadmap in healthcare; its benefits and challenges in different industries, and the method used in developing roadmaps. In addition, the chapter discusses the conceptual framework best suited to HIS.

Chapter 4: Research Methodology

This chapter presents the research strategy, methods, approaches, case study, and practices that were applied during data collection and analysis.

Chapter 5: Data Analysis

The chapter presents how Activity Theory was used to identify and categorise technical and non-technical actors, and how the collected data was analysed interpretively.

Chapter 6: Findings, Interpretations and Discussions

This chapter concentrates on the interpretation of the findings in Chapter 4 based on the analysis carried out in Chapter 5.

Chapter 7: HIS Adoption Roadmap

This chapter presents the main objective of this research, which is to design an HIS adoption roadmap for quality healthcare in Namibia.

Chapter 8: Research Summary, Conclusions and Recommendations

The chapter provides a summary of the research, conclusions, and recommendations for future work.

1.11 CONCLUSION

This chapter introduced the research by explaining the research contents, main points, and keywords from the topic. In addition, the chapter included the problem statement and gave the background to the research problem, research benefits, research scope and ethical considerations. This affords the reader to gain an understanding of the objectives and benefits of the research. The chapter ended by giving an overview of each chapter covered in this thesis.

CHAPTER 2: HEALTH INFORMATION SYSTEM ADOPTION AND QUALITY HEALTHCARE

2.1 INTRODUCTION

The focus of this chapter is to discuss HIS adoption in general, with the aim of identifying adoption strategies. This is followed by a discussion of technology adoption in healthcare, including its challenges and benefits. Furthermore, the chapter discusses how quality healthcare is achieved through the implementation and adoption of HIS.

This chapter also discusses technology roadmap motivation and conceptualisation, its benefits in different industries, methods used in developing roadmaps, and finally the best framework for HIS implementation.

2.2 AN OVERVIEW OF HEALTH INFORMATION SYSTEMS

A number of health information technology vendors are ready to offer HIS in order to maximise the potential benefits of ICT to improve access to healthcare information for today's society (Cresswell & Sheikh, 2013). Joos, Nelson and Smith (2014) state that HIS continue to support that network within healthcare organisations.

The spread of ICT has been witnessed in various sectors such as banking, higher education institutions (e-learning), e-commerce and agriculture (Mutelo, 2015). In agriculture, for example, ICT is utilised for shuttle train technology to improve the efficiency of grain shipping.

ICT has changed healthcare systems globally. It can help deliver quality healthcare and attend to future health difficulties. It has reduced healthcare costs by allowing patients to receive services at home (Somoye, 2015). ICT is also used in information management and decision-making for doctors.

2.2.1 HIS Adoption in Healthcare

Whitacre (2015) elaborates on strategies to endorse health information technology that have played a serious part in the consideration of how to improve the safety, quality, efficiency and effectiveness of healthcare systems. HIS has provided the following benefits to organisations where it has been in use: provides accurate, up-to-date, and complete information; enables quick access to patients' information; helps to effectively diagnose patients; improves communication; allows information exchange with various departments; and facilitates the secure sharing of electronic information (Hamine, Gerth-Guyette, Faulx, Green & Ginsburg,

2015). The utilisation of ICT in healthcare solves the increasing demand for information by using well integrated health information systems (Kuipers, 2016).

HIS can be developed and implemented correctly, but without user acceptance and adoption, it will not serve its purpose. Hence, Oaikhena (2016) says the core factors that influence the successful adoption and use of HIS include: the willingness of an individual (or group) to accept and use the technology; the performance expectancy and social influence among professionals in the healthcare scene; and adequate facilitating conditions. In every organisation, the acceptance of every individual is vital.

Cresswell and Sheikh (2013) conducted research on HIS adoption in primary healthcare with the motive of understanding the reasons affecting HIS adoption. Their findings indicate that there are a variety of technical, social and organisational considerations when trying to ensure that technological innovations are useful for both individuals and organizational processes.

Additional research found that resistance by health practitioners to adopt the use of HIS contributes to the absence of understanding of the positive outcomes attributed to HIS (Bandara, Syed, Ranathunga & Kulathilaka, 2018). Based on the literature, most HIS that are used effectively support patient healthcare. However, patient HIS are not utilised to their full potential to support effective healthcare due to fragmented information creation and storage. HIS are typically isolated within hospitals, physician practices, laboratories or pharmacies (Haoses-Gorases, 2015). HIS must achieve interoperability, standards, quality, security, scalability, reliability, and timeliness in data storage and process terms (Jardim, 2013).

The use of HIS combined with other technologies already in use will enable the health sector to deliver quality services in different ways and places that health experts currently do not reach. HIS can also support patient management (Hughes, Wibowo, Sunderland, & Hoti, 2017).

Health Information Technology (HIT), electronic health and computerised medical information increase the quality of services, while also reducing medical costs and advancing information among medical personnel (Xhafa, Li, Zhao, Li, Chen, & Wong, 2015). Electronic Health Records (EHR) can be better than traditional paper-based patient records because of concurrent access, fast information recovery, better quality, high accessibility and higher confidence. In short, EHR enable communication and collaboration between different units

in healthcare. One example of HIS used in developed countries is Personal Health Records (PHR). The most important PHR benefit is greater access to a wide range of credible health information, data and knowledge (World Health Organization, 2016).

Today's technology systems allow for the distribution of data and information. Collaborative tools also bring geographically dispersed teams together for virtual meetings. Thanks to wireless and mobile technologies, healthcare can be easily linked with ICT.

2.2.2 HIS Adoption Challenges

Rouleau, Gagnon, and Côté (2015) state that the use of ICT in healthcare has well-known advantages: it increases patient-centeredness, improves healthcare quality and teaches health practitioners and patients. ICT use is already widespread, which is why it is important to equip community healthcare workers with technology literacy (Pagalday-Olivares, Sjöqvist, Adjordor-van de Beek, Abudey, Silberberg, & Buendia, 2017). Despite the fact that ICT promises to enhance the quality of healthcare, the adoption of HIS beyond traditional health applications has been relatively slow in Namibia. Researchers have cited numerous reasons why this so. Jauhiainen, and Hooli (2017) in their case study highlighted the challenges of creating an IS in a developing country with limited resources and a mismatch between strategies and policies. To Mutelo & Jere, (2017) these challenges include financial resources, a lack of qualified information technology experts, and a lack of infrastructure (or simply standalone systems with no possibility of being integrated).

Research on the adoption of HIS in Sri Lanka (Jeyakodi 2015) found that several barriers hinder HIS adoption, such as healthcare settings, and the financial and legal risks linked to technology purchases and use. HIS are not being fully utilised to effectively and efficiently manage healthcare, and this is due to disparate information and software. HIS are neglected in hospitals, health directorates, laboratories and pharmaceutical facilities (Rahurkar, Vest & Menachemi 2015). When HIS are not fully utilised, no health benefit is expected. Thus, adoption needs to be planned ahead for users to understand the benefits and challenges of using the system.

Achieving interoperability is also very important, as this will reduce unwanted costs and contribute to effective patient treatment. The cost of integrating patient access with existing

systems is unclear, but it seems likely that systems not originally designed for lay use would entail significant costs. Operational modelling could provide estimates of some of these potential cost implications (Saini, Garcia-Armesto, Klemperer, Paris, Elshaug, Brownlee, & Fisher, 2017).

2.2.3 Quality Healthcare

Prince, Comas-Herrera, Knapp, Guerchet, and Karagiannidou (2016) define healthcare quality as the extent to which healthcare services for persons and peoples raise the possibility of desired health results. For the Ministry of Health and Social Services, patient-centered care is the core of a high-quality healthcare system and a necessary foundation for safe, effective, efficient, timely, and equitable care. Feinberg, Frijters, Johnson-Lawrence, Greenberg, Nightingale, and Moodie (2016) noted that the association's vision is leading the advancement and ethical use of quality health information to promote health and wellness worldwide. Similarly, the WHO (2015) says the quality of care is a key component of the right to health, and the route to equity and dignity for patients. For health facilities to achieve universal health coverage, it is essential to deliver health services that meet WHO criteria. In order to achieve this, healthcare must be safe, effective, timely; efficient, equitable and people-centered. These requirements are further explained below (WHO, 2015):

Safe. Delivering healthcare that minimizes risks and harm to service users, including avoiding preventable injuries and reducing medical errors.

Effective. Providing services based on scientific knowledge and evidence-based guidelines.

Timely. Reducing delays in providing and receiving healthcare.

Efficient. Delivering healthcare in a manner that maximizes resource use and avoids waste.

Equitable. Delivering healthcare that does not differ in quality according to personal characteristics such as gender, race, ethnicity, geographical location or socioeconomic status.

People-centred. Providing care that takes into account the preferences and aspirations of individual service users and the culture of their community.

Therefore, electronic health information systems' distribution availability is required for the exchange of healthcare information and the affordability of quality healthcare. According to Meigs and Solomon (2016), the Institute for Urban Family Health implemented a fully

integrated electronic health record (EHR) to improve healthcare and health outcomes for their patients. Thus, HIT is fundamental to improving the quality of healthcare.

2.3 Effect of HIS Adoption on Quality Health Service Delivery

Gibson (2016) says that theoretical frameworks serve as guides on how to shape and support a study. In addition, the framework provides a particular viewpoint, or lens, through which to scrutinise a topic.

A well-researched framework for measuring the complex qualities of a successful information technology/ information system (IT/IS) implementation is that of DeLone & McLean (Kuipers, 2016). This research adopted this very model.

For an HIS to be effective in the health sector, the organisation needs to follow the five DeLone & McLean (D&M) measurement elements that are used to evaluate any adopted information system (Kuipers, 2016).

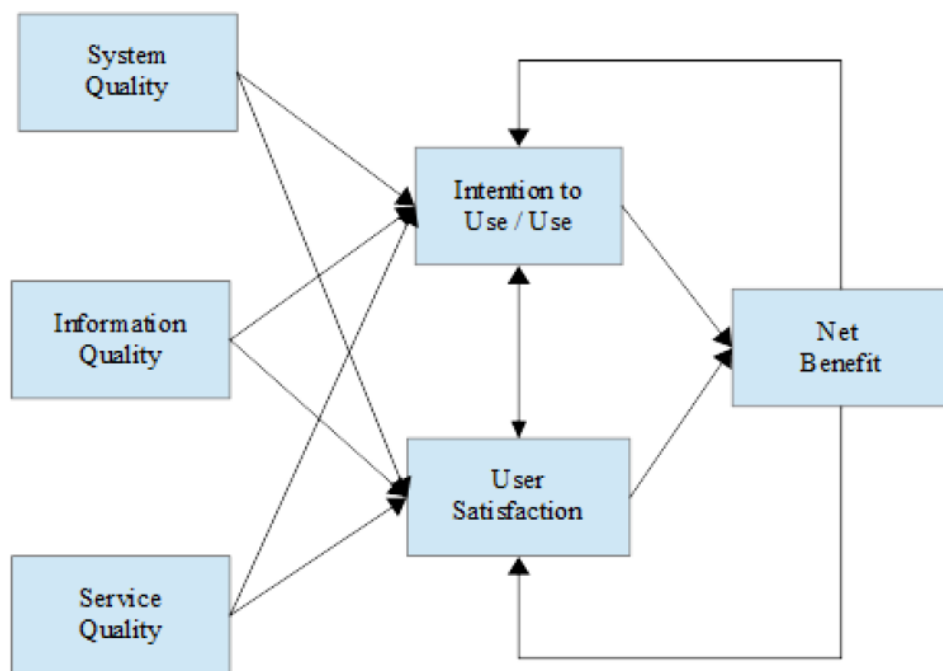


Figure 2.1 Revised IS System Success Model (Kuipers, 2016)

In order to measure the degree of service output from the HIS system, D&M during their review added a third dimension, service quality (SQ), which measures the perceived quality of the IT service, to the two original system characteristics: system quality and information

quality. Delone and McLean specifically indicate that to measure the success of a single information technology (IT), information or system quality may be very important, but to measure the overall success of an information system, SQ may be the most important factor (Kuipers, 2016). In this study, the design of a roadmap for quality healthcare in Namibia will focus on service quality, while the evaluation of existing HIS systems will focus on the other two dimensions.

2. 4 OVERVIEW OF HEALTH INFORMATION SYSTEMS IN NAMIBIA

Karon (2016), wrote an article to investigate how HIS can be used to improve service delivering in the hospitals from developing countries perspective study done in Namibia. The study discovered the use of parallel systems, lack of systems integration, lack of portable devices and users' incompetency are some of the factors which impact the use and management of HIS in hospitals. The study recommended research efforts and the practical application to be directed toward the adoption the use of IT, as sustained healthcare development can positively produce quality services. Shaanika (2016) in the article "Human Interaction in the Use of Health Information Systems: A Case of a Developing Country: A case study of a developing Country" (p.257) with the focus on the interaction between the healthcare professionals and the HISs, discusses that the reason to improve quality of healthcare with HIS is faced by stakeholder who do not understand the problem. The study identifies challenges on daily operation of HIS.

Hamunyela and Iyamu (2016) presented a critical analysis of the role and account of actors in the mobility of healthcare services in Namibia. Their study considered the importance of the relationship between health practitioners and patients. Karon and Dlodlo (2017) the study identifies the lack of a framework for effective assessment drivers that drive challenges in supporting investment decisions towards ICT in the public healthcare sector. Moreover, it designs an electronic impact assessment framework from a perception of nurses. In addition, Hamunyela and Jere (2018) outlined guidelines on HIS evaluation before integration and presented a framework for evaluation HIS.

Technical changes:

- Slow internet connectivity,

- System downtime.

Non-technical challenges:

- Lack of know-how (user not able to use computers),
- Lack of communication among the healthcare professionals.

The study concluded by recommending training to employees using HIS and IT awareness programmes for them to embrace ICT.

Nengomasha, Abankwah, Uutoni, and Pazvakawambwa (2018) noted that, the aim of any HIS is to yield quality and timely information for confirmation based decision-making and interventions. In addition, Nengomasha et al., (2018) wrote an article with the aim to report some findings of a study that investigated HISs in Namibia and come up with recommendations. The study showed fragmented HISs which results in duplicated diagnosis, tests and treatment and errors in capturing data which compromises service delivery. The articles presented the following recommendations on how the MoHSS' HISs can be enhanced:

- The MoHSS needs to come up with an HIS that integrates all health service providers; public and private to ensure complete health records for patients. In doing so, Namibia can learn from experiences of other countries, such as Tanzania.
- Until such a time that there is a fully integrated HIS, there is a need to educate patients to look after their health records, which are entrusted to them, such as the health passport and X rays.
- There is a need to train health professionals on recording and keeping complete patient data, which will ensure accurate and reliable health indicators.
- The MoHSS should employ and train staff dedicated to data entry into the NHIS and production of reports.

2.5 CHALLENGES OF HEALTH INFORMATION SYSTEMS

Malaysia, Ibrahim, Auliaputra, Yusoff, Maarop, Zainuddin, and Bahari (2016), noted that HIS has become popular and is used by many health institutions plus government both in private and public hospitals. The study aim was to measure the success of HIS called as Professional Medical Office (PMO) used by several clinics and health centres in Klang Valley using the DeLone and Mclean. The result noted that System Quality clearly linked to the Intention to Use and User Satisfaction while Use positively related to Net Benefits.

Uganda, Namakula Mayoka Kituyi (2014) mentioned that “Healthcare Health Information Systems offer several benefits towards healthcare service delivery in Uganda including easy record keeping, enhancing communication, performing simple calculations, supporting decision making, gaining competitive advantage, better management of chronic diseases, faster retrieval of records, improving process flow and increasing productivity”(p.1). But these benefits seem not to exist yet in Uganda due to failure of HIS. The most affected group are the Small and Medium Healthcare Enterprises who have limited resources and semi-skilled employees. According to Namakula et al., (2014) added that the success of HIS influences for Information Systems in Ugandan healthcare system are mainly unknown.

Kenya, Kamau, Osuga, and Njuguna, (2017) highlighted that, standard health is a fundamental human right and, primary to this right within health system, is the existence of well-functioning system that allows stability of care throughout the health organisation. The study specifically investigated the influence of infrastructure, capacity of health workers, HIS and financial resources on implementation of healthcare system. After data analysis the study concludes that, infrastructure, HISs, capacity of workers and resources are challenges towards implementation of health systems. Furthermore, the author recommends that, Kiambu County Health care facilities:

- improve infrastructure;
- implement a standard referral system monitoring toolkit and curriculum to train health workers on the referral policies and guidelines;
- Develop standard referral forms/registers and provide adequate funds for implementation monitoring and evaluation.

Namibia, Khan and Edward (2012) in the HIS assessment report of 2012, echoes that, the MoHSS had over 60 HISs, and fragmented systems with the following challenges: a lack of agreed standards across systems and databases, inadequate training which resulted in inadequate IT skills, poor work practices and fast staff rotation and high staff turnover, an absence of common patient identification numbers. The report recommends to the Ministry to come up with HIS strategic plan.

2.6 CONCLUSION

Reviewed articles on HIS have shown evidence that the use of HIS in healthcare brings about quality healthcare services. HIS help organisations meet the demand for sharing information electronically, allowing for the efficient management and delivery of information to a healthcare organisation's processes. From the literature review, it is clear that the adoption of HIS in the healthcare sector is a challenge.

CHAPTER 3: TECHNOLOGY ROADMAPS IN HEALTHCARE

3.1 INTRODUCTION

This chapter discusses roadmaps in healthcare, roadmap benefits and challenges in different industries, and the methods used in developing roadmaps. In addition, the chapter discusses the framework best adopted for HIS. The chapter then provides an overview of Activity Theory framework, which was used to analyse the qualitative data.

3.2 OVERVIEW OF ROADMAPS IN HEALTHCARE

3.2.1 Roadmap technologies in use

An ICT roadmap may be useful to many organisations. Technology roadmapping represents a powerful technique for supporting technology management and planning in an organisation (Lee et al., 2013). Among many future-oriented technology analysis approaches, the roadmapping approach has become popular and has been adopted by many organisations in the past decades because of its ability to integrate technology, strategies and social drivers (Haddad et al., 2016). However, many organisations face challenges in developing technology roadmapping with a clear vision, including determining targets, critical system requirements, and technology substitutes (Aleina, Viola, Fusaro, & Saccoccia, 2017).

Lee, Phaal, & Lee (2013) suggested that the critical factors for the successful development and implementation of roadmaps are people, processes and data. Thus, the process of technology roadmapping and the integration of roadmaps into an ongoing business process are said to be difficult.

Haddad and Maldonado (2016) argued that technology roadmapping in organisations can support existing expertise to generate relevant strategic plans and policies, and assist in understanding fundamental technology gaps. In addition, Haddad et al. (2016) found that the roadmap approach has been used to develop Future-Oriented Analysis (FTA) linking technology innovation, policy, business and social drivers. In addition, their study proposed “the use of functions of innovation systems as drivers within sectoral roadmap to direct decision making and policy making towards tasks” (p. 251). In this study, system innovations were used as the technology approach, where system functions helped to plot the present and the desired future state of the sector, providing policy-makers with strategies to draw on in order to build the roadmap.

A roadmap can introduce new ways of conceptualising sophisticated things without applying a complicated process. Roadmaps enable organisations to use different approaches involving different people in strategic decision-making through collaborative planning, communication, and sharing knowledge.

According to Vishnevskiy, Karasev and Meissner (2016) stated that, integrated roadmapping approaches brings together two perspectives and focus on strategic planning by organisation for private and public authorities to achieve social and economic development bringing together the “pull” and technology “push” approach.

To Skillman, Andrilla, Patterson, Fenton & Ostergard (2015), roadmap technologies have been found to align health IT with strategic planning, measuring an organisation’s readiness to change and become technology champions.

3.2.2 Technology Roadmap in other Industries

Among other benefits, the basic benefit of a technology roadmap is linking technology to business (Zamberlan, 2015). The suitable use of these techniques contribute to improving the productivity of an organisation (Jin et al., 2015). Accordingly, a technology roadmap was initially developed by Motorola more than two decades ago. Haddad & Maldonado (2016) emphasise how technology roadmaps impact innovation and argue that roadmaps are important drivers of innovation because they allow the merging of anticipation and innovation, represent the co-evolution of technologies and markets, and contribute to technology government over time. Jin et al. (2015) added that a technology roadmap is an approach that is applied to the development of emerging technology to meet an organisation's goal, and an adopted tool to support innovation.

To Toro-Jarrín, Ponce-Jaramillo, and Güemes-Castorena (2016), a technology roadmap is a medium-and long-term technology planning methodology to determine the technologies that need to be developed to meet the future demand, or select the best alternatives. Aleina, Viola, Fusaro, and Saccoccia (2017) write that these technology roadmaps provide a powerful instrument for premeditated, programmatic and technical decisions. In addition, they state that the technology roadmap has been used to highlight the role of technology within operational capabilities of significance. Bloomberg and Volpe (2018) found that the main benefit of technology roadmaps has to do with improving organisations' ability to plan and make decisions.

3.2.3 Technology Roadmaps

Technology Roadmapping (TRM) has been widely used as a strategic management device to help governments and private sectors effectively recognise potential services for the future, determine proper technology alternatives, and map these to resource allocation plans (Carvalho, Fleury & Lopes, 2013). Aleina, et al. (2017) argue that technology planning is important for decision-makers considering the competitive problems that many organisations are facing. TRM is used to compare many parameters and situations to establish financial plans (Aleina, et al., 2017).

To Carvalho, Fleury and Lopes (2013), technology roadmapping has become one of the most widely used management tools for supporting innovation endeavours at organisational and national level. Furthermore, technology roadmaps are the most widely used technique for supporting the strategic management of technology (Lee, Phaal & Lee, 2013). Technology roadmaps aid organisations in forecasting future technological trends (Cho, 2013). According to Tierney, Hermina and Walsh (2013), roadmaps are used to determine future technologies using knowledge put together from expert opinions.

HIS roadmap stakeholders hold great responsibility in the adoption of HIS in an organisation. The HIS Assessment Report of the MOHSS (2012) reports that “stakeholders’ support can meaningfully affect both current and future needs for the HIS to influence effective information flow and evidence-based policy, planning, decision making, and implementation” (Khan & Edwards, 2012, p.20). Stakeholders ensure that appropriate, strong and effective safeguards for HIS are in place. System restructuring involving all stakeholders is important in changing HIS and improving healthcare quality in the country (Jin, Jeong, & Yoon, 2015). Stakeholders in healthcare support professional practice of individuals who use their data and security rules, while considering the preferences of individuals (Califf, et al., 2016).

HIS stakeholders need to establish the criteria, conditions and other implementation guidelines. Stakeholders such as physicians and other staff who do not adopt the HIS technology will prevent the full realisation of the benefits of health IT, ultimately reducing its overall value (Davis et al., 2014). Stakeholders nationwide therefore need to coordinate to accomplish HIS interoperability.

3.2.4 Success Stories of the roadmap framework

Kevorkova and Popov (2018) discussed how the United States National Aeronautics and Space Administration (NASA) used technology roadmaps to consider a variety of required technology and development methods for 2015-2035.

Carvalho et al. (2013) found that a roadmap helped provide a framework for technological innovation in road vehicle systems. Motorola followed these factors below, which contributed to a successful and sustainable initiative.

- Real benefits and timing of the activity.
- Organisational architecture
- Commitment and ownership from management.
- relevant information
- Effective communication

In an article by Eckstrand, Lunn and Yehia (2017), a roadmap was presented for reducing racial and ethnic disparities in care, while outlining a unique process whereby persons can intervene. The roadmap emphasised that organisations and providers need to take responsibility for reducing these disparities.

Means (2017) reported on a roadmap for the control and elimination of the more widespread National Transmitted Diseases. This required an inter-sectoral approach that bridges public health, social services, and environmental interventions. In a similar study by Streiner, Norman and Cairney (2015), their roadmap recommended numerous activities to improve the Centre for Disease Control's (CDC) capabilities and increase the use of CDC throughout the health sector to ensure that best practical and operational clinical decision support is commonly available.

3.3 AN OVERVIEW OF ACTIVITY THEORY (AT)

According to Minick (2017), Activity Theory (AT) originated in the former Soviet Union as cultural and historical psychology by Vygotsky (1978) and Leont'ev (1978). The theory focuses on understanding social activity and work practices. It incorporates the concepts of intentionality, mediation, history, collaboration, and development. Iyamu and Shaanika (2019) mentioned that AT works as a lens to guide data analysis in information systems (IS) studies. This theory is also useful to assess and gauge Information Systems and Information technologies (IS/IT) adoption in organisations.

The theory emphasises studying and understanding the context of human actions within their socio-environment. Berente, Seidel and Safadi (2018) noted that AT is a valuable tool for researchers as it enables the learning of human activity without the express explication of tasks by participants; instead, through the mediated study of the participants' tools, an understanding of activity is revealed, which includes tacit and explicit actions. The theory is broken down into units such as a subject, tool, and object. The subject represents the individual in the study, the tool represents the mediating device, and the object is an activity to work on (Coleman & Coleman, 2013).

AT also includes community, rules, and division of labour. Rules are described as sets of conditions that help to determine how and why individuals may act, and are a result of social conditioning. The division of labour provides for the distribution of actions and procedures among a community of workers.

These concepts of AT are illustrated in Figure 3.3.

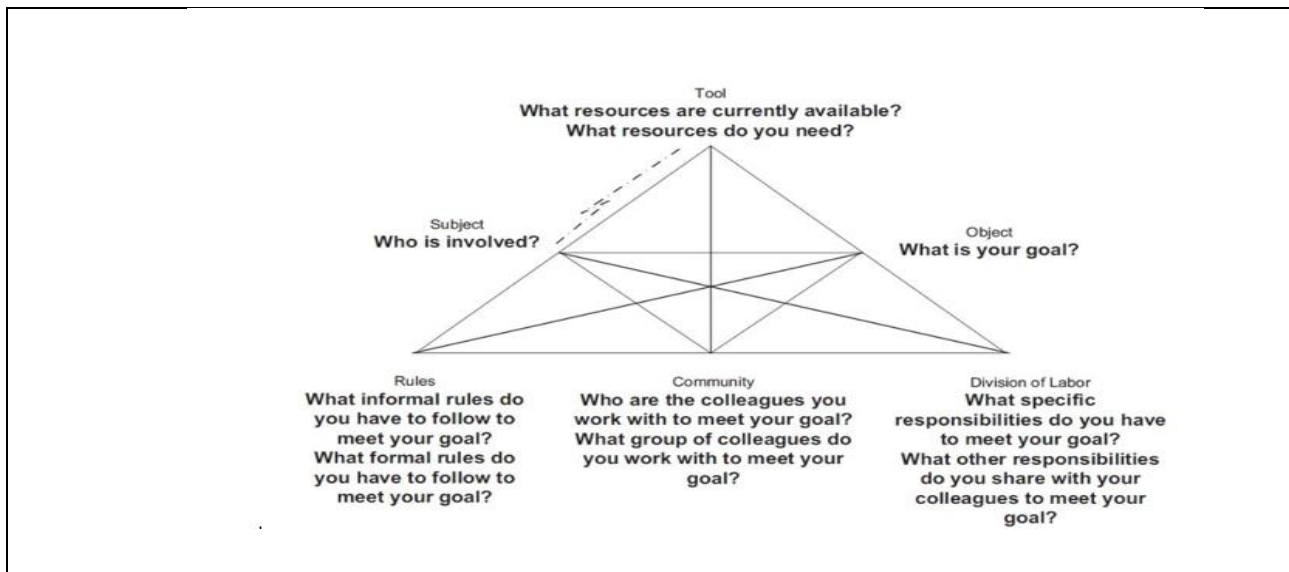


Figure 3.1 Activity Theory Model adopted from Engeström (2001)

This study used AT to analyse the collected data. The main advantage that AT offers researchers is a complete lens for understanding the patterns of activities, situations and difficulties in different work sectors and cultural settings (Collins, 2018). Ifinedo (2016) found that this theory understands the integration of technology as tools that mediate social action. Wolff-Piggott and Rivett (2016) drew on the lenses of AT and affordance to actualisation to help in the analysis of their evidence. They found that professional identities, local priorities and technology features work together in modelling the forms that mHealth users take in practice.

Weeger and Ott-Schwenk (2017) conducted an interpretive case study of an implemented HIS. Their study took AT into account and established initial expectations about the aspects of healthcare activities that need to be recognised, shared, and considered during IS implementation. They write that “AT informed our understanding of the elements and complexities of collective activities, the significance of diverse perspectives and the role of HIS as a mediating instrument” (Weeger & Ott-Schwenk, 2017, p.545).

To Bhattacharjee, Davis and Hikmet (2013), AT is not a “theory”, but rather a general conceptual framework intended to underpin the building of predictive theories: “AT is centered on the notion of an activity, defined as a system of actions undertaken by subjects (actors) to transform an object in order to achieve a desired outcome” (p.2546). In the same

way, Riechert et al. (2016) stated that, “the use of computers in social, organisational, and political contexts cannot be studied sufficiently because the relationship to the user's goals, plans and values cannot be analysed”; this is why they “proffer Activity Theory as an appropriately rich and robust lens to analyse the data” (p.990).

In this study, the AT framework helped the researcher to understand the complex and dynamic problems faced in HIS adoption.

3.4 CRITICAL ANALYSIS OF REVIEWED LITERATURE

This section of the research discusses the methods, focal point, gaps and relevance of the reviewed literature. A study on roadmaps in health by Whitacre and Williams (2015) recommended methods that are appropriate to rural healthcare providers. The study outlined several reasons for the non-implementation of health IT, such as financial constraints, limited availability of in-house IT expertise, and lack of high-speed internet. They focused on health providers who are at the start of using information tools to effect safer, and effective and efficient systems (WHO, 2018).

Garavand, Mohseni, Asadi, Etemadi, Moradi-Joo and Moosavi (2016) found that the factors that have a significant impact on the intention to use healthcare technology are performance expectancy, effort expectancy and facilitating conditions. Further literature review revealed that for HIS to be adopted in health organisations, the organisations need support from higher decision-making bodies such as government, which can allocate sufficient resources. Baird, Furukawa, Rahman and Schneller (2014) explained that measures of IT adoption, IT standardization, and innovative IT adoption are significantly associated with control of IT decision rights and strategic alignment. The World Health Organization (2018) stated that “health system governance is governance undertaken with the objective to protect and promote the health of the people”. Governance involves “setting strategic direction and objectives; making policies, laws, rules, regulations, or decisions, and raising and deploying resources to accomplish the strategic goals and objectives; and overseeing and making sure that the strategic goals and objectives are accomplished” (p.9).

Policies and strategic plans are important for organisations adopting new systems to assist in the implementation. Stakeholder involvement is critical when it comes to systems design, adoption and implementation. Piña, Cohen, Larson, Marion, Sills, Solberg and Zerzan (2015)

said that healthcare systems need to be redesigned, and that this huge task must be taken on together with key healthcare stakeholders including doctors, nurses, administrators, health information managers and policymakers, and as well as patients.

Information Technology (IT) expertise and Information systems (IS) infrastructure need to be in place for an organisation to adopt information systems. Stergiou, Psannis, Kim and Gupta (2018) define IS as data, people, and work processes and a combination of hardware, software and communications technology. Computer hardware, software, and wireless or wired networks are needed when an organisation wants to run a successfully integrated HIS. This will allow the organisation to share information and operate organisational databases.

The organisation needs to have employees that are qualified to use information systems. Literature points the utilisation of health informatics. Health informatics involves learning the computer and information literacy skills necessary for safe and effective healthcare delivery in today’s increasing automated healthcare effective healthcare delivery system (Joos, Nelson & Smith, 2014). According to Kayser, Kushniruk, Osborne, Norgaard and Turner (2015), informatics is the use of information systems and technology to redesign, improve, and recreate the way work is done in disciplines such as medicine, nursing, medical imaging, and public health.

Table 3 below shows the factors affecting HIS adoption in order of importance. As revealed by the reviewed studies, the most important factors are governance, stakeholder involvement, and IT skills and IS infrastructure.

Table 3.1 Factors affecting HIS adoption

Factor	Literature
Governance	World Health Organization (2015) Baird, Furukawa, Rahman and Schneller (2014)
Stakeholder engagement	Piña, Cohen, Larson, Marion, Sills, Solberg and Zerzan (2015)
IT skills and IS infrastructure	Khan and Edwards (2012)

While there exist many articles and papers on HIS and roadmaps, there is a gap in the research with regard to HIS adoption for quality healthcare. Furthermore, much of the research on HIS roadmaps has been done from the perspective of developing countries, but no research has been done on the challenges to HIS adoption in the Namibian context.

For example, Hamunyela and Iyamu (2016) presented a critical analysis of the role and account of actors in the mobility of healthcare services in Namibia. Their study considered the importance of the relationship between health practitioners and patients. Karon and Dlodlo (2017) in their research identified the lack of a framework for effective assessment drivers supporting investment decisions about ICT in the public healthcare sector. In addition, Hamunyela and Jere (2018) outlined guidelines for HIS evaluation before integration, and presented a framework for the evaluation of HIS.

So far, several studies on HIS have been conducted in Namibia; yet none of the reviewed studies covered an HIS roadmap for achieving quality healthcare. This research presents such a guide to the MoHSS in order to adopt and use HIS successfully.

3.5 CONCLUSION

Research shows that roadmaps allow organisations to meet their business goals and align their strategic planning. The successful implementation of a roadmap involves people, processes and information. Activity Theory (AT) is known for it is used in the analysis of qualitative IS data. AT centres on understanding social actions and work practices. The theory assisted this researcher to identify technical and non-technical factors that affect HIS adoption.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 INTRODUCTION

This chapter presents the methodology that was used in this research. Research methodology consists of the different approaches, methods and techniques used by the researcher to collect and analyse the data. The first part of the chapter is an overview of the research strategy. The next sections cover the research design and data collection process. An overview is also provided of how the data was interpretively analysed. The chapter ends with ethical considerations in this research.

The methodology in this study was influenced by the objectives of the study, which include to:

- i. Evaluate the current state of HIS and roadmaps within the MoHSS in Namibia.
- ii. Assess HIS technologies for healthcare.
- iii. Analyse the components of HIS roadmap adoption.

In order to meet the research objectives, the researcher collected factors which influence HIS adoption from the literature review. Questionnaires were sent to the list of TWG as stakeholders for the Ministry (including MSH employees) as respondents. Ministry employees were also interviewed.

4.2 RESEARCH APPROACH

The qualitative research method was the selected strategy for this study. According to Silverman (2013), the reason for using the qualitative method is that the method is particularly important in the behavioural sciences, where the aim is to realise the underlying motives of human behaviour. Rexhepi, Åhlfeldt, Cajander, and Huvila (2018) defined qualitative study as an inquiry procedure of understanding a social or human problem, based on a composite, rounded picture, formed with words. Katz (2015) stated that qualitative methodology refers in the broadest sense to research that produces descriptive data, people's own written or spoken words, and observable behaviour. Merriam and Grenier (2019) emphasised that qualitative research consists of the gathering, analysis, and interpretation of data that is not reduced to figures. Qualitative research is concerned with

deducing and understanding people's ideas and views subjectively. To accomplish this, qualitative research is conducted in natural settings and using words rather than numbers.

The qualitative method was applied through a case study approach to study the State's information systems and the usage of technologies within the Ministry of Health and Social Services. Semi-structured interviews, online questionnaires, and documents were used to collect data for the case study. The data collected was interpretively analysed.

4.3 RESEARCH DESIGN

According to Flick (2018), research design is a strategy that one chooses to integrate the different components of a study, ensuring that the researcher will successfully address the research problem.

A case study is the most common qualitative method used in information systems (IS) research (Woods, Paulus, Atkins & Macklin, 2016). A case study can focus on individuals, groups, organisations or a community. Choosing a case enables the researcher to emphasise a specific object that is part of the general population. Yin (2017) defines the scope of a case study as an observed inquiry that investigates a contemporary phenomenon within its real-life setting, especially when the boundaries between phenomenon and context are not evident.

In this study, the Ministry of Health and Social Services (MoHSS) was used as a case study. Mutelo and Jere (2017) state that "case studies are described as a tool of examination found in several fields, in which research brings out an in-depth analysis of the case" (p.3). Two directorates and one USAID agency organisation were selected to represent the MoHSS. The selection was mainly because of the role of the directorates and the fact that they have a direct link to HIS within the Ministry.

4.4 DATA COLLECTION

Data was collected by means of semi-structured interviews, questionnaires and documentation from the Ministry directorates and Management Science for Health (USAID). A semi-structured interview was used as the primary data collection technique because it allows for flexibility and fullness of data. During the interviews, interviewees were able to request clarity on questions they did not understand, ensuring that they give relevant

information in response to the questions. The interviewees included systems users, top managers, and HIS implementers from the organisations, who were knowledgeable and skilled in the areas pertaining to the questions. For privacy purposes, interviewee names are not mentioned or revealed in any part of the study, and they are only referred to by the positions they occupy within the organisations. Data from the interviews were not and will not be used for any other purposes other than for this research; this also motivated interviewees to fully express and expand on their opinions. During the interviews, the researcher used a predefined set of questions, based on the four main research questions, to sustain consistency. Additional questions were formulated ad hoc to get further details from the participants.

4.4.1 Semi-Structured Interviews

Semi-structured interviews played an important role in this study. Before the interviews commenced, a meeting with the director for each directorate was convened to help identify the sample population. The researcher was provided with a list of 30 employees, of which 12 were interviewed. All interviews were conducted in English as it is the medium of instruction in Namibia.

All these interviews were conducted at the Ministry of Health and Social Services building in Windhoek. Appointments for interviews were at times cancelled, and in cases where an interviewee was not available at the agreed time, the interview was re-booked. The researcher took notes and the interviews were recorded using a mobile phone. Interviewees were shown the approval letters from the Ministry and the University, and were asked for permission to be recorded. All interviewees agreed to the recording process and participated. To answer the main objective of the study, the interviews aimed to gain in-depth knowledge of existing HIS and to find out if there were any existing roadmaps within the MoHSS. An interview was stopped as soon as no new information was forthcoming. After each interview, the researcher transcribed the recorded data into a Microsoft Word document.

Table 1.1 shows the distribution of interviewees.

Table 4.1 Number of interviews conducted

	Directorates and MoHSS Stakeholder		
Interviewees (Participants)	Directorate of HIS and Research	Directorate of Policy, Planning and Human Resource Development	Management Science for Health
Directors	1	1	1
Policy Planners	-	1	-
HIS Chief Officers	3	-	-
System Analysts	2	-	-
HIS developers and implementers	-	-	3
Total	12		

4.4.2 Questionnaires

A questionnaire is a method for gathering data in which a respondent provides responses to a series of questions. In this study, a questionnaire was used to obtain qualitative data about developing a technology roadmap from different HIS and IT roadmap experts. Due to the respondents being located in different places, Google Forms was utilised. This also allowed the researcher to keep an eye on the feedback and set reminders for participation.

The questionnaire was developed by the researcher and used statements as well as different types of questions: dichotomous (yes/no), open ended, multiple choice and ranking questions. Instructions on how to complete the questionnaire were clear and concise. The open ended questions were particularly useful in gaining insight into the respondents' views. The questionnaires were kept short deliberately, since long questionnaires get few responses and can be discouraging to respondents (Niessen, Meijer, & Tendeiro, 2016).

The questionnaire targeted 50 participants of which not all were willing to provide their email addresses. Therefore, the questionnaire was distributed electronically to 38 stakeholders of

the Ministry, while 12 hard copies were handed to the HIS director. None of the hard copies was returned. The 38 stakeholders who received the e-mail link consisted of 16 HIS experts working in the Ministry, 12 members of the Technical Working group. Of the 38 stakeholders, 12 responded to the questions.

Participants could not change their answers after completing the questionnaire. No names were collected, i.e. the participants remained anonymous. Tonnie (2017) mentions that by allowing respondents anonymity, they might feel greater choice hence being more frank in their replies. Respondents received a thank you message after submitting their responses. The collected responses were analysed using Google Sheets and Google Charts.

4.4.3 Documents

Documents refer to written texts, which cannot be subjected to an interview, yet their interpretation holds the meaning of the underlying social world (Onwuegbuzie, Leech, & Collins, 2010). Additionally, Silverman (2013) points out that documents are social facts in that they are produced, shared and used in a socially organised way. In this study, documents provided supporting data that interviewees were incapable of explaining in detail due to limited time. Documents were requested from the interviewees during the interview process. The obtained documents were in soft or hard copy and all documents obtained were in English.

The documents acquired were studied in two ways. Firstly, the documents were reviewed to check if they support or contradict the interviews' transcribed data. Secondly, the documents were reviewed against the research objectives.

Table 4.3 Documents obtained

Name of Document	Directorate obtained from
ASSESSMENT OF NATIONAL HIS Ministry of Health and Social Services (MOHSS), Republic of Namibia (2012)	HIS-DIVISION
Proposed Structure Directorate Health Information and Research National Level (n.d)	Epidemiology Division
HIS Technical Working Group (TWG) List (n.d)	HIS division
Letter-For Technical Assistance towards the Development of Ministerial Strategic Plan: 2017/18-22-23 (2017)	Directorate of Policy Planning and Human Resources

4.5 SAMPLING DESIGN

Rahi (2017) states that sampling is the process of selecting a segment of the population for investigation.

4.5.1 Research Population

This research population was limited to MoHSS's two Directorates and the Management Sciences for Health (MSH), in the Khomas region. The research targeted a sample of 80 participants: 50 for the questionnaire, of whom 12 responded, and 30 for interviews, of whom 12 participated.

4.5.2 Sampling Technique

Purposive sampling, a non-probability sampling technique, was used to pick from the above-mentioned stakeholders. Non-probability sampling is the sampling approach in which the chance or probability of each unit to be selected is not known or confirmed (Rahi, 2017). As mentioned above, the population for this research was MoHSS's two Directorates and the Management Sciences for Health (MSH) in the Khomas region. The top management members from each directorate participated in the interviews and those participating in the

drafting of the strategic plan. The random sample of 50 participants for the online questionnaire was selected from all potential HIS stakeholders in Namibia, including USAID (Management Sciences for Health) stakeholders.

4.6 ETHICAL CONSIDERATIONS

Research ethics ensures that researchers follow the policies of the organisation they are representing and collecting data from. Ethical standards promote the values that are essential to collaborative work, such as trust, accountability, mutual respect, and fairness (Gajjar, 2013). Ethics was considered in this study to guide the researcher's actions. Before carrying out data collection, the researcher sought permission from the respective Ministries via the Permanent Secretary's office and the University Faculty. The research proposal was submitted to the Ministry stressing the importance of not doing any harm to the organisation or the participants. An approval letter was granted by the Ministry to collect data (see APPENDIX H attached). Furthermore, an ethical clearance certificate was issued by the University.

During the interview, the researcher explained the purpose of the study and requested permission to record, as well as whether the respondent wanted to remain anonymous. The data collected was only shared between the researcher and the supervisor. Throughout the research, the interviewees' identities were not revealed under any circumstances; instead, labels were used.

4.7 DATA ANALYSIS

Gibbs (2018) says that the purpose of analysing data is to obtain usable information. According to Chen, Jiang, Wang, and Tang (2016) noted "data analysis refers to the sorting, sorting, organizing, storing, processing, analysing and studying on the basis of collecting and occupying the data, the whole process of discovering new knowledge"(p.1). Qualitative data analysis can therefore be described as the method of making logic from research members' understandings and views of situations.

Activity Theory (AT) was adopted for this research in the analysis of the interview data. AT is a socio-technical theory that is concerned with the development of social activities. The approach was applied to this study as it allowed the research to analyse and interpret interviewees' independent reasoning. The six components of AT are instrument, subject,

object, rules, community, and division of labour. Each of these components contributed towards a good understanding of HIS.

- i. The **instrument** component revealed which information technology (IT) instruments are in use within the Ministry. This component also identified the users of these instruments, and how these instruments are acquired and used.
- ii. The **subject** component identified the individuals and groups of actors using HIS as well as the stakeholders taking part in policy making and decision making with regard to HIS. This component also disclosed how these subjects work together to enable the organisation's goals.
- iii. Through the **object** component, technical and non-technical objects within the HIS division were outlined. Technical objects include HIS and technologies adopted in healthcare, while people and their thoughts and ideas are examples of non-technical objects.
- iv. The **rules** component aided in discovering how strategic plans, Technical Working Group documents, policies and regulations are used in the selection, development and implementation of HIS and their technologies.
- v. The **community** component helped to uncover different groups in the HIS division within the Ministry. This helped the researcher to understand how the HIS and IT technologies have been endorsed.
- vi. The **division of labour** component showed how tasks and responsibilities are shared among employees within the communities, and how these are carried out to attain the Ministry's goals.

Further details on AT are covered in Chapter 5.

4.8 CONCLUSION

Research methodology provides guidance to the researcher. It defines the necessary steps to study a phenomenon. The qualitative research method used in this study was selected on the basis that it best suits the research objectives and questions. The researcher needed to understand the criticalities of the research strategy and design to apply the correct steps in resolving the research problem under study. Data was collected by means of semi-structured interviews, questionnaires and documents. Activity Theory (AT) was used for interview data analysis, which is to be discussed in the next chapter.

CHAPTER 5: DATA ANALYSIS AND PRESENTATION

5.1 INTRODUCTION

This chapter presents the data analysis. The objective of the study, as stated in Chapter 1, was to develop an HIS adoption roadmap for quality health in Namibia. The data was collected from two different directorates of the Ministry of Health and Social Services: the Directorate of Health Information Systems and Research, and the Directorate of Policy Planning and Human Resources, together with the international partner USAID Management of Health Systems (MHS). In order to develop the HIS adoption roadmap, the factors which affect HIS adoption were first to be understood from the data collected.

Data analysis was guided by Activity Theory (AT), as stated in Chapter 4. The first section of this chapter covers a brief discussion of AT in the data analysis process. The findings are then presented, and finally the chapter conclusion.

5.2 ACTIVITY THEORY (AT) OVERVIEW

Activity Theory (AT) is a socio-technical theory that is concerned with the development of social activities. AT is one of the theories used in information systems (IS) and technology studies for the development, designing, implementation, management, and maintenance of systems and technologies. AT has the advantage of supporting the analysis of dialectic interactions between people and the way technologies shape and are shaped by human activity (Lindlof & Taylor, 2017). Furthermore, the AT framework is distinctive and universal nature of computer systems as primary, secondary, and tertiary tool underpinning a number of organisational ISs.

The six components of AT were followed in data analysis as presented here:

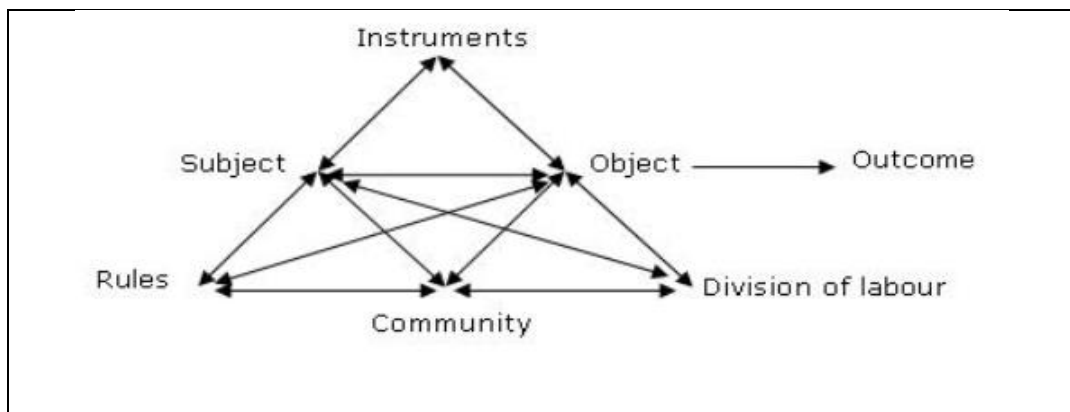


Figure 5.1 Activity Theory (Engeström, Lompscher, & Rückriem, (Eds.), 2016)

AT was considered for this research because it helps in the identification of many actors during planning, designing, creating, implementation and management of systems in an organisation. HIS design considers many actors and these actors own different specialisations. Thus, it was found fit to use AT in analysing the data.

Table 5.1 AT components relevant to HIS adoption roadmap

Component	How it was used
Instruments	To identify which tools are used in MOHSS to run HIS
Subject	To identify MoHSS stakeholders (HIS users, developers, policymakers, technical working groups, and systems analysts)
Objects	To identify technical objects as HIS software and technologies To identify HIS users and their thoughts and ideas as examples of non-technical objects
Rules	To identify ministerial policies, strategic plans, technical working group documents, government regulations, and legislation
Community	To identify the MOHSS's various communities
Division of labour	To identify task specialisation and the sharing of activities among the actors in the HIS division

5.3 ANALYSIS WITH ACTIVITY THEORY

5.3.1 Interview Analysis

Activity Theory: Instruments

The MoHSS as the case study is currently well equipped with different instruments. These include technical and non-technical instruments. The technology tools available for use are computers, laptops, 3G internet, software, and other hardware, which enable HIS usage. The District Health Information System (DHIS-2) and others mentioned in Chapter 1 (Table 1.1) are instruments used in the Ministry to enhance quality healthcare. As described by one of the Ministry employees,

“Currently, in our division, we only have one Health Information System which is DHIS version 2, so what we are trying to do with the DHIS is to integrate all other existing systems within the Ministry, we kind of being at the initial stage, of that integration. That is the status of HIS: 61 standalone systems, and we have identified the DHIS2 to be the main system” (RES6, p.12, 2018).

The available instruments are used in different directorates within the Ministry. According to an employee in the HIS and Research directorate,

“The ministry is moving ahead with technology and we are utilising technology to fully benefit our ministry. Computers and wireless internet are available to support health information systems planned” (RES4, p.2, 18).

During the interview when one interviewee from the Directorate of Policy Planning, and Human Resource revealed that,

“The office of the Prime Minister as the main custodian of the government approves all systems and technology that goes into the Ministry, be it for purchasing or donated by NGOs” (RES2, p.2, 18).

This is evidence that the Ministry can face challenges in managing donated systems implemented with no proper guidance (i.e. a roadmap). Systems and technologies adopted within the Ministry were designed and developed or even acquired based on the donors' business needs and not as local needs required. One employee alluded to this as follows:

“About 61 systems on health exist with the Ministry and these were adopted from donors and the ministry has no control of what is donated but receives as a developing country from well-established countries such as USAID” (RES1, p.2, 18).

HIS adoption in the Ministry is allocated to different directorates and these systems are not integrated. Each directorate has their own systems, with some not working or not being used. An employee from the Directorate of HIS and Research added:

“One reason for these systems not working is that we do not have experts to maintain and use them” (RES4, p.2, 18).

Activity theory: Subject

The subject of an activity is the individual or group of actors engaged in the activity. A subject uses tools to achieve an object (objective) or outcome which in this case is quality healthcare. In this study, the subjects are MoHSS stakeholders (HIS users, developers, policymakers, technical working groups, and systems analysts). The non-technical actors are the employees within the computing environments in the Ministry.

The ministry currently needs all actors. The actors include information systems such as DHIS and technologies such as databases, computers, and servers. These tools are used to achieve objectives throughout the Ministry. The subjects in activity theory who have articulated a need for HIS experts and technologies and the work process that users engage in is the object while the ICT applications are the tools. The information systems are tools of mediated human activities. An employee of the Ministry stated,

“For HIS to be effective in this ministry both technical equipment such as computers, internet technologies, internet and IT experts are needed. He added to say we cannot have all HIS in use for now because we lack expertise in IT” (RES1, P.1, 2018).

In developing a roadmap for HIS adoption in MoHSS, the subjects involved are all stakeholders. According to the acting director of HIS from the Ministry,

“In the strategic planning session, we involved all directorates on national level except patients” (RESP4, p.2.18).

Furthermore, a document obtained from the Directorate of PP and HR stated,

“The Ministry held a planning workshop for its management across all levels (involving both Referral Hospitals, National and Regional Directorates) to interrogate, undertake environmental scanning and identify critical overarching pillars and high level ministerial statements (Vision, Mission, and corporate Values). That would underpin the strategic direction to the attainment of vision 2030, Harambee Prosperity Plan, and Sustainable Development Goal and Africa Agenda 2063” (RESP4, p.2.18).

Activity theory: Object

AT describes an object as a goal to which an activity points, and from which an outcome is expected. This can be technical or non-technical, and motivates the actors on the actions they should carry out. The actors have to know the goal they want to achieve. In this study, technical objects include health information systems and technologies adopted in healthcare, while people and ideas are the non-technical objects. In most cases, the objects are shared amongst actors participating in that activity. Additionally, an object can be a material thing, but it can also be less real (like a plan) or intangible (like a common idea) as long as the participants of the activity can share it for manipulation and transformation. Thus, one employee alluded to say,

“I could have said yes to the designing of a roadmap, but the challenge is the politics of today. The Ministry changes the Permanent Secretary now and then; once they come they bring in their new ideas without even considering what was planned” (RES1, p.1.2018).

Furthermore, the responded continued to say,

“So if I was to rate if we really have to create a roadmap, yes because the implementation is blocked by the politics of today” (RES1&6-7, p.1.2018).

The DHIS is used in the HIS division to support and enable the Ministry to collect data and share collected data with other system users. Thus, a systems analyst of the Ministry emphasised that,

“Currently in our division, we only have one health information system which is DHIS version 2, so what we are trying to do with the DHIS is to integrate all other existing systems within the Ministry, we kind of being at the initial stage of that integration” (RES6-7, p.12.18).

Different activities happening across the Ministry influence the reasons for acquiring an HIS, but adopting the HIS is a challenge with many employees. Implementation and adoption of HIS are guided by activities and objectives within each division. However, the selection and development of HIS are usually done by the office of the Prime Minister's IT department. In addition, one employee shared the challenge of the donated systems by NGOs:

“Yes the ministry has HIS in place, but maybe I can tell you that there are several (over 60 according to the assessment done in 2008) HIS that are scattered around the Ministry, around various directorates of the Ministry not working together” (RESP2, p.2.18).

He further said,

“Some of these were donated to the Ministry and the people who implemented them left, no one can maintain, or they are expensive to maintain. It is a plan that we have our strategic plan to integrate and make them interoperable” (RESP2, p.2.18).

Activity theory: Rule

Rules within the ministry of health and social services health information systems include ministerial policies, strategic plans, technical working group documents, government regulations, and legislation. The Ministry will not function properly without these rules to govern and manage its activities in achieving its planned goals and objectives. Without policies and strategic plans to guide and regulate the use of HIS, the Ministry would have various types of HIS not needed for their business processes. Two of the non-technology instruments were the strategic plan and the HIS assessment report. The strategic plan under draft is the guiding document that the Ministry plans to utilise to guide their Health Information System implementation and selection. The Director of HIS said,

“The IT policies are managed by the office of the Prime Minister as the custodian of the government ministries. All of the activities, such as HIS, hardware selection and implementation, and software designing and the replacement they provide. But when a system is donated to the Ministry through government we just receive it. There is no governing roadmap or policy of what we should take and what not, because we are a developing country (RES1, p.1, 18).

The Director of Policy Planning and Human Resources also repeated this statement:

“Yes but we also do know that we are being guided, the office of the Prime Minister is the head of government, has a department that is responsible for all those IT things, whenever we do procurement we normally get the specification from them” (RES3,p.2,18).

The policies regarding IT in the Ministry were formulated and developed by the IT department at the Office of the Prime Minister (OPM) together with the Deputy IT directors and other management from the various Ministries including MoHSS. According to one of the directors from the MoHSS when asked if it was a good idea to develop a roadmap for HIS adoption for the Ministry,

“Having that may be the best thing to do, if there will be a roadmap for that, we have to make sure that we align ourselves to any other tool that is in existence within the strategic plan and other policies” (RES3, p.2, 18).

Therefore, one can conclude that users of HIS have an interest in adopting HIS, but are held back by existing processes and policies and its leadership.

Activity theory: The Community

After Engestrom’s modification to Vygotsky’s original theory, he added two more units of analysis. The two additional units (rules, and division of labour) have an effect on the work activity system. The division of labour provides for the distribution of activities and processes among a community of employees. The two units affect a new plane of reality called the community (Micheal, 2007). In AT, a community refers to a group of people to which actors belong when carrying out tasks. The MoHSS is made up of various communities, the HIS and Research Directorate being one of them. Within the community of HIS and Research, various communities also exist, such as the community of the health information division with the HIS director, acting HIS deputy director, systems analyst, and senior data analyst. The existence of this community is according to the Ministry's proposed structure and employees’ skills and knowledge. An employee from the HIS community of the MoHSS mentioned that:

“When we implemented DHIS-2, of course, we started with direct users and the key people are the HIS officers which we have at every district. We have 35 districts and at each regional office, these are the people we have trained in the system” (RESP4, p.8, 2018).

Thus, the relationships between the employees individually and between them and their environment are considered through the component of the community in AT.

Activity theory: Division of labour

Division of labour in AT has to do with how tasks are shared among employees within the community. The division of labour represents task specialisation and the sharing of activities among the actors. Within the MoHSS' Directorate of Health Information and Research, the division of HIS has two sub-divisions; the sub-division of data management and coordination, and the sub-division of integrated information management. Employees from the division of HIS are allocated different tasks and work as individuals or as a team depending on their qualification specialisation. The Director of HIS in the division continued to share his views as follow:

“Another big challenge is the shortage of staff. They are very few employees in the division, only 12 out of 200 available posts are filled. The ministry does not have money to employ, we are challenged there, and like right now, only four people of these 12 are in the offices. The rest are either in the regions or outside the country” (RESP-1, p.2.18).

The division of labour can be viewed as one important activity in AT. Thus, employees cannot be effective which means poor quality healthcare is experienced if MoHSS have fewer employees working with HIS. Therefore, HIS task allocation is according to their IT specialisation. However, one employee shared that:

“We have only a few qualified IT experts working with systems, which is one of our challenges. Posts are available but not yet advertised, no money, our few people are overloaded with work. As we speak, only a few are in the office, most of them are out to regions to do DHIS training” (RESP-2, p.2.18).

Lack of dividing tasks accordingly can lead to poor performance and the use of legacy systems in an organisation.

5.3.2 Questionnaire Analysis

The questionnaires were analysed using Google Forms. The responses were combined in a summary sheet (see Appendix D). The questionnaire data was aimed at analysing the HIS

roadmap adoption components and developing an adoption roadmap for the Namibian health sector.

5.3.3 Analysis from Documents

Documents acquired as a result of the interviews provided supporting evidence on the status of HIS and the TWG's existence (Appendix F and H). These documents contained valuable data that supported respondents' views.

5.4 DATA ANALYSIS

In this discussion, interviews will be referenced by respondent as RES1-RES8; documents will be referenced as ITD-18, and transcribed questionnaire data as QTD-18.

5.4.1 Data from Interviews

It was found during the interviews that the directorate has about 61 health information systems, but as part of their challenges, not all of these are in use. The directorate is using the district health information system (DHIS-2) a web-based system to collect routine data.

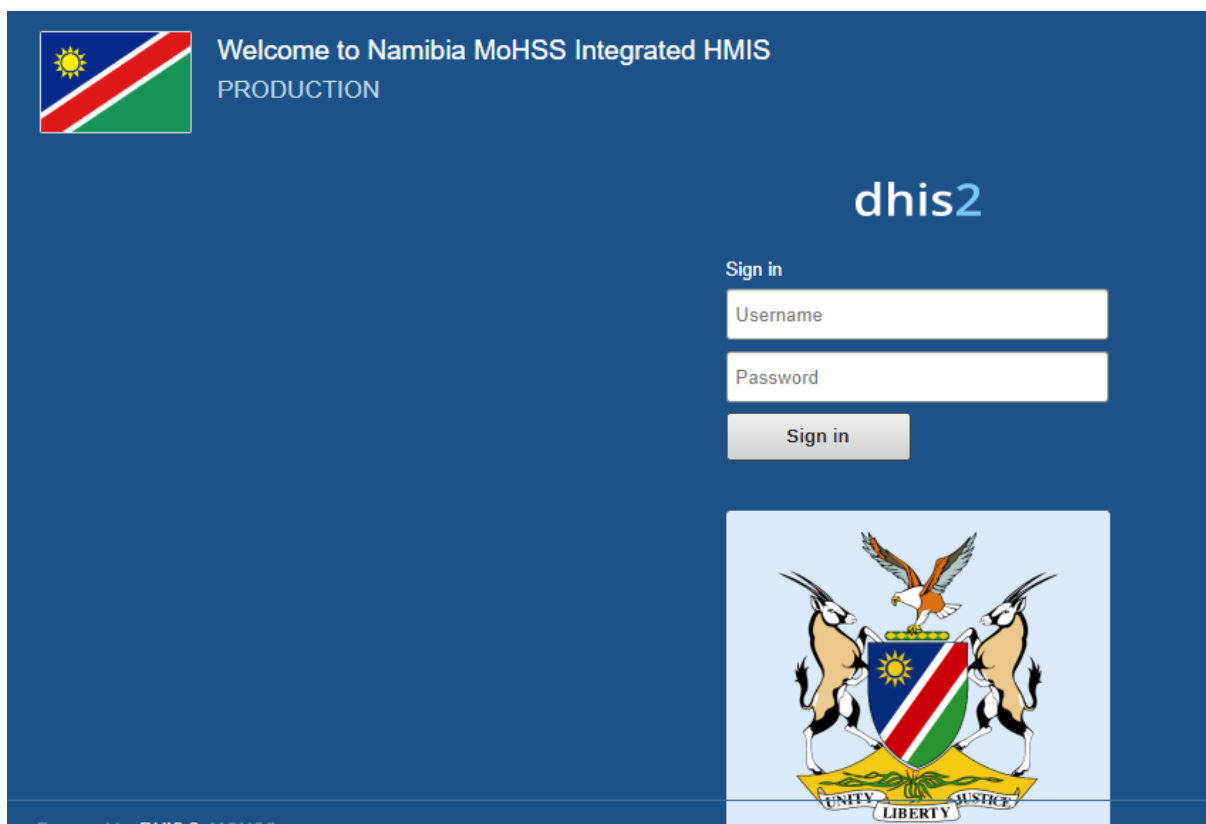


Figure 5.2 The District Health Information System-2 login page

The system is used only by the HIS division; other directorates have other systems (RES1, P.1, 2018). Systems analysts from the divisions showed the researcher the DHIS on a computer and said,

“DHIS version 2 is in place in all districts, we have 4Gs for internet available even for our health works in the regions” RES7, P.1, 18 (ITD-18).

5.4.2 Data from questionnaires

The following themes were discovered in the data collected from the questionnaires:

General understanding of technology roadmap by experts

One of the reasons for studying the understanding of technology roadmaps by Ministry stakeholders was to measure the level of expert knowledge. Figure 4.1 shows that the term “technology roadmap” is not very well known among expert MoHSS stakeholders. The IT experts of MoHSS had different levels of technology roadmap understanding. Participants’ understanding was informed by their area of specialisation in the field of IT.

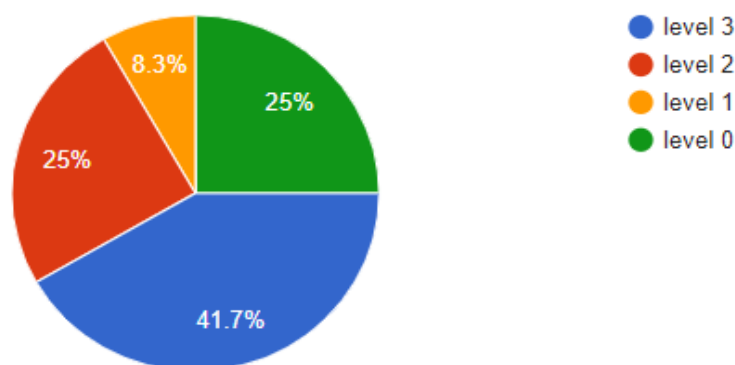


Figure 5.3 Technology roadmap (TRM) level of understanding

To assess respondents’ level of understanding, four (4) categories were created.

- Level 3 represented IT experts who could define what technology roadmap is. Five out of 12 participants (41.7%) had this highest level understanding of TRM.

- Level 2 represented experts who understand the concept of a technology roadmap. The findings show that 3 respondents out of 12 (25%) fell into this category.
- Level 1 represented experts who had heard of the term “technology roadmap”, but had no idea what it is. According to the results, this was 3 out of 12 respondents (25%).
- Level 0 represented experts who had no idea of what TRM is and had never heard of it (1 respondent).

The results show that the majority of experts did know what a TRM is and could define it.

Roadmap categories

The participants had to choose a category of roadmap that they think is most suitable to be developed for technology. Figure 5.4 shows the different types of roadmaps and the number of participants who chose them.

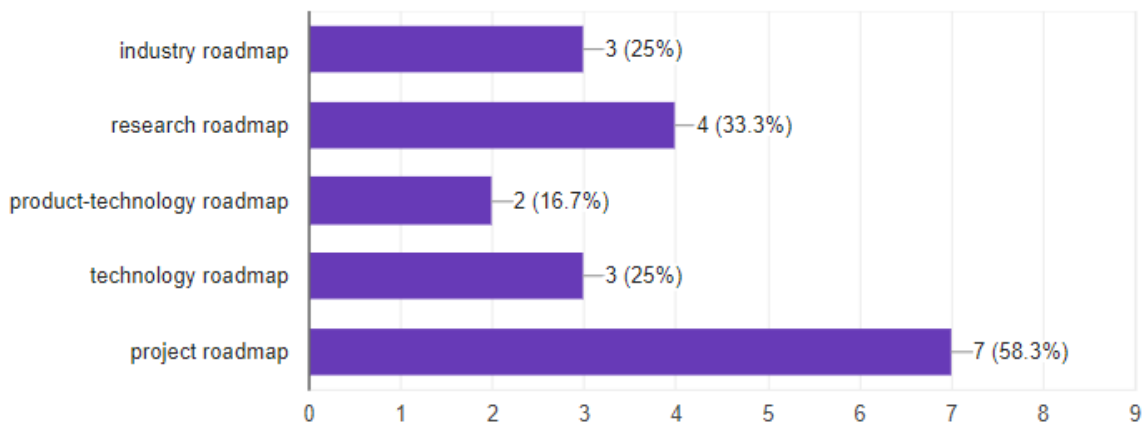


Figure 5.4 Categories of roadmaps

Out of the 12 engaged experts, seven (7) chose the project roadmap, resulting in the highest proportion (58.3%). Most of them advised that this is best for project administration and that it is useful for managing forecasts together with communicating plans and resources with others in an organisation. The research roadmap came second at 33.3% or 4 participants. They reasoned that a research roadmap can be developed for HIS because proper research projects are vital. Three participants (25%) chose the industry and technology roadmap, and two participants (16.7%) chose a product-technology roadmap. The difference in selections is

explained by the fact that participants have different understandings of roadmaps and also different specialisations.

Roadmap Designing for the Ministry of Health and Social Services

The main objective of this research was to develop an HIS adoption roadmap for MoHSS in order to have quality healthcare. Thus, participants were asked if they believe it is important for the Ministry to have a roadmap.

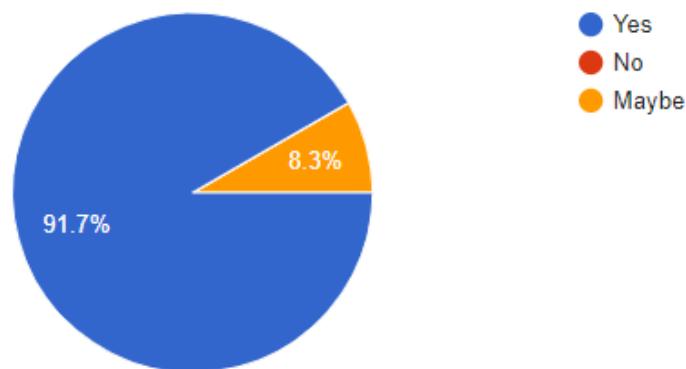


Figure 5.5 Roadmap design

Figure 5.5 shows the responses from the 12 participants, with 91.7% saying Yes. Only one (1) participant said Maybe, with the reason that they were not sure what a roadmap is.

Figure 5.6 shows the feedback from the experts when asked if they think a roadmap will bring a framework to assist in planning and coordinating HIS designs within the organisation at any level.

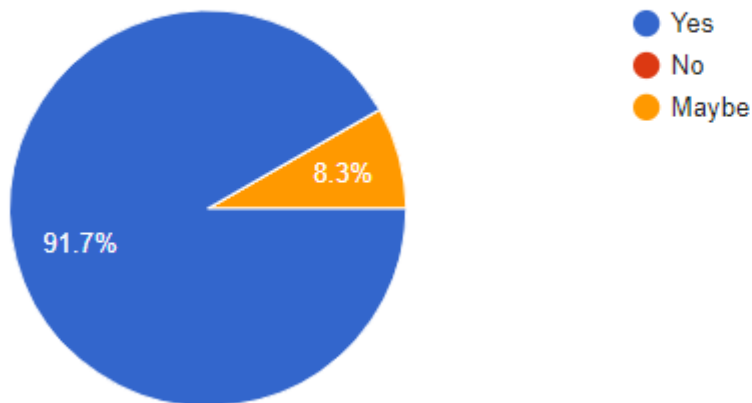


Figure 5.6 Roadmap for planning and coordination of HIS for the Ministry of Health and Social Services

A total of 91.7% experts said Yes, only 8.3% said Maybe and none said No. Therefore, the majority feels it is important to develop a roadmap for the MoHSS.

Key elements to consider for roadmap designing

Figure 5.7 illustrates the elements to consider when developing a roadmap according to Kostoff & Schaller, 2001. Participants had to choose the most important element and could choose one or all of the options.

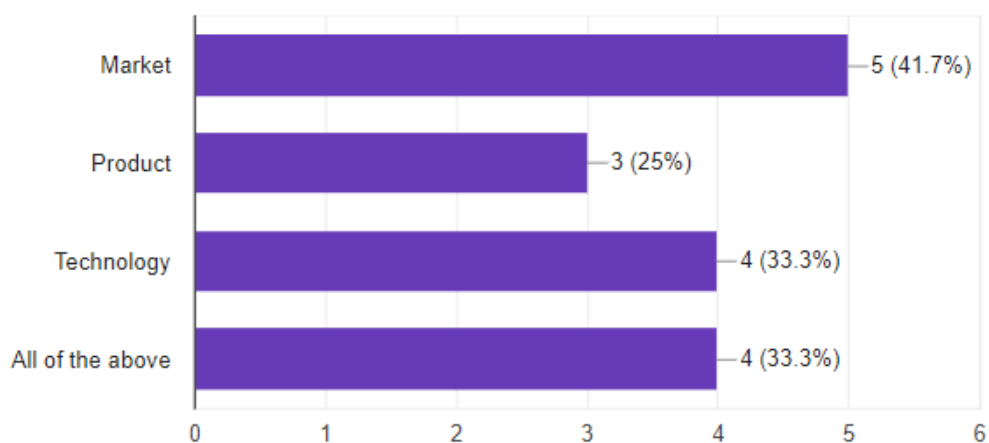


Figure 5.7 Roadmap key elements for Health Information System roadmap

Figure 5.7 shows the key elements and the number of participants that opted for which element. The market element was the most popular (41.7%), followed by technology and all elements with 33.3% each. Lastly, the product element received 25%. All 12 participants answered this question.

HIS adoption roadmap design stakeholder

The participants were asked to determine who should be part of designing the HIS adoption roadmap. Five categories of stakeholders were offered from which the participants had to choose: Policymakers; HIS users; HIS software developers; the entire Ministry's directorates, and health practitioners. Figure 5.8 shows the distribution of their choices.

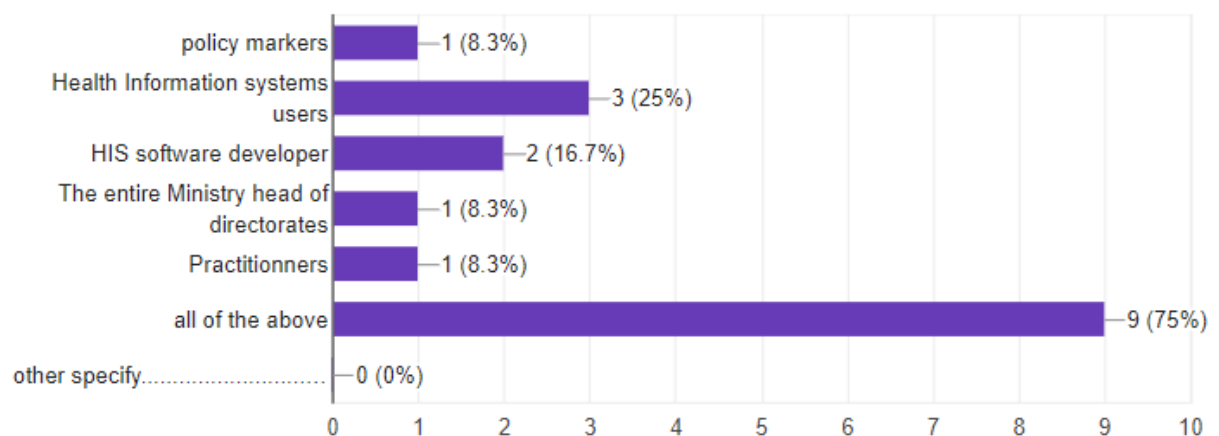


Figure 5.8 Health Information System adoption roadmap design and stakeholders

The relationship between Health Information Systems roadmap and Quality Healthcare

The healthcare sector is very sensitive by nature as it involves people's lives, and any errors can lead to serious damages such as loss of life. An HIS roadmap can healthcare professionals, patients, and management on how they should interact for the provision of quality healthcare services using technology. There is a link between an effective HIS roadmap and quality healthcare services. According to one of the respondents,

“A good HIS roadmap facilitates HIS technology adoption and use, which in turn contributes to the provision of quality healthcare” (RS2, pg7, 18).

In addition, one of the respondents shared her views as follows:

“Roadmaps allows regular monitoring and evaluation thus spontaneously ensuring data quality is checked for timeliness and completeness” (RS8, pg7.18).

In short, quality healthcare services are not offered in isolation, but rather there is a need for the integration of various components such as technologies and people.

Technologies to enhance Quality Healthcare

Figure 5.9 shows the different technologies that can be used to sustain the implemented HIS in the health sector of MoHSS in Namibia, as indicated by the participants.

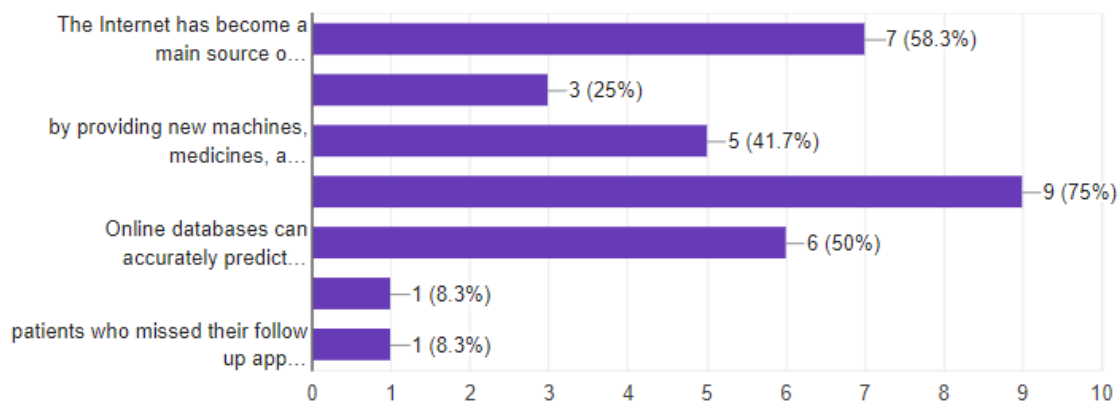


Figure 5.9 Technologies to enhance Quality Healthcare

Experts and stakeholders of MoHSS have different levels of knowledge and experience in information technology. The researched wanted to find out the technologies which could best suit the utilisation of HIS or are in use in the MoHSS to enhance quality health. The participants’ choices were influenced by their IT knowledge and skills. This question allowed for more than one choice. All 12 participants responded to the question. Seven (7) or 58.3% said the internet has become the main source of medical information. Three (3) of the respondents (25%) agreed to the statement “Healthcare facilities are reaching patients using social media”. Nine (9) of the respondents (75%) agreed to the statement “Nurses and doctors use hand-held computers to record a patient's medical history and check that they are

administering the correct treatment”. Lastly, six (6) respondents (50%) agreed that online databases can accurately predict medical trends.

Health information System implementation training

Training for a new system helps strengthen the employee skills needed and leads to effectiveness and productivity. Figure 5.8 shows the responses to the question of whether HIS training was important after the system implementation.

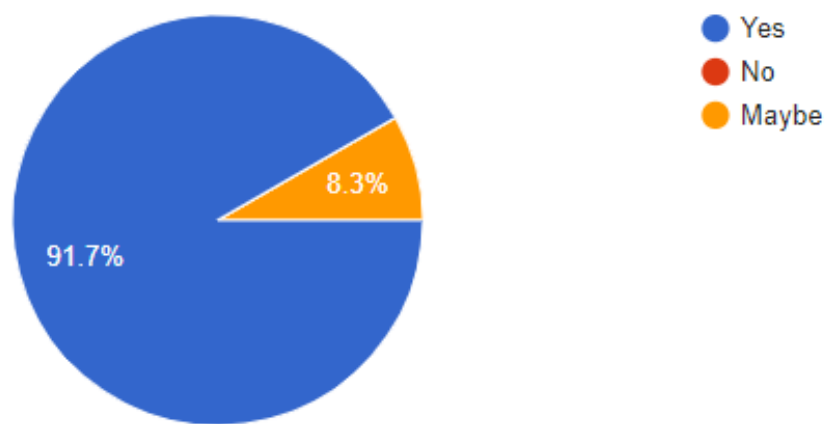


Figure 5.10 Health Information System training

Eleven of the participants (91.7%) said Yes, one said Maybe and none said No.

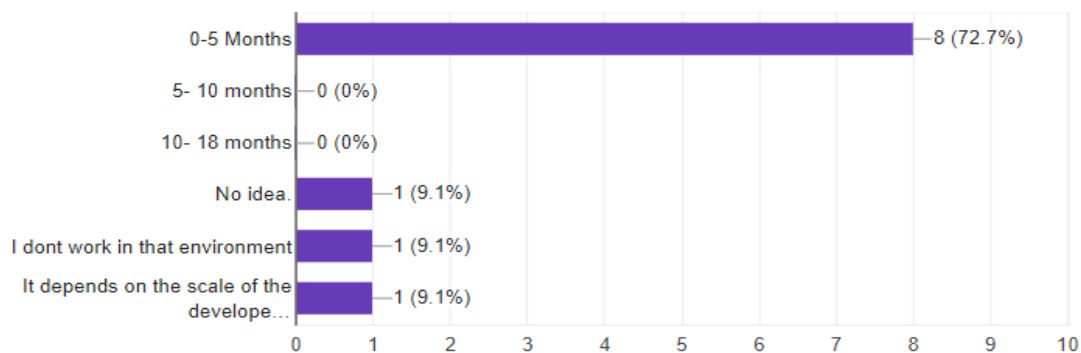


Figure 5.10. Duration of Health Information System training

Various training durations to occur after system implementation were suggested by the participants. Most (8 participants or 72.7%) suggested 0-5 months. Four (4) respondents said “no idea”, “I do not work in that environment” and “it depends on the scale of development” respectively.

Six Domains of Healthcare Quality

The Institute of Medicine has defined healthcare quality using six attributes: safe, patient-centered, timely, effective, efficient and equitable. The participants were asked what other aspects should be considered when determining healthcare quality. Figure 5.9 shows their suggestions.

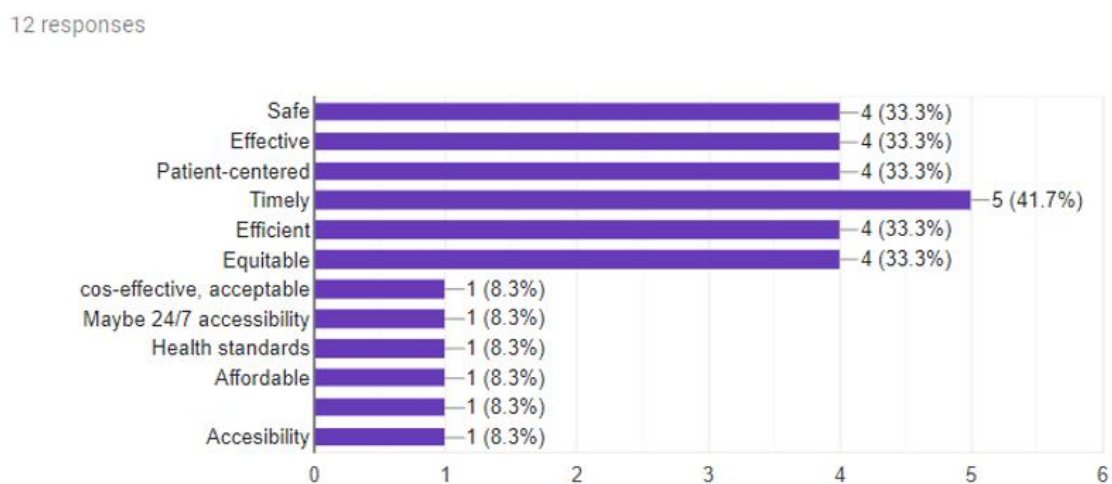


Figure 5.11 IOM and experts attribute towards Quality Healthcare

Aside from the six original attributes, participants suggested cost-effective, acceptable, health standards, affordable and accessible. All experts chose all six original attributes and each suggested one additional attribute. All of these aspects are therefore of importance in healthcare quality.

Health Information System Status in Namibia

Respondents had different views about the usage of HIS in Namibia.

“HIS is still at its infancy stage, with a chance to grow” (RS1, pg10, 18).

“... the establishment of the new HIS directorate offers new hope for un-integrated systems” (RS2, pg10, 18).

“Healthcare in Namibia seems satisfactory to me yet there's more to be done to improve and technology can be the greatest enabler for more” (RS3, pg10, 18).

“Current automation could be improved to provide further capabilities such as data sharing, predictions of epidemics, research etc.” (RS10, pg10, 18).

“There is still room for improvement. Data quality issues are a concern” (RS1, pg11, 18).

Therefore, from the experts' views, we can confirm that the status of HIS in Namibia is still at the advancement stage. The MoHSS needs a roadmap to plan and align their strategies towards quality healthcare when using HIS.

5.4.3 Data from Documents

A copy of the assessment of the National HIS, MoHSS, Republic of Namibia and an invitation letter to TWG were obtained during the interviews with stakeholders. The HIS assessment document (Appendix D) describes the current national HIS data sources, structures and dataflow, as well as infrastructure and technical issues and the HIS indicator framework. This document confirms that the Ministry has a fragmented HIS that is managed by different divisions in different directorates and runs on different software platforms. However, to help address these issues the MoHSS has put in place a team called HIS Technical Working Group (TWG). The documents also confirmed that MoHSS is seeking HIS support from USAID for a comprehensive HIS assessment.

5.5 CONCLUSION

This chapter presented an analysis of the data collected, as enabled by AT. From the analysed data, it was discovered that the factors affecting HIS adoption that were identified from the literature review also exist within the MoHSS. The analysis revealed inconsistency and delays in governance-side decision making, inadequate support and stakeholder engagement, a deficiency of IT experts, and IS infrastructure disposal. It is clearly the case that the design of an HIS adoption roadmap will be of great importance to enhance quality healthcare in Namibia.

CHAPTER 6: FINDINGS AND INTERPRETATION

6.1 INTRODUCTION

This chapter concentrates on the interpretation of the findings presented in Chapter 5. The interpretive approach was applied to understand the role of HIS adoption to enhance quality health in the MoHSS. The first part of this chapter presents a discussion of the interview data and the second part a discussion of the questionnaire data. The chapter ends with a summary of the key findings, which were used to develop the roadmap covered in Chapter 7.

6.2 FINDINGS FROM THE DATA ANALYSIS

The results from Chapter 5 were interpreted into factors that are influential to designing an HIS adoption roadmap for quality healthcare in Namibia. The factors discovered in the interview data analysis were legacy HIS; HIS strategic plan and policies; and HIS stakeholder involvement. Incidentally, the factors drawn from the interviews aligned well with the findings from the literature review. The factors derived from the questionnaire findings were HIS status in Namibia; HIS technologies for quality healthcare, and roadmap components. These factors are explained below.

6.3 FINDINGS FROM INTERVIEWS

6.3.1 Legacy HIS

It was discovered during the interviews with the HIS division employees that the Ministry has 61 HIS in its directorates. The DHIS2 is the only active system in use in the HIS division; it was founded after the HIS assessment done in 2012 as one of the efforts to integrate their stand-alone systems. Yet Khan and Edwards (2012) found that “weak in-house technical capacity and a lack of external support for necessary customization of systems (e.g., District Health Information System [DHIS] 1.4, NDW) dam up the flow of information” (p.18).

Most of the other systems appear to not be working and are located in other directorates, as discussed in Section 1.1 of Chapter 1. Some of the systems available in other divisions include management information systems (MIS), which are located in the Directorate of Policy Planning and HR; the health infrastructure; and logistics, in the Directorate of Special Programs (DSP), a system that handles HIV, TB and malaria surveillance. The research also confirmed from the HIS assessment report that a number of systems are defunct, such as the

Social Service system. The National Medicine Regulatory Council (NMRC) and Radiographic Services are using both paper and electronic methods.

Legacy information systems refer to HIS that significantly prevent change (Kimball & Ross, 2013). Legacy systems are difficult to expand and expensive to maintain, and they run on old hardware and software, which may block integration and are time-consuming. The systems implemented by outside vendors may be costly to repair due to a lack of documentation and a lack of understanding in users of the system. The HIS directorate is not responsible with the entire HISs found within the Ministry, but only one web application DHIS2 that was started by the TWG with an effort to start the integration, even without a plan. The research found a number of issues hindering HIS adoption as highlighted by different respondents. These include:

6.3.2 Lack of qualified HIS Personnel

The HIS division in the Directorate of HIS and Research was found to have only 12 employees whereas it was supposed to have 200+ employees. These few qualified HIS employees are based in Windhoek, but are not in office most of the time due to traveling for training or attending workshops. The division is therefore excessively understaffed. According to the director of the division,

“Quality service delivery will be a challenge as we are understaffed, we only have two people in the division with IT qualifications” (RES1, p.1.18).

The challenge of understaffing has a big impact on delivering quality healthcare.

6.3.3 Lack of Information systems Infrastructure

The research found that there is some technology usage within the Ministry. Employees have desktop computers connected to the internet (3G, including in district offices). One employee reported that the desktop is not very effective for them as they travel often and need the latest portable devices for their activities, especially during workshops. The HIS within the Ministry of Health and Social Services is not integrated, which created duplication of data and prevents sharing information in real time. The employees wish to have tablets and laptops at all facilities to allow data entry at all levels. The deputy director of the HIS division felt that the budget for directorates is not adequate to meet all their needs. Support received from partners such as Management Health Sciences (MHS) appears to be minimal.

6.3.4 Political appointment HIS interruption

Political power has a big influence on how activities are done in government Ministries. The separation of the IT and HIS divisions seems to be affecting the HIS. Staff turnover is also said to be a big factor affecting the HIS division. In most cases, those trained to use the systems are either promoted or leave for other jobs. The director of HIS felt that the Ministry should allow the directorate to make the decisions regarding HIS.

The research found that HIS progress is also hindered by the political appointment of staff members in the Ministry, such as changes of Permanent Secretaries. After all, the Ministry's Permanent Secretary has influence on the decisions taken concerning HIS adoption and implementation. The director of HIS stated,

“The politics of today and the changes in Permanent Secretary now and then, this one comes and says, remove IT from the directorate let them work from facilities” (RES1, p.2.18).

They feel that political powers overpower policies or plans. According to Shaanika (2015),

“Politics is a manifestation of actors' relationships. Because of their roles and responsibilities, employees use their power to influence the selection process. In most cases, it is carried to satisfy individuals' or groups' personal interests rather than the organisation's business interest”.

In addition, since Namibia is a developing country, the Ministry receives donations from NGOs. These are sometimes systems that are just received with little or no training for the users. The HIS and research directorate says it has given access to the DHIS2 to the Ministry's top management to allow them to view and use data at any time for decision-making.

6.3.5 Lack of HIS Technologies Infrastructure for Quality Healthcare

A number of factors prevent the adoption of HIS, of which technology as a leading factor. Even though technology is in use in MoHSS, one of the HIS officers using the web application DHIS2 mentioned,

“The Directorate does not have fully qualified IT experts, IT knowledge is lacking with our nurses, doctors. Even systems implemented, no one is utilising it fully” (RES1, p.1.18).

Khan and Edwards (2012) state that the infrastructure for both local and wider information and communication technology (ICT) is either inadequate or totally absent, and the lack of required hardware and software at multiple levels essentially makes key current systems inaccessible. Donors such as USAID have donated a number of systems to the Ministry, but maintenance of the IT equipment and systems is a challenge. One employee in the ministry said,

“The IT policies are managed by the OPM as the custodian of the government ministries. All of the activities, such as HIS, hardware selection and implementation, and software designing and the replacement they provide. We have little control” (RES1, p.1.18).

6.3.6 HIS Strategic Plan and Policies

It is clear that, as the primary health custodian of the government, the MoHSS requires a strategic plan for HIS. HIS can help healthcare organisations meet the rising burdens of patients, providers, and payers for electronic information (Yabroff, Gansler, Wender, Cullen, & Brawley, 2019).

At the time of the researcher’s interviews, the Ministry had no strategic plan in place, as mentioned during one of the interviews:

“As we speak, we have developed an HIS strategic plan in a draft form and it is in the process for approval” (RESP1, P.1.18).

In addition, another respondent said,

“Yes, there is a strategic plan in place with targets to say what we want by when and can we integrate HIS” (RESP2. P.4.18).

Yet another employee said,

“But when a system is donated to the Ministry through government we just receive it. There is no governing roadmap or policy of what we should take and what not because we are a developing country” (RESP1.P.3.18).

Information Technology (IT) policy categorises the rules and procedures for every individual using the organisation's IT resources and infrastructures. It is also a document for the organisation to outline its objectives, confidentiality measures, and access to information policy (Avgerou & Walsham, 2017). Currently, IT decision making centres on the Office of the Prime Minister (OPM). According to an employee in the Ministry,

"The Office of the Prime Minister is the head of government, has a department that is responsible for all those IT things, whenever we are to do procurement we normally get the specification from them [...] However, if we perhaps have what you are proposing, to have a specific roadmap or plan just for HIS/IT, I think that it will be good. That will enable us to focus". (RESP2, p.5.18).

Centralised decisions from one office can be a distraction to development, not least because this leads to waiting periods. HIS should be planned by the system users using their IS and IT knowledge and experience. The OPM should allow the ministry to make its own decisions and procurements of ICT equipment. Decisions made closer to the patients will improve the quality of health service delivery. However, it should be noted that some employees did seem to be satisfied with the current process:

"However, the support we getting from the Office of the Prime Minister is sufficient" (RESP2, p.5.18).

6.3.7 Stakeholder Engagement

Stakeholders in healthcare are defined as those objects involved intrinsically in the system and who would be affected by transformations to the system. The most important stakeholders in healthcare are patients, physicians, employers, insurance companies, pharmaceutical firms and government (Arney, Senges, Gerke, Canca, Ihle, Kupke, & Meléndez-Cintrón, 2019). Interviews have shown that the Ministry values the presence of stakeholders when it comes to HIS issues. In fact, the Ministry confirmed the involvement of stakeholders in their drafted strategic plan for the Ministry. The director of policy planning and HR said:

"We involve our stakeholders in the strategic plan; I remember we had an engagement meeting with government ministers, UN agencies, those are the many ones and we have NGOs. Some NGOs have been working with the ministry for long now".

However, the Director of HIS and Research confirmed that stakeholder involvement is in progress:

“Yes, we have now started with stakeholders; we are busy establishing the Namibian Institute of Public Health. One of their functions is stakeholder collaboration and stakeholder coordination, as we are already working with the Office of the Prime Minister for health emergencies, and the Minister of Finance, we need them for money. WHO, UNAM, NUST, and other agencies like [the regional council, Coca-Cola]], the Centre for Disease, UNDP, MHS, Ministry of Agriculture division, Veterinary division, NCRST, NSA, medical school, Namibia Statistics Agency, Namibia Standard Institute, Red Cross, Centre for Disease Control, UN family (UNDP)” (RESP1.p.2.18).

The Ministry recently established a TWG for the HIS division, which comprises of stakeholders from different organisations. An employee of the Ministry directly working with the group stated,

“After the assessment, the HIS Technical Working Group (TWG) was established to guide the integration of the systems in the Ministry. It is responsible to develop guiding documents to foster that process. DHIS2 introduction is one of the integration efforts that the Ministry has embarked upon” (TD-18, RESP4. P.7, 18).

Even though efforts to use stakeholders are taking place, interruptions have delayed the developments in plans, as one employee stressed:

“The strategic plan is still not done as the TWG was on "recess" for some months due to lack of a chairman after the former chair retired. It had revived but I cannot tell when it is likely that the strategic plan will be done as there are many new members now” (RESP4. P.7, 18).

In conclusion, this research found stakeholder engagement critical to the Ministry’s decisions. The absence of stakeholder involvement will hinder progress and developments. Successful implementation and adoption of HIS and IS infrastructure that lead to quality healthcare will depend on joined forces between different stakeholders.

6.4 FINDINGS FROM THE QUESTIONNAIRES

The status of HIS was important to know before developing a roadmap for its adoption. Experts working within the MoHSS and stakeholders who participated in the research confirmed that HIS in Namibia is at in its infancy. One participant who uses HIS stated that:

“The health information systems in Namibia are not interoperable” (RSP5, pg. 9, 18).

Similarly, other respondents referred to “un-integrated systems” (RSP3.pg. 9. 18).

For efficiency purposes, the status of HIS should be of concern to its implementers and users, because if systems are interoperable and un-integrated, the organisation should expect poor quality of healthcare. An effective HIS can contribute to improved health outcomes for patients, but this is seemingly not the case in the current Namibian context.

6.5 HIS TECHNOLOGIES INFRASTRUCTURE FOR QUALITY HEALTHCARE

A lack of IT infrastructure leads to poor quality healthcare. Computers are critical for the gathering and sending of health information (Laudon, & Laudon, 2016). HIT tools enable the sharing of service delivery performance measures and work processes. Key HIS technologies include software, hardware, networks, telecommunications, databases, and the internet. The fact that HIS is not integrated within the ministry is an indication that IS infrastructure is lacking, and this prevents adding to the know-how of employees. Respondents had this to say with regards to HIS and IS technology infrastructure:

“Healthcare in Namibia seems satisfactory to me yet there's more to be improved and technology can be a great enabler for more”.

“The health information systems in Namibia are not interoperable”.

The interoperability of computer systems or software requires systems whose interfaces are complete and work with other systems. This cannot be realised when IS infrastructure and expertise are limited.

6.6 SUMMARY OF FINDINGS

The results showed that for an organisation to implement and adopt HIS, the Ministry management and policy makers should take into consideration the following factors: governance, IT skills and IT/IS infrastructures, and stakeholder engagement.

6.7 CONCLUSION

This chapter presented a discussion of the research findings, which assisted the researcher to answer the research questions and achieve the research objective. Based on these findings, an HIS adoption roadmap was developed, which is presented in Chapter 7.

CHAPTER 7: HIS ADOPTION TECHNOLOGY ROADMAP

7.1 INTRODUCTION

This chapter addresses the main objective of the study, namely to develop an HIS adoption roadmap for quality healthcare. The design of this roadmap was guided by the findings from the interviews and questionnaires, and supported by the literature review. The chapter will discuss the process for developing a roadmap, present the developed HIS adoption roadmap, discuss the status of HIS in Namibia before and after roadmap implementation, and offer a conclusion.

7.2 ROADMAP PROCESS

Pora, Thawesaengskulthai, Gerdri and Triukose (2018) noted that worthwhile roadmap development incorporates stakeholders and organisational management, leading to a clear understanding of the factors affecting HIS adoption. In roadmapping, organisations seek to deconstruct complex systems into subsystems and ultimately into elements that are represented on the roadmap (Leffingwell, 2018).

In this study, the researcher aimed to create a roadmap that would enable HIS experts to share knowledge, map the future and plan HIS outcomes. This research followed the steps below for the roadmap development. The steps are individually discussed next.

1. Identify supporting literature.
2. Engage key stakeholders.
3. Understand the HIS environment.
4. Formulate the roadmap components.

7.2.1 Identifying the supporting literature

The relationship between HIS and quality healthcare (discussed in Chapter 2) and roadmap technology (Chapter 3) were the identified key topics for literature review. The literature revealed the factors affecting HIS adoption and gave the researcher ideas on how to go about developing an HIS roadmap, as discussed in Section 3.6 of Chapter 3.

7.2.2 Engaging key stakeholders

Key stakeholders identified during data collection were engaged further for clarity in a meeting. A meeting discussion with HIS experts is the process used during research to network and get requirements for the roadmap development. Cho, Yoon and Kim (2016) note that roadmap stakeholders need to clearly specify their needs. As stated in Chapter 4, key stakeholders such as systems analysts, the HIS director and deputy director, and HIS implementers were engaged.

7.2.3 Understanding the HIS environment

From the analysed data, the researcher understood the past and present status of the HIS environment. This helped the researcher discover the components to include when developing the roadmap. The data also highlighted the weaknesses of HIS that a roadmap can solve, and helped identify key technologies and IS infrastructure required for running HIS easily and efficiently.

7.2.4 Formulating the roadmap components

From the literature review and data analysis, the four main components of the roadmap were identified as governance, HIS stakeholders, IT development skills, and IT technologies. These components are described in more detail below.

7.3 HIS ADOPTION ROADMAP DEVELOPMENT

Blanchard, Livet, Ward, Sorge, Sorensen, and McClurg (2017) note that a roadmap is an information establishing framework that takes together diverse matters into a common view. A roadmap can arise in different forms because there is no fixed method for roadmap development. It can be represented in the form of text or diagrams. In this study, the researcher adopted a diagram format based on current HIS technologies, future HIS technologies and the roles by TWG stakeholders in MoHSS. The following factors were taken into account:

Factor 1: Governance

Wang and Guo (2015) write that governance recognises the capacity to get things done without relying on the power of the government to command or use its power. They emphasise that, in modern society, the government is moving its responsibilities to private

sector organisations and NGOs groups, which are undertaking responsibilities that were formerly in the hands of the government. Shaanika (2015) defines governance as ways in which information, resources, and goods are ordered by those in charge. The MoHSS in the government of Namibia is led by the OPM as a government Ministry. The OPM's responsibility is to ensure that the required IS/IT complies with the defined ICT policies and standards, and to advise the Ministries concerned on the best practices and strategies to deploy and manage their supporting technologies.

The management and governance of HIS via the OPM's IT director may be an obstacle to the adoption of HIS in the MoHSS, because this this means that processes take long and decisions may exclude the actual users of systems. Those dealing with HIS selection may lack knowledge of all systems. As a result, some decisions are not made to the best interest of the whole organisation. Politics also plays a role in the development of HIS systems. HIS adoption lacks management support and empowerment. In AT terms, non-technical actors are withholding the development of HIS adoption.

Factor 2: HIS Stakeholders

This research found that the un-integrated systems of the MoHSS were a result of not engaging stakeholders. An HIS assessment revealed that "until the new directorate was created, there was no single body to lead and coordinate the HIS" (Khan and Edwards, 2012, p.15). The MoHSS has, however, started with stakeholder engagement in the HIS division.

Stakeholders are actors that will bring different ideas toward the enhancement of the HIS. Stakeholders are often those who are most interested in solving the problem (Andriof & Waddock, 2017).

Factor 3: Strategy

This concept represents the integrative strategy of the HIS adoption roadmap. The research determined that e-health systems need a strategic plan to guide HIS acquisition, selection, designing, development, and implementation. Furthermore, strategic IS planning activities would require significant resources in terms of managerial time and budget.

To achieve HIS adoption, and for themselves to be effective, system users and IT professionals must embrace technology. Khan and Edwards (2012) emphasise that much of the effort in

this regard to date has been uncoordinated. It has been directed mostly at isolated technical aspects of the HIS and not at institutional coordination, and other behavioural aspects. Especially at national level, leadership has been tentative and uncoordinated until very recently, and there has been too little political support for HIS improvement. Employees are the actors who will ultimately offer better services for quality healthcare.

The application of HIS also requires user awareness and proper user training supported by qualifications. Employees are, after all, the actors who will ultimately offer better services for quality healthcare. The adoption of HIS requires a specific attitude towards knowledge and an interest in using IT, which means adopting HIS will involve major organisational change.

Factor 4: HIS Technologies

Certain technology would need to be in place before embarking on HIS adoption. The Ministry is affected by a lack of HIS infrastructure because of low resources. It was observed during the interviews that the division of HIS has been moving offices, and documents were still packed in boxes with other computers. In order for the Ministry to successfully adopt HIS, they require proper equipment such as a database, instead of relying on web application DHIS-2. An obtained HIS assessment also showed that the infrastructure for both local and wider area information and communication technology (ICT) is either inadequate or absent, including both hardware and software. This also means that facilities are not properly operational and interlinked throughout the health system (Khan & Edwards, 2012).

Factor 5: HIS Experts Skill Development

Qualified experts are required who can use HIS to enhance healthcare quality. Information technology (IT) has proven an effective instrument when utilised by people with IT knowledge. Advanced technology and IT experts are key to the utilisation of HIS. This HIS adoption framework was designed to include the features of quality healthcare, the technologies needed, who to involve in HIS, and how to ensure adoption. These can be seen in Figure 7.1.

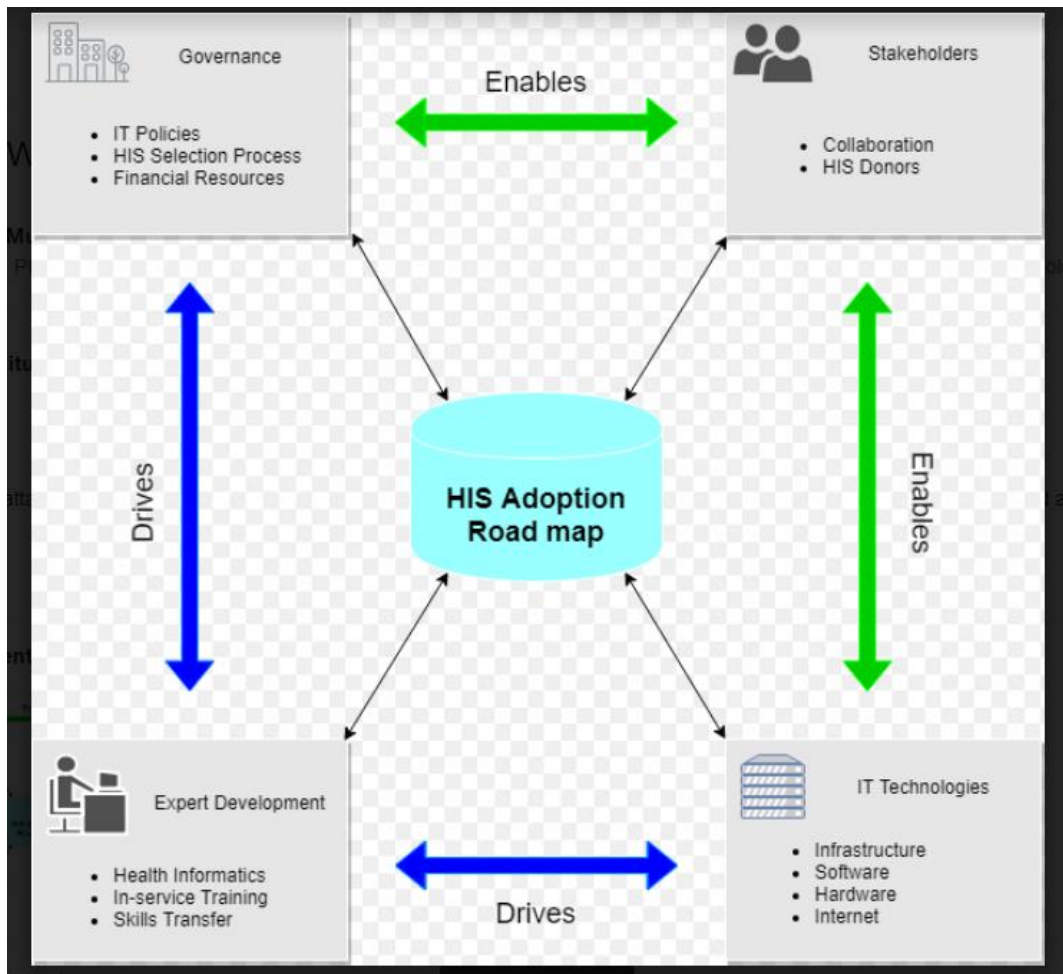


Figure 7.1 HIS adoption framework

Table 7.1 and Figure 7.2 describe the components of an HIS adoption framework, which include HIS outcomes, HIS projection, HIS technologies, characteristics, and challenges. The components address the social and technological aspects affecting the adoption of HIS.

Table 7.1 HIS adoption roadmap component for Present and Future HIS

HIS Adoption Roadmap Components		
HIS Factors	HIS Projection	HIS Outcome MoHSS
<ul style="list-style-type: none"> • Technological factors • IS infrastructure factors • Political factors • Stakeholder Factors 	<ul style="list-style-type: none"> • HIS integration • HIS management • E-services • HIS advancement • HIS Web services • Wireless internet • Centralised database 	<ul style="list-style-type: none"> • Patient Platforms • Mobile platforms • E-Health services • Health Information Exchange • m-health • Web services
HIS Challenges	HIS Technologies	HIS Characteristics
<ul style="list-style-type: none"> • Poor Health informatics • Poor IT infrastructure • Low financial resources • Lack of HIS policies 	<ul style="list-style-type: none"> • Databases • Wireless sensors • Tablets • Laptops • Smartphones • Smart TVs • Warehousing 	<ul style="list-style-type: none"> • Efficiency • Accessibility • Reliable • User-friendly • Maintainable • Analysis • Currency

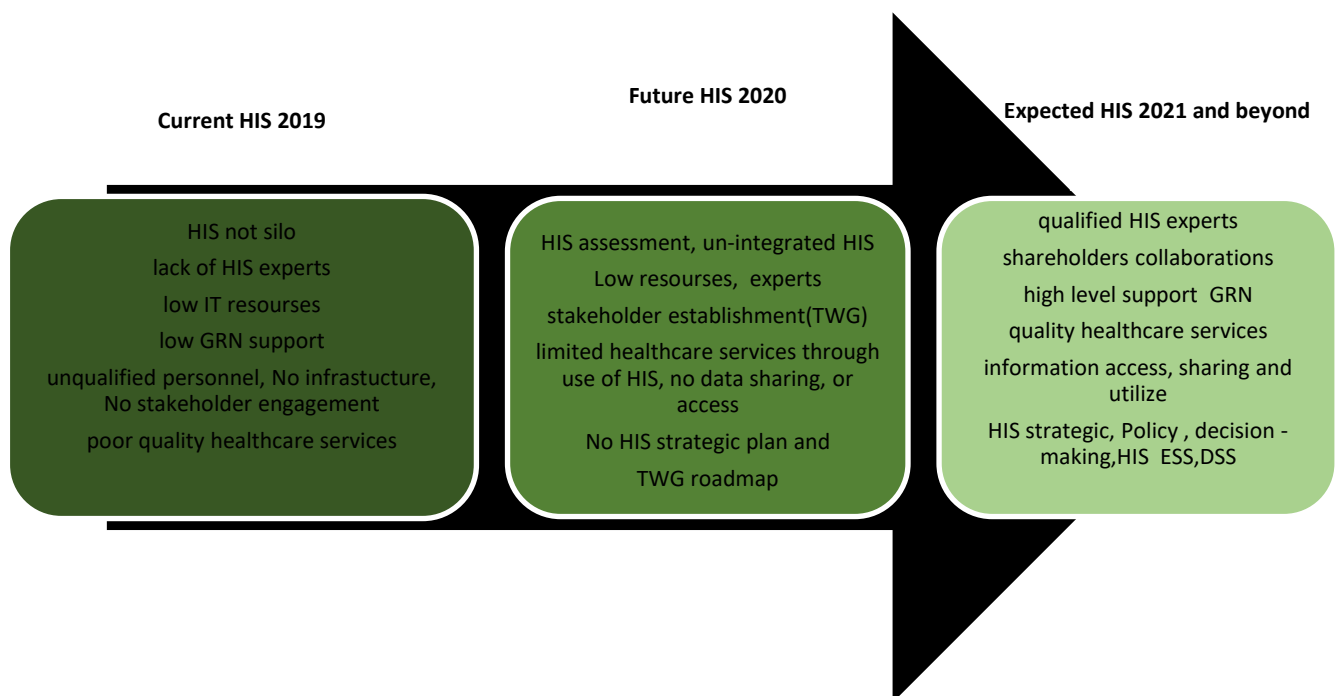


Figure 7.2 the status of HIS in Namibia before and after roadmap implementation

Figure 7.2 shows the journey of the HIS state from the present to after the roadmap is implemented. In order to achieve the projected outcomes, the involvement of top management in the government offices heading IT and HIS is key, as is the engagement of stakeholders from different specialties in Health informatics and IT.

7.4 BENEFITS OF HIS ADOPTION ROADMAP

The developed HIS adoption roadmap will enhance the quality of healthcare services in Namibia. It will also enhance collaborations between HIS users, stakeholders, and TWG. The top management within the directorates of HIS and research and of Policy planning decision-making will be guided by the roadmap.

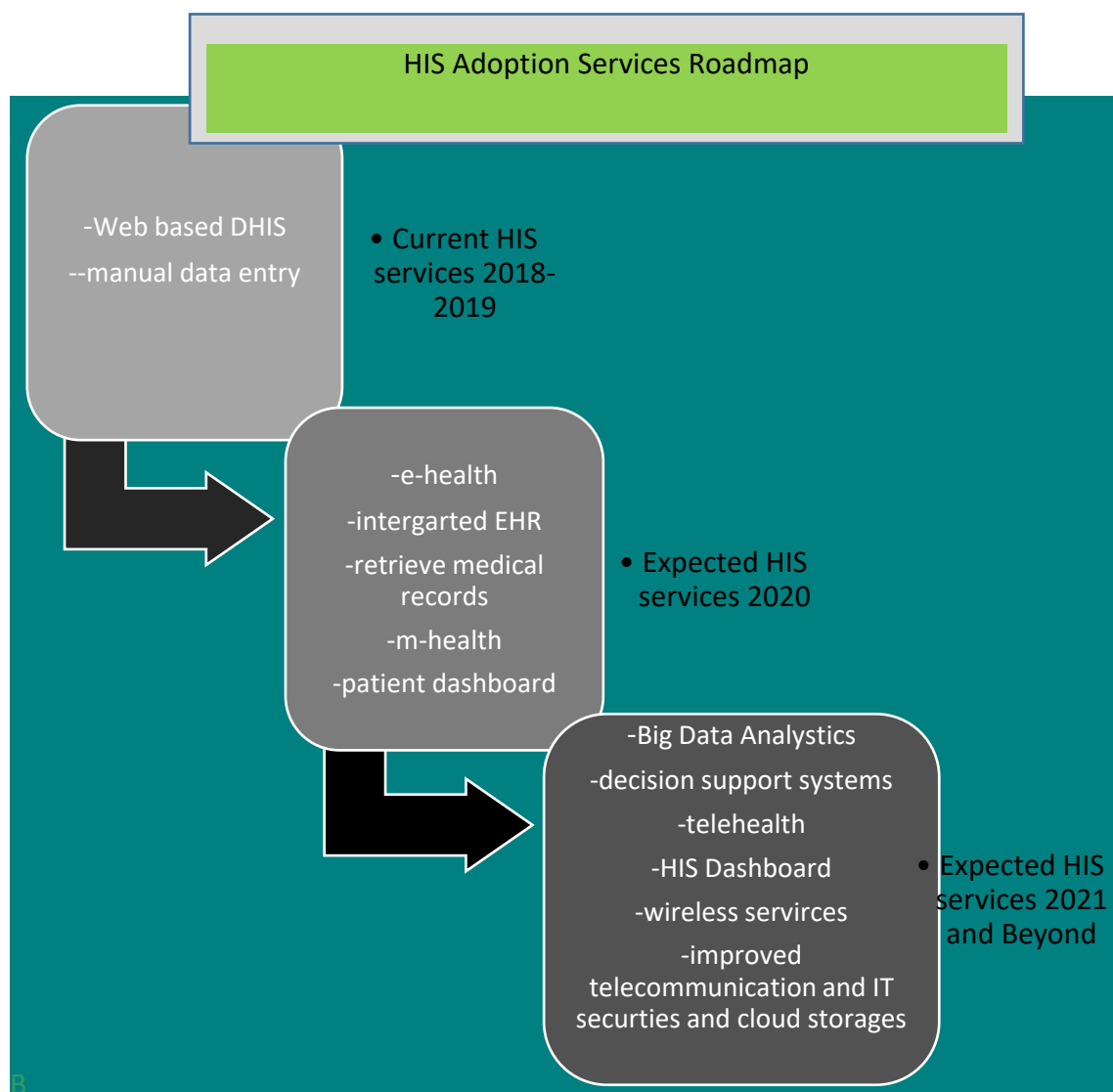


Figure 7.4 HIS Adoption Services

In order to offer the HIS services projected for the future, the supporting IT infrastructure with the right technologies and devices is required, together with qualified HIS experts.

7.5 EVALUATION OF THE HIS ADOPTION ROADMAP

In this study, the evaluation to check for validity and applicability was done using existing HIS/ICT roadmaps. The reason for the evaluation was to identify the framework's level of performance and its appropriateness for an HIS roadmap. The HIS roadmaps discussed in Chapter 3 (including the analysed questionnaire data from HIS roadmap experts) were considered during the evaluation of the framework. The framework was found to be valid as it had also been used in a number of other studies in IS. This evaluation also helped the researcher look at aspects such as roadmap components, functions, stakeholders and key HIS technologies used to enable quality healthcare.

7.6 CONCLUSION

This chapter presented the main objective of this research, which was the design of an HIS adoption roadmap for quality healthcare in Namibia. The findings from Chapter 6 were used to develop this roadmap. Factors that influence HIS adoption were discussed in this chapter, as were the benefits of the adopted framework, the challenges experienced, and what is envisioned for the future. HIS can only be successful if the organisation applies the developed roadmap and addresses all the factors that affect adoption.

CHAPTER 8: RESEARCH SUMMARY, RECOMMENDATIONS AND CONCLUSION

8.1 INTRODUCTION

In this study, semi-structured interviews, questionnaires, and documents were used to collect data from the MoHSS. The study then applied Activity Theory as a lens through which to visualise the research surroundings and articulate the findings of the technical and non-technical factors that could influence the design of an HIS adoption roadmap in the health sector. This chapter contains a summary of the research, recommendations based on the research findings, and the study's conclusion.

8.2 RESEARCH SUMMARY

In an attempt to describe the study, this thesis was structured into seven chapters. Each chapter is summarised below.

Chapter 1

This chapter gave an overview of what the study entailed, including the background, problem statement, research objectives, and research questions.

Chapter 2

This chapter presented a literature review of HIS and technology roadmaps. The chapter also covered Activity Theory (AT), which was used to underpin the study.

Chapter 3

This chapter discussed roadmaps in healthcare, referring to benefits and challenges in different industries, and methods used in developing roadmaps. In addition, the chapter discussed the conceptual framework best suited to HIS.

Chapter 4

This chapter described the research methods used to achieve the research objectives. The research methodology included the research strategy, design, data collection analysis, sample techniques, and ethical considerations.

Chapter 5

This chapter described how the collected data was analysed using AT.

Chapter 6

In this chapter, the findings and their interpretation were presented.

Chapter 7

This chapter presented the HIS adoption roadmap, which was the main objective of the study.

Chapter 8

This chapter provides recommendations and a conclusion.

8.3 RESEARCH ACHIEVEMENTS

The research aim was to develop an HIS adoption roadmap for quality healthcare services in Namibia. In order to do that, the researcher had to identify factors that could affect such an HIS adoption roadmap. To achieve this, four objectives were formulated. As discussed in Chapter 1, these were to:

- i. Evaluate the current state of HIS and existing roadmaps within the MoHSS in Namibia.
- ii. Assess HIS technologies that contribute to quality healthcare.
- iii. Analyse the components of HIS roadmap adoption.
- iv. Create an HIS adoption roadmap for the Namibian health sector.

In order for the above-listed objectives to be accomplished, research questions were formulated. As presented in Chapter 1, these were as follows:

- i. What is the current state of HIS and existing roadmaps in Namibia?
- ii. What HIS technologies are used for quality healthcare?
- iii. What are the components of HIS roadmap adoption?
- iv. How should an HIS adoption roadmap be developed?
- v. What is the current state of adoption of HIS in Namibia?

To collect data with regard to the research aim of designing an HIS adoption roadmap, semi-structured interviews, questionnaires, and document analysis were utilised. The questions

used during the interviews were framed according to the first two research objectives and the same questions were asked to all interviewees. Semi-structured interviews allowed follow-up questions by the researcher to probe the interviewees to elaborate more on the topics. Some participants, due to limited time, opted to provide documents to the researcher instead. The acquired documents were then also used as data, and provided evidence for the status of HIS in the health sector. The interview data were analysed using Activity theory (AT). The questionnaire data, on the other hand, concentrated on the third and fourth research objectives. The interpretive method was applied to the data collected from the questionnaire. The analysis and findings assisted in the achievement of the research objectives.

8.4 SUMMARY OF THE RESEARCH RESULTS

This study's main objective was to develop a Health Information System adoption roadmap to enable quality healthcare in Namibia. This objective was accomplished, as reported in Chapter 7. The research questions based on the secondary research objectives will now be answered from the collected data.

Objective 1: To evaluate the current state of HIS and existing roadmaps within the MoHSS in Namibia.

Question 1: What is the current state of HIS adoption and existing roadmaps in Namibia?

The interview data found satisfactory use of HIS in MoHSS. The Ministry does have HIS, and the division of HIS in particular has DHIS in use. Through the interviews, it was revealed that no HIS adoption roadmap is in place to guide the division. However, a strategic plan was reported to be in a draft form. The questionnaire feedback also revealed that HIS status is satisfactory, and still at its initial stage, while others felt that its implementation is poor and under-resourced. This research objective assisted the researcher to identify the following factors that affect the adoption of HIS:

Non-technical

- Governance and management
- Stakeholders
- Strategic plans and HIS policies
- HIS resources

Technical

- HIS
- IT technologies

The design of an HIS adoption roadmap for quality healthcare in this study therefore took into consideration the factors above.

Objective 2: To assess HIS technologies for quality healthcare.

Question 2: What HIS technologies are used for quality healthcare?

The interview data revealed that standalone computers are available in the Ministry and connected to 3G internet. However, interviewees feel that this is not enough, and that they need portable devices with more advanced technology. The challenge faced in the Ministry is a lack of integrated systems that hinder the efficient management and distribution of information that is crucial to a healthcare organisation's operation. In addition to hardware and software limitations, another challenge that was revealed is a lack of health information experts.

Objective 3: Analyse the HIS roadmap adoption components.

Question 3: What are the HIS roadmap adoption components?

From the questionnaire data, the majority of respondents believed technology and the market are components to consider in order to have successful use of an HIS. Furthermore, technology should be a number one priority as HIS cannot work without proper hardware and software. Stakeholder involvement was found to be key during the planning, implementation, and use of HIS. However, the research found that stakeholder engagement is currently only at an initial stage and very little is being done to enhance HIS efficiency.

Objective 4: To create an adoption roadmap for the Namibia Health sector

Question 4: How can an HIS adoption roadmap be designed?

The HIS adoption roadmap was developed using the factors that were found to influence roadmap design (governance, strategy, stakeholders, IT skills development and IS infrastructure).

8.5 CONTRIBUTION OF THE RESEARCH

The study built on the existing literature in the field of health informatics using qualitative methodology. The use of AT for data analysis allowed the researcher to identify technical and non-technical factors that impact the design of an HIS adoption roadmap for health service delivery in the MoHSS of Namibia. This knowledge can benefit MoHSS, but also other researchers in their use of AT in health information systems. The study also contributed to the understanding of the social relationship between the subjects (people), objects (such as HIS), and tools (such as technology), especially how this relationship can affect the design of a roadmap.

8.6 RECOMMENDATIONS

The following recommendations were derived from the findings in this study.

Recommendation 1: Understand HIS factors

It is recommended that for a sustainable roadmap, an understanding is formed of the different HIS factors in Table 7. The understanding of technology factors, for example, could help the organisation tackle internal obstacles that hinder technology goals. Within the HIS, a status report on technology factors (based on the roadmap) could keep employees informed of progress. The IS infrastructure factors outlined in the roadmap could assist the organisation to map their IT goals to their organisation business objectives. Stakeholder collaboration should be strengthened.

Recommendation 2: Consider and predict the future of HIS

Prediction can assist in making plans about possible HIS development. Maintaining a list of HIS benefits will help stakeholders plan which networks, databases, staff, and software and hardware to acquire in future. If the organisation understands their HIS options beforehand, they will be in a better position to determine which technology to monitor, as well as to design, develop and implement the new HIS.

Recommendation 3: Consider in-service HIS training

Having noted that employees within the organisation have limited skills and knowledge of information systems, it is recommended that continuous on-the-job training be offered to HIS

users. This training can be done in the form of workshops by stakeholders, or by establishing an e-learning platform on the system employee use during work hours, with video tutorials to upgrade their skills and reach employees around the country. Recruiting senior university Health Informatics students from NUST and UNAM to do their work-integrated learning internships in the organisation will also boost skills transfer.

Recommendation 4: Align IT policies with HIS strategic plan

Developing HIS strategic plans linked to IT policies that support HIS adoption and skills development is key to achieving quality healthcare. Proper HIS policies will enhance the usage of service delivery within the organisation.

Recommendation 5: Identify and understand the key stakeholders

The identification of key stakeholders with HIS expertise to work as a team and provide the relevant support needed for HIS adoption is vital. Stakeholders should include HIS users, TWG, and HIS implementers. Communication should be effective amongst the team. Skills development can be enhanced when stakeholders work together.

Recommendation 6: Update the roadmap

Roadmapping is an ongoing process that helps the organisation keep track of and remain focused on important objectives. Key roadmap components to stay informed about are goals (short and long term), new HIS capabilities, resources, training, risk factors, and status.

8.7 CONCLUSION

The research evaluated the status of HIS in the MoHSS, identified the factors that could hinder HIS adoption in Namibia, and developed an HIS adoption roadmap. The researcher collected data from the Ministry of Health and Social Services' HIS and Research directorate, the HIS division and its stakeholders (TWG), and from the Directorate of Policy Planning and HR. The data collected through interviews was analysed using AT, and the questionnaire data through the interpretive method. By interpreting the data, technical and non-technical factors that affect HIS adoption were identified.

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APPENDIX

APPENDIX A: TRANSCRIBED DATA

APPENDIX A: Transcribed Data [TD-2018]

Interview were conducted at the Ministry of Health and Social Services, directorate of Health Information systems, directorates of Policy Planning and Human resources, and director Management Science for Health.

RES1- Director of Health Information Systems and Research Directorate of HIS and Research

1. **Researcher:** Thank you very much for your time Director, the purpose of this interview is to find out the current state of HIS and find out whether exciting roadmap, and find out what HIS technologies are currently in place to support quality health. I have a few questions to ask and want to assure you that all data collected will used for the research only.

Interviewee: You are welcome, health information systems is our interest.

Researcher: Does the Ministry of Health and Social Services currently have Health Information System(s)?

Interviewee: of Course Yes, We currently using District Health Information System (DHIS version 2). We using it to collect our routine data, in this system you will not find the name but cumulative totals. We have inpatient data.

Researcher: Does the Ministry of Health and Social Services have strategic plan to guide HIS ADOPTION, with indicators of timeline, anticipated budget of activities a roadmap in place?

Interviewee: As we speak, we have developed HIS strategic plan in a draft and in the process of approval.

Researcher: What is the status of technology usage, utilisation, and resource allocation level in the ministry to embark towards quality health care of a patient?

Interviewee: DHIS version 2 is in place, training is on-going and this system is now rolled to the whole country. At district level, we have health works using 4G, and internet is available. Computers are made available with our works and data is made available thus not in time.

Researcher: What plans are in place for the next 10 year to increase the availability, quality, value and use of timely and accurate health information systems?

Interviewee: Right now, our drafted strategic plan is for 5 years, by 2020, we targeting 100% moving towards paperless quality data, we busy training people we call epidemiologist... who are going to interrogate data in order to trigger research..... The HIS plan include some We also have busy with inpatient data, to calculate death rate.

APPENDIX B: INTERVIEW QUESTIONS

Research Title: Development of Health Information System Adoption Roadmap for Quality
Healthcare in Namibia

Dear Sir/Madam,

My name is Sinte Christabel Mutelo. I am currently conducting research for a Master of Informatics degree on **Health Information System Adoption- a Roadmap for Quality Health in Namibia**. I will appreciate your help by answering the questions honestly. I want to assure you that information provided by you will be kept confidential and will be used for the purpose of this research alone. Thank you in advance for the contribution to this research.

The objective of this research is to develop a health information system adoption roadmap to enable quality healthcare in Namibia.

Further information, if needed can be obtained using the following contact details; email: smutelo@nust.na

Tel: 061 207 2648

Questions:

Please answer all questions:

1. Does the Ministry of Health and Social Services currently have HIS?
2. Does the Ministry of Health and Social Services have strategic plan to guide HIS ADOPTION, with indicators of timeline, anticipated budget of activities a roadmap in place?

Outline the strategic planning process, procedures and guiding policy.

3. What is the status of technology usage, utilisation, and resource allocation level in the ministry to embark towards quality health care of a patient?

4. What plans are in place for the next 10 year to increase the availability, quality, value and use of timely and accurate health information systems?

5. Does the MoSS involve all stakeholders such as (patients, medical practitioners, policy makers, HIS developer /implementers) in decision making during selection and planning of HIS? **Mention some of the stakeholders.**

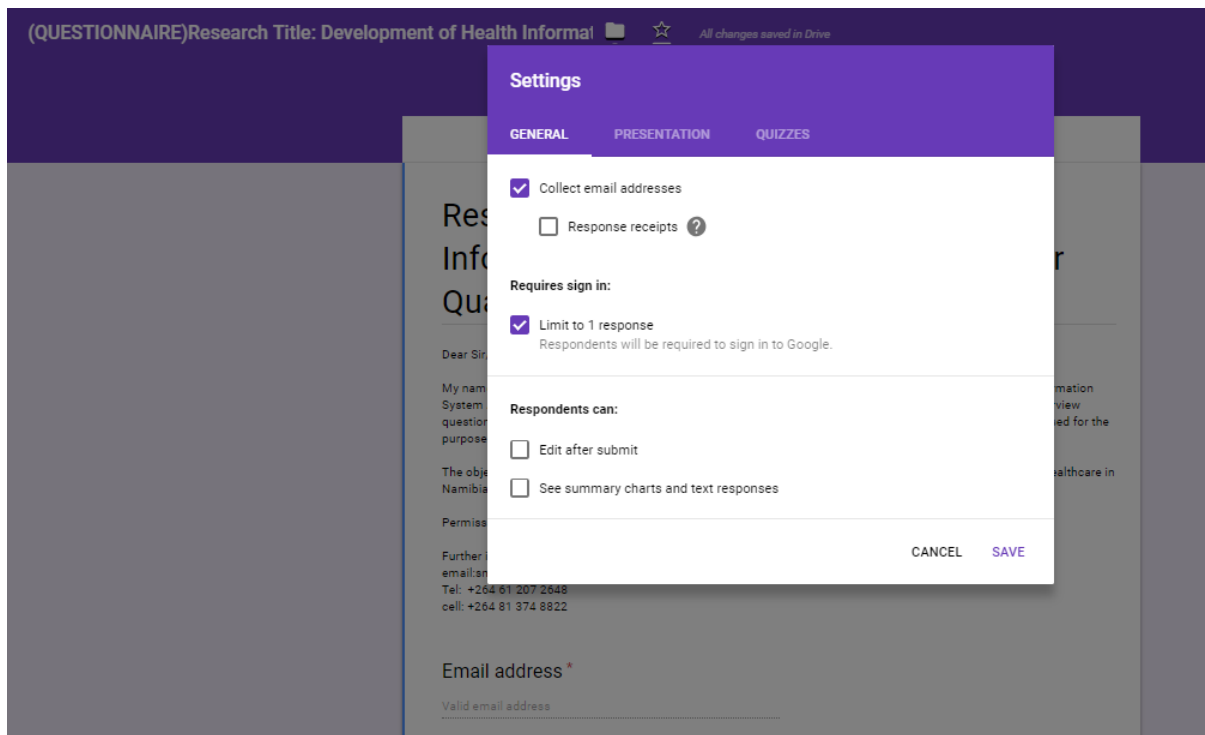
6. Do you think the Ministry needs a roadmap principles, processes, and tools?

7. What components is covered in the roadmap for implementation of HIS?

8. What challenges are been faced in having efficient HIS which could enhance quality health.

Mention and explain.

APPENDIX C: SETTINGS APPLIED ON THE ONLINE QUESTIONNAIRE



EXPERT QUESTIONNAIRE

Research Title: Development of Health Information System Adoption-Roadmap for Quality Healthcare in Namibia

Dear Sir/Madam,

My name is Sinte C Mutelo, I am currently conducting research for master of Informatics degree on Health Information System Adoption - a Roadmap for Quality Health in Namibia. I will appreciate your help by answering these interview questions honestly. I want to assure you that information provided by you will be kept confidential and will be used for the purpose of this research alone. Thank you in advance for the contribution to this research.

The objective of this research is: To develop a health information system adoption roadmap to enable quality healthcare in Namibia.

Permission to conduct the study has been granted by Ministry of Health and Social Services.

Further information, if needed can be obtained using the following contact details;
email: smutelo@nust.na / sinte.mutelo79@gmail.com
Tel: +264 61 207 2648
cell: +264 81 374 8822

What level of technology roadmap understanding do you possess? choose from below level 3 highest and 0 lowest.

Multiple choice

- level 3
- level 2
- level 1
- level 0
- Other...
- Add option

Which category of roadmap can be developed for Health Information systems Adoption to enhance quality health care.

- industry roadmap
- research roadmap
- product-technology roadmap
- technology roadmap
- project roadmap

Do you think the Ministry of Health and Social Services need a Roadmap?

- Yes
- No
- Maybe
- Other...

Roadmapping brings a framework to assist in planning and coordinating developments of an organisation at any level. Do you agree with this statement?

Who should be involved in developing the roadmap for Health Information systems in health sector?

- policy makers
- Health Information systems users
- HIS software developer
- The entire Ministry head of directorates
- Practitioners
- all of the above
- other specify.....

In your opinion, what is the link/relationship between an effective HIS roadmap and Quality Health

Long answer text

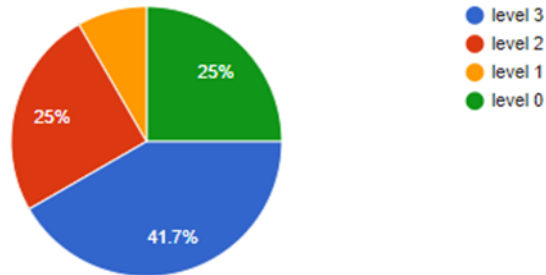
What technologies are used to enhance quality health to sustain the implemented HIS in health sector

- The internet has become a main source of medical information
 - Healthcare facilities are reaching patients using social media
 - Nurses and doctors use hand-held computers to record a patient's medical history and check that they are administ...
-

APPENDIX D RESPONSE FROM QUESTIONNAIRE

What level of technology roadmap understanding do you possess? choose from below level 3 highest and 0 lowest.

12 responses



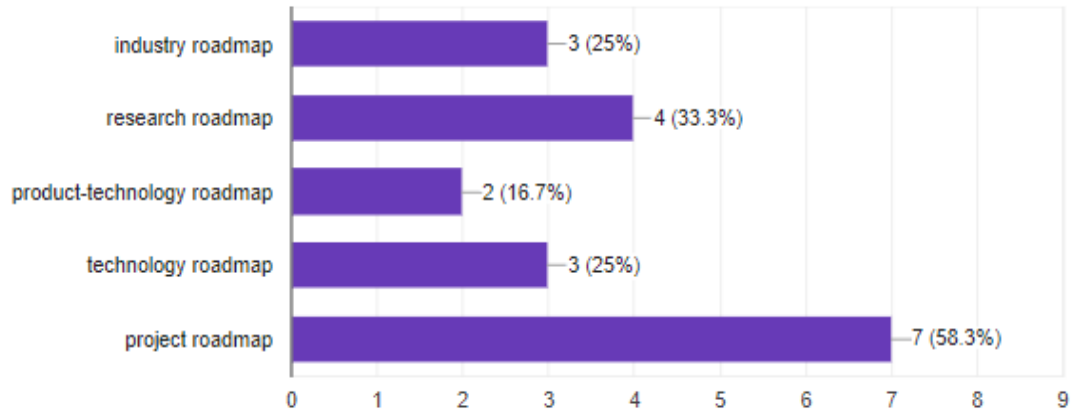
Which category of roadmap can be developed for Health Information systems Adoption to enhance quality health care.

12 responses



Which category of roadmap can be developed for Health Information systems Adoption to enhance quality health care.

12 responses



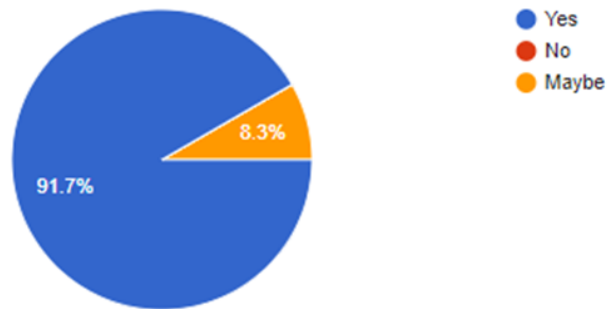
Do you think the Ministry of Health and Social Services need a Roadmap?

12 responses



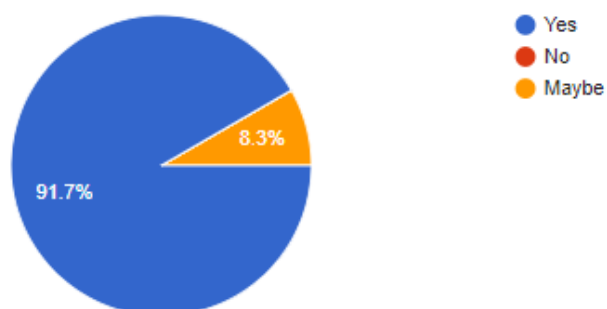
Do you think the Ministry of Health and Social Services need a Roadmap?

12 responses



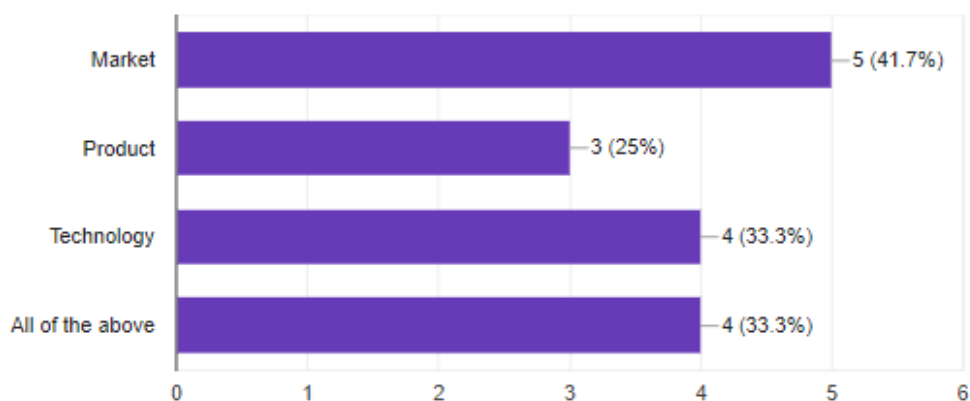
Roadmapping brings a framework to assist in planning and coordinating developments of an organisation at any level. Do you agree with this statement?

12 responses



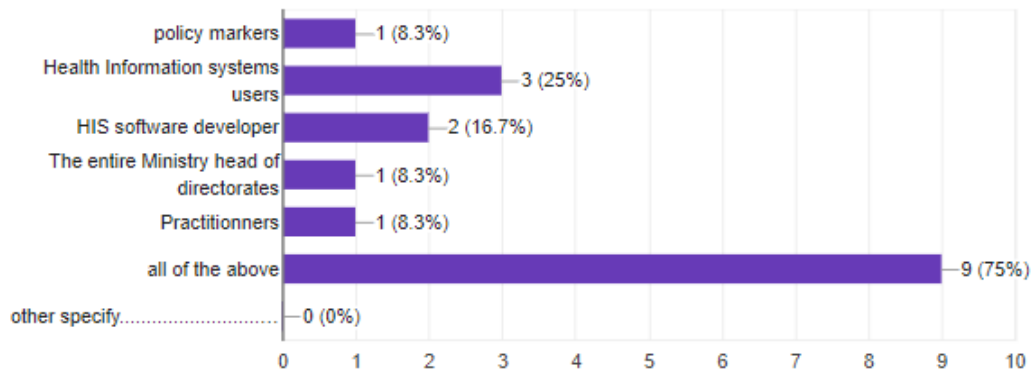
What are the key elements to consider when developing a roadmap?

12 responses



Who should be involved in developing the roadmap for Health Information systems in health sector?

12 responses



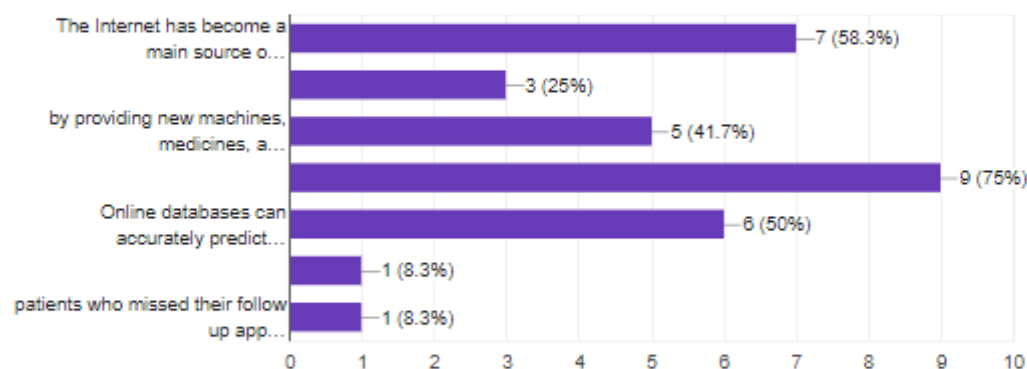
In your opinion, what is the link/relationship between an effective HIS roadmap and Quality Health

11 responses

- HIS road map must address challenges in the delivery of quality health services as outlined in various MoHSS policies and strategic documents
- A good HIS roadmap facilitates HIS technology adoption and use; which in turn contributes to the provision of quality health care
- roadmap ensure/guides the implementation of quality healthcare
- I have no idea what HIS roadmap is all about.
- Is almost the same concept
- the HIS roadmap comprises of the implementation of technology that can enhance quality health
- An effective HIS roadmap can contribute to improved health outcomes for patients
- Roadmap allows regular monitoring and evaluation thus spontaneously ensuring data quality is checked for timeliness and completeness
- I think there needs to be a deep understanding of what problems really do exist in Namibia's health care system that cause inefficiencies and poor service. It is easy to create software that sounds good, but doesn't solve a real problem because the people designing it didn't really fully understand the real problems.

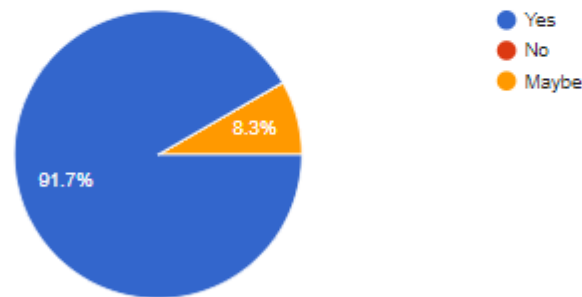
What technologies are used to enhance quality health to sustain the implemented HIS in health sector

12 responses



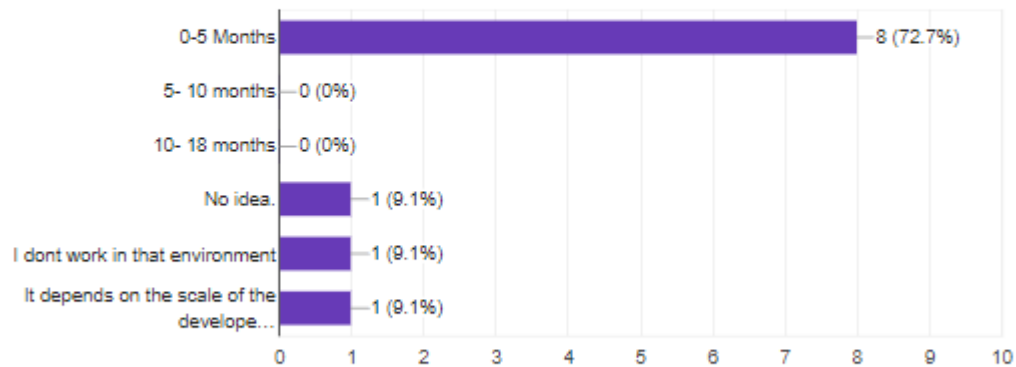
As implementers or researchers or developers of informations systems in health do you train users of these systems or do you think training is important?

12 responses



How long is the training or How how should the train be?

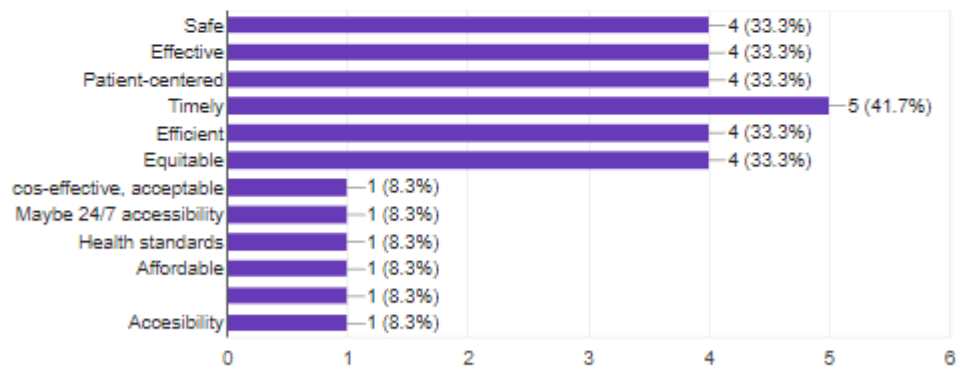
11 responses



0 1 2 3 4 5 6 7 8 9 10

Apart from the six domains of quality health by the Institute of Medicine (IOM) below, What other aspects to consider in determining quality health

12 responses



In your opinion what is the status of HIS in healthcare in Namibia MoHSS.

12 responses

- It is still at its infancy stage, with a chance to grow
- It has been low and poorly resourced. However, the establishment of the new HRID directorate offers new hope
- un-integrated systems
- Health care in Namibia seems satisfactory to me yet there's more to be improved and technology can be a greatest enabler for more. . .
- The health information systems in Namibia are not interoperable
- Poor to Average depending where the patients are allocated. we still experience baby deaths due to healthcare negligence
- In a scale of 3 to 0, where 3 is highest I would say level 2
- Available at district, regional and national level.
- Expansion envisaged to the health facility level (health centres and clinics) and later at community health worker level (use of hand held devices)
- It seems as if there are some backend systems being used, but they are being used inefficiently and not taking in as much data as should be possible. Also, it seems that there are no health informatics systems to enter

APPENDIX E: INTERVIEW FOLLOW-UP QUESTION

The screenshot shows the Outlook interface for the user smutelo@nust.na. The main window displays an email from Emmy-Else Ndevaetela (Emmy-Else.Ndevaetela@mhss.gov.na) dated Tuesday, October 2, 2018, at 9:34 AM. The subject is "Re: Research follow-up Question and Document Request".

The email body contains the following text:

Good morning

I have attached the HIS assessment report for your perusal. After the assessment, an HIS Technical Working Group (TWG) was established to guide the integration of the systems in the ministry. It is responsible to develop guiding documents to foster that process. DHIS2 introduction is one of the integration efforts that the Ministry has embarked upon.

The strategic plan is still not done as the TWG was an "recess" for some months due to lack of chairman after the former char retired. It had revived but I can not tell when is likely that the strategic plan will be done as there are many new members now.

Thank you.

Emmy-Else Ndevaetela, MPH, RN
 Epidemiology Division
 Health Information and Research Directorate
 Ministry of Health and Social Services

The email interface includes a left-hand navigation pane with folders like Inbox (19), Drafts (11), and Deleted Items (184). The top ribbon shows various actions like Reply, Forward, and Delete. A search bar at the top contains the text "emmy". The bottom status bar indicates "ITEMS: 15" and "CONNECTED TO: MICROSOFT EXCHANGE". The system tray at the bottom right shows the time as 11:40 on 12/12/2018.

APPENDIX F: HIS ASSESSMENT REPORT

**ASSESSMENT OF NATIONAL
HEALTH INFORMATION SYSTEMS**

**MINISTRY OF HEALTH AND SOCIAL SERVICES
(MOHSS), REPUBLIC OF NAMIBIA**

MAY 2012

This publication was produced for review by the Namibia MOHSS HIS Technical Working Group (TWG) technical and financial support from United States Agency for International Development. It was prepared by Tariqul Khan and Duncan Edwards through the Global

APPENDIX G: PERMISSION TO COLLECT DATA



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18 August 2017

Office of the Permanent Secretary
Ministry of Health and Social Services
Private Bag 13198
Windhoek

SUBJECT: PERMISSION TO COLLECT RESEARCH DATA, MRS SINTE MUTELO, STUDENT NUMBER 200962076

Dear Sir/Madam

This letter serves as a formal introduction of a Masters student, Mrs Sinte C. Mutelo. Mrs Mutelo is a registered Postgraduate student in the Department of Informatics, Faculty of Computing and Informatics. She is working on a study titled "Development of Health Information System adoption - a Roadmap for quality healthcare in Namibia".

On behalf of Ms. Mutelo, I hereby request your permission to engage with your organisation as a case in her study. If granted permission, interviews will be conducted with some of the MoHSS employees. Questionnaires will be distributed to some members of the MoHSS, and focus group meeting conducted. The table outlining outlines the targeted Directorates, sample size (n) and data collection methods.

Directorate	Sample size (n)	Method
Directorate of Policy and Planning	n=50	Questionnaire and focus group
Health Information and Research Directorate	n=10	Interviews
Primary Health Care Directorate.	n=10	Interviews

Collected data will be treated confidential and applicable only for this research purposes. Identity of interviewees will be kept anonymous throughout the interviews process. The names of the organisation will be presented with a pseudonym in publications.

Your assistance in this regards will be highly appreciated.

Should you need more information, please do not hesitate to contact the undersigned.

Yours Sincerely

Dr N Robert Jere
Research Supervisor
HOD – Department of Informatics
Tel: 207 2746 Email: njere@nust.na

APPENDIX H: MOHSS PERMISSION GRANTED LETTER



REPUBLIC OF NAMIBIA

Ministry of Health and Social Services

Private Bag 13198
Windhoek
Namibia

Ministerial Building
Harvey Street
Windhoek

Tel: 061 – 2032150
Fax: 061 – 222558
Email: shimenghipange@wa71@gmail.com

OFFICE OF THE PERMANENT SECRETARY

Ref: 17/3/3 SM
Enquiries: Mr. J. Nghipangulwa

Date: 14 November 2017


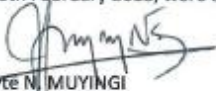

Ms. Sinte C. Mutelo
Namibia University of Science and Technology
Windhoek
Namibia

Dear Ms. Mutelo

Re: Development of Health Information System adoption Roadmap for quality Healthcare in Namibia

1. Reference is made to your application to conduct the above-mentioned study.
2. The proposal has been evaluated and found to have merit.
3. Kindly be informed that permission to conduct the study has been granted under the following conditions:
 - 3.1 The data to be collected must only be used for academic purposes;
 - 3.2 No other data should be collected other than the data stated in the proposal;
 - 3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects' should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;
 - 3.4 A quarterly report to be submitted to the Ministry's Research Unit;
 - 3.5 Preliminary findings to be submitted upon completion of the study;

APPENDIX I: ETHICS CLEARANCE CERTIFICATE

 <p>NAMIBIA UNIVERSITY OF SCIENCE AND TECHNOLOGY</p>	<p>FACULTY RESEARCH ETHICS COMMITTEE (F-REC) DECISION/FEEDBACK ON RESEARCH PROPOSAL</p>
<p>Dear Mrs: Sinte MUTELO</p>	
<p>Research Topic: <u>DEVELOPMENT OF HEALTH INFORMATION SYSTEM ADOPTION ROADMAP FOR QUALITY HEALTHCARE IN NAMIBIA</u></p>	
<p>Supervisor (if applicable): <u>Dr Nobert JERE</u></p>	
<p>Qualification registered for (if applicable): <u>Master of Informatics</u></p>	
<p><u>(Reference number of application: FACULTY RESEARCH ETHICS COMMITTEE REGISTRATION NUMBER: 09/2018)</u></p>	
<p><u>Re: Ethical screening application No: F-REC-09/2018</u></p>	
<p>The Faculty of Computing and Informatics (FCI) Ethics Screening Committee of the Namibia University of Science and Technology reviewed your application for the above-mentioned research. The research as set out in the application has been:</p>	
<p>Approved <input checked="" type="checkbox"/></p>	
<p>We would like to point out that you, as researcher, are obliged to maintain the ethical integrity of your research, adhere to the ethical guidelines of NUST, and remain within the scope of your research proposal and supporting evidence as submitted to the F-REC. Should any aspect of your research change from the information as presented to the F-REC, which could have an effect on the possibility of harm to any research subject, you are under the obligation to report it immediately to your supervisor or F-REC as applicable in writing. Should there be any uncertainty in this regard, you have to consult with the F-REC.</p>	
<p>We wish you success with your research, and trust that it will make a positive contribution to the quest for knowledge at NUST.</p>	
<p>Recommendation: The application is approved: Recommendations of FCI/F-REC, communicated to you on the 20th February 2018, were addressed to the satisfaction of the Chairperson.</p>	
<p>Sincerely,  Prof. Hippolyte MUYINGI Chair: Faculty Ethics Screening Committee</p>	 <p>NAMIBIA UNIVERSITY OF SCIENCE AND TECHNOLOGY</p> <p>PSag 13300 Windhoek NAMIBIA</p> <p>2018 -02- 23</p>

APPENDIX J: TURN IT IN REPORT

