Analysis on Data Governance Policy in the Health Sector of Zambia: Perspective of Big Data

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Abstract: The study explored the data governance policy in Zambia's health sector, focusing on big data. To fully realize the potential of data in our digital age, proper data governance is required. However, questions have been expressed concerning Zambia's health sector's ability to exploit data as a valuable resource due to the state of data governance. This study attempts to address this critical issue and shed light on the functions of big data governance aspects in the health sector. This work is significant because it has the potential to improve healthcare service quality, decision-making, and resource allocation through strong data governance. This study aims to bridge the gap between data governance and the requirements of big data in the Zambian health sector by reviewing existing policies, procedures, and practices. A mixed methods approach is used in the research, involving qualitative interviews with key informants and secondary data analysis. To get a full understanding of data governance difficulties, practices, and their alignment with big data demands, thematic and content analysis methodologies were used. The findings show that data governance is critical to managing data in the health sector, yet gaps in governance procedures impede the efficient implementation of ICT efforts. These concerns are exacerbated by challenges relating to competent human resources and ICT infrastructure. Accountability and transparency are also identified as areas for improvement. While this study offers insight on the existing state of affairs, it recognizes its limits and advocates for further research to investigate specific aspects of policy implementation. Nonetheless, this study contributes significantly to the field of big data and data governance in the Zambian health sector, encouraging stakeholders to work for an ICT driven, data-governed future that promotes openness, accountability, and improved healthcare results. Finally, this article emphasizes the importance of improving data governance procedures in Zambia's health sector, as well as the transformative potential of big data in healthcare as a catalyst for good change in the country's healthcare environment.

Keywords: Data Governance, Big Data, Information and Communication Technology, Health, Policy

Introduction

In our rapidly evolving digital age, Data collection and transmission have reached unparalleled levels. In comparison to the information era of just a few decades ago, data expansion now approaches geometric progression rather than arithmetic progression (Sen, Ozturk, & Vayvay, 2016). This data explosion includes a plethora of formats structured, unstructured, and semi-structured that are sourced from multiple channels on a daily basis. A 2011 analysis by Gantz and Reinsel emphasized the rapid increase in worldwide information generation, which reached 1.8 zettabytes (ZB) in 2011, with a 50fold increase expected in 2020 (Gantz & Reinsel, 2011).

With this backdrop, concepts such as data governance, big data, the information age, information systems, and e-government have emerged as key issues in this data-rich society. Data governance, which is inextricably linked to information governance, is critical in regulating the use of this massive information resource. Big data, on the other hand, refers to the collection of structured, unstructured, and semi-structured data in vast quantities, which is then analyzed and disseminated to interested parties (Sen et al., 2016).

As a cornerstone of modern society, information plays an important role in both the public and private sectors, supporting personal growth, competitive advantage in business, and governmental transparency and accountability (American Library Association, 2006; Davenport, 2006; Davis, 2014; Tyagi, 2003). Different governments use different tactics and rules to regulate the lifespan of information, which is known as data governance a critical

characteristic that Zambia shares.

Further, Walker defines public policy analysis as a systematic strategy for making informed decisions by considering the pros and drawbacks of various programs (Walker, 2000). The General Data Protection Regulation (GDPR) of the European Union shows how institutions should handle data in order to protect privacy and empower data stakeholders (European Union, 2015). The National Archives Act of 1994 in Zambia stresses the administration and regulation of public data, touching on privacy, public value, and the use of technology (Government of Zambia, 1994).

However, this legislation is vague when it comes to technical advances in data collection, processing, and storage, leaving policies, procedures, and laws unexplained (Secchi, 2018). In this sense, governance refers to the measures done by institutions to efficiently and effectively manage resources in order to fulfil organizational goals.

According to Dyche and Levy (2007), data governance entails managing data availability, usability, integrity, dependability, and security inside an organization, which necessitates a governing body, established procedures, and an execution plan. Another important term related to data governance is information systems (IS), which includes people, data records, and activities that process data and information within businesses (Paul, 2009).

The growth of social networking and media platforms, such as Facebook, Twitter, and public blogs, has boosted data volume tremendously, with each interaction producing structured, unstructured, or semi-structured data points (Kelly, 2014). The term "big data" became popular around the world in 2011, with an emphasis on insights to reduce storage space and maintenance expenses (Gandomi & Haider, 2015). According to Gartner (2013), big data is defined as "high volume, velocity, and variety of data resources that require innovative processing for enhanced decision-making" (Gartner, 2013). This concept stresses three major components: diversity, velocity, and volume, which are critical for comprehending the relevance of big data (Laney, 2001).

The rise of mobile phones, particularly smartphones and tablets, has added to data growth, causing issues in data access, usage permissions, and effective processing (Kelly, 2014; Moro, Rita, & Vala, 2016). To maximize the value of data, it must remain relevant, emphasizing the interaction between big data and data governance. Data governance, through its policies, underlies decision-making at multiple levels inside institutions, solving the difficulties of information overload encountered by governmental organizations (Guetat & Dakhli, 2015; Fan & Bifet, 2013). Martin (2016) defines information governance as decision rights and accountability structures that regulate the lifespan of information, from creation and storage to retrieval and review.

The digital revolution has exacerbated problems with information quality, public value, privacy, and security (Oakleaf, 2009). Information assets, like human resources, require strategic governance plans in governmental organizations (Nelson, 2017). Data collection in health institutions is accelerating to fulfil stakeholder expectations, outpacing human capability for traditional processing. The relationship between data governance and information distribution is highlighted by e-government, which is described as government involvement with stakeholders through information and communication technology (Government of Zambia, 2006).

Therefore, this study is a thorough examination of data governance rules, issues, and practices in the Zambian health sector, with a particular emphasis on their compatibility with big data demands. It will investigate how the current framework may be modified to fully realize the potential of big data for improved healthcare outcomes.

Statement of the Problem

The lack of appropriate data governance policies and practices poses a serious barrier in Zambia's health industry. This deficiency limits the government's capacity to capitalize on data's potential as a valued resource, hampering informed decision-making and service development. The study's goal is to research and analyze the present data governance structure in Lusaka, Zambia's health sector, with an emphasis on its implications and effectiveness in the age of big data Nelson (2017). The existing level of data governance in Lusaka, Zambia, raises questions about the city's ability to fully utilize data's potential.

The significance of this issue cannot be emphasized. Data governance is critical in the healthcare sector because it has a direct impact on the quality of healthcare services and decision-making. Understanding data governance policies, problems, procedures, and practices is critical for leveraging the benefits of big data in healthcare. Without a strong data governance strategy in place, Zambia's healthcare industry may miss out on potential for better patient care, resource allocation, and epidemiological insights. To fully realize the benefits of big data, it is necessary to understand the complexities of data governance rules, issues, procedures, and practices in the healthcare industry (Banda, Mwape, & Mwansa, 2019).

Previous study in the Zambian health sector established the groundwork for comprehending data governance and its issues. However, a full investigation of how the existing data governance structure interacts with the needs and opportunities given by big data remains a research deficit. While previous research has recognized concerns, it has not delved fully into the relationship between data governance and big data, creating a crucial knowledge vacuum in the literature. Despite the useful insights provided by previous research, there is a void in the literature regarding the integration of data governance and big data requirements in the Zambian health sector (Phiri & Tembo, 2021).

Our understanding of data governance in the Zambian health sector has been aided by a number of research. The studies "Big data and data governance in the Zambian health sector: A review of the literature" by Mwape and Banda (2023), "Data governance challenges and opportunities in the Zambian health sector: A case study" by Zulu and Chileshe (2022), "Data governance for big data in the Zambian health sector: are notable ones.

This study will fill current gaps by undertaking a thorough examination of data governance rules, issues, and practices in the Zambian health sector, with a particular emphasis on their compatibility with big data demands. It will investigate how the current framework may be modified to fully realize the potential of big data for improved healthcare outcomes. This study intends to provide actionable recommendations to promote data governance in the Zambian health sector and uncover the potential of big data by integrating findings from prior studies and incorporating modern viewpoints. Building on prior research, this project will provide practical recommendations for improving data governance in the Zambian health sector, bridging the gap between data governance and big data requirements (Chiluba & Mweene, 2020).

Research Objectives and Research Guiding Questions

Research Objectives

1. To find out the status of Zambia's data governance policy in the health sector
2. To find out the role of major elements of big data governance in the health sector
3. To suggest recommendations on improving the use of technology in data governance policy of the health sector of Zambia

Research Guiding Questions

Based on the objectives of the study the following research questions are formulated;

1. What is the status of Zambia's data governance policy in the health sector?
2. What are the major roles of elements of big data governance in the health sector?

Conceptual Framework

The conceptual framework tries to explain the study further. Therefore, the researchers looked at the various factors and how they affect data governance, and how they contribute to the perspective of big data. It becomes easy to comprehend and describe the efficiency and effectiveness of current practices towards the research problem. Based on a review of theories and models, and the use of the institutional approach the framework was formulated and depicted the relationship that exists among these variables. The researcher tried to understand how these components individually contribute to data governance by evaluating the current practices.

Figure 1-1 Conceptual Framework
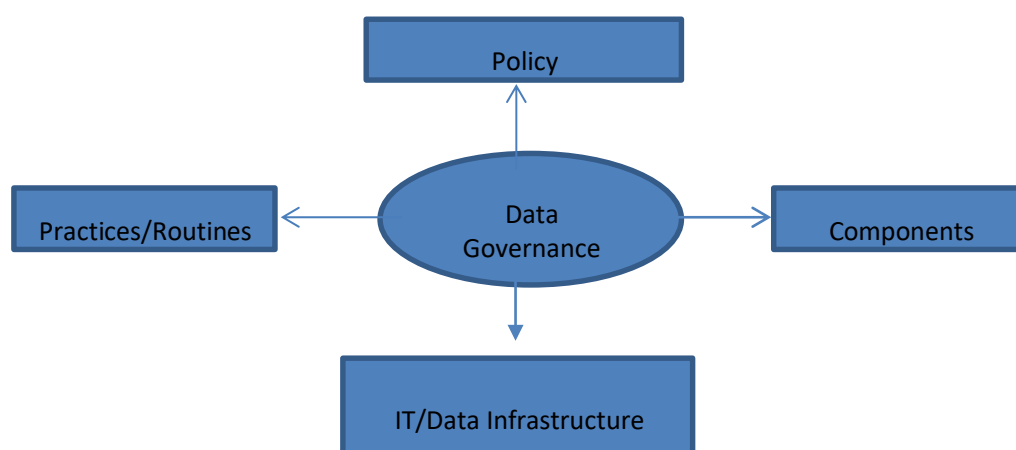
Literature Review

Review on Data Governance Policy in The Health Sector from A Global, Southern African Region, and Zambian Perspective

Big Data and Health Governance: A Review of the Ethical and Legal Challenges by Michael J. Dunn (2021) makes an important contribution from a global viewpoint by giving a comprehensive study of ethical and legal challenges linked to big data in the health sector globally. However, there is a gap in the study because it focuses on worldwide issues and may not effectively address the specific challenges faced by Zambia. Nonetheless, this research can be used as a significant reference point for policy formation in Zambia, providing insights into the broader issues of big data governance.

Transitioning to a global health governance framework, the World Health Organization's (2018) Data Governance for Global Health: A Framework for Action provides a collection of principles and guidelines for global data governance in health. This framework's methodology is the result of a collaborative effort involving professionals and stakeholders. Nonetheless, it presents a global viewpoint that may not completely understand Zambia's unique difficulties. Nevertheless, by applying global concepts to local situations, it can serve as a model for building Zambia's data governance policy.

The Global Health Council's (2015) report Big Data and Global Health: Challenges and Opportunities examines the issues and opportunities associated with big data in global health. This report's methodology includes interviews, questionnaires, and data analysis. However, because of its broad breadth, it may not solve specific Zambian difficulties. On the other hand, it gives a broader context for comprehending the potential benefits and challenges of big data governance as they relate to Zambia's health sector.

Moving to the Southern African region, Christopher J. Colvin's (2020) Data Governance for Health Research in Southern Africa: A Review of the Ethical and Legal Challenges examines the ethical and legal challenges in health research data governance in Southern Africa. While this study focuses on the Southern African region as a whole, it may not address Zambia-specific issues. Nonetheless, it can provide insights into regional concerns and solutions that Zambia might tailor to its specific circumstances.

Continuing with the regional viewpoint, the Southern African Development Community (SADC) Region's "Data Governance for Public Health in the Southern African Development Community (SADC) Region" (2019) provides a policy framework that leads SADC member states in data governance for public health. This regional framework, developed collectively by SADC member states and experts, may not address Zambia's specific circumstances. Nonetheless, Zambia can adopt this framework as a starting point while tailoring it to its own health-care needs.

Lesego M. Maruatona's (2018) study "Big Data and Health Governance in Botswana: Challenges and Opportunities" focuses on big data difficulties and potential in Botswana's health industry. Case studies and a review of local data governance procedures are part of the process. While the healthcare ecosystems in Zambia and Botswana differ, this research can provide significant insights for Zambia by drawing on Botswana's experiences and adapting suitable solutions.

Finally, from a Zambian perspective, Chibeza G. Mwila's (2022) "Data Governance for Health Research in Zambia: A Review of the Ethical and Legal Challenges" examines the ethical and legal challenges related to Zambia's health research data governance. Although this paper provides a Zambian perspective, it is not exhaustive.

In addition, Big Data and Health Governance in Zambia: Challenges and Opportunities by Mwaka S. Chileshe (2020) investigates the challenges and potential of big data in Zambia's health industry to acquire a thorough knowledge. While it gives context for Zambia, it may not go further into policy concerns.

Requirements of Big Data Governance from the Public Management Perspective, Effects and Risks Soares (2011) addresses the emergence of big data and how it is classified according to volume, velocity, and diversity. Soares underlines the importance of incorporating big data into existing data governance frameworks. However, there is a gap in addressing the unique requirements and threats connected with big data governance in the health sector, which this study seeks to solve.

Further, Ejedafiru (2010) emphasizes the importance of ICT infrastructure in information systems but recognises accessibility and affordability limits, particularly in developing countries. Ineffective policies, insufficient tools, and a lack of competent individuals are identified as barriers to ICT adoption in the research, which is pertinent to the broader context of data governance. The purpose of this research is to address the need to modify ICT infrastructure for efficient data governance in healthcare.

Mayer, Figueredo, Kelly, and Green (2008), as well as Williams, Mayer, and Minges (2011), analyze the condition of internet connectivity in Sub-Saharan Africa, focusing on limited access and high costs (Mayer, Figueredo, Kelly, & Green, 2008; Williams, Mayer, & Minges, 2011). The report emphasizes the difficulties associated with broadband internet affordability, which affects data processing and analytical capabilities. The study identified a lack of appropriate ICT infrastructure as a danger to data governance, which is consistent with the larger subject of data governance in healthcare.

According to Tusubira and Mulira (2004), computer access and upkeep are difficulties in underdeveloped countries. This study focuses on the difficulty of sustaining technology for data governance objectives. This challenge is risky for those who are deploying big data solutions. Addressing ICT access and maintenance challenges is critical for effective data governance in healthcare. The cost of hardware and software, according to Agbetuyi and Oluwatayo (2012), is an impediment to integrating ICT in enterprises. They imply that many firms struggle to manage the massive amounts of data they face. This discovery emphasizes the necessity of cost-effective data governance systems, which this study will investigate further.

Laaria Mingaine's (2013) research in Kenya indicates problems faced by public schools in integrating ICTs, such as financial limits, inadequate infrastructure, and unfavorable attitudes. These difficulties match those encountered when implementing data governance measures, underscoring the importance of a complete approach to ICT and data governance in healthcare. Rossi and Hirama (2015) explore big data management from three perspectives: technology, people, and processes, emphasizing the importance of trained human resources. They also emphasize the importance of big data in a variety of industries, including health. This study will go more into the function of competent employees in healthcare data governance.

Ballard et al. (2014) emphasize the necessity of information governance in handling big data, including data security and privacy. They argue that data governance is vital for successfully categorizing and exploiting data. This bolsters the case for strong data governance policies in healthcare. In Zambia, the national health strategy strives to increase equitable access to healthcare services (Government of Zambia, 2011). The policy acknowledges the need of data governance in attaining these objectives. This study will look at how data

governance is being implemented in Zambia's health policy.

Zambia's e-health strategy plan aims to use ICT to improve healthcare (MOH, 2017). This is consistent with the broader debate about ICT infrastructure and data control in healthcare. This study will look into the connection of the e-health strategy with current data governance procedures. Zambia's Seventh National Development Plan highlights the importance of equitable access to high-quality healthcare (Government of Zambia, 2017). However, infrastructure and personnel challenges are highlighted. This study will look into how data governance can help to address these issues and achieve healthcare goals.

In summary, the studied literature emphasizes the significance of data governance in the context of big data and healthcare ICT infrastructure. These research papers provide insights on data governance, ICT adoption issues, the role of governance in healthcare, and the possibility for using data in policymaking. Additionally, they examine the role of policies and big data in Zambian public healthcare. They emphasize the need of health-related policies with particular goals and initiatives. Big data is viewed as a tool for improving healthcare through improving data interchange and services via ICTs. Governance is emphasized as a critical aspect influencing economic, political, and institutional dimensions. Zambian health policy strives for equitable access to healthcare. The Result-Based Financing (RBF) initiative and Health Management Information Systems (HMIS) are both ways to improve healthcare data management in the evaluation. The government's e-health policy is highlighted, as well as the necessity for infrastructure development. The potential for progress in the sector is recognized, and data processing is viewed as critical for guiding health practitioners.

However, there is a gap in understanding the specific state of Zambia's data governance policy in the health sector, which this research seeks to fill. This research will give a detailed analysis of Zambia's present data governance policy in the health sector, as well as throw light on the major features and responsibilities of big data governance in healthcare in Zambia, contributing to the existing body of knowledge in this field.

Theoretical Framework

The research was underpinned on the diffusion of innovation theory by Rogers and focused on two sub-theories which are; the Theory of Perceived Attributes and Theory of Innovation Adoption Decision Process. The theory attempts to explain how and period that an idea or product takes to spread across a specific area or over its intended population.

Theory of Innovation Adoption Decision Process

The focus point of this theory is that people should be able to adopt new ideas, behavior or product. The primary emphasis under adoption is that the individual under this institution must be able to perceive the idea or behavior as something new or innovative thereby making diffusion possible. It is of significant value to note the adoption process evolves in such a way that certain people or groups of people are more apt to adopt innovation as compared to others. According to Rogers (2003) diffusion is considered the process in which innovation is communicated to various participants over time within a social system. Rogers further, proposals a five-step process to decisionmaking, which occurs through various communication channels that are carried out over a period among different people but are of a similar social system. A social system is defined as a combination of external influences and internal influences that are carried to the potential adopter (Stang, Soule, Sarah 1998). Rogers five steps in the decision innovation process include; knowledge, persuasion, decision, implementation and confirmation.

Knowledge, in this case, refers to an individual under an organization being exposed to the innovation but lacks the knowledge and skill for effective innovation adoption. At this point in time, there is little or no inspiration to seek more information. Persuasion, on the other hand, is the individual actively interested in the innovation by means of seeking for information such as linking the innovation, discussing the innovation with others all of which lead to the formation of a particular image about the innovation. The decision is when the individual takes up the concept by understanding the pros and cons of using the innovation before choosing between either accepting or rejecting the innovation. Implementation, the people or individual puts the innovation to work at a varying degree which is susceptible or dependent on the situation. This is a period where the individual can tell

how useful the innovation might be and further finds out more about the innovation. And lastly confirmation, the final decision is made whether the innovation can be fully adopted or not Roger (2003).

Theory of Perceived Attributes

The theory focuses on members of the organization, and the perceptions they have towards innovation. In their eyes, they can only adopt an innovation if it has specific attributes and thus Rogers (2003) identified five (5) attributes of innovation. These are; relative advantage, compatibility, complexity, trialability and observability. The first which is relative advantage is defined by Rogers (2003) as the extent an innovation is looked at as being better, efficient and effective in comparison to the idea it supersedes. Compatibility of the innovation looks at the similarity of ideas that exist with the existing values and potential values of the organization. Complexity refers to how organizations or individuals perceive innovation as challenging to understand and use. Trialability of innovation adoption refers to the number of times an innovation can be experimented on while being considered for adoption; thus it is positively related to higher chances of innovation adoption based on a number of times innovation is tested. and lastly, observability reflects the results of the innovation.

Theory Adoption in Zambian Context

The theoretical approach used in this research on data governance policy in Zambia's health sector, focused on the perspective of big data, is based on Rogers' diffusion of innovation theory. Within this framework, the research integrates two essential sub-theories: The Theory of Perceived Attributes and the Theory of Innovation Adoption Decision Process.

The Theory of Innovation Adoption Decision Process, as used in this study, provides useful insights into how Zambians perceive and adopt new ideas or innovations connected to data governance legislation. For example, when examining Zambia's data governance policy in the health sector (Research Question 1), this theory aids in comprehending the decision-making process that individuals go through when exposed to data governance innovations. Rogers' fivestep process, which comprises knowledge, persuasion, choice, implementation, and confirmation, serves as a systematic framework for investigating how stakeholders in the health sector interact with data governance policies. Researchers can look into whether individuals in the sector initially lack awareness about these policies (knowledge stage) and then advance through the subsequent stages, eventually leading to a decision to embrace novel data governance procedures. The study will use this theory to identify barriers and facilitators in the adoption process and make recommendations to improve policy dissemination and implementation.

Furthermore, the Theory of Perceived Attributes is critical for answering Research Question 2, which seeks to identify the key functions of elements of big data governance in the health industry. This theory, which highlights the significance of perceived features of innovations including relative advantage and compatibility, aids in determining how healthcare professionals and companies perceive big data governance methods. For example, while investigating the relative advantage of big data governance in the health sector, researchers will look into whether stakeholders believe these practices are more efficient and successful than traditional techniques.

Additionally, the study will measure how well these practices connect with the current healthcare landscape in Zambia by examining the compatibility of big data governance with existing values and ideals within the sector. The research can discover which traits are most influential in pushing the adoption of big data governance in the health sector by applying the Theory of Perceived traits, offering light on the critical roles of these features.

In summary, Rogers' diffusion of innovation theory, supplemented by the Theory of Perceived Attributes and the Theory of Innovation Adoption Decision Process, serves as a solid theoretical framework for this research, allowing for a systematic examination of the state of data governance policy in Zambia's health sector, as well as the major roles played by big data governance elements within this context, and providing valuable insights for policy improvement and implementation.

Methodology of the Study

Research Design

The study will take a mixed-methods approach, integrating qualitative and secondary data analysis to provide a comprehensive view of data governance in Zambia's health sector. Primary Information: In-depth insights was gathered through interviews with key informants inside Zambia's Ministry of Health. These interviews were used as primary data sources, providing for a more nuanced knowledge of the current state of data governance and its issues. Secondary Information: An detailed evaluation and analysis of secondary sources was done to supplement the original data. Reputable journals, official Ministry of Health websites and portals, and important policy papers such as the national health policy, national health strategic plan, and national development plans were among these sources.

Sampling Design

The sample survey method was employed. Snowball sampling was used to select respondents because not everyone understands big data governance. A total of 8 key Ministry of Health informants with more than five years of working experience were interviewed. The composition included policymakers, ICT experts, and Managers. Additionally, documents provided more of qualitative data which was purposively sampled to acquire data. This involved identifying relevant documents that have the information needed. The research made use of secondary data as the research was based on the analysis of formal documents.

Data Analysis

The interview data was interpreted using qualitative analysis, providing rich insights into the views and practices of data governance in the health industry. Furthermore, secondary data analysis assisted to contextualize the findings and draw relationships between the theoretical framework and real-world data governance policy implementation. Finally, this study method combines the strengths of qualitative data collecting, secondary data analysis, and a strong theoretical framework to investigate the state of data governance policy in Zambia's health sector via the lens of big data. This strategy ensures that the research issues are thoroughly explored and that a detailed understanding of the complex processes surrounding data governance in the health industry is gained.

Data Analysis Techniques

This research design provides a well-structured approach to investigating the status of data governance policy in Zambia's health sector from the perspective of big data. The following data analysis techniques were used. Thematic Analysis: This technique was used to analyze qualitative data gathered from key informant interviews. It involves identifying and analyzing themes, patterns, and trends in the interview transcripts. Content analysis was used for secondary data analysis to systematically review and code the content of documents such as policy documents, reports, and articles. This technique can assist in identifying essential topics, policy trends, and relevant data governance information in the health industry.

Findings

Status of Zambia's Policy on Data Governance in the Health Sector

Past Status and Contributions of Zambia's Policy

Zambia's policy on data governance in the health sector has been affected by a variety of variables, including legislative structures and governance practices. The Zambian government launched initiatives to improve the efficiency, equality, and effectiveness of the health sector in 1992. This entailed the establishment of sector-wide decentralized structures, functions, and roles. Zambia also adopted changes in socioeconomic development programs, engaging the private sector and implementing structural adjustment programs to increase resource mobilization, leadership, accountability, and collaboration at all levels. Lusaka, the capital city, has a big healthcare facility that deals with numerous illnesses (Ngulube et al (2004).
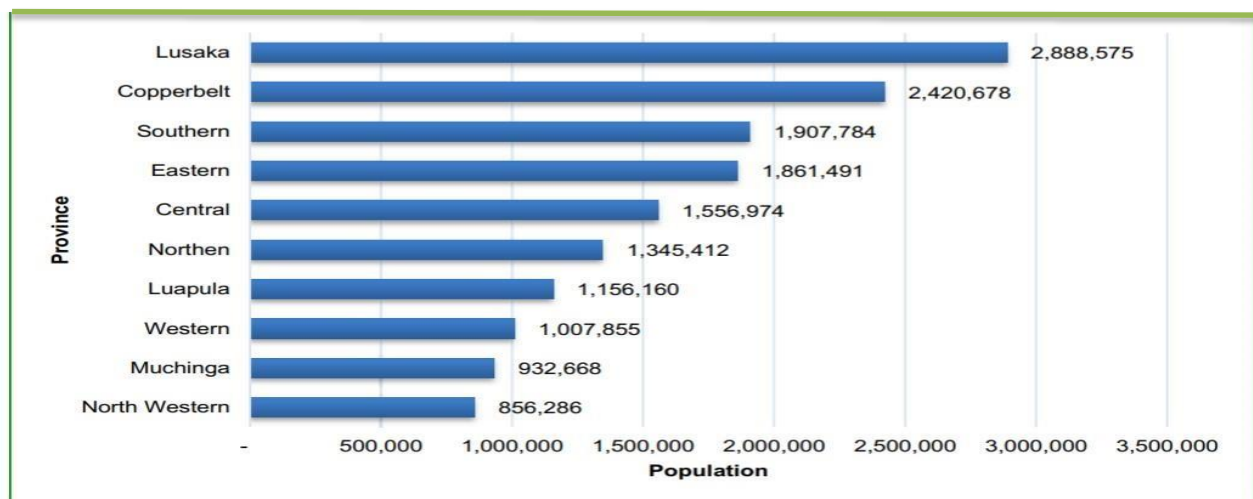
Figure 4-1 Population Distribution by Province, Zambia 2016

Figure 4-1 shows Population Distribution by Province, Zambia with Lusaka recording the highest (2888575) and North-western the Lowest (856288)

The following are the significant findings from Status Zambia's previous data governance strategy in the health sector.

a). Historical Efforts: The Zambian government has undertaken ongoing efforts to improve the health sector, focusing on equity, efficiency, and effectiveness. It developed decentralized legal frameworks, responsibilities, and functions for governance in 1992. Several steps and reforms have been implemented, including enlisting the private sector to improve resource mobilization, leadership, accountability, and collaborations.

b). Legal Framework for Data Governance: The Electronic Communications and Transactions Act (2009) governs data governance in Zambia. This act ensures the safe and effective use of electronic communications while protecting the interests of consumers and businesses. It imposes restrictions and penalties for handling sensitive data (Electronic Communications and Transactions Act, 2009).

c). Freedom of Expression and Privacy: The constitution of Zambia ensures freedom of expression and privacy. People have the right to receive information without interference, but this does not include infringing on the rights of others. The law is in place to protect secrecy while also protecting free expression. Zambian Constitution, 1996.

d). E-Health and Data Governance: The World Health Organization emphasizes the relevance of information and communication technology (ICT) in the health sector, highlighting the necessity for data governance mechanisms to oversee electronic transactions and data storage. (World Health Organization 2006).

e). Data Governance Issues: Despite the 5NDP's favourable accomplishments, there were difficulties in accessing information on donor monies inside government sectors. Aid estimates were not clearly recorded in budget documents, showing data governance flaws. (Government of Zambia, 2009)

f). The Need for Coordination and Information Sharing: The 5NDP emphasized the importance of coordinating activities and breaking down silos in order to achieve effective data governance. It emphasized the need of information sharing and the establishment of sector information systems that cross geographical and sectoral boundaries. (Government of Zambia, 2009)

g). Sixth National Development Plan (SNDP): From 2011 to 2015, the SNDP underlined the need for further policies and reforms in the health sector. It attempted to consolidate existing policies, create a national health Act, and improve healthcare services in accordance with the country's 2030 objective. Zambian Government, 2011.

h). SNDP successes: The SNDP achieved results in lowering maternal death rates and strengthening healthcare facilities. Maternal mortality fell from 591 per 100,000 live births to 398 per 100,000 live births. In addition, the government made strides in increasing healthcare facilities. Zambian Government (2011).

i). ICT and Health Investment: The SNDP prioritized investment in information and communication technologies (ICTs) and rural healthcare. The government's goals were to improve public service delivery, attain

the 2030 vision of being a middle-income country, and develop an information and knowledge society.

To summarize, via the implementation of different National Development Plans and laws, Zambia has made substantial efforts to improve data governance in its health sector. Although the country has witnessed great results in terms of healthcare facilities and service quality, difficulties remain in data governance and access to donor monies.

Current Status and Aims of Zambia's Policy

The following are the key findings on the current status and aims of Zambia's Policy:

a). Current Policy Status and Goals in Zambia: Zambia's current policy to accomplish its 2030 ambition is the Seventh National Development Plan (7NDP). It takes a "Primary Health Care Approach" to improve health-care systems and services. This technique consists of five important components:

- Enhancing public health initiatives with a focus on illness prevention; and increasing capacity to enhance access to quality healthcare by enhancing facilities, human resources, and medical supplies.
- Improving food security and nutrition to combat malnutrition.
- Encouraging private-sector involvement in healthcare delivery, particularly publicprivate partnerships.
- Increasing the speed with which human resources are recruited and retained. Infrastructure, human resources, leadership, governance, and health financing are key development sectors (Government of Zambia, 2017; MOH, 2017).
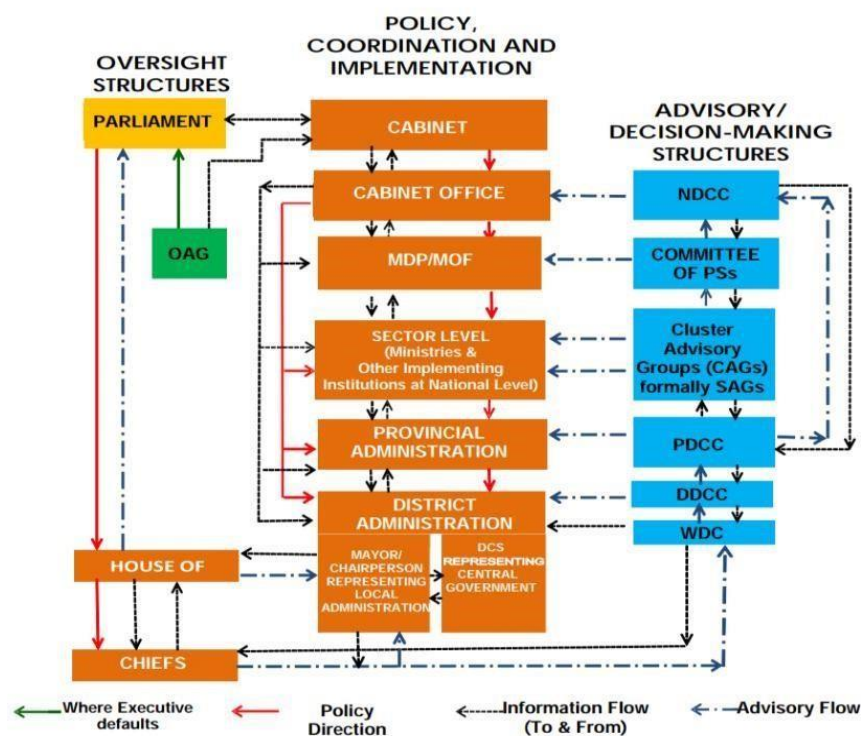

Figure 4-3 Overall Institutional Arrangements for Coordination

The graphic depicts the significance of coordination at various levels in attaining policy goals in Zambia. Coordination is essential for aligning vision with growth outcomes. National, Sectorial, Provincial, District, and Ward are the five levels of coordination. From contextualizing development benchmarks at the national level to local planning and evaluation at the Ward level, each level serves a distinct purpose. The goal of this decentralized strategy is to empower local communities and customize development to their specific requirements.

b). Coordination Institutional Arrangements: Coordination is critical to attaining policy objectives. Decentralization in Zambia is divided into five levels: national, sectorial, provincial, district, and ward. Each level has a distinct role to play in policy development and execution (Government of Zambia, 2017).

c). Health Services and Regulation: Proper health service delivery and regulation are critical for a population's well-being. Health-care regulation is vital to ensuring that standards are met and citizens are safeguarded. In Zambia, various institutions and statutory entities are in charge of regulating various elements of healthcare, such as environmental health, radiology, medicines, and so on (UNDP, 2011).

Figure 4-4 Situating the 7NDP in the Vision 2030

According to Figure 4-4, health services are regarded an important part of any race or nation's well-being because they may also be utilized to determine human growth. A country with a healthy population and prioritizes this sector is bound to have a productive workforce, so the globe has banded together to advocate for greater health care service delivery through a variety of channels. Universal health care promotes equal access to quality and basic services, which are recognized as essential to long-term human development. This industry is regarded as one of the most essential and faces possible hazards if not properly handled; therefore, it should be regulated in order to eliminate any concerns both within and outside the sector.

d). Data Governance in the Health Sector: Good governance is critical in managing health information because it involves aspects such as accountability, access to information, state capacity, and legitimacy in decision-making. The WHO acknowledges governance as an essential component for health systems. The government of Zambia aims to harmonize various health data initiatives, aligning with international and regional decisions to strengthen the health information system, improve access to health information, and improve access to health care. (Mutale et al., 2013; WHO and HMN, 2009).

e). Monitoring and Evaluation: To monitor and evaluate the performance of the health sector, Zambia's Ministry of Health use a variety of measures, including surveys and data gathering systems such as the Health Management Information System (HMIS) and the Financial Administration and Management System (FAMS). This approach includes Joint Annual Reviews (JAR), Mid-Term Reviews (MTR), and Final Evaluations (Government of Zambia, 2011).

f). Health Information Systems: Zambia has created a robust health information system that integrates both routine and non-routine data sources. HMIS, Integrated Disease Surveillance, Human Resource Information System, and other common sources are used. Population-based surveys and assessments are examples of non-routine sources (Government of Zambia, 2011).

g). Policy and Strategic Plans: Zambia's health policy documents are interconnected, with links among National Health Policy, National Health Strategic Plan, Governance and Management Capacity Strengthening Plan, Ministry of Health Action

Plan, and District Action Plan (Seventh National Development Plan). Ministry of Health (2011) emphasizes primary healthcare, equity, accountability, and performance in these papers.

h). The Role of Hospitals in Policy Implementation: Hospitals are critical in understanding, implementing, and assessing health policies. They directly deliver services in accordance with policy instructions and are impacted by the majority of MOH policies. Hospitals are critical to meeting policy objectives (Masiye, 2007).

i). E-Health plan: Zambia's e-health plan intends to provide better health services via the use of ICTs. It addresses issues such as fragmented health systems and a lack of infrastructure. Capacity building, mobile health, information systems, e-learning, telemedicine, and health education are among the topics addressed by the strategy (MOH, 2013; MOH, 2017).

j). Health Sector Reforms: To strengthen the health system, Zambia has implemented health sector reforms, addressing challenges such as high disease load and HIV/AIDS prevalence. To attain health goals and objectives, these reforms focus interventions, human resources, and supporting systems. Poor infrastructure, finance, manpower, and a high illness load are among the challenges (MOH, 2005; MOH, 2011).

k). National Health Strategic Plan (2017-2021): The plan seeks to reduce disease burden and align with Sustainable Development Goals by addressing challenges such as financial irregularities, governance issues, and regional inequities. The plan focuses on building resilient health systems and using a Primary Health Care approach (MOH, 2017).

Table 4-1 Links in the Policy and Strategic Plans Source: Seventh National Development Plan

Program Area	Links in the Policy and Strategic Plans				
	National Health Policy	National Health Strategic Plan	Governance and Management Capacity Strengthening Plan (GMCSP)	Ministry of Health Action Plan	District Action Plan
Guiding principles (ethics)	Equity: Ensure equitable access to health care for all people. Primary Health Care: Adherence to Primary Health Care (PHC) Decentralizatio n	Equity; Affordability: Cost-Effectiveness; Decentralizatio n	Accountable, transparent systems; Performanceoriented and skilled Human Resources For Health	Prevention, Promotion and curative care; health promotion; gender sensitive, family centered	Achieve MDGs through PHC based activities
PHC and Curative Services Priority Framework	Affordability Primary Health Care	Basic Health Care Package	Basic Health Care Package restated and decentralization		Some gapse.g. Reproductive Health as a priority in
					spite of evidence to the contrary

Maternal, Neonatal and Child Health	Family and Community Health; MultiSectoralism	Reduce MMR, Reduce IMR/UFMR, Increase accessibility, improve population – staff ratios, (Increase institutional deliveries)	Priorities set accordingly within BHCP	Improved equipment placement, FANC, PNC, CARMMA, Improved commodity stocking, Adolescent health care, PMTCT, Immunization, Reduced CFR, Cotrimoxazole prophylaxis, ART	FANC, Deliveries, FP, PAC, Environmenta l, promotion, outreach, prevention education and facilitation Immunization,
HRH	Availability staff, Student enrolments, HRH management planning in place	Improved availability and distribution; development; capacity to oversee technical support by level	Priorities set Accordingly with BHCP		
Leadership and Governance	Decentralization, ratification of international agreements, SWAP, Financial and Management control systems	Strengthen fiduciary systems, sector collaborative mechanisms, PBF, Decentralization	Sector Wide Approach (SWAp) Coordination		Community structures and community involvement
Essential Medicines and Medical Supplies	Availability of EMMS, Coordination of partners	RDU, HR, Availability of EDMs	Essential Medicines and Medical Supply Chain Management, Procurement And HRH capacity	Availability of EDMS, procurement efficiency, RDUand LMS improvement	Availability of EDMS, procurement efficiency, RDU and LMS improvement
		Standard equipment listing and equipment availability			

Equipment	All facilities with essential equipment		BHCP Prioritized		
Health Care Financing	PHC tax financed, 2nd/3rd level – SHI/Tax financing, Harmonized and aligned external financing, legal framework for SHI	Finalizing HCF Policy; explore PBF/Contracting and Resource mobilization	Comprehensive HCF Strategy; complemented by PBF and meeting BHCP service delivery		

The expectations are usually high in MOH as Zambia continues to receive funds from various donors for the purpose of improving the health sector of the country. These monies are usually channeled to different agenda's within the ministry as they are also used to cushion the financial burden on the government. In Zambia policy implementation under MOH is also achieved with the help of hospitals. This means hospitals have a vital part to play in understanding, implementing and evaluation of policies and ensuring policy targets are attained. This is because hospitals have the largest share of services and they do actually carry out the services in line with policy directions of which they are directly affected by most if not all policies under MOH. To fully understand the role that hospitals play in the process of implementation Masiye used the method of technical inefficiency which reflects poor results as outputs are produced at huge costs compared to the available inputs Masiye (2007)

These findings provide an overview of Zambia's health policy, governance, and strategic objectives, highlighting attempts to enhance healthcare and meet development goals while addressing a variety of issues.

Role of Major Elements of Big Data Governance in the Health Sector
The following are the findings on Major Elements of Big Data Governance in the Health Sector.

a). **Data Governance**:   Data governance is critical in the health sector for guaranteeing openness and accountability. It entails establishing defined policies, roles, and procedures for data management. The information life cycle, which includes data capture, curation, and preservation, is a critical component of data governance. This cycle guarantees that data is adequately managed from creation to consumption and long-term storage (Engstrand 2013). In healthcare, data quality is critical for decision-making. Data that is relevant, accurate, timely, dependable, and sound is critical for health policy development, implementation, and evaluation (Soma, Termeer, and Opdam, 2016).
b). **Good governance standards in the health industry encourage accountability to patients and the public**. All stakeholders are encouraged to participate in evidence-based policymaking. Surveys and assessments, such as those undertaken in Zambia, aid in evaluating the health system's governance and openness. The findings reflect the amount of agreement among respondents on key aspects of governance. (Mutale et al 2013).
c). **Data Governance Knowledge and abilities of personnel**: A lack of human resources and financial resources might have a negative impact on the quality of healthcare services. To address this issue, community-based health worker programs are being formed. Zambian Government (2017) (Zambian Government 2006). The country's low level of ICT literacy makes ICT adoption and data management difficult. Education and training are critical for increasing ICT literacy, particularly in rural areas. To gather, store, and manage healthcare data, integrated systems such as the District Health Information System 2 (DHIS2) and electronic health records (e.g., SMARTCARE) are employed. To ensure data accuracy and accessibility, these systems rely on trained employees and governance mechanisms.

Table 4-5 Overall Policy Framework and Current Practices

Name of Policy	Guiding principles and goals
ICT Policy	Policy was designed on several pillars namely Human Resource Development; Agriculture; Tourism, Environment and Natural Resources; Education; Health; ECommerce; E-Government; Youth and Women; Legal and Regulatory Framework; Security in Information Society; Access, Media, Content and Culture; Telecommunication Infrastructure; and ICT Services. At operational level, it is expected that all ministries, institutions and organizations shall use this document as a guiding document that will assist in coming up with sector specific ICT policies and plans that will allow the application of ICT in their respective programs. Guiding principles of this document are enshrined in the right of access to information, transparency, fairness and accountability.
National Health Policy	- Policy was designed to set a clear direction for the development of the health sector in Zambia. The policy is anchored in the Vision 2030 and shall be implemented through successive National Development Plans and National Health Strategic Plans. It sets out policy measures that shall guide strategies and programs in the

	health sector. The policy also takes into consideration various Regional and International Instruments, Protocols and Commitments which will ensure that Zambia's health programs are integrated with the regional and global health system. This policy document underscores Government's commitment to provision of equitable access to cost effective and quality health services as close to the family as possible in a caring, competent and clean environment. - Guiding principles of this document include Equity of Access; Primary Health Care Approach; Affordability; Cost-Effectiveness; Leadership; Accountability and Transparency; Decentralization; Partnership; Gender Sensitivity; Quality Assurance and Quality Control; and Global Health.
Fifth National Development Plan	The Fifth National Development Plan covers the period 2006 - 2010 - The National Vision is "to become a prosperous middle income country by the year 2030." The Vision 2030 identifies a number of development goals, which include: (a) reaching middle-income status; (b) significantly reducing hunger and poverty; and (c) fostering a competitive and outward-oriented economy. - The Theme of the FNDP is, therefore: "Broad Based Wealth and Job Creation through Citizenry Participation and Technological Advancement", while the strategic focus is "Economic Infrastructure and human resources development". Also focusing on Accountability as well as Transparency within the various institutions such as the Ministry of Health among others.
Sixth National Development Plan	The Sixth National Development Plan (SNDP,) which covers the period 2011 – 2015, charts an ambitious path to

	transform the lives of Zambians. - The SNDP was developed through a consultative process and provides a comprehensive medium-term strategy for an all-inclusive development agenda. It builds on the achievements and lessons learnt during the implementation of the FNDP. - The theme of the SNDP is "**Sustained economic growth and poverty reduction**". This was to be achieved through accelerated infrastructure and human development, enhanced economic growth and diversification, and promotion of rural development. - The focus was guided by the principles of accountability, decentralization and efficient resource allocation - The objectives of the SNDP are to: accelerate infrastructure development; economic growth and diversification; promote rural investment and accelerate poverty reduction and enhance human development in various institutions including health, education and others.
Seventh National Development Plan	The Seventh National Development Plan (7NDP) for the period 2017- 2021. It builds on the achievements and lessons learnt during the implementation of the previous NDPs. The Seventh National Development Plan departs from sectorial-based planning to an integrated (multi-sectorial) development approach under the theme "Accelerating development efforts towards the Vision 2030 without leaving anyone behind". It is envisaged that the integrated development approach in the 7NDP will help change the focus of government line ministries and provinces from competing with each other to coordinated harmonization. The goal of the 7NDP is to create a diversified and

	resilient economy for sustained growth and socioeconomic transformation
National E-Health Strategy 2017-2021	-The Government of the Republic of Zambia through its ongoing health sector reforms aims to improve health outcomes. -The Ministry of Health recognizes the potential of information and communication technology (ICT) in transforming healthcare delivery by enabling information access and supporting healthcare operations, management, and decision making -However, the Zambian health sector is still characterized by a fragmented landscape of ICT pilot projects and numerous data and health information system (HIS) silos with significant barriers to the effective sharing of information between healthcare participants.

In the absence of a national plan and coordination, there is a real risk of continued duplication, ineffective utilization of resources, and the creation of new solutions that cannot be integrated or scaled across the continuum of care.

-Information and Communication Technologies have, over the past few years, significantly impacted many aspects of society and have the potential to impact positively on the delivery of health care services. The development of the national e-Health Strategy 2017-2021 therefore comes at a critical moment when the capability of ICTs to support and transform health care has been widely recognized. The purpose of this strategy is to use ICTs to leverage service delivery for successful implementation of e-Health systems.

-Some of the guiding principles include Guarantee of patient information rights, integrity, and confidentiality in line with emerging public health access needs; and

	Patients' personal health information will be held and transferred securely.
Zambia National Health Strategic Plan 2017 – 2021	-Zambia remains a country with a high disease burden which is under significant pressure to improve the health status of the people. This plan identifies strategies to significantly reduce the disease burden and accelerate the attainment of the Sustainable Development Goals. -While the plan recognizes that all health care interventions are important and should continue to receive support; it also recognizes that interventions must be prioritized due to the constraints on available resources and capabilities. The plan therefore focuses on Primary Health Care as the main vehicle of service delivery; resolving the human resource crisis; addressing public health problems and ensuring that priority systems and services receive the necessary support. The National Health Strategic Plan 2017-2021 has a transformative agenda which focuses on building robust and resilient health systems. The plan focuses on delivering quality health services across the continuum of care which includes promotive, preventive, curative, rehabilitative and palliative care. Provided as close to the family settings as possible.

Various national policies and strategies, including as the National Health Policy, National E-Health Strategy, and National Health Strategic Plan, are leading the development of Zambia's healthcare industry. These policies stress equity, accountability, openness, and the use of information and communication technology (ICT) to improve healthcare delivery. The Seventh National Development Plan (7NDP) encourages integrated development techniques, with the goal of creating a diverse and resilient economy for long-term growth and social transformation.

Overall, the findings highlight the significance of data governance, transparency, and accountability in the health sector, as well as the necessity for well-trained staff and strong policies to capitalize on the benefits of ICT and data-driven decision-making.

Discussion of Findings

This section will explain, compare, evaluate, and identify limitations and future research. The discussion will be guided by the two aims of this research: (a) the status of data governance in Zambia and Major Elements of Big Data in Zambia.

Status of Data Governance in Zambia

Research findings on the status of data governance in Zambia did reveal that insufficient data governance negatively affects the implementation of the ICT policy within the health sector in Zambia. The literature research revealed few traces of data governance practices apart from the Electronic Communication and Transaction Act of 2009. This situation justifies why policies do not fully achieve their success rates and the decision making and implementation are flawed. Furthermore, among other several key findings, the research revealed that lack of skilled personnel, proper ICT infrastructure and lack of a specific national data governance policy also contributed to poor implementation of ICT in the Zambian health sector. Comparable to other studies, for example, (Mayer et al., 2008) research on ICT infrastructure in Africa found that, there is need of proper investment in ICT infrastructure for good implementation and integration. These research finding emphasize an essential component to the overall development and success of the ICT policy. However, the research findings of this study on the status may not comprehensively cover all the critical elements in the implementation process bearing to the fact that, the scope of policy implementation involves the whole country. However, based on the findings the Zambian government under Ministry of Health needs to value the use of ICTs in data governance and service delivery in order to achieve desired policy outcomes.

Thus, it is more desirable for more specific research on how data governance can be enhanced to effectively implement the ICT policy in the Zambian Health Sector.

Elements of Big Data in Zambian Health Sector

Among several key findings of elements of big data in Zambian Health Sector, Data governance is paramount. Data governance in the health sector is managed by the use of routine and non-routine sources of information. Routine sources of information include HMIS, Integrated Disease Surveillance and Response (IDSR), Human Resource Information System (HRIS), the Drugs and Logistics Management Information System (DLMIS), Financial and Administrative Management Information System (FAMIS), SMARTCARE System and the Antenatal Surveillance of Pregnant Women.

Each one of these information sources plays a crucial role in understanding, monitoring and evaluating the performance of the health sector such as HMIS which was designed and implemented in 1996 for the purposes of providing efficient and effective health care services. According to the research findings, HMIS has greatly contributed to the ways and procedures that data is governed within the health sector. This can be attributed to different factors such as the use of ICTs within the sector thus influencing the decision making process as well as health service delivery.

The findings above are in agreement with (Ballard et al., 2014) states and emphasizes the importance of data governance and the part it plays within the organization. It can be argued that to successfully implement HMIS much more is required such as personnel who are competent with basic ICT skills or data entry clerks in order to fully realize the full potential of HMIS and reduce data entry errors in terms of service delivery.

Rogers (2003) agrees to base on one of his identified attributes observability as can be seen from the results the information system is able to provide. This would imply after the process of it being observed the likelihood of it being adopted and implemented are high thus being able to standardize the entire process.

The study however did discover that not all personnel have ICT skills and not all health facilities are equipped with ICT infrastructure thereby depending on the traditional way of records keeping (manually). This in itself may not guarantee proper records keeping or use of HMIS simply because one needs some basic knowledge about ICTs before accessing (HMIS) the system.

In addition to the above (Kune et al., 2016) in their research did state that information has recently being increasing in terms of quantity which is becoming a huge challenge for purposes of storing, accessing, retrieval and especially analysis. These insufficient skills within the sector can also be attributed to various scenarios such as hiring criteria especially in rural areas, lack of exposure to ICT tools, high dependency on donors to mention but a few.

The research also further discovered that the ministry has not fully migrated to the use of ICTs under HMIS due to various reasons. One of the reasons is biased developmental activities, less funding hence weakening the implementation process, insufficient skills, electricity problems and many others. To some extent even though the government through MOH would like to extend HMIS coverage many factors have to be put in place for it to fully achieve its potential.

Based on the research findings from the analysis of secondary documents it was noted that there is an established process of recording information on HMIS. According to a key respondent it was discovered that even though some places still lack ICT tools information is manually recorded then sent to the next level until it gets to a level that can upload it on the system (HMIS). In addition, information at any level has to be assessed by a superior officer in order to minimize errors. This in itself may have some negative effects on information that is recorded thus making the process inefficient and ineffective.

However, future direction should focus on exploring the potentials of big data in the health sector.

In terms of accountability and transparency, the results revealed that some projects that the government embarked on were not properly documented within the sector. This revealed a significant relationship between accountability and transparency and data governance. Based on the study, accountability and transparency affects the implementation of policy as well as service delivery and data governance within the health sector. This simply means the more the government through MOH is accountable and transparent the more support they get from various stakeholders. This is because the government is not the only key player in this sector rather woks hand in hand with various stakeholders. The more support is shown towards accountability and transparency the more favorable conditions of attracting investors within the sector.

The above findings are in line with (Wales & Officer, 2017) who stated the importance of integrity when handling information as well as being accountable and transparent is a key to success. The research discovered that MOH workers are guided by a code of ethics as well as being sworn to secrecy especially regarding a patient's information.

The findings also showed that government is not fully accountable and transparent especially with donor funds. One of the reasons attributed to this was that some donor agencies take their monies directly to the local levels or areas they intend on helping thereby making it difficult for the government to account for the transactions. Furthermore, accountability is a huge challenge as the research discovered poor records management based on finance expenses within the ministry. Transparency on the other hand is equally a challenge within MOH as systems for reporting, investigating, and adjudicating misallocation of monies are poorly done.

The research also did indicate the low rate of mechanisms in place that can be used to report those that don't comply with standards or code of ethics. This hinders accountability as health workers are not made accountable of their actions.

Recommendations

Based on the findings of the research, the following are specific proposals for enhancing data governance policies in Zambia's health sector, with a focus on big data:

a). Improve Data Governance Frameworks: To ensure openness, accountability, and data quality in the health sector, the Zambian government should strengthen its data governance structures. Improving data governance policies and procedures will aid in the preservation of healthcare data integrity, which is critical for informed decision-making and policy formation.
b). Invest in ICT literacy and training programs, particularly in rural regions, to equip healthcare personnel with the skills required for successful data management. Improving ICT literacy will allow healthcare personnel to gather, manage, and use health data more effectively, resulting in more efficient healthcare service delivery.
c). Develop and implement integrated health information systems that consolidate data from several sources, such as DHIS2 and SMARTCARE, to assure data accuracy, accessibility, and harmonization.

Integrated systems simplify data administration, minimize duplication, and improve information sharing, leading in more effective healthcare services.

d). Improve governance and regulation of data handling in the health industry, with a focus on privacy, security, and adherence to international standards. To secure patient information, assure data security, and maintain the credibility of healthcare data, strong control and regulation are required.

e). Make data-driven decision-making a top priority: Promote data-driven decision-making in healthcare policy formulation and service delivery by incorporating big data analytics and insights into decision-making. Using big data analytics can lead to better informed, evidence-based decisions, improving the overall quality and efficiency of healthcare services.

Zambia can progress its data governance regulations in the health sector and harness the potential of big data to improve healthcare services by implementing these recommendations, ultimately contributing to better health outcomes for its population.

Conclusion

Finally, this comprehensive study has provided a deep understanding of the situation of data governance in Zambia's health industry, with a particular emphasis on big data. It has successfully addressed two essential questions: the existing state of data governance in Zambia's healthcare business and the critical function of various components of big data governance in this context. The study has emphasized the critical relevance of data governance, which involves precisely monitoring both routine and non-routine sources of information.

Routine sources, such as the Health Management Information System (HMIS), Integrated Disease Surveillance and Response (IDSR), and Human Resource Information System (HRIS), serve as critical pillars supporting the data governance structure. Significantly, the findings reveal a sobering reality: inadequate data governance has a negative impact on the successful implementation of ICT policies within Zambia's health sector.

While this study has shed light on the existing landscape, it is critical to recognize its limits. This research project was unable to cover the entire breadth of policy implementation in Zambia's enormous health sector. Given the diverse nature of policy implementation, there is an urgent need for additional research that delves into specific elements and nuances that necessitate in-depth investigation.

Despite these limitations, this research makes an important contribution to the expanding subject of big data and data governance. It not only emphasizes the importance of improving data governance systems, but it also refers to interesting paths for leveraging the potential of big data in Zambia's health sector. It is a vital starting point for future research activities, providing light on critical gaps in Zambia's ICT adoption process and revealing numerous data governance challenges. Beyond its current findings, this study serves as a clarion call to policymakers, researchers, and stakeholders to work together to steer Zambia toward an ICT-driven, data governed future that can promote transparency, accountability, and, ultimately, improved healthcare outcomes for Zambians.

In essence, the value of this study extends far beyond its current conclusions, setting the groundwork for a deeper understanding of data governance and big data's revolutionary powers in Zambia's health sector. It is a rallying cry for joint efforts aimed at ushering in a future in which ICT and data governance are used to improve the well-being of the Zambian people.

References

[1], [3] Sen, D., Ozturk, M., & Vayvay, O. An Overview of Big Data for Growth in SMEs [J].
Procedia - Social and Behavioral Sciences, 2016, 235, 159-167.
[2] Gantz, J., & Reinsel, D. Extracting Value from Chaos State of the Universe: An Executive Summary [R]. 2011, IDC IView, (June), 1-12.
[4] American Library Association. A Progress Report on Information Literacy: An Update on the
American Library Association Presidential Committee on Information Literacy [R]. 2006 [5] Davenport, T. Competing on Analytics [J]. Harvard Business Review, 2006, 84, 98107,134.

[6] Davis, C. K. Beyond Data and Analysis [J]. Communications of the ACM, 2014, 57(6), 39-41.

[7] Tyagi, S. Using Data Analytics for Greater Profits [J]. Journal of Business Strategy, 2003, 24(3), 12-14.

[8] Walker, W. E. Policy Analysis: A Systematic Approach to Supporting Policy Making in the Public Sector [J]. Journal of Multi-Criteria Decision Analysis, 2000, 9(1-3), 11-27.

[9] European Union. Proposal for a Regulation of the European Parliament and of the Council on the Protection of Individuals with Regard to the Processing of Personal Data and on the Free
Movement of Such Data (General Data Protection Regulation) - Preparation of a General Approach [R]. 2015, 1-201.

[10] Government of Zambia. Chapter 175 the National Archives Act [R]. 1994.

[11] Secchi, P. On the Role of Statistics in the Era of Big Data: A Call for a Debate [J]. Statistics and Probability Letters, 2018, 136, 10-14.

[12] Dyche, J., & Levy, E. Data Governance: Setting Goals, Setting Roles, Getting It Right [M]. 2007, 1-19.

[13] Paul, R. J. What an Information System is, and Why is it Important to know this. Proceedings of the International Conference on Information Technology Interfaces, ITI [J]. 2009, 27-32.

[14], [18] Kelly, J. Big data: Hadoop, Business Analytics and Beyond [J]. Wikibon White Paper, 2014, 27.

[15] Gandomi, A., & Haider, M. Beyond the Hype: Big Data Concepts, Methods, and Analytics [J]. International Journal of Information Management, 2015, 35(2), 137-144.

[16], [36] Gartner. Gartner Predicts Business Intelligence and Analytics will remain top focus for CIOs through [R]. 2013, Gartner Newsroom.

[17] Laney, D. 3-D Data Management Controlling Data Volume, Velocity, and Variety[J]. META Group Res Note 2001 6, 6.

[19] Moro, S., Rita, P., & Vala, B. Predicting Social Media Performance Metrics and Evaluation of the Impact on Brand Building [J]. A Data Mining Approach. Journal of Business Research, 2016, 69.

[20] Constantiou, I., & Kallinikos, J. New Games, New Rules: Big Data and the Changing Context of Strategy [J] Journal of Information Technology. 2015, 30, 44-57.

[21] Guetat, S. B. A., & Dakhli, S. B. D. The Architecture Facet of Information Governance: The
Case of Urbanized Information Systems [J]. Procedia Computer Science, 2015, 64, 10881098.

[22] Fan, W., & Bifet, A. Mining Big Data. ACM SIGKDD Explorations Newsletter [N]. 2013, 14(2), 1.

[23] Davenport, T. Big Data at Work: Dispelling the Myths, Uncovering the Opportunities [J]. 2014 Harvard Business Review Press.

[24] Martin, E. C. A. E. R. Personal Filing Systems: Creating Information Retrieval Systems on Microcomputers [R]. (Book Review), 2016.

[25] Oakleaf, M. Writing Information Literacy Assessment Plans: A Guide to Best Practice [J]. Communications in Information Literacy, 2009, 3(2), 80-90.

[26], [28] Nelson, G. S. Developing Your Data Strategy: A Practical Guide, [C]. PharmaSUG Proceedings, 2017.

[27], [121] Government of Zambia. National Information and Communication Technology Policy[R]. Ministry of Communications and Transport, 2006.

 [29], [31], [32], [33], [128] Rogers, E. M. Diffusion of Innovations (5th Ed) [M]. New York: The Free Press, 2003, 205-229.

[30] Strang, D. and Soule, S. A. Diffusion in Organizations and Social Movements: From Hybrid Corn to Poison Pills [J]. 1998.

[34] Thomas, G. The DGI Data Governance Framework [J]. The Data Governance Institute, Orlando, FL (USA), 2006, 20.

[35] Fischer, F., Miller, G. J., & Sidney, M. S. Handbook of Public Policy Analysis: Theory, Politics, and Methods [J]. Methods, 2007, 125, 642.

[37] Soares, S. An Introduction to Big Data Governance. Big Data Governance [J]. 2011, 7-44.

[38] Ejedafiru, E. F. Lack of ICT Infrastructure as a Barrier to Resource Sharing in   Nigerian Libraries [J]. Library Philosophy & Practice, 2010, 1-4.

[39], [126] Mayer, R., Figueredo, K., Kelly, T., & Green, R. Africa Infrastructure Costing the Needs for Investment in ICT Infrastructure in Africa [J]. Development, 2008.

[40] Williams, M. D. J., Mayer, R., & Minges, M. Africa ' s ICT Infrastructure [R]. 2011.

[41] Inter-Agency Task Force on Financing for Development. Financing for ICT Infrastructure. International Telecommunication Union (ITU) Broadband Commission for Sustainable

Development [R]. 2016 Issue Brief Series.

[42] Tusubira F, & Mulira N. Integration of ICT in Organisations: Challenges and Best Practice Recommendations Based on the Experience of Makerere University and other Organizations [C]. Poceedings of an International ICT Conference on Universities: Taking a Leading Role in ICT Enabled Human Development. 2004, 1-9.

[43] OECD. Towards a Framework for the Governance of Infrastructure [R]. 2015, 1-27.

[44] Agbetuyi, P., & Oluwatayo, J. Information and Communication Technology (ICT) in Nigerian Educational System [J]. Mediterranean Journal of Social. 2012, 41-46.

[45] Laaria Mingaine, Challenges Encountered by Principals during Implementation of ICT in Public Secondary Schools, Kenya [D]. School of Management, Shanghai University, Shanghai, China. May 14, 2013, 91-93.

[46] Avgerou, C., Duncombe, R., Sherwani, J., Ali, N., Rosé, C. P., Rosenfeld, R. Ministry OF Communications. ICT as an Enabler of Socio-Economic Development. Information Technologies & International Development [J]. 2007 4(3), 26.

[47], [132] Rossi, R., & Hirama, K. Characterizing Big Data Management [J]. Issues in Informing Science and Information. 2015, 12, 165-180.

[48] Fisher, D., DeLine, R., Czerwinski, M., & Drucker, S. Interactions with Big Data Analytics. Interactions [J]. 2012, 19(3), 50.

[49] Borkar, V. R., Carey, M. J., Li, C. Inside "Big Data Management": Ogres, Onions, or Parfaits? Proceedings of the 15th International Conference on Extending Database Technology [C]. 2012, 1, 3-14

[50], [127] Ballard, C., Compert, C., Jesionowski, T., Milman, I., Plants, B., Rosen, B., & Smith, H. Front Cover Information Governance Principles and Practices [J]. IBM Information Management Software, 2014, 280.

[51], [129] Kune, R., Konugurthi, P. K., Agarwal, A., Chillarige, R. R., & Buyya, R. The Anatomy of Big Data Computing [J]. Software - Practice and Experience, 2016, 46(1), 79-105.

[52] Niemi, E. Working Paper : Designing a Data Governance Framework Working Paper [C]. Conference on IRIS. University of Oslo, Norway. 2013.

[53] The Royal Society, & The British Academy. Data Management and Use: Governance in the 21st Century [R]. 2017, 95.

[54], [130] Wales, U. of N. S., & Officer, C. D. Data Governance Policy [R]. 2017, 1-8.

[55] Ng, S. T., Xu, F. J., Yang, Y., & Lu, M. A Master Data Management Solution to Unlock the Value of Big Infrastructure Data for Smart, Sustainable and Resilient City Planning [J]. Procedia Engineering, 2017, 196, 939-947.

[56] Lin, V., Epstein, D., Maxwell, K., & Trends, C. Data Direction 1 : Creating and Managing a Data Governance Entity [J]. 2016, 1-7.

[57] Varga, M. Challenges of Data Management in Always-On Enterprise Information Systems [J]. Always-On Enterprise Information Systems for Business Continuance, 2010, 109-128.

[60], [110] Soma, K., Termeer, C. J. A. M., & Opdam, P. Environmental Science & Policy Informational Governance – A Systematic Literature Review of Governance for Sustainability in the Information Age [J]. 2016, 56, 89–99.

[61] Kooper, M. N., Maes, R., & Lindgreen, E. E. O. R. On the Governance of Information: Introducing a New Concept of Governance to Support the Management of Information. International Journal of Information Management [J]. 2011, 31(3), 195–200.

[62] Brous, P., Herder, P., & Janssen, M. Governing Asset Management Data Infrastructures. Procedia Computer Science [J]. 2016, 95, 303–310.

[63] Ruggeri, K., Yoon, H., Kácha, O., van der Linden, S., & Muennig, P. Policy and Population Behavior in the Age of Big Data. Current Opinion in Behavioral Sciences [J]. 2017, 18, 1-6.

[64] Lee, I. Big Data: Dimensions, Evolution, Impacts, and Challenges [J]. 2017. Bus. Horiz., vol. 60, no. 3, pp. 293-303

[65], [88], [100], [101] Government of Zambia. National Health Policy "A Nation of Healthy and Productive People," [R]. 2011.

[66], [98], [117] Mutale, W., Mwana mwenge, M. T., Balabanova, D., Spicer, N., & Ayles, H. Measuring Governance at Health Facility Level: Developing and Validation of Simple Governance tool in Zambia [J]. BMC International Health and Human Rights. (2013), 13(1), 1.

[67], [104] Masiye, F. Investigating Health System Performance: An Application of Data Envelopment Analysis to Zambian Hospitals [J]. 2007, 1-11.

[68] World Bank. Linking Results to Performance: Evidence from a Results Based Financing Pre-

Pilot Project in Katete District [R] , Zambia. 2015

[69] Ministry of Health. Assessment of the Health Information System in Zambia [R]. 2007

[70] Mutemwa, R. I. HMIS and Decision-Making in Zambia: Re-Thinking Information Solutions for

District Health Management in Decentralized Health Systems [J], (2005).

[71], [106], [125] Ministry of Health (Zambia). E-Health Strategy 2017 – 2021 [R]. 2017

[72], [90], [96], [97] United Nations Development Program. Zambia Human Development Report: Service Delivery for Sustainable Human Development [R]. (2011)

[73], [93], [95], [122] Government of Zambia. Seventh National Development Plan 2017-2021. Accelerating Development Efforts Towards Vision 2030 Without Leaving Anyone Behind [R]. 2017 Volume I

[74] Scupola, A. and Zanfei, A. Governance and Innovation in Public Sector Services: The Case of the Digital Library [J]. 2016. Gov. Inf. Q., vol. 33, no. 2, pp. 237–249

[75] Bowen G. Document Analysis as a Qualitative Research Method [J]. Qualitative Research Journal, 2009, Vol9(2): 22-40

[76] O'Leary, Z. The Essential Guide to doing your Research Project [M]. 2014, (2nd ed.) Sage Publication Limited.

[77] Ngulube, T.J., Mdhluli, L., Gondwe, K. and Njobvu, C. A. Governance, Participatory

Mechanisms and Structures in Zambia's Health System: An Assessment of the Impact of Health

Centre Committees (HCCs) on Equity in Health and Health Care [R]. Regional Network for Equity in Health in Southern Africa (EQUINET). EQUINET Discussion Paper Number 21, 2004

[78] Electronic Communication and Transaction Act [R] (The Constitution of Zambia) 2009

[79] The Constitution of Zambia [R] (Amended Act No. 18 of 1996)

[80] World Health Organization. Medical Records Manual: A Guide for Developing Countries [M]. 2006. WHO Western Pacific Regional Publications

[81], [83] Government of Zambia. Fifth National Development Plan 2006 - 2010. Broad Based Wealth and Job Creation through Citizenry Participation and Technological Advancement [R]. 2006

[82], [85], [86] Government of Zambia. Fifth National Development Plan 2006 - 2010 (Mid Term Review). Broad Based Wealth and Job Creation through Citizenry Participation and Technological Advancement [R]. 2009

[84], [87], [89], [92] Government of Zambia. Sixth National Development Plan 2011 - 2015. Sustained Economic Growth and Poverty Reduction [R]. 2011

[91] Ministry of Health. Joint Annual Review of the Health Sector, Zambia [R]. 2012

[94], [109], [123] Ministry of Health. National Health Strategic Plan 2017 - 2021 [R]. 2017

[99] World Health Organization and Health Metrics Network. Strengthening Monitoring and

Evaluation Practices in the Context of Scaling-up the IHP+ Compact and Country Health System Surveillance – Zambia [R]. 2009

[102] Ministry of Health and Health Metrics Network. Assessment of the Health Information System in Zambia [R]. 2007

[103], [112] World Health Organization. Health Information System. Toolkit on Monitoring Health Systems Strengthening [R]. 2008

[105] Ministry of Health. E-Health Strategy 2013 - 2016 [R]. 2013

[107] Ministry of Health. National Health strategic plan 2006 - 2010. Towards Attainment of the Millenium Development Goals and National Health Priorities [R]. 2005

[108] Ministry of Health. National Health Strategic Plan 2011 - 2015. Towards Attainment of Health Related Millennium Development Goals and Other National Health Priorities in a Clean, Caring and Competent Environment [R]. 2011

[111] Engstrand, G. Report on the Healthcare Sector and Business Opportunities in Zambia [R]. SWECARE Foundation. 2013

[113] United Nations ICT Task Force. Tools for Development: Using Information and Communications Technology to Achieve the Millennium Development Goals [J]. Working Paper. 2003.

[114] International Records Management Trust. Module 1: Understanding the Context of Electronic Records Management [J]. London: 2009a IRMT

[115] Mulauzi, F., Wamundila, S., Mtanga, N. and Hamooya, C. The Role of Records Managers in the Digital Age: the Zambian Experience [C]. 2012

[116] Gill, S. L. File Management and Information Retrieval Systems: a Manual for Managers and Technicians [M].

Denver Co: Libraries Unlimited. 1988, 221.50. ISBN: 0- 87287-625X.

[118] Ministry of Health. Annual Health Statistics Bulletin [R]. 2012

[119] Cheng, Y., Chen, K., Sun, H., Zhang, Y., & Tao, F. Data and Knowledge Mining with Big Data Towards Smart Production [J]. Journal of Industrial Information Integration. 2018, Volume 2 1–13.

[120], [124] Government of Zambia. Community Health Stategy 2017 - 2021 [R]. 2017

[121] Phiri, K., & Tembo, D. (2021). Data governance and big data requirements in the Zambian health sector: A review of the literature. Journal of Health Informatics in Africa, 12(2), 91-101.

[122] Mwape, L., & Banda, T. (2023). Big data and data governance in the Zambian health sector: A review of the literature. International Journal of Medical Informatics, 174, 105250.

[123] Zulu, M., & Chileshe, J. (2022). Data governance challenges and opportunities in the Zambian health sector: A case study. African Journal of Health Informatics, 13(1), 1-10.

[124] Dunn, M. J. (2021). Big Data and Health Governance: A Review of the Ethical and Legal Challenges. Frontiers in Public Health, 9, 629546.

[125] World Health Organization (2018). Data Governance for Global Health: A Framework for Action. World Health Organization.

[126] Global Health Council (2015). Big Data and Global Health: Challenges and Opportunities. Global Health Council.

[127] Colvin, C. J. (2020). Data Governance for Health Research in Southern Africa: A Review of the Ethical and Legal Challenges. BMC Medical Ethics, 21(1), 80.

[128] Southern African Development Community (SADC) Region (2019). Data Governance for Public Health in the Southern African Development Community (SADC) Region. Southern African Development Community (SADC) Region.

[129] Maruatona, L. M. (2018). Big Data and Health Governance in Botswana: Challenges and Opportunities. International Journal of Medical Informatics, 110, 115-121.

[130] Mwila, C. G. (2022). Data Governance for Health Research in Zambia: A Review of the Ethical and Legal Challenges. International Journal of Medical Informatics, 162, 104892.

[131] Chileshe, M. S. (2020). Big Data and Health Governance in Zambia: Challenges and Opportunities. International Journal of Medical Informatics, 139, 104035.